Of Molluscs and Men:

Pearling Labour and Environments in the Indian Ocean 1880-1925

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Declaration

This thesis is the result of my own work and includes nothing which is the outcome of work done in collaboration except as declared in the preface and specified in the text. It is not substantially the same as any work that has already been submitted before for any degree or other qualification except as declared in the preface and specified in the text. It does not exceed the prescribed word limit for the History Faculty Degree Committee.

ABSTRACT

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Tamara S. Fernando

This dissertation studies three pearl fisheries in the northern Indian Ocean – the Persian Gulf, the Gulf of Mannar, and the Mergui Archipelago – at the height of the global pearl boom in the late nineteenth and early twentieth centuries. Based on archives in the Emirates, India, Myanmar, Sri Lanka, and the United Kingdom, this project employs a comparative and connected methodology across the three sites, all of which came under the British Empire. By combining methods from environmental history, the history of science, and labour history, this dissertation aims to write a history below the water line. An eclectic combination of sources, including scientific diagrams, local poetry, oyster specimens, and undersea maps, allows new stories of submarine environments, animals, and marine extraction at the turn of the twentieth century to emerge.

By the 1930s, the industry in natural pearls was eclipsed by the trade in 'cultured pearls.' Instead of reading the last fifty years of natural pearling as a period of decline, I argue that it was an important juncture in attempts to domesticate marine creatures and construct the ocean as a site of value. Until this point in time, the shallow continental shelf at sea (where oysters lived) was largely invisible in cartography, science, and law. What does it mean to see like a state at sea? Using the concepts of *visibility* and *translation*, I argue that the precise configuration of science, statecraft, and increasing global revenues to be derived from pearls led to new attempts to render submarine space into a source of value. I show here how the seafloor was a space of *potential value* which required the embodied labour of pearl divers to translate across

medium, terrain, species, language, and culture to bring the pearl-oyster bearing reef into focus.

Despite this, attempts to domesticate both labourers and oysters at sea in the early twentieth century were largely unsuccessful. The dynamic, changing nature of seafloor ecologies and materials eluded the grasp of the tools of state visibility. It was only once the oyster was brought onto land, stripped of the terrain of the ocean, that domestication was partly completed.

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Christine, Nitz, Petra, Rai, Sandev and Uli (who also often corrected my slides!). My family watched patiently as I navigated the PhD, accompanied me on research trips, tolerated my absences, and indulged my strange writerly moods. Tudor Giurgica-Tiron encouraged me to apply to a PhD four years ago and continues to challenge me to surmount new heights each day. *Mulțumesc.*

GLOSSARY

Arabic

Alqadaa' al-shari'i: religious courts

Bedu: nomadic

Dar: captain's house or meeting place

Dhow: sea-going vessel

Fjiri: pearling song

Ghawwas: diver

Ghaus al-Kabir: The Great Dive, referring to the main diving season

Hadar: sedentary

*Hair/*pl. *Hairat*: pearl reef

Altasalluf: system of payment for the crew of a pearling vessel

Majlis: tribal council

Mudun al Ghaus: pearling town

Nakhoda: ship captain

Nahhaam: singer

Seb: hauler

Tawwawish/ pl. *tawwash*: pearl buyer or merchant

Khaliji: person belonging to the Gulf

Tamil

Adapan/Adapannar: parava caste headmen

Aumani/Amanii: system of direct state management

Kadalcutti: 'sea-binder' or shark charmer

Kottoo: large enclosure or shed

Lebbai: Muslim priest but also a Muslim caste group in the Gulf of Mannar

Manduck: hauler

Mudliar: local headman

Muttu sippi: pearl shells

Sammati : vallam owner

Siddi: African diver

Paar: pearl reef or rocky undersea substrate

Parava: Tamil-speaking caste-group in the Gulf of Mannar

Uliyam: compulsory caste-based labour

Vallam: a type of vessel in the Gulf of Mannar

ABBREVIATIONS

CO	Colonial Office
CSAS	Centre of South Asian Studies, Cambridge
FO	Foreign Office
MAA	Museum of Archaeology and Anthropology, Cambridge
MSA	Maharashtra State Archives, Bombay
NMN	National Maritime Museums, Sharjah
NMNH	National Museum of Natural History, London
IOR	India Office Records, British Library, London
SLNA	Sri Lanka National Archives, Colombo
SLNAK	Sri Lanka National Archives, Kandy branch
TNSA	Tamil Nadu State Archives, Madras
UKNA	National Archives of the United Kingdom, Kew
UL	University Library, Cambridge
YNA	National Archives of Myanmar, Yangon

CONTENTS

Introduction

Pearls and Pearling

In 2019, archaeologists working on Marawah Island off the coast of Abu Dhabi found a tiny, round, pink-hued object buried in the sand. [1] The survival of this particular item, less than half a centimetre across, was surprising to archaeologists. This was because similar goods, comprised of chains of a calcium carbonate threaded through with organic proteins, decompose – or, more precisely, dehydrate – quickly compared to similar high-value objects made of gold, silver, and diamonds. This find, however, was unusual because it was 8000 years old. The Abu Dhabi Department of Culture and Tourism was quick to claim a vaunted title: the world's oldest pearl had been unearthed.

In fact, the origins of the long relationship between humans and the spherical, iridescent, organic by-products of molluscs – better known as pearls – remains unclear. [2] What *is* evident, however, from early archaeological sites like the one above, is that humans have coveted these objects for at least several thousand years, using oysters' iridescent shells and pearls as decoration and adornment across the world. Ample literary and visual evidence sits alongside pearl-encrusted crowns and diadems, tapestries, carpets, and, of course, an array of finely wrought jewellery. [3]

Many molluscs grow gregariously, that is, they cluster together in large communities in the shallows of rivers or oceans, meaning that even before the invention of boats or sailing technology, several brackish northern waters and island archipelagos provided venues for human-mollusc interactions. [4] At some point during one of these

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[1] 'Abu Dhabi Pearl: The world's oldest known natural pearl discovered on Marawah Island,' Department of Culture and Tourism, Abu Dhabi, last modified 20 Oct 2019, https://tcaabudhabi.ae/en/media.centre/press.releases/abu.dhabi.pearl.the.worlds.oldest.known.natural.pearl.discovered.on.marawah.island.aspx.

[2] Neil H. Landman, *Pearls: A Natural History* (New York: Harry N. Abrams, 2001).

[3] R. A. Donkin, *Beyond Price: Pearls and Pearl-Fishing : Origins to the Age of Discoveries* (Philadelphia: American Philosophical Society, 1998).

[4] Brian Fagan, *Fishing: How the Sea Fed Civilization* (New Haven: Yale University Press, 2017).

hunting expeditions, cracking open the brittle valves, running human fingers over the soft molluscan insides with the creature's gills still pulsing, someone, or maybe several people simultaneously, discovered, wedged within the folds of flesh, a luminescent object. Perhaps it was no bigger than a poppy seed or as large as a pigeon's egg; it could have been tinged light pink or even dark green, depending on its host mollusc and its environs; it may equally have been rounded or flat, bulbous, or paper-thin. These earliest moments of discovery in warm, tropical waters are lost: how, why, and when did humans decide pearls and mother-of-pearl were objects of beauty, worthy of holding up, as one unnamed highlander of Papua New Guinea in 1935 did, watching the sunlight glint off the pearly sheen of an oyster shell with the 'utmost reverence'? [5]

Although we cannot pin down precise reasons or chronologies for the early development of these standards of desirability, this context helps us appreciate why the scholar Abu Rihan al-Biruni reflected from Persia in 1040 that 'the desire for pearls is a thing found in all nations.' [6] Al-Biruni wrote in a world where pearls had long been incorporated into overland and oceanic trade routes, systems of tribute, payment and gift-exchange, and notions of royalty and elites across the world. Despite this claim, from 1500 onwards, regional markets for pearls were increasingly integrated into a world economy that was fast diverging, often through the force of empire, and the regions of extraction and consumption became more clearly bifurcated. By the end of the nineteenth century, the wealth of the industrial revolution fuelled a major demand for pearls in Europe and North America, leading to a global 'pearl boom.' [7]

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[5] Jeffrey Clark, 'Pearlshell Symbolism in Highlands Papua New Guinea, with Particular Reference to the Wiru People of Southern Highlands Province,' *Oceania* 61, no. 4 (1991): 310.
[6] Al-Biruni, *Kitāb al-Jamāhir fi Ma'rifat al-Jawāhir* (Hyderabad, 1936), 129; English translation, see F. Krenkow, 'The Chapter on Pearls in the Book on Precious Stones by al-Beruni,' *Islamic Culture* 15 (1941): 399-421.
[7] Matthew S. Hopper, *Slaves of One Master: Globalization and Slavery in Arabia in the Age of Empire* (New Haven: Yale University Press, 2015).

The late nineteenth century, where this dissertation is situated, was pearling's great acceleration, one where historians have characterised the pearl trade as witnessing 'exponential growth.' [8] Pearl fisheries expanded and intensified in every part of the world. By the early twentieth century, the American gem expert George Kunz could muse in his *Book of the Pearl*, 'How strange is the providence of God, who, by granting the pearl to the poor Arab, the Tamil of India, the South Sea Islander, and the forgotten Selang of Mergui, makes the greatest and the wealthiest in the world contribute to their support.' [9] The major sites 'granted' this ample supply of pearls, that is, provided with shallow, reef-rich tropical waters where pearl oysters could thrive, and where 'poor' divers would harvest them, lay close to the equator, with several of these located in the northern Indian Ocean. [10]

The largest fishery was the Persian Gulf, which outstripped most other sites in terms of workforce, revenue and volume of pearls harvested. [11] This was followed by the notoriously intermittent fishery in the Gulf of Mannar, between South India and Ceylon, where plentiful oysters could be found one year followed by a years-long period of absence. [12] In contrast to these long-standing centres of natural pearling, from the 1860s, a new pearling frontier developed in north-western Australia, and capitalists soon exported new industrial methods involving mechanical dress diving into older

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[8] Ibid., 81.
[9] George Frederick Kunz and Charles Hugh Stevenson, *The Book of the Pearl: The History, Art, Science and Industry of the Queen of Gems* (New York: De Vinne Press, 1908) , 81.
[10] Pedro Machado, Steve Mullins and Joseph Christensen, eds., *Pearls, People, and Power: Pearling and Indian Ocean Worlds* (Athens, OH: Ohio University Press, 2020).
[11] Robert A. Carter, *Sea of Pearls: Seven Thousand Years of the Industry That Shaped the Gulf* (London: Arabian Publishing, 2012); Hopper, *Slaves of One Master*.
[12] Samuel Ostroff, 'The Beds of Empire: Power and Profit at The Pearl Fisheries of South India and Sri Lanka, C. 1770-1840' (PhD diss., University of Pennsylvania, 2016); Ostroff, 'Can the Oyster Speak? Pearling Empires and the Marine Environments of South India and Sri Lanka, c. 1600–1900,' in *Animal Trade Histories in the Indian Ocean World*, eds. Martha Chaiklin, Philip Gooding, and Gwyn Campbell (New York: Springer, 2020), 65–98; Sanjay Subrahmanyam, 'Noble Harvest from the Sea: Managing the Pearl Fishery of Mannar, 1500-1925,' in *Institutions and Economic Change in South Asia*, eds., Burton Stein and Sanjay Subrahmanyam (New Delhi: Oxford University Press, 1996); Tamara Fernando, 'A Multispecies History of the Ceylon Pearl Fishery 1800-1925' *Past & Present* (forthcoming).

centres of pearling in the Torres Strait, the Aru Islands, the Sulu Zone and Southern Burma. [13]

Although there are regional historical works on pearling and a recent edited volume on Indian and Pacific Ocean pearling, none of these treat the above sites within the same comparative or connected frame, although they pertain to the same ocean, came under the same imperial framework, and shared labour, merchant capital, legal and scientific expertise in the late nineteenth century. Reading these sites together is instructive not only in terms of what they shared but also in terms of the comparisons that emerge around regulation, ecology, and the material conditions which constrained and shaped the nature of a specific kind of work: pearl diving.

This dissertation strives to approach the work and lives of tropical divers, and the submarine environments they encountered and transformed. 'What (if anything) did pearls want?' the art historian Natasha Eaton has asked. She explains: '[p]erhaps more than any substance associated with European imperialism, pearls speak to luxury, a certain fetishization of scarcity and to the politics and aesthetics of kitsch.' [14] Historians have written on the importance of recovering neglected actors 'from the shadows.' Even after discounting for academic hubris and the question of who is rescuing whom in this declaration, in the case of pearls, the inverse metaphor is more apposite: it is rather the lustre of the object, so conspicuous, gleaming, and easy to trace, which has blinded observers to the realities of human and non-human labour, commodification and production.

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[13] Michael McCarthy, 'Early Pearling on the Indian Ocean's Southeast Fringe,' in *Pearls, People and Power,* 147-179.
[14] Natasha Eaton, 'In Search of Pearlescence: Pearls, Empire and Obsolescence in South Asia,' *Journal of Material Culture* 21, no. 1 (2016): 34.

The overdetermined focus on elite accumulation and display of pearls (corroborated in turn by large gemstone-centric museum exhibitions) is changing.[15] In fact, the last five years have seen a scholarly "vogue for pearls" with new histories covering sites as diverse as the twelfth-century Mongol Empire to sixteenth-century Venezuela and twentieth-century Japan.[16] Pearls are now metonyms for imperialism, for coercion, for merchant capital, and the integration of far-flung sites into global capitalist economies in the nineteenth century.[17] This dissertation is therefore a contribution to this new work that aims instead to treat pearls as a neglected element of marine extraction and as a commodity which offers insights into the making of the ocean into a space of value.[18]

Across the following five chapters I offer a comparative – and occasionally connected – history of three sites of extraction in the Indian Ocean in the late nineteenth and early twentieth century: the Persian Gulf, the Gulf of Mannar between South India and Ceylon and the Mergui Archipelago in Southern Burma. Rather than narrate an economic or commodity history, which is already well-trodden ground for historians of the pearl, I turn instead to science, surveying, maritime labour, and the law of the sea to uncover stories about the sea, its creatures, and management by humans in the late nineteenth century which have, hitherto, received scant attention. I suggest that this contributes to a more robustly environmental study of the Indian Ocean and that it advances new methods for thinking through science, labour, and law at sea.

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[15] See exhibition publications: Beatriz Chadour-Sampson and Hubert Bari, *Pearls* (London: V&A Publishing, 2013); Museum of Islamic Art in Doha, *Pearls* (Milan: Skira Editore, 2009).
[16] Molly A. Warsh, *American Baroque: Pearls and the Nature of Empire, 1492-1700* (Williamsburg, VA: Omohundro Institute of Early American History and Culture, 2018); Thomas T. Allsen, *The Steppe and the Sea: Pearls in the Mongol Empire* (Philadelphia: University of Pennsylvania Press, 2019); Kjell David Ericson, 'Nature's Helper: Mikimoto Kokichi and the Place of Cultivation in the Twentieth Century's Pearl Empires' (PhD diss., Princeton University, 2015).
[17] Warsh describes pearls as imbued with an 'inherent ungovernability,' *American Baroque*, 253; Machado writes of pearls entangled with 'projects of self-fashioning,' *Pearls, People and Power*, 5-6; Eaton of pearls as 'tainted with imperial cohesion,' 'In Search of Pearlescence,' 33.
[18] Machado, Mullins and Christensen eds., *Pearls, People and Power*, 2.

The history of pearling is ripe for declensionist narratives, a genre which – despite several warnings to the contrary – continues to characterise much of environmental and fisheries history. [19] By the 1930s, the market in 'natural' pearls, that is, pearls occurring randomly in wild oysters at sea, was eclipsed entirely by cheaper 'cultured' pearls supplied from Japan (see *Conclusion*). This process relied on the insertion of foreign nuclei into purpose-reared oysters to stimulate pearl production-to-order. [20] The oyster was domesticated, and, in the process, the nature of pearling labour transformed. [21]

This means that the five decades covered by this dissertation were the last great gasp of the natural pearl beds in the Indian Ocean, and the height of their commercial and scientific exploitation. Blending colonial, scientific, and local material, I make two distinct but related claims about the nature of human engagement with the shallow continental shelf of the Indian Ocean at this period. First, rather than read this as an inevitable period of decline, I argue that the late nineteenth and early twentieth century represented a high point of the extension of empire into these tropical, reef-rich sites and oyster and submarine lifeworlds. The result of this imperial oversight coupled with the global pearl boom was an increased *visibility* of the Indian Ocean's seafloor and reefs in political, legal, and ecological terms. Visibility, generated through pearl divers' labour, was required to create value and to safeguard it in legal terms, although oysters' patterns of mobility and life often unsettled attempts to hold the sea and its material stable.

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[19] Joachim Radkau, *Nature and Power: A Global History of the Environment* (Cambridge: Cambridge University Press, 2008), 4.
[20] Shohei Shirai, *The Story of Pearls* (Tokyo: Japan Publications, 1970).
[21] Kiyohito Nagai, 'A History of the Cultured Pearl Industry,' *Zoological Science* 30, no. 10 (October 2013): 783–93, https://doi.org/10.2108/zsj.30.783; Kjell D. Ericson, 'Judging the *Perle Japonaise*: The Techno-Legal Separation of Culture from Nature in 1920's Paris,' *Technology and Culture* 62, no. 4 (October 2021): 1032-1062.

Achieving this visibility of the ocean floor and its creatures was contingent on the embodied work of pearl divers who reached the ocean floor and translated what they found and encountered across beings, language, and terrain. These experiences translating the seafloor were filtered from local littoral peoples into colonial oyster science and imperial cartography, and finally also extended to the individual oyster, in an attempt by colonial authorities and capitalists to transform the oyster into a compliant agent of capitalism. Although these attempts to domesticate the oyster (and human labourers) in the Indian Ocean ultimately failed, the afterlife of these interfaces between society and the sea continue to shape the contemporary pearl trade, and indeed, the ocean as we know and engage with it today.[22] I return to these two core concepts of *visibility* and *translation* and their link to value in each chapter, bringing them together in the conclusion.

Histories below the Water Line

This dissertation does not follow the pearls once they leave the sea. Writing an environmental history around saltwater oysters using pearls would be akin to writing a history of whaling using streetlights in New England or corsets in London. Instead, focused on marine extraction, this is a history that is situated firmly in the ocean and on its coasts. The project reaches towards a historical account of human engagements with submarine environments which is attentive not only to patterns of trade and commerce but also to the depletion of communities of oysters, as well as to sharks, whales, other molluscs, seaweed, microbial parasites and other living and material objects and beings in the ocean.

[22] Scholarship on domestication at sea is more sparse compared to on land, but for one example see Marianne Lien, 'Domestication "Downunder": Atlantic Salmon Farming in Tasmania,' in *Where the Wild Things Are Now: Domestication Reconsidered*, eds. Rebecca Cassidy and Molly Mullin (Oxford: Berg, 2007), 205–28.

Before we proceed then, a word on terrain and methodology is in order. The transition from writing about pearls to studying pearling itself involves a shift from the terrestrial to the marine. Almost all pearls are experienced and encountered on *terra firma,* but their origins, the pearl-bearing oysters, are oceanic (several other oysters, it should be pointed out, are also riverine, so an account of pearl fishing in Scotland or Mississippi, for example, would concern itself with rivers, not with the ocean). Once they are fished up from the seabed and extracted from within the flesh and shells of once-living oysters, wild pearls, 'perfected by nature', display immense variability in size, shape, colour, and lustre, as I described in the opening paragraphs. [23] Owing to this diversity, pearls required *translation* of their qualia into units of value to enable trade and commerce. [24] Put simply, the *visibility* of pearls on land rendered the commodity legible for trade. [25]

But to obtain pearls, there had to be oysters. And in the nineteenth and early twentieth century, the majority of these bivalves lived in the sea, a space that humans did not permanently, or easily, inhabit. [26] This notion of terrain is central to this dissertation. From a human perspective, especially that of the state, colonial agents, or capitalists, compared to the visibility of the pearl on land, the pearl-bearing oyster on the seafloor was twice obscured. First, by the medium of the ocean – not directly accessible to most humans –, and second, by the fact that even on the ocean floor, a

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[23] Kunz, *Book of the Pearl,* 1.

[24] The *chau* in the Persian Gulf and the *chevu* in the Gulf of Mannar involved complex computations across pearl size, weight, lustre, and shape to determine their value: for the early modern Caribbean, see Warsh, *American Baroque*, 59; Persian Gulf, see Carter, *Sea of Pearls*, Appendix 1, 287-308; Gulf of Mannar, see Senthil Babu and M.V. Prakash, eds. *Muttukkanakku* (Puducherry: French Institute of Pondicherry, forthcoming). I am grateful to the anonymous reviewer at *CSSH* for this insight on terrain, visibility, and value.

[25] On the role of the *chau* unit in standardizing value, see Fahad Bishara and Hollian Wint, 'Into the bazaar: Indian Ocean vernaculars in the age of global capitalism,' *Journal of Global History* 16, no. 1 (March 2021): 57-58.

[26] Visibility underwater see also John Childs, 'Extraction in Four Dimensions: Time, Space and the Emerging Geo(-) politics of Deep-Sea Mining' *Geopolitics*, 25, no. 1 (June 2018): 189-213.

closed oyster might carry zero or several dozen pearls within it. Seeing like a state was harder at sea.

This occlusion of the substance and substrate of the sea in the eyes of the state or capitalists stands in contrast to divers and other seafaring men, who lived along and with the sea every day and had, as we will see in Chapters 2, 3, and 5, a host of ways of reading the seascape. As their work diving for pearls in the nineteenth century met increasingly racialized notions of European science, immersing the body underwater became a distinctly racialised activity. One outcome of the increased visibility of the ocean during this period was that the sea became a space where race was experienced and constructed.

Here it is important to situate this work in relation to critical ocean studies and oceanic history more broadly: what does writing from the ocean mean as/for historical method? Although humanities scholarship was once adamantly or implicitly wedded to the terrestrial, a cursory survey today reveals how by contrast, the ocean is, if not central to scholarly endeavour, then at least highly conspicuous.[27] The ocean is, by turns and by discipline, an actor, a zone of critical inquiry or poetics, a space to be theorized and a site for human history and geopolitics.[28] The 'blue humanities' are gaining traction, ocean-themed groups receive major grant funding, and critical-ocean-studies framings proliferate across media studies, literature, anthropology, and geography.

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[27] Steve Mentz, 'Blue Humanities,' in *Posthuman Glossary,* eds. Rosi Braidotti and Maria Hlavajova (London: Bloomsbury Academic, 2018), 69-72.

[28] A small sample includes: Astrida Neimanis, *Bodies of Water: Posthumanist Feminist Phenomenology* (London: Bloomsbury Academic, 2017); Christina Sharpe, *In the Wake: On Blackness And Being* (Durham, NC: Duke University Press, 2016); Elizabeth DeLoughrey, 'Submarine Futures of the Anthropocene,' *Comparative Literature* 69, no. 1 (March 2017): 32–44, https://doi.org/10.1215/00104124-3794589; Melody Jue, *Wild Blue Media: Thinking Through Seawater* (Durham, NC: Duke University Press, 2020); Stacey Alaimo, 'The Anthropocene at Sea: Temporality, paradox, compression' in *Routledge Companion to Environmental Humanities*, eds., Jon Christensen, Michelle Niemann and Ursela Heise (London: Routledge, 2017), 153-162; Stefan Helmreich, 'Nature/Culture/Seawater,' *American Anthropologist* 113, no. 1 (February 2011): 132–44, https://doi.org/10.1111/j.1548-1433.2010.01311.x; Sujit Sivasundaram, *Waves Across the South: A New History of Revolution and Empire* (London: Harper Collins, 2020).

Despite this vogue for 'ocean thinking,' not all fields have been equally receptive to the new emphasis on the materiality of the oceans. This dissertation sits within the burgeoning field of Indian Ocean histories. Yet ironically, given its name, the field of Indian Ocean history has remained largely anthropocentric, although approaching pearling through the history of science, where the archive contains much information on the ocean's material, and creatures, offers a chance to partly address this gap. In the preceding two decades, oceanic history has fully come into its own. The 'oceanic turn' has offered (and to a large extent, delivered upon) the promise of breaking down regional or nation-centric studies, foregrounding connection and movement across spaces that were culturally, economically, or socially cohesive. [29]

Indian Ocean Studies was inaugurated in the 1970s with a series of monographs on economic history related to the largely peaceful, long-distance, monsoon-dependent patterns of trade which connected sites and persons across the ocean. [30] The field continues to grow in exciting new directions. [31] Although economic history retains its place, new work has broadened the field to include law, labour, convicts, pirates, ideas of revolution, and religious and political experience across the waters. [32] Historians today can appraise a historic Indian Ocean that was not just a zone united by trade but also one knit together by sacred geographies of Islam and Buddhism, undergirded by the labour of thousands of indentured Indian workers or enslaved people, linked by

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[29] David Armitage, Alison Bashford, and Sujit Sivasundaram, eds., *Oceanic Histories* (Cambridge: Cambridge University Press, 2018).
[30] Edward A. Alpers, *The Indian Ocean in World History* (New York: Oxford University Press, 2014); K.N. Chaudhuri, *Trade and Civilisation in the Indian Ocean: An Economic History from the Rise of Islam to 1750* (Cambridge: Cambridge University Press, 1985); M. N. Pearson, 'Littoral Society: The Concept and the Problems,' *Journal of World History* 17, no. 4 (October 2006): 353–73, https://doi.org/10.1353/jwh.2006.0059; Sugata Bose, *A Hundred Horizons the Indian Ocean in the Age of Global Empire* (Cambridge: Harvard University Press, 2006); Sivasundaram, 'The Indian Ocean,' in Armitage, Bashford and Sivasundaram eds., *Oceanic Histories*.
[31] *The Indian Ocean World: Taking Stock, Looking Ahead,* (Papers presented at Annual Indian Ocean World Conference, Online, January 28-30), https://iowconference.org/.
[32] Ibid.; See also Smriti Srinivas, Bettina Ng'weno, and Neelima Jeychandran, eds., *Reimagining Indian Ocean Worlds* (Oxford: Routledge, 2020).

diasporic groups with vernacular codes of belief, and glued together by legal frameworks, religious 'universalisms', or, later in the twentieth century, by transnational anti-colonial movements. While the large landmasses around the ocean supplied traders, religious movements and other goods, smaller islands across the waters became colonial laboratories, heterogenous social experiments, sites of revolution, and penal or plantation colonies.

And yet, for a field that is ostensibly preoccupied with oceans, the material ocean itself and its other living beings have remained notably absent from historical accounts. Although the monsoon is widely credited with being the predominant structural force of the Indian Ocean before the first steamship voyages (and, indeed, even after, in terms of the impact of seasonal rains on farming and food supply), is largely taken for granted as a passive backdrop, with little change over time. [33] In turn, the sea itself is often presented as timeless and ahistorical, functioning primarily as a flat surface over which pilgrims, traders, sailors, statesmen and labourers move laterally. There is little sense of other life below the waves or the significance of these other creatures to those who inhabited the coastal littorals and seabed of the Indian Ocean. This dissertation asks what would happen if we approached the Indian Ocean through its ecological and material parameters instead. [34] What if humans, and their structures of labour and law, were read as part of, rather than separate from, ecology and terrain?

If Indian Ocean histories have not, to date, matched their Pacific or Atlantic counterparts for their (still tentative) attempts to bring the non-human into oceanic

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[33] For an exception see Sunil Amrith, *Unruly Waters: How Mountain Rivers and Monsoons Have Shaped South Asia's History* (London: Allen Lane, 2018).
[34] Indian Ocean as a 'maritime space defined…by its distinctive ecologies,' see Machado, Mullins and Christensen, eds., *Pearls, People and Power,* 3.

history, there are now signs of change.[35] Intimations of this are evident in Isabel Hofmeyr and Charne Lavery's recent suggestion that Indian Ocean studies might move past 'surface histories' to delve 'below the water line,' and indeed, below the seafloor itself, in cases such as deep-sea mining.[36] Alternately, scholars working on empire in and across the ocean might follow Renisa Mawani and Antoinette Burton's recent insistence that the British Empire (like other empires across time and space) was a thoroughly 'multi-species enterprise' which was 'entangled with animal life at every possible scale,' including in the oceans.[37] Others may point to the recent volume edited by Gwyn Campbell, Martha Chaiklin and Philip Gooding which makes the case that many of the Indian Ocean's trade histories also pertain to animal lives and animal products, although the volume stops short of adopting interdisciplinary or multispecies methods, staying within the well-trodden field of economic and commodity history instead.[38]

The pearl-bearing reef and its use by humans offers instead a closer view to changing ecosystems, exhausted reefs, climatic, tidal, and seasonal change, both above and below the waves. These changes were inseparable from human activity, whether law making, labour movements or urban settlement. An important contention of my

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[35] Ryan Tucker Jones, 'Running into Whales: The History of the North Pacific from below the Waves,' *The American Historical Review* 118, no. 2 (April 2013): 349–77; Armitage, Bashford, and Sivasundaram eds., *Oceanic Histories*, 8, 13.

[36] Isabel Hofmeyr and Charne Lavery, 'Exploring the Indian Ocean as a Rich Archive of History – above and below the Water Line,' *The Conversation*, last modified June 7, 2020, https://theconversation.com/exploring-the-indian-ocean-as-a-rich-archive-of-history-above-and-below-the-water-line-133817.

[37] Antoinette Burton and Renisa Mawani, *Animalia: An Anti-Imperial Bestiary for Our Times* (Durham, NC: Duke University Press Books, 2020), 1. Rohan Deb Roy's work on the non-human in the context of the British Empire pre-dates *Animalia* and uses actor-network theory and animal studies to the context of the British Empire. See Rohan Deb Roy, *Malarial Subjects: Empire, Medicine and Nonhumans in British India, 1820–1909* (Cambridge, United Kingdom: Cambridge University Press, 2017); or, more recently, idem., 'White Ants, Empire, and Entomo-Politics in South Asia,' *The Historical Journal* 63, no. 2 (October 2019): 1–26, https://doi.org/10.1017/S0018246X19000281. See also Jonathan Saha, *Colonizing Animals: Interspecies Empire in Myanmar* (Cambridge: Cambridge University Press, 2022).

[38] Campbell, Chaiklin and Gooding, *Animal Trade Histories in the Indian Ocean World*; Ostroff, 'Can the Oyster Speak?'

dissertation is that the space below the waves was, in addition to being turbulently material, also, like many other terrains, 'always already inhabited.' [39] And, furthermore, that historical archives can help us approach these questions and actors in the past. In each of the following chapters I take seriously the claim that oysters, oyster reefs and oceanic parameters shaped human arrangements and vice versa.

This is also in keeping with the new attention to materiality and water in studies of South Asia in particular. [40] Consider Debjani Bhattacharyya's recent attempt to put law and ecology in dialogue in the watery, marshy landscape of colonial Calcutta. In her narrative, this terrain is a layered space of affective ties, dynamic and 'dense spaces of habitation,' which, crucially, interrupt and intrude into the colonial archive. [41] Here the implication for method is that we might read the materiality of space through archives; space encompasses a 'multitude of inhabited worlds: rational, natural, and spiritual' and creative readings of archival sources allow the historian to approach space in these multidimensional, material, multispecies ways. [42] Might we read plural seascapes and encounters with the ocean in similar fashion?

In the case of the seascapes considered here, imperial cartography, legal protections, and the regulation of migration, aimed to fix in space and time the fluid, seasonal, oceanic ecologies, and cyclical migrations of seagoing people and other creatures, although not altogether successfully. The story told here is still, largely, a history of failure. To approach phenomena below the water line, I borrow methods from labour history, environmental history, and history of science. This layering of sources

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[39] Rachel Squire, 'Where theories of terrain might land: Towards "pluriversal" engagements with terrain,' *Dialogues in Human Geography* 11, no. 2 (2021): 210.
[40] Sivasundaram, 'Review Essay: Debjani Bhattacharyya. Empire and Ecology in the Bengal Delta: The Making of Calcutta; Sudipta Sen. Ganges: The Many Pasts of an Indian River; Sunil Amrith. Unruly Waters: How Rains, Rivers, Coasts, and Seas Have Shaped Asia's History,' *The American Historical Review* 126, no. 1 (March 2021): 237–41, https://doi.org/10.1093/ahr/rhab057.
[41] Debjani Bhattacharyya, *Empire and Ecology in the Bengal Delta: The Making of Calcutta* (Cambridge: Cambridge University Press, 2018), 9, 4.
[42] Bhattacharyya, *Empire and Ecology,* 12.

pertaining to labour, law, science, animals, and colonial governance allows a new reading of the history of oceans to emerge.[43] Reading my archives, I see agency not as a pre-determined given, but as one that emerges relationally out of the 'dynamism of forces' between people, things, beings, and knowledge in the world.[44] Pearling and the historic construction of spaces of marine extraction involved a process of mutually coevolving seascapes. We can begin then with the tools that historians already have on hand to write about forests, fields, and mountains – in other words, with environmental history.

Environmental History & the Sea

Environmental historians of South Asia and the Middle East (like their counterparts elsewhere) have both been strongly wedded to the terrestrial.[45] In its early iterations in South Asia, environmental history shared much with peasant and agrarian studies, as well as with the subaltern studies movement, which aimed to illustrate histories from below, rather than from the perspective of the state or nation.[46] Scholarship focused on competing claims made over resources, focused on conflict-

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[43] To think about the behaviour of actors at and in the sea, I follow Barad, reading the agency of objects and beings emerging through 'intra-actions.' Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* (Durham, NC: Duke University Press, 2007), 33-34.

[44] Ibid.

[45] There is no engagement with the oceans in David Arnold and Ramachandra Guha, eds., *Nature, Culture, Imperialism: Essays on the Environmental History of South Asia*, new edition (Oxford: Oxford University Press India, 1997); There is only one essay concerned with the oceans in Richard H. Grove, Vinita Damodaran, and Satpal Sangwan, eds., *Nature and the Orient: The Environmental History of South and Southeast Asia* (Delhi ; New York: Oxford University Press, 1998). In the Middle East the focus has been on agriculture, pastoralism and oil. See Alan Mikhail, ed. *Water on Sand: The Environmental History of the Middle East* (New York: Oxford University Press, 2012); Jeff Albert, Magnus Bernhardsson and Roger Kenna, eds. *Transformations of Middle Eastern Natural Environments: Legacies and Lessons* (New Haven: Yale University Press, 1998); Izzat H. Feidi, 'Fisheries Development in the Arab World,' *Tale Forestry and Environmental Science Bulletin* 103 (1997): 388-406; Sam White, 'Middle East Environmental History: Ideas from an Emerging Field,' *World History Connected* 8, no. 2 (2011); For an exception see V. P. Hightower, 'Pearls and the Southern Persian/Arabian Gulf: A Lesson in Sustainability,' *Environmental History* 18, no. 1 (January 2013): 44–59, https://doi.org/10.1093/envhis/ems113.

[46] Ramachanda Guha, *The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya* (Delhi: Oxford University Press, 1989).

models which pit peasants against the state, for instance.[47] Fields and forests were central; this was determined based on their perceived relevance to human lifeworlds (and presumed outsize archival traces as a result), whereas the oceans were not considered a place where sustained human interaction took place.

In a 1996 review (which describes South Asian environmental history as being in its 'adolescence') David Arnold and Ramachandra Guha wrote that the importance of the ocean paled compared to rivers, because 'maritime trade and contacts have been of only secondary, if not marginal, significance, at least until the opening of the European age.'[48] Of course, long before Europeans entered the Indian Ocean, Moken sea people in Southern Burma, Tamil parava in the Gulf of Mannar and sailors in the Persian Gulf were plying the waters and engaging with oceanic environments. The notion that the oceans are not a considerable space of human engagement – of little 'significance' as in the quote above – signals, more than anything, the ongoing marginalisation of fishers' histories in state, civilizational or historical narratives, a topic that I return to in the next section.[49]

Another complementary body of scholarship we might consider here is the literature on empire and environment.[50] It is certainly no longer true that historians of British rule are overwhelmingly focused on the social and political consequences of

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[47] Mahesh Rangarajan and K. Sivaramakrishnan, *Shifting Ground: People, Animals, and Mobility in India's Environmental History* (New Delhi: Oxford University Press, 2014), 7-8.
[48] Arnold and Guha, 'Introduction: Themes and Issues in the Environmental History of South Asia' in *Nature, Culture, Imperialism*, 11.
[49] I use the neutral term 'fisher' rather than 'fisherman' throughout this dissertation so as not to naturalize a gendered reading of the term. This is established practice in maritime and fisheries histories, although it may sound awkward to others. After all, 'We don't call 'em farmermen or minermen or loggermen,' qtd. in Joshua L. Reid, *The Sea Is My Country: The Maritime World of the Makahs* (New Haven: Yale University Press, 2015), xv-xvi.
[50] For regions located outside of Europe and North America, environmental history initially concerned itself primarily with the impact of colonialism on the natural world, with older scholarship perceiving it to be a particularly aggressive break. the narrative arc of *Raubwirtschaft* (plunder economy) runs through most of these studies. Guha, *The Unquiet Woods*; Arnold and Guha, eds., *Nature, Culture, Imperialism*; Damodaran, Grove and Sangwan, eds., *Nature and the Orient.*

empire at the expense of the environmental. As William Beinart and Lotte Hughes write in the environment-themed companion volume to the *Oxford History of the British Empire,* 'European imperialism was also inseparable from the history of global environmental change.' [51] Scholars of South Asia especially have been sensitive to this rupture. Despite this, the take-up of environmental history across South and Southeast Asia is uneven: the scholarship on environment and history in Sri Lanka is still vastly underdeveloped compared to India, or even the Middle East (although the Persian Gulf is very much the neglected sibling within Middle Eastern Studies more generally). [52]

Despite their relative omission from environmental history, fisheries have loomed large in anthropological and development literature, both in South Asia and in the Persian Gulf region. [53] In fact, it is perhaps only the outsize threat that climate change poses to the Indian Ocean's littorals that has shifted scholarly attention somewhat more towards the sea and coastal environments, at least in the Bay of Bengal.

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[51] William Beinart and Lotte Hughes, *Environment and Empire* in *The Oxford History of the British Empire: Companion Series,* ed. Roger Louis (Oxford: Oxford University Press, 2007), 1. Other scholars have provided intellectual histories of the environment, best encapsulated in Richard Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism 1600-1860* (Cambridge: Cambridge University Press, 1995) and Richard Drayon, *Nature's Government: Science, Imperial Britain and the "Improvement" of the World* (New Haven: Yale University Press, 2000); Focused studies of colonised spaces have helped re-think naturalised categories such as race, animal, nature, environment, ecology, and sustainability, see Aaron Skabelund, 'Animals and Imperialism: recent historiographical trends,' *History Compass* 11, no. 10 (October 2013): 801-807; Jonathan Saha, *Colonizing Animals*; Peder Anker, *Imperial Ecology: Environmental Order in the British Empire, 1895-1945* (Cambridge, MA: Harvard University Press, 2002); Philip Armstrong, 'The postcolonial animal,' *Animals and Society* 10, no 4. (2002): 413-419; Timothy Barnard, *Imperial Creatures: Humans and Other Animals in Colonial Singapore, 1819-1942* (Singapore: NUS Press, 2019).

[52] Fahad A. Bishara, 'Ships Passing in the Night? Reflections on the Middle East in the Indian Ocean,' *International Journal of Middle East Studies* 48, no. 04 (November 2016): 758–62, https://doi.org/10.1017/S0020743816000891.

[53] Contemporary anthropology, see Ajantha Subramanian, *Shorelines: Space and Rights in South India* (Stanford: Stanford University Press, 2009); Dionisius A. Agius et al., 'Remembering the Sea: Personal and Communal Recollections of Maritime Life in Jizan and the Farasan Islands, Saudi Arabia,' *Journal of Maritime Archaeology* 11, no. 2 (June 2016): 127–77; Jessica S Lehman, 'Relating to the Sea: Enlivening the Ocean as an Actor in Eastern Sri Lanka,' *Environment and Planning D: Society and Space* 31, no. 3 (June 2013): 485–501, https://doi.org/10.1068/d24010; Maarten Bavinck, *Marine Resource Management: Conflict and Regulation in the Fisheries of the Coromandel Coast* (New York: SAGE Publications, 2001); Rapti Siriwardane-de Zoysa, *Fishing, Mobility and Settlerhood: Coastal Socialities in Postwar Sri Lanka* (New York: Springer International Publishing, 2018); R. L. Stirrat, *On the Beach: Fishermen Fisherwives and Fishtraders in Post Colonia Lanka* (New Delhi: South Asia Books, 1988).

This dissertation is not a study in development, but rather offers a pre-history to some of these pressing contemporary concerns about the ocean. In their perceptions of the oceans as marginal to the forces of history, South Asian and Middle Eastern environmental history stands as a contrast to the North Atlantic world, where fish stocks run through even the earliest accounts of colonisation, settlement, and historic lifeworlds on the north-eastern seaboard. Jeffery Bolster's pathbreaking work in marine environmental history in particular has meant that historians are well versed in the fact that the North Atlantic Ocean 'rather than simply serving the narrative purpose of separating the Old World from the New, was … a player in the historical drama.' [54]

In North America, cod, herring, and salmon feature regularly as central protagonists in marine environmental histories, which continue to grow in new directions, especially beyond charismatic mammals and also beyond the 'Age of Discovery.' [55] One aim of this dissertation, therefore, is to shift the focus onto oceans and species outside of the Global North, and to bring the ocean and its creatures more into dialogue with the emerging literature in animal studies across South Asia and Southeast Asia. [56]

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[54] Jeffrey W. Bolster, *The Mortal Sea: Fishing the Atlantic in the Age of Sail* (Cambridge, MA: Harvard University Press, 2014), 3; Bolster., 'Opportunities in Marine Environmental History,' *Environmental History* 11, no. 3 (2006): 567–97; Bolster, 'Putting the Ocean in Atlantic History: Maritime Communities and Marine Ecology in the Northwest Atlantic, 1500-1800,' *The American Historical Review* 113, no. 1 (2008): 19–47.

[55] Arthur F. McEvoy, *The Fisherman's Problem: Ecology and Law in the California Fisheries, 1850–1980* (Cambridge University Press, October 1986); Frederick Rowe Davis, *The Man Who Saved Sea Turtles: Archie Carr and the Origins of Conservation Biology* (Oxford: Oxford University Press, 2012); Harold A. Innis, *Cod Fisheries: The History of an International Economy* (New Haven: Yale University Press, 1940); Joseph E. Taylor, *Making Salmon: An Environmental History of the Northwest Fisheries Crisis* (Seattle: University of Washington Press, 2015); Mark Kurlansky, *Cod: A Biography of the Fish that Changed the World* (New York: Putnam's, 1997); Matthew McKenzie, *Clearing the Coast*; Idem., *Breaking the Banks: Representing and Realities in the New England Fisheries 1866-1966* (Boston: University of Massachusetts Press, 2018).

[56] Anthropologists especially have worked to highlight the role of the non-human, including dogs, tigers, bears and other creatures in their narratives, see Nayanika Mathur, *Paper Tiger: Law, Bureaucracy and the Developmental State in Himalayan India* (Cambridge: Cambridge University Press, 2015); Radhika Govindrajan, *Animal Intimacies: Interspecies Relatedness in India's Central Himalayas* (Chicago: University of Chicago Press, 2018); Rangarajan and Sivaramakrishnan, *Shifting Ground*, 18. On the general geographic coverage of environmental history, see Sverker Sörlin and Paul

Early work in fisheries history was closer to political economy than to environmental history. Oysters, like fish and other living creatures, are renewable but not inexhaustible. Fisheries history therefore asked how legislation regulated harvest, and how different actors negotiated and shaped these matrices.[57] As a result, these accounts often have a fixed set of preoccupations: establishing baseline populations, approximating stock size and assessing relative depletion.[58] These studies tend towards the managerial and resource-centric.[59] Of course, as several scholars have pointed out, models based on acultural, ahistorical abstractions work poorly for both oyster stocks and fishers: whether the caste *panchayat* [meeting] of Tamil fisherfolk in South India, or the whalers' New Bedford inn, fishers had ways of thinking through (often socially) their behaviour at sea. While I take from fisheries history an eagerness for yield data, for traces of other creatures and climate patterns, as well as the environmental impacts of human activity at sea, this dissertation is broader than a lesson in resource management – although some scholars have certainly chosen to read the historic pearl fisheries in this way.[60]

Searching archives for fishery data yields different results based on the political context of each fishery. In Ceylon and Burma, state-level authorities collected data on

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Warde, 'The Problem of the Problem of Environmental History: A Re-Reading of the Field,' *Environmental History* 12 (January 2007): 107–30, https://doi.org/10.1093/envhis/12.1.107.

[57] Unlike terrestrial environmental history, interest in the history of fisheries has come also from marine scientists, fishery managers and policy makers in addition to historians. Jeremy B.C. Jackson et al., 'Historical Overfishing and the Recent Collapse of Coastal Ecosystems,' *Science* 293 (July 2001): 629-637; For a review of how these trends bear upon environmental history, see Lance Van Sittert, 'The Other Seven Tenths,' *Environmental History* 10, no. 1 (January 2005): 106-109.

[58] For two more critical overviews of how these fields developed see Carmel Finley, *All the Fish in the Sea: Maximum Sustainable Yield and The Failure of Fisheries Management* (Chicago: University of Chicago Press, 2011); Jennifer Hubbard, *A Science on the Scales: The Rise of Canadian Atlantic Fisheries Biology 1898-1939* (Toronto: University of Toronto Press, 2006).

[59] They also often espouse one set of values (the oceans as unpeopled and fish as economic resources). Lisa M. Campbell, Noella J. Gray, Elliott L. Hanzen and Janna M. Shackeroff, 'Beyond Baselines: Rethinking Priorities for Ocean Conservation' *Ecology and Society* 14, no. 1: 14.

[60] Two resource-management approaches to pearling, see Hightower, 'Pearls and the Southern Arabian Gulf'; Subrahmanyam, 'Noble Harvest.' For a critique of marine historical ecology, see Tamara Fernando, 'Ecology's Ghosts,' *Hypocrite Reader* 97 (April 2021), https://hypocritereader.com/97/ecologys-ghosts.

the number of oysters fished, and the weight of pearl-oyster shell exported, respectively. These were directly managed colonies, reporting to Rangoon as part of British India or to the colonial government of Ceylon in Colombo. In the Burmese case, the state generated revenue from the sale of diving pump licenses and export duties, and in the Ceylon case, from the sale of oysters. The resulting data on catch of oysters or weight of shell is therefore preserved in state-level archives, and it has been possible for me to plot this data year-on-year to reveal trends. By contrast, in the dispersed world of the Persian Gulf, the development and emergence of the state took place far later than Ceylon or Burma. [61]

This absence of an entrenched state bureaucracy in the Persian Gulf has bearings on the history narrated here. For instance, there was no centralised repository for the number of oysters fished, which was dispersed across a number of boats who each had individual transactions with multiple pearl merchants and buyers. British agents stationed in this western frontier acted as enforcers of informal empire. [62] While they had access to total trade revenue statistics, they had little sense of the weight of each boat's haul, which private captains dispensed, paying a fee to their regional emir. Making an approximation of the numbers of oysters which were fished from the seafloor from these rupee or pound values in the Persian Gulf is not straightforward. Thus, it is in Ceylon, where state penetration was deepest and most thoroughgoing, where we get the clearest picture for environmental change at sea.

A final point to make which links environmental history to the next section on labour history is that fisheries histories in both the North Atlantic and Pacific worlds

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[61] These is voluminous literature on the Gulf state. See fn. 110 below.

[62] James Onley, *The Arabian Frontier of the British Raj: Merchants, Rulers, and the British in the Nineteenth-Century Gulf* (London: Oxford University Press, 2007); Onley, 'The Raj Reconsidered: British India's Informal Empire and Spheres of Influence in Asia and Africa,' *Asian Affairs* 40, no. 1 (March 2009): 44–62, https://doi.org/10.1080/03068370802658666.

tend to follow a standard arc of North American industrialization; technological ruptures push the fishing frontier further out and lead to increasing desecration of fish stocks.[63] In contrast, this dissertation makes the case that the late nineteenth-century intensification of pearling was not caused by new technologies such as the dredge or deep-sea fishing, but rather through an increase in labour force.

This reveals a different picture of fisheries intensification that was labour-intensive, rather than technologically driven, and is in keeping with new histories of capitalism outside of the west.[64] The standard technological antagonists of the stories of human exploitation of the oceans – steam and diesel, beam trawls, deep sea fishing – do not apply in the case of the historic pearl beds. Even during the Great Pearl Boom, it was human bodies that were the most effective instruments for removal of oysters. Thus it is to the diver and his work that we turn next.

The History of Divers

The successful domestication of the oyster transformed the nature of work. But as long as oysters remained at sea, divers were an indispensable part of the industry. Those who were employed as pearl divers across the Indian Ocean were a heterogenous and overwhelmingly male group, ranging from Bedouin from the Arabian Peninsula, enslaved African men and boys from up the Swahili coast, Tamil and Muslim coastal dwellers from the Coromandel Coast in South India, indigenous boat peoples from the Mergui Archipelago known as the Moken, as well as Japanese, Aruese, Malay and Filipino men. When Kunz, the well-known gem expert working for Tiffany and Company in New York, wrote on the pearl in 1908, he understood imperial pearl

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[63] Fagan, *Fishing*; John G. Butcher, *The Closing of the Frontier: A History of the Marine Fisheries of Southeast Asia c. 1850-2000* (Singapore: Institute of Southeast Asian Studies, 2004).
[64] Andrew B. Liu, 'Production, Circulation, and Accumulation: The Historiographies of Capitalism in China and South Asia,' *The Journal of Asian Studies* 78, no. 4 (November 2019): 767–88, https://doi.org/10.1017/S0021911819000676; Liu, *Tea War: A History of Capitalism in China and India* (New Haven: Yale University Press, 2020).

fisheries as a benefit to these southern regions, rather than exploitative of labourers.[65] But despite Kunz's highlighting the gap between 'the greatest and wealthiest in the world' and the figure he described as the 'half-starved diver of the tropical seas,' the latter has largely been ignored by labour historians.

Pearl diving was a seasonal occupation. Feasibility for diving required suitable water temperatures, gentle currents and low tidal variation, good winds for navigation, the absence of storms, and, of course, ample availability of oysters. The outsize role of the natural environment is evident especially if one plots the major periods of pearl fishing against the meteorological environment of the Indian Ocean since fishing times coincide precisely with the activity of the Asian monsoon. In the Persian Gulf, the *ghaüs-al-Kabir*, or the great dive, took place during the summer months between April and September before the northeast monsoon. On the opposite end of the ocean, in the Mergui Archipelago, diving took place from October to April, before the advance of the rains of the south-west monsoon. In Ceylon, between the Bay of Bengal and the Arabian Sea, diving took place in the interval between the two monsoons, in the relative calm between April and mid-May.

There are no accounts of pearl diving that cut across time and space, which describe this labour as a form of work in its own right, with a distinctive history, culture, social characteristics and ecological impact.[66] This is in part because many accounts of pearl diving labour are individual, regionally demarcated case-studies. But it is also because social histories of diving and the experience of working underwater are harder to access than histories of merchants or states.[67] Many of the communities who practiced diving were not textual. Despite this, they recorded and passed down their

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[65] Kunz, *Book of the Pearl*, 81.
[66] Individual case-studies see Machado, Mullins and Christensen, *Pearls, People, and Power*.
[67] Fernando, 'Seeing like the Sea.'

experiences in songs, stories, oral histories and in the cultural practices and skills of their trade. In Muharaqq, Bahrain, when the ninety-year-old diver Ali Khalifa Ali Hammed Damri was asked to recount his experiences pearling, he merely recited poetry which had been chanted on board the dhow. 'It was through verse that he retained this information, and it was likewise through verse that he was able to share and reproduce it,' the maritime archaeologist Dionisius Agius explains. [68]

Fisherfolk, of course, fare poorly in history, even beyond the pearling industry. Writing on the history of the English Channel in the eighteenth-century, Renaud Morieux makes a case for recovering fishers' actions in history. He explains how fishers tend to become flat archetypes for the projection of national stereotypes: 'the fisherman, at first mainly described as ignorant, vulgar, intemperate, disorderly and lazy, soon came to embody the "national or European version of the good savage,"' or, alternatively, he was the personification of 'an immutable time and space over which upheavals had little hold.' [69] Of late, legal historians especially, such as Morieux and Fahad Bishara have helped foreground fishers and sailors as actors in history, ranging from the Atlantic world to the English Channel and into the Indian Ocean. [70] This dissertation likewise tries to foreground the labourer in this account of pearling.

Predictably, the stereotypes about fishers that Morieux highlights run through the English-language archives from across the Persian Gulf, Ceylon, and Burma: that they are idle, backwards, primitive, given to drink, and helpless. Here the major

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[68] Agius et al., 'Remembering the Sea.'
[69] Renaud Morieux, 'Diplomacy from below and Belonging: Fishermen and Cross-Channel Relations in the Eighteenth Century,' *Past & Present* 202 (February 2009): 113.
[70] Fahad A. Bishara, ''No Country but the Ocean': Reading International Law from the Deck of an Indian Ocean Dhow, ca. 1900,' *Comparative Studies in Society and History* 60, no. 2 (April 2018): 338–66, https://doi.org/10.1017/S0010417518000075. In turn, in marine anthropology, Siriwardena-de Zylwa explains how the 'overwhelmingly resource-centric gaze' of fisheries anthropology risks 'masking a host of nuanced saltwater socialities and relational assemblages implicating both people and the non-human (animals, flows, technologies, organic and inorganic materials, etc.) through richer, more vibrant interspecies worldings.' Zoysa, *Fishing, Mobility and Settlerhood,* 38.

challenge of writing divers into history emerges. For although they inhabited diverse socio-cultural worlds rich with poetic, narrative, and devotional references, the vast majority of divers were not literate – they left us no documents in their own hands and scant few in their own voices.

This fact makes fishers distinct from the conspicuous, mobile individuals who crossed the interconnected world of the Indian Ocean's waters. For although this subfield of history vaunts its focus on the vernacular, more often than not, these are accounts from elites who wrote texts in Persian, Urdu, Gujrati, Arabic, and other languages. These lyrical and intriguing accounts often did not extend to the level of the labourer – to the tea plantation worker, the dock-yard cleaner or the pearl diver. [71] As one historian of Sri Lanka recently appraised: 'historians writing on Sri Lanka's colonial past have rarely focused their attention on the lives and practices of subaltern men and women who did not keep journals or diaries.' [72] Certainly the same critique cannot be levelled at all historians of the Indian Ocean, who have worked hard to recover narratives of slavery, indenture, and imprisonment. Yet with some notable exceptions (Marina Carter and Clare Anderson, for instance), these accounts are often economistic, concerned with charting large-scale patterns of recruitment and industry, rather than individual life histories. [73]

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[71] Sujit Sivasundaram, 'Towards a Critical History of Connection: The Port of Colombo, the Geographical 'Circuit,' and the Visual Politics of New Imperialism, ca. 1880–1914,' *Comparative Studies in Society and History* 59, no. 02 (April 2017): 346–84, https://doi.org/10.1017/S001041751700007X.

[72] Nira Wickramasinghe, *Slave in a Palanquin: Colonial Servitude and Resistance in Sri Lanka* (New York: Columbia University Press, 2020), 9.

[73] Clare Anderson, *Subaltern Lives: Biographies of Colonialism in the Indian Ocean World, 1790–1920* (Cambridge: Cambridge University Press, 2012); Janet J Ewald, 'Crossers of the Sea: Slaves, Freedmen, and Other Migrants in the Northwestern Indian Ocean, c. 1750-1914,' *American Historical Review* 105, no. 1 (February 2000): 69-91; Marina Carter, 'Slavery and Unfree Labour in the Indian Ocean,' *History Compass* 4, no. 5 (September 2006): 800–813, https://doi.org/10.1111/j.1478-0542.2006.00346.x; Richard B. Allen, 'The Mascarene Slave-Trade and Labour Migration in the Indian Ocean during the Eighteenth and Nineteenth Centuries,' *Slavery & Abolition* 24, no. 2 (August 2003): 33–50, https://doi.org/10.1080/01440390308559154; Allen, 'Licentious and Unbridled Proceedings: The Illegal Slave Trade to Mauritius and the Seychelles during the Early Nineteenth Century,' *The Journal of African History* 42, no. 1 (April 2001): 91–116; William Gervase Clarence-

The history of pearl diving ostensibly fits with a specific subfield of labour history: that of maritime labour. Maritime work in general was a late entrant to the ambit of labour history.[74] Sailors, 'lascars,' and enslaved persons, to name but a few, were mobile and crossed vast distances; as a result, they often fell outside of electoral politics, urban spaces and factory-based unions which were the favoured purview of labour historians.[75] Within the last decades, scholars of the Atlantic world especially have taken up the challenge of returning maritime labour and work at sea to the academy.[76] Matthew Hopper's work on enslaved African divers in the Persian Gulf and Julia Martínez and Adrian Vicker's study of Indonesian labourers in northern Australia are two notable and excellent examples here of individual life-histories of pearl divers embedded into larger stories of trade, globalisation and citizenship.[77]

And yet, for the most part, many excellent works of maritime labour remain 'above deck' – they are 'dry' in the sense that they do not descend underwater, nor explore fully how human histories of labour intersect with the domain below the waves and its non-human occupants, with the exception of whaling histories. In fact, owing to pearling's seasonality and contingency on oyster stocks, it is perhaps from agrarian

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Smith, *The Economics of the Indian Ocean Slave Trade in the Nineteenth Century*, (London: Routledge, 1989).

[74] Matthias van Rossum, 'The Rise of the Asian Sailor' in *Towards a New History of Work,* ed. Sabyasachi Bhattacharya (New Delhi: Tulika Books, 2014), 180.

[75] For classic works of what I am calling 'terrestrial' labour history, see Dipesh Chakrabarty, *Rethinking Working-Class History: Bengal 1890-1940* (New Jersey: Princeton University Press, 1989); Rajnarayan Chandavarkar, *The Origins of Industrial Capitalism in India: Business Strategies and the Working Classes in Bombay, 1900-1940* (Cambridge: Cambridge University Press, 1994); Samita Sen, *Women and Labour in Late Colonial India: The Bengal Jute Industry* (Cambridge: Cambridge University Press, 1999).

[76] Margaret S. Creighton, and Lisa Norling, eds. *Iron Men, Wooden Women: Gender and Seafaring in the Atlantic World, 1700-1920* (Baltimore: Johns Hopkins University Press, 1996); Peter Linebaugh and Marcus Rediker, *Many-Headed Hydra: Sailors, Slaves, Commoners and the Hidden History of the Revolutionary Atlantic* (Boston: Verso Books, 2000); For a South Asian equivalent, see Gopalan Balachandran, *Globalizing Labour?: Indian Seafarers and World Shipping, c. 1870-1945* (Oxford, New York: Oxford University Press, 2012).

[77] Hopper, *Slaves of One Master*; Adrian Vickers and Julia Martínez, *The Pearl Frontier: Indonesian Labor and Indigenous Encounters in Australia's Northern Trading Network* (Hawaii: University of Hawaii Press, 2015).

studies that historians of pearling have most to learn, where the role of the natural environment on the politics and lifeworlds of workers was more direct, rather than urban-centric labour history with its factory-based, mechanical, standardized lines of production, working hours, and structures of oversight and control. [78]

In the following chapters, I read the labour history archive for traces of action(s) taken by pearl divers. Attending to a history of fishers requires compassionate and imaginative readings of preserved archival traces; in Saidiya Hartman's words, these are methodological efforts to 'make visible the production of disposable lives.' [79] It also requires attention to be paid to embodied experience. The majority of pearl divers in the Indian Ocean were free divers. They trained from the time they were young boys and relied on a weighted stone to augment the body's weight and speed up their descent to the ocean floor. Here, they used bare hands to pick up as many oysters as possible and shove these into a coir or rattan bag hung around their waists, necks, or arms. Medical reports have been especially helpful when they allow me a closer insight into embodiment, even if the verbal or textual utterance is missing from the archive. After all, as feminist scholars have reminded us, the body too can be read as archive. Sara Ahmed and Jackie Stacy, for instance, describe how 'skin is already written upon, as well as being open to re-inscription,' calling attention to the 'fleshy interface between bodies and worlds … inter-embodiment, on the mode of being-with and being-for, where one touches and is touched by others.' [80]

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[78] See fn. 75.
[79] Saidiya Hartman, 'Venus in Two Acts,' *Small Axe: A Caribbean Journal of Criticism* 12, no. 2 (June 2008): 1–14, https://doi.org/10.1215/-12-2-1; for an attempt to integrate black feminist scholarship with South Asian studies, see Mark Balmforth, 'In Nāki's Wake: Slavery and Caste Supremacy in the American Ceylon Mission,' *CASTE: A Global Journal on Social Exclusion* 1, no. 1 (February 2020): 155-174.
[80] Sara Ahmed and Jackie Stacey, *Thinking Through the Skin* (Oxford: Routledge, 2001), 1.

When scholars have written about divers, their stories have been rooted in anthropological or political economy-based questions.[81] In this dissertation, I maintain that for the labour historian writing a history of '[t]he sea and those who live with the sea,' the challenge is not to look for the grimacing bourgeoise overseer on a factory floor, but to look also for recalcitrant molluscs, fearsome sharks, helpful forests, and ocean currents.[82] Taking inspiration from the work scholars have done on indentured labour especially, I incorporate oral material such as collections of pearl divers' songs, known as *fjiri* in Arabic, and Tamil and Moken stories and poetry.

As a result, I have not always been able to limit my chronology to the nineteenth century: Tamil poetry which describes cultural associations around sharks and pearls often come to us from the corpus of *cankam* literature, which was at least a thousand years old by the nineteenth century, although several of these narratives continue to circulate in oral form up to the present (see Chapter 4, *Science*). Similarly, many of the Moken tales and songs were collected by anthropologists in the twentieth century (see Chapter 3, *Maps*). Although this approach to oral material pushes the bounds of history's demand for specific empirical dates, I have chosen to incorporate this material because it offers sidelong glimpses into maritime lifeworlds.

From the other end of the relationship of capital to labour, I also draw on records kept by the men or states who supervised and profited off pearling, which I read against the grain for divers' actions. This means that in large part, I have had to read sources written about divers, rather than those authored by them. To some extent, this problem

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[81] Kenneth McPherson, 'Paravas and Portuguese: A Study of Portuguese Strategy and its Impact on an Indian Seafaring Community,' *Mare Liberum* 13 (1997): 69-82; S. B. Kaufmann, 'A Christian Caste in Hindu Society: Religious Leadership and Social Conflict among the Paravas of Southern Tamilnadu,' *Modern Asian Studies* 15, no. 2 (April 1981): 203–34; Idem., *Saints, Goddesses and Kings: Muslims and Christians in South Indian Society, 1700-1900* (Cambridge: Cambridge University Press, 2004); Patrick A. Roche, *Fishermen of the Coromandel: A Social Study of the Paravas of the Coromandel* (Manohar, 1984).

[82] Barbara Watson Andaya, 'Oceans Unbounded: Transversing Asia across 'Area Studies,' *The Journal of Asian Studies* 65, no. 4 (November 2006): 673, https://doi.org/10.1017/S0021911806001550.

applies to all labour histories, and is far from prohibitive in terms of writing accounts of labour movements, solidarity, and action. In fact, there is a quality of friction to the archive: overseers often recorded events when things did not go according to plan. That included when divers did not pay their debts, when they escaped to other territories, and when they refused to work (or to work hard or long enough). So, evidence of strikes, brawls, and refusals to work are, in fact, plentiful in fishery archives. What is harder to access are secret moments of collaboration, joy, discovery, and leisure. I offer some thoughts on recovering these stories as well in the conclusion, but they do not feature centrally in the chapters.

Taken together, we might use these sources to answer Marcus Rediker's call for maritime historians to 'get back to basics, to careful empirical reconstructions of the lifeways of peoples long rendered silent in the writing of history,' and to provide a holistic picture of pearling labour in the Indian Ocean at the turn of the twentieth century. [83] Diving to the seafloor, however, was about reaching oysters, so it is to the history of the oyster that we turn next.

The History of Oysters

Bivalves and other marine creatures are unlikely candidates for the protagonists of posterity. [84] They did not speak in our language(s) and left no written testimonials – perhaps explaining why historians writing on pearl fishing have generally been more concerned with empire, labour, citizenship, fashion, or merchant networks. [85] But these

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[83] Marcus Rediker, 'Towards a people's history of the sea', in *Maritime Empires: British Imperial Maritime Trade in the Nineteenth Century*, eds. David Killingray and Nigel Rigby (London: Boydell Press, 2004), 199.

[84] Attempts to render molluscs 'personable,' see Michael Carrithers, Louise J. Bracken, and Steven Emery, 'Can a Species Be a Person?: A Trope and Its Entanglements in the Anthropocene Era', *Current Anthropology* 52, no. 5 (October 2011): 661-685.

[85] A classic work on ventriloquising for oysters from an actor-network theory perspective, see Michel Callon, 'Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay', in *Power, Action and Belief: A New Sociology of Knowledge?* ed. John Law (London: Routledge, 1986).

human categories always operated within ecologically-circumscribed frames; the question, as for all environmental historians, is not *whether* humans exist in relation to natural history, but instead one of how to access and write the history of this relation. The problem is compounded, as Arthur F. McEvoy put it in his seminal work on fisheries history, by the fact that fish 'neither strike, nor sue, nor vote.' [86]

Rather than seeing the pearl-bearing oyster as a fixed composite of the landscape for capitalist forces to exploit, in this dissertation I try also to animate oysters and other beings underwater who were transformed by the pearling industry. After all, 'animals do *not* naturally become private property, no more than humans "naturally" come to sell their labour,' as Jason Hribal reminds us. [87] In part, the attention to the oyster as an individuated creature comes to us from the archive itself, as the oyster and reef became a subject for colonial science and surveying. The space below the waves was not just inhabited by oysters, however, and other animals, just like humans, are also possessed of the agency to sting, trample, dig, feed, build, harvest, compete, excavate, and thus, transform landscapes. [88]

But how does the historian bring these creatures into her writing? Here I am asking how one writes a history from the sea if, as Graham Burnett puts in his book *Sounding the Whale*, whales and paper are 'immiscible': 'though they breathe air, cetaceans basically like being in the water, while books are written mostly on paper, a substance that fares poorly when submerged.' [89] If dissertations, likewise, cannot be

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[86] McEvoy, *The Fisherman's Problem*, 9.
[87] Jason Hribal, '"Animals Are Part of the Working Class": A Challenge to Labor History,' *Labor History* 44, no. 4 (November 2003): 435–53, https://doi.org/10.1080/0023656032000170069.
[88] Leah M. Gibbs, 'Animal Geographies I: Hearing the Cry and Extending Beyond,' *Progress in Human Geography* 44, no. 4 (August 2020): 769–77, https://doi.org/10.1177/0309132519863483.
[89] Graham D. Burnett, *The Sounding of the Whale: Science and Cetaceans in the Twentieth Century* (Chicago: University of Chicago Press, 2012), 1.

submerged, and oyster reefs or sharks cannot be brought into my chapters, how is the submarine environment to be animated?

Animal studies proponents and detractors alike share the concern that multi-species histories, while fast gaining ground, are fundamentally about representations: ventriloquized traces in language that attest less to animals, and more to humans thinking with, on, or about them.[90] But not all material effects are premised on interlocutors. The ocean has its own chemistry, physics, and biology beyond those that involve humans. As such, the following sections survey available evidence, asking how these histories of trade in the Indian Ocean were built on the lifecycles of molluscs, what Samuel Ostroff has described as 'live actors in a complex formed by interactions between humans, animals and the environment.'[91]

In adopting multispecies approaches to history, it is worth asking, as Stefan Helmreich and Eben Kirksey do in their review article on the same trend in anthropology: what can [multispecies ethnography] do – what is it doing – in history?[92] To answer this question, we can return to the sites of pearl extraction, where nature and other beings were ever-present. Might multispecies methods bring us closer to the historical lifeworlds of maritime actors? For although historians shy away from attributing agency to the natural world, the actors featured in this dissertation felt few such compunctions. Divers described how oysters moved, menstruated, and protected

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[90] Ironically, in the 'animal turn', critiques of anthropocentricity have haunted the very attempt to decentre humans. See, Erica Fudge, 'A left-handed blow: writing the history of animals,' in *Representing Animals,* ed. Nigel Rothfels (Bloomington: Indiana University Press, 2002), 3-18; Hilda Kean, 'Challenges for Historians Writing Animal Human History: What Is Really Enough?', *Anthrozoos* 25 (April 2015): s57-s72; **Iman Jackson Zakiyyah, 'Animal: New Directions in the Theorization of Race and Posthumanism',** *Feminist Studies* **39, no. 3 (2013): 669-685; In anthropology see** Anna Lowenhaupt Tsing, *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins* (New Jersey: Princeton University Press, 2015); **Eduardo Kohn, *How Forests Think: Toward an Anthropology beyond the Human* (Berkeley: University of California Press, 2013)**; Govindrajan, *Animal Intimacies*.

[91] Campbell, Chaiklin and Gooding eds. *Animal Trade Histories*, 71.

[92] S. Eben Kirksey and Stefan Helmreich, 'The Emergence of Multispecies Ethnography,' *Cultural Anthropology* 25, no. 4 (2010): 545–67, https://doi.org/10.1111/j.1548-1360.2010.01069.x.

one another. Overseers wrote about the untrustworthiness of both divers and oysters. Folk ritualists promised divers that sharks felt fear just as other religious arrangements ensured that the god(s) responsible for the oceans could be appeased. The ocean was so violent and stormy that it prevented harvesting for much of the year. One primary way to make oysters and other creatures visible in histories of pearling is through the scientific archive, and its implications in the attempts to domesticate oysters, which I turn to shortly.

The history of pearling is, of course, only one strand in the broader context of human-mollusc engagement.[93] The oyster was a food source in coastal and riverine societies throughout the ancient world. By the early modern period, as the working populations of cities increased, oyster consumption shot up across urban areas.[94] Entanglements of the state and oysters in France and England were pronounced enough by the seventeenth century that some writers have even used oyster management as a litmus test for comparing European statecraft.[95] But despite intersections with the above, pearling departs from the history of oyster cultivation for food in one crucial way: commensurability.

To dive for pearls was to gamble on the sea. The random occurrence of pearls in wild oysters meant that pearling was distinct from other fisheries. In the case of cod, anchovy, bluefin tuna, or edible mussels, the animal itself was the desired commodity:

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[93] In fact, systematic oyster cultivation began not with nacre, that is, oyster shell, but with oyster flesh. The Romans farmed both mussels and oysters between the fifth and second century BCE, see R. Bruce Hitchner, 'More Italy Than Province? Archaeology, Texts, and Culture Change in Roman Provence,' *Transactions of the American Philological Association* 129 (1999): 375–79; Christine Keiner, *The Oyster Question: Scientists, Watermen, and the Maryland Chesapeake Bay since 1880* (Athens, GA.: University of Georgia Press, 2010); M. H. Gervis and Neil Anthony Sims, *The Biology and Culture of Pearl Oysters (Bivalvia Pteriidae)* (London: International Center for Living Aquatic Resources Management, 1992).

[94] English native oysters were such a dietary staple that by the first decades of the nineteenth century, commentators bemoaned how the 'capacious maw of omnivorous London received a hundred and thirty thousand bushels [of oysters] this season.' D. Esdaile, 'Oyster Culture', pamphlet 6249/10, Maharashtra State Archive, Mumbai.

[95] Robert Neild, *The English, The French, and the Oyster* (London: Quiller, 2001).

a harvest of 600 tuna meant that a roughly corresponding number would be sold in the fish market. But in the case of pearling, the commodity (pearls) and animal (oysters) did not correlate in number or quality: that is, several tens of oysters may not yield even a single valuable pearl, while several excellent pearls may, on occasion, arise in a single oyster. Hence the frequently repeated phrase by historical actors that pearling was a gamble or lottery. The ultimate demise of natural pearling was premised on removing this unreliability of the sea. Domesticating the oyster involved a new relation to the terrain of the ocean (see *Conclusion*).

To return to my initial question: how can we write about oysters? Scholars in animal studies and animal ethics have spilt considerable ink pondering the question of charismatic species: the creatures who merit affective responses of identification, protection, and sympathy in humans. [96] On this balance, oysters fare poorly. As a team of anthropologists studying conservation recently concluded: the freshwater mussel, without big eyes or fur, was 'rhetorically disadvantaged.' Mussels, the authors explained, suffered from being referred to mostly as 'inchoate pronouns' which were 'unclear, unformed, and hence, inchoate.' They contrast this indistinguishable multitude from an individuated (if fantastic) figure of Percy the Pearl Mussel, who might stand a greater change of prompting sympathetic human responses. [97]

The question of discourse, meaning, and representation around oysters has a longer legacy which predates Percy. Oysters (or scallops to be more precise) were central to one of the foundational texts in the history of science, an article which helped establish what would later become known as Actor-Network Theory. In his 1984 essay, "Some elements of a sociology of translation," sociologist Michel Callon took as his

[96] Lori Gruen, *Ethics and Animals: An Introduction* (Cambridge: Cambridge University Press, 2021)
[97] Bracken, Carrithers, and Emery, 'Can a Species Be a Person?', 664.

subject the management of scallops in the Bay of St Brieuc. (Long before Latour popularized many of the same arguments) Callon focused on the processes of knowledge generation at each stage of conservation, arguing that management involved translation between various actors including fishers, scientists, and scallops, for instance, in 'establishing their identities and the links between them.' [98]

Callon's seminal text, as well as the insights of the anthropologists working on species as rhetorical tropes, pushes us to think critically about approaches to the study of oysters. In other words, what is the oyster doing in this dissertation; and, in turn, what is this dissertation doing to the oyster?

I approach the oyster by thinking about oysters' lives and pearl-production as work. When I discuss work, I refer both to work as human labour, with all its associated political connotations, but also the work of oysters in producing pearls. This is not a labour history of oysters, but a history that takes oysters' work seriously as material fact and historical event and aims to trace the processes by which humans aimed to bring oyster work in line with other schemes of capital and empire.

Scientists today write and speak easily about molluscs 'building' and coral 'working.' [99] This language is not as new as we might think. As I show in Chapter 4, *Science*, in the nineteenth century, as production was scaled up, imperial authorities took a view which shifted from pearls to oysters and rendered the oyster as an object of science. In the face of declining yield, market competition and seasonal fluctuations, the 'problem' and the promise of oysters' work came to the fore. A labour history of

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[98] Bringing these actants into dialogue allowed Callon to argue (prefiguring many of the arguments that Bruno Latour would later popularize) that 'reality is a process. Like a chemical body it passes through successive states.' Callon, 'Some Elements of a Sociology of Translation,' 8.

[99] Chang-Yu Sun et al., 'Spherulitic Growth of Coral Skeletons and Synthetic Aragonite: Nature's Three-Dimensional Printing,' *ACT Nano* 11, no. 7 (2017): 6612-6622, https://doi-org.ezp.lib.cam.ac.uk/10.1021/acsnano.7b00127.

diving which did not consider the concomitant, albeit different, work of oysters also, would be an incomplete account.

The History of the State

This dissertation is not intended to be a contribution to the comparative history of imperial statecraft or the expansion of the British Empire, themes which have been amply covered by other historians.[100] But, the state does appear across each of the chapters that follow, and differences in governance had important bearings on the extent of underwater visibility to the state. The important point to note here is that the historical development of the state varied. Put in the simplest fashion: pearling in the Persian Gulf preceded the state, in Ceylon it was accompanied by it, and in Burma, it post-dated it. These different trajectories of state-formation affected the narratives that emerge about pearling in the following five chapters.

The pearl-bearing reefs in the Gulf of Mannar were more thoroughly entangled with European empire than any other pearling site in the world, including the Caribbean.[101] Throughout the medieval and early modern periods, local South Indian rulers often assumed control of reefs in the waters directly adjoining their territory, in a similar process to the Persian Gulf.[102] These patterns echoed long-standing forms of domain, tribute, and tax to rulers of kingdoms or territories across the western shores of the island of Lanka and the coast of the Coromandel.[103] Pearls were embedded in

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[100] Eric Stokes, 'Late Nineteenth-Century Colonial Expansion and the Attach on the Theory of Economic Imperialism: A Case of Mistaken Identity?' *The Historical Journal* 12, no. 2 (1969): 285-302.
[101] Subrahmanyam 'Noble Harvest,' 135.
[102] These share allocations were similar to other ancient systems of taxation. C.R. de Silva, *Ceylon under British Occupation: its political, administrative, and economic development,* vol. 2 (New Delhi: Navrang, 1995), 526.
[103] De Silva, 'The Portuguese and Pearl Fishing off South India and Sri Lanka', *South Asia: Journal of South Asian Studies* 1, no. 1 (1978): 16; *The Rajavaliya or Historical Narrative of the Sinhalese Kings from Vijaya to Wimala Dharmasuriya II* ed. B. Gunasekara (Colombo: Govt. Printer, 1926), 71-2.

local economies of gift-giving, tribute, and religious worship.[104] In the Gulf of Mannar, copper plate inscriptions and testimonials of village record-keepers (Tam: *Karanam* or *kanakkupillai*) record grants by local rulers to temples.[105] There are few such documentary traces for the Persian Gulf before the eighteenth century, but archaeological evidence is fast uncovering more sources, albeit not of the documentary type.[106]

The Portuguese entanglement with the Gulf of Mannar dates to the early sixteenth century, when, lured by the promise of lucrative revenue to be gained from pearls, they entered a plural world of rights and obligations.[107] At the same time, the Portuguese were also drawn into the Persian Gulf partly by pearls, although as far as I am aware, there is no comparative account of Portuguese management of pearling across these two sites.

In South India, the *Estado da India* never displaced local organisation of labour and capital.[108] The nature of pearling labour is a key factor here: the dominance of caste-based occupationally specialised groups in the harvesting of pearls in the Gulf of Mannar meant that the fisheries never constituted a fishers 'commons,' open to all from

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[104] The Setupatis of Ramnad, for instance, allowed Hindu temples to fish for pearls in order 'for the purposes of making jewels to the said Deity to be worn on Friday festivals,' Board of Revenue Proceedings, vol. 1151, 3 July 1828, TNSA.

[105] In 1828, for instance, agents of the temple Avudaiyarkoil, a Shaivite temple in Pudukkottai had come across to Ceylon to demand *māṉiyam*, that is, tax-free boats and diving stones based on one such *Karanam.* In agrarian contexts, these were held by rural institutions of the *kāvalkārar* or village watchman and by the *pāḷaiyakkārar* or smaller chieftains, see Pandian's discussion of *māṉiyam* lands granted to rural watchmen or *kāvalkārar* in rural parts of nineteenth-century Madura in Anand Pandian, *Crooked Stalks: Cultivating Virtue in South India* (Durham, NC: Duke University Press, 2009), 77; Ostroff, 'Beds of Empire', 281-5.

[106] For an example of this approach, see Carter's essay in *Pearls, People and Power*, 231-262.

[107] Inroads of Jesuit missionary activity coupled with strategic caste planning led to the wholesale conversion of 40,000 Hindu Tamil paravas to Roman Catholicism in 1640.This was a momentous event in the history of the Gulf of Mannar, not least because of their occupational specialisation as divers which reveals how religion, customary rights, caste, and economic life interacted at this time. For a good account of parava motivations to convert see Roche, *Paravas of the Coromandel* and Bayly, *Saints, Gods, Goddesses*.

[108] De Silva, 'Portuguese and Pearl Fishing,' 17; S. Ravichandran, 'The Dutch Trade on the Pearl Fishery Coast,' *Proceedings of the Indian History Congress* 73 (2012): 318–26.

South India and Ceylon, nor did Europeans ever displace this long-standing labour with new groups of workers such as migrants, convicts, or slaves. Samuel Ostroff's PhD work on the Gulf of Mannar convincingly argues that distinctly modern forms of governmentality were forged in the theatre of the pearl fishery during the late eighteenth-century transition between Dutch and British rule. [109] This stands in contrast to the Persian Gulf, where the development of centralised, bureaucratized, and hierarchical states is tied only to 1920s and later. [110]

In the late nineteenth century, the Persian Gulf polities still had no modern state bureaucracies, borders, emigration offices nor naturalization policies. [111] From the perspective of empire, Britain's involvement in the Gulf was limited 'mainly to the regulation of external affairs,' at least until Lord Curzon's 'forward policy' in the 1890s. [112] Locally, then, coastal settlements were still sites of active tribal contestation and frequently, also migration. In this world of British maritime protectorates, many Gulf polities came to enjoy what Fuad Khuri calls 'stabilized form[s] of tribal rule,' where the sources of authority were the tribal councils or *majlis* and the religious courts or *al-qada' al-sharia*. [113] The modern forms of statecraft that Ostroff has highlighted in Ceylon were still to come.

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[109] Ostroff, 'Beds of Empire.'
[110] On the state in the Persian Gulf see Fuad I. Khuri, *Tribe and State in Bahrain: The Transformation of Social and Political Authority in an Arab State* (Chicago: University of Chicago Press, 1980); Khaldun Hassan Al-Naqeeb, *Society and State in the Gulf and Arabian Peninsula: A Different Perspective* trans. L.M. Kenny (London: Routledge, 1900); Mohammed Al-Rumaihi, 'Social and Political change in Bahrain since the First World War,' (PhD. diss., University of Durham, 1973); Omar H. AlShehabi, *Contested Modernity: Sectarianism, Nationalism and Colonialism in Bahrain* (London: One World Academic, 2019); Rosemarie Said Zahlan, *The Making of the Modern Gulf States: Kuwait, Bahrain, Qatar, the United Arab Emirates and Oman* (London: Garnet Publishing, 1989); Steffen Hertog, 'The Sociology of the Gulf Rentier Systems: Societies of Intermediaries' *Comparative Studies in Society and History* 52, no. 2, (April 2010): 282 – 318. On the use of the term 'tribal' or 'tribe' (*qabila*), which I use throughout the dissertation, see Dale F. Eickelman, 'Tribes and Tribal Identity in the Arab Gulf States,' in *Emergence of the Gulf States*, 223-241.
[111] AlShehabi, 'Policing Labour in Empire: the modern origins of the Kafala sponsorship system in the Gulf Arab States,' *British Journal of Middle Eastern Studies* (February 2019), doi.org/ 10.1080/13530194.2019.1580183, 4.
[112] Ibid., 3.
[113] Khuri, *Tribe and State*, 35.

In the Persian Gulf, in the absence of direct colonial rule, local power was shared between an emir or sheikh of the ruling tribe and other allied tribes, according to their relative strength. [114] Centres of pearling like Manama and Muharraq in Bahrain were governed through an administrative apparatus called the '*imara*, including the ruling emir and thirty *fidawis* or proxies. Ruling families did not control the pearl industry directly, leaving it in the hands of powerful tribal families; there were no license fees on pearling boats until the 1920s nor direct taxes on the value or magnitude of the catch. Captains managed labour, punishment, and payment to their crews on their own terms. The threat of emigration of these powerful tribes who brought in pearling revenue, rents, and foreign merchants to other territories in turn checked the power of the ruling tribe. [115] Conditions for pearling, overall, were 'permissive' and loose. [116]

The end of the nineteenth century marked a turning point. The centre of imperial presence became Bahrain, 'ground zero' for Britain's imperial ambitions in the Gulf. [117] Britain had signed exclusivity treaties with Bahrain in 1880 and 1892, forbidding the ruler from establishing diplomatic ties with other foreign powers (similar agreements were signed in the Trucial States in 1893, Kuwait in 1899 and Qatar in 1916). In Khaldun Al-Naqeeb's telling, British incursions into the Gulf in the nineteenth century 'froze' the position of traditional ruling families, buttressing and ensuring their continued dominance; post-1922, these became tiny 'dependent authoritarian states'. [118] The key point here, however, is that compared to Ceylon and Burma, an intrusive state apparatus did not exist in the same way.

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[114] Khuri, 36.
[115] Khuri gives the example of the Bin Ali tribe who migrated in 1895. *Tribe and State*, 66.
[116] Ibid.
[117] Ibid.
[118] Al-Naqeeb*, Society and State*, 83, 122.

Unlike the informal empire of the Persian Gulf, British statecraft in Burma was far from abstractly strategic and political, as in many accounts of imperial history in the Persian Gulf before 1890; instead, from the 1820s, in Burma it was deeply embedded with violence and extraction. Following Britain's three wars with the ruling Konbaung dynasty, in Thant Myint-U's most recent appraisal, colonial Burma was 'born as a military occupation.' [119] The British state, annexing Burma to British India, focused especially on the extraction of valuable resources, in particular timber, oil, and later, (perhaps most spectacularly) rice. [120] Although in the Persian Gulf too, the integration of Britain's hegemonic power was felt through the privileged position of Indian *bania* traders, who extended credit through the Gulf as protected 'British subjects,' the extent of intervention in the region's economies was feather light, when compared to Burma.

The civil servant and writer J.S. Furnivall, after all, in his classic formulation of Burma's 'plural society,' wrote of its service to 'unfettered capitalism far more complete and absolute than in the homogenous western lands.' Furnivall contrasted the west, where there was 'production for life,' to Burma, where this was reversed, resulting in 'life for production.' [121] In each of the chapters that follow, these distinct patterns of statecraft will affect the extent to which labourers and reefs were regulated, that the oyster was surveyed, or that the sea was tamed.

Sources Used and Basis for Comparison

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[119] Thant Myint-U, *The Hidden History of Burma: Race, Capitalism, and the Crisis of Democracy in the 21st Century* (Atlantic Books: London, 2019), 23-24.

[120] Ibid; For a 'natural history of war' in these early conquests see Sujit Sivasundaram, 'The Oils of Empire,' in *Worlds of Natural History*, ed. Helen Anne Curry et al. (Cambridge University Press, 2018), 379–98; tin see John Hillman, 'Capitalism and the Development of the Tin Industry in Burma,' *The Journal of Burma Studies* 15, no. 1, (2011), 119-52; See also Ian Brown, *Economic Change in Southeast Asia* (Oxford: Oxford University Press, 1997); Jonathan Saha, *Law, Disorder and the Colonial State: Corruption in Burma c. 1900* (London: Palgrave Macmillan, 2013); Michael Adas, *The Burma Delta: Economic Development and Social Change on an Asian Rice Frontier* 1852-1941 (University of Wisconsin Press, 1974).

[121] J.S. Furnivall, *Colonial Policy and Practice: A Comparative Study of Burma and Netherlands India*, rev. ed. (Cambridge: Cambridge University Press, 2014), first published 1948, 310-12.

The field of Indian Ocean scholarship is uniquely open to transnational, comparative work. Whether scholars have followed *sufi* saints, exiled political leaders, or merchant diasporic traders across the waters, histories which run across space have been central to the discipline. One way to write this dissertation would have been to follow actors-in-motion. Here we might trace the oysters shipped in 1866 from the Persian Gulf to Ceylon for transplanting, or the lives of men like Uthman al-Kharazz, a Kuwaiti pearl diver, who along with several hundred other men, travelled to Ceylon to work the pearl fisheries there between 1887 and 1907.[122] In the same vein of connection and movement, we would explore how Burma's southern archipelago was surveyed for its viability as a pearling site in 1826, right after the first Anglo-Burmese war, using South Indian divers and a shark charmer.[123]

But even apart from these stories of connection, the three sites here can be placed alongside one another based on their environmental parameters: in particular, the tropical, warm, shallow, and sheltered waters where pearl-bearing oysters can thrive in sufficiently large quantities to enable human harvesting. Another way of reading the sites together is that they all loosely fell under the British empire at the high imperial moment, and therefore that discussions around science, law, ecology, and local labour circulated amongst colonial and imperial agents, as well as between divers, captains, and capitalists.

This was the case when determining maritime sovereignty in terms of ownership and use rights in the Persian Gulf in the 1850s (see Chapter 5*, Law*) and also in terms of scientific precedents for studying the Indian Ocean seafloor (see Chapter 4*,*

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[122]Migrant divers see Tamara Fernando, 'පර්සියානු බොක්කෙහි සිට ලංකාව වෙත මුතු කිමිදෙන්නන්ගේ සංක්‍රමණ, 1881-1925' [The Migration of Persian Gulf Pearl Divers to Ceylon, 1881-1925], ප්‍රවාද [Pravada, Journal of the Social Scientists Association, Sri Lanka], 35.

[123] On South Indian divers used to explore Mergui see 'Shark Charmer sent to be employed in the pearl fisheries of the Mergui Archipelago,' Z/E/4/42/S422: 1824-1830, IOR, BL.

Science). Burmese authorities' decision not to manage the pearl fishery directly, likewise, drew on Ceylon as a negative precedent. The advent of cultured pearling in Mergui drew partly on scientific expertise which was honed by those in the employee of the Ceylon Company of Pearl Fishers between 1904 and 1912 (see *Conclusion*).

In so far as there were connections, there were also divergences, notably the use of dress diving to exploit Mergui's deeper beds, as well as Mergui's integration into different circuits of capital and investment when compared to those in the Western Indian Ocean. The Mergui fishery was also a dual fishery, by which I mean that oyster shell was prized for buttons and other mother-of-pearl inlays, and pearls were an added bonus, while the Ceylon and Gulf fisheries were entirely oriented around pearls.

This dissertation uses sources from all three sites of pearling, and is broadly comparative across four of the five chapters, but the central site in this narrative is Ceylon. This reflects the fact that one chapter is based exclusively on material from Ceylon (Chapter 4, *Science*) and that the number of sources used are most extensive for the Gulf of Mannar, compared to the Persian Gulf or Burma. In part, this reflects my own language skills and greater familiarity with the Sri Lankan archives (the pandemic offered little chance to correct this in the last stages of my PhD research), but it is also the result of the nature of colonial governance and imperial rule. Of all the pearling sites considered here, the colonial state was most deeply embedded in the Ceylon fishery, where it acted as labour overseer, provided a site for sale and commerce, and profited from sale as the largest oyster dealer (see *Chapter 1, Fishery*). This means that certain fishery particulars were most closely integrated into the state bureaucratic apparatus and survive in the Sri Lanka National Archives. Pearling in both Mergui and the Persian Gulf was more dispersed across individual capitalists, boat owners and captains, which means that centralised repositories of sources are harder to come by. I

offer below my ways of reading across these sites to enable comparative and connected work.

Because the fishery of Ceylon was managed as a bureaucratic object of the state, the Jaffna and Mannar *kachcheri* [government office] archives at the Sri Lanka National Archives in Colombo and Kandy, are rich sites for sources on the fishery. These archives include both state-level and more daily, mundane materials relating to day-to-day administration. The latter include lists of crews, fishers' petitions, letters exchanged between sailors and state officials, boutique license applications, and, of course, copious diaries and reports sent by the European officials in charge of the fishery. Almost the entirety of this material, related to day-to-day running of the fishery, is only preserved in Sri Lanka, as it did not make it up to the Colonial Office in London. Further material including copies of the diaries and letters mentioned above are also found in the E.L.Pawsey papers, which are now in the Centre for South Asia Studies Archive, Cambridge (CSAS). The Sri Lanka material has hitherto not been treated by historians in any significant way, although Ostroff's work out of the Tamil Nadu State Archives in Chennai suggests that fishery particulars were very similar on both sides of the Gulf. [124]

In addition to these low-level documentary traces, from 1858 onwards, each pearl fishery generated a report that was printed in the *Ceylon Sessional Papers*. These can be read alongside *Administrative Reports* for Mannar district. At the higher level of colonial bureaucracy, Foreign Office and Colonial Office correspondence is useful when it comes to charting broad legal changes, such as questions of state sovereignty around Ceylon's reefs, or the leasing of the fishery to private capitalists. To cross-

[124] For an exception; cf. Bertram Bastiampillai, *Northern Ceylon (Sri Lanka) in the 19th Century* (Colombo: Godage International Publishers, 2006).

contextualize these text-heavy sources, I have also used scattered scientific papers such as those of Ceylon's first marine biologist, James Hornell, which are held at the University Library, Cambridge (Haddon Papers) and his collection of photographs and objects at the Museum of Archaeology and Anthropology, Cambridge (Hornell Collection, MAA). I read these administrative archives alongside the scientific reports published on the oysters across Ceylon, India and the UK, and their maps, collections of specimens, diagrams, and illustrations.

For material on the Persian Gulf, I have relied largely on India Office Records from the 1850s onwards. Even more than the Ceylon case, where there is a profusion of colonial source material, the Gulf context has thus far been dominated by English language, colonial sources. As Lawrence G. Potter and others have pointed out, there is a dearth of written and textual material on the history of the Persian Gulf. [125] Tribal society in the Gulf, both the Bedouin (*bedu*) and settled people (*hadar*) left few written records in the nineteenth century. J.E. Peterson explains how as a result, 'European archives – particularly the British – still remain perhaps the most comprehensive source of primary data for pre-1971 history' in the Gulf. [126]

This does not mean that these sources are without merit, not least because they are often further organised into thematic collections by archivists and scholars. Invaluable for any study of Gulf pearling is the three-volume collection of sources related to pearling compiled by Anita Burdett, *Records of the Persian Gulf Pearl Fisheries 1857-1962* (Archive Editions, 1995) which can be complemented with other collections of sources such as the *Records of Bahrain 1820-1960,* edited by Penelope

[125] 'Writing the history of the Persian Gulf has long been the preserve of outsiders,' in Lawrence Potter ed. *The Persian Gulf in History* (London: Palgrave Macmillan, 2010), 3.
[126] J.E. Peterson writing in 2016 appraised Gulf history writing as 'still in its infancy.' J.E. Peterson, *The Emergence of the Gulf States: Studies in Modern History* (London: Bloomsbury Academic, 2017), 1.

Tuson. Like the Euro-centric historians Peterson and Potter describe, I too, have relied on Charles Belgrave's diaries, John G. Lorimer's *Gazetteer*, Allan Viller's account of sailing on a dhow, and other similar materials to flesh out qualitative aspects of pearling. Despite this, there *is* vernacular material in Arabic, including in the colonial documents themselves, as I show in Chapter 3, *Maps.* Other prominent sources are the *chau* books that merchants and captains used to record pearl values, as well as the legal and commercial ephemera which Fahad Bishara has studied. By the 1930s there were diving manuals in Arabic (*Mukhtasar Al-Ghaus)*, and Islamic legal proceedings, which Alexandre Caeiro is now working on.

In both Ceylon and the Persian Gulf context, I have also aimed to use secondary material from these sites, rather than solely English language material published by western presses. This includes Arabic-language secondary sources such as accounts of pearling by local historians, including Saif Marzooq al-Shamlan's *Tarikh al-Ghaws 'ala 'l-Lu'lu fi'l-Kuwait wa 'l-Khalij al-'Arabi* (1975), or dissertations on pearling which were written in South Indian Universities. [127]

In the Burmese case, the archive in Yangon, Myanmar (YNA), holds more material related to fishery particulars than the India Office or colonial materials in London at the British Library. From the archives in Yangon, I use material related to letters exchanged between scientific and colonial officials, pearlers' petitions, police and crime reports, as well as the *Settlement* and *District Gazetteers* for Mergui. As with the Bedouin and other actors in the Persian Gulf, one group, the indigenous Moken left no written sources. To counterbalance this, I have used anthropological writings to flesh out the lifeworlds of the Moken – in particular the writings of Jacques Ivanoff and

[127] Saif Marzooq al-Shamlan, *Pearling in the Arabian Gulf: A Kuwaiti Memoir*, trans. Peter Clark (London: London Centre of Arab Studies, 2000). Originally published in 1975 in Arabic.

Maxime Boutry. These collections of stories, mythologies and folktales help to elucidate lifeworlds beyond the gaze of colonial documents.

In each site, in addition to state-level documents, I have also interspersed maps, oyster specimens, songs, poetry, devotional, and historical epics. The latter sources help to bring in material in Arabic, Tamil or Moken into a story that would otherwise be told largely through English-language materials. The relative weight assigned to these sources varies: within the coercive and extractive matrices of empire, certain chapters, such as those on science and law, concerned with the colonial state, feature much more English-language material than the chapters on the fishery, labour, or mapping.

Chapter Outline

Chapter 1 *Fishery*, explores the role of the fishery across each site surveyed in this dissertation, asking what constituted the extractive bounds of a fishery. I use the metrics of gender, migration, and seasonality to explain why the fishery as assemblage took on distinct forms across the sites, with the Ceylon model being closer to a terrestrial plantation. Chapter 2, *Labour*, considers why no large-scale labour movements developed among pearl divers at any site of pearling, concluding that this had to do largely with the undomesticated nature of the oyster, which maintained incredible variation at sea. Chapter 3, *Maps,* studies the first maps made of the Indian Ocean's seafloor in attempts to plot and pin down the position of oysters in submarine space, contingent on the labour of divers who moved between the surface of the ocean and the seafloor. Chapter 4, *Science*, plots the ways that the oyster was read over the course of the nineteenth century as colonial science aimed to render it into a regular and efficient pearl producer. The attempts to read oysters were processual, involving varying scales of analysis related to terrain and ecology, which made the oyster both unsettled and unsettling as a scientific object. In turn, Chapter 5, *Law,* reveals the action

of the reef in stretching the bounds of law making around sovereignty and ownership. In each of the three cases, a different answer was reached in terms of delineating ownership and local regulation. In the *Conclusion,* I return to changes in *visibility* and *translation* to consider the legacy of pearling on domestication and capitalism at sea and how these were transformed at the turn of the twentieth century.

A Note on Naming and Taxonomy

Throughout this dissertation, I have refrained from italicized scientific taxonomy to refer to the non-human, such as *Pinctada radiata* for the oysters living in the Persian Gulf, *Pinctada fucata* for those in Ceylon, or *Margaritifera maxima* for oysters in Southern Burma. This is not least because these precise classifications were still debated throughout the twentieth century, and not used by my historical actors, but also because it prioritizes one epistemology over others: why describe oysters as *Pinctada fucata* but not human actors as *Homo Sapiens*? In addition, these modern scientific names privilege particular English or Latin metropole-centric modes of 'expert' knowledge: *P. radiata* rather than the Arabic *mahharah* or the Tamil/Sinhalese *muttu sippi* or *bella*, as would be closer to the terms that many of the historical actors surveyed here used. As Eben Kirksey and other anthropologists have convincingly argued, scientific taxonomy performs 'species' in a particular way, and a careful account inflected by the history of science should seek to refrain from unproblematically reproducing these schemas of understanding. [128]

Although of course, this dissertation is written and will be defended in English, not Tamil, Burmese or Arabic, I have still tried to ensure that non-English terms, actors, and geographic terms are not unduly otherized as indigenous and foreign. While pearls

[128] Marine Lien and John Law, '"Emergence Aliens": On Salmon, Nature, and Their Enactment,' *Ethnos* 76 (March 2011): 65-87, 10.1080/00141844.2010.549946.

are no longer *muttu* (Tamil) or *lu'lu* (Arabic), I have used the descriptive term 'oyster' throughout in place of scientific terminology. Certain other commonly occurring terms in non-English language such as nakhoda (Arabic: ship captain), adapannar (Tamil: parava caste headmen), parava (a specific caste in the Gulf of Mannar) are not italicized for the same reason.[129] Although I would have preferred to keep the local terms for reef, that is, *hair* in Arabic and *paar* in Tamil, free from italics, to aid comprehension these are italicized throughout.

A few other names are worth briefly discussing. I use the term Persian Gulf, instead of the Arabian Gulf, although *khalijis*, or denizens of the Gulf states, hotly contest which term to use. British administrators in the nineteenth century used the term Persian Gulf in English. Similarly, I have also opted for English-language, nineteenth-century place names: thus, Ceylon rather than Sri Lanka; Tuticorin rather than Thoothukoodi; and Burma over Myanmar. In the Mergui Archipelago, each island has plural nomenclatures, with varying names in Moken, Malay, Thai, Burmese, and English.[130] When referring to colonial maps of Mergui, I have used the English language nineteenth-century names.

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[129] Eben Kirksey, 'Species: a praxiographic study,' *Journal of the Royal Anthropological Institute* 21, no. 4 (December 2015): 758–80, https://doi.org/10.1111/1467-9655.12286. I am grateful to the anonymous reviewer at *CSSH* for this insight.

[130] List of varied island nomenclatures across language see: Jacques Ivanoff, *Rings of Coral: Moken Folktales*, Mergui Archipelago Project (Bangkok: White Lotus, 2001), 6-8.

Fishery

The paratavas of the sturdy timil [boat] *identify the*
shore with the help of the lights on tall houses
on the sea-shore – Paṭṭiṉappālai, 2 CE, South India [1]

[The migration of the ruling Al-Khalifa dynasty to Bahrain was akin to] *the descent upon Muharraq after al-Zubara* –Muahmmad al-Nabhani, [2]

Eh, Wood of the Forest. Eh! Forest!
You are trees, branches, leaves, flowers, fruits
and you are no longer able to speak. You will no longer speak!
Wood! You can no longer speak! – Moken Tale of the Feminine Ancestors

Introduction

At some point between 1820 and 1830, the painter Hippolyte Silvaf made twelve water-colour paintings of the Pearl Fishery of Ceylon. [3] Today, most of these works are lost, but an image affixed to the inside lid of a box of oyster 'specimens' is likely a sole survivor (figure 1). [4] The artwork is divided into three: above the horizon, a cloudless sky boasts a stylized, rising sun; the space below is shared between the ocean and the shore. The sea is dotted with vessels whose white, billowing sails are set off against an uninterrupted swathe of blue. These craft drift amidst small canoes and a single, large European ship. The point where the coastline meets the sea is entirely obscured, crowded in with delicate strokes to reveal hundreds upon hundreds of immaculately sketched figures – a vast crowd watching the pearling fleet depart. The

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[1] *Netunkal matatu olleri nokkik/ kotuntimil paratavar kuruuccutar ennavum,* quoted in V.S. Arul Raj and G.V. Rajamanickam eds., *Maritime History of South India: indigenous traditions of navigation in the Indian Ocean* (Thanjavur: Tamil University, 1994), 55.
[2] *…muzul al-Muharraq ba'da al-Zubara*, al-Nabhani, *al-Tufah al-Nabhaniyyah*, 82-98; qtd. in Fuccaro, *City and State*, 27.
[3] In 1989, the paintings were stolen from the Royal Commonwealth Society where they were held since 1908. See Donald Simpson ed., *The manuscript catalogue of the library of the Royal Commonwealth Society* (London: Mansell, 1975).
[4] 1868.5.29.1, Natural History Museum, UK; Tamara Fernando, 'James Steuart's box of oysters at the Museum of Natural History (1868)' *Doing History in Public*, blog post, 19 December 2018, https://doinghistoryinpublic.org/2018/12/19/19-james-steuarts-box-of-oysters-at-the-museum-of-natural-history-1868/.

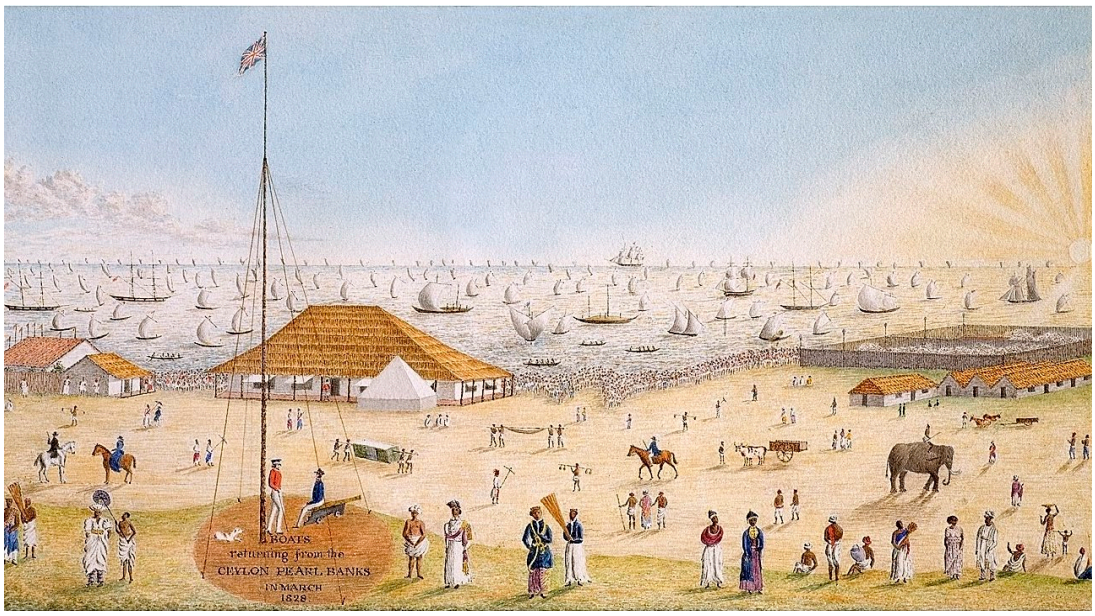

Figure 1: 'Boats returning from the Ceylon Pearl Banks in March 1829' probably by H. Silvaf, from inside lid of a box of molluscs sent to British Museum in 1868, Natural History Museum, NHMUK 1868.5.29.1.

shore is busy with activity, with huts, sheds, and other built infrastructure to facilitate the work of pearling. Unsurprisingly, given that he was an early nineteenth-century painter working in colonial South Asia, Silvaf's skill is demonstrated in the depiction of a wide variety of 'native types' in their characteristic dress who assemble along the beach.

On the far western end of the same ocean, in the shallow, enclosed sea of the Persian Gulf, during the pearling season, the shore-based reception of the fleet was bookended by a three- or four-month interval, rather than taking place daily, as in Ceylon (see comparative table 1). Here on the southern coast of the Gulf, one former nakhoda recalled how 'the ports were like beehives, boiling with divers. Some were loading the boats with supplies of rice and date baskets; some were fixing the sails; some were exchanging notes with pilots and merchants on unpaid bills, debts, contracts, and the like. Crowds of women and children stood by the shore waving hands and handkerchiefs, bidding goodbye to husbands, brothers and sons as the rhythm of sea

Pearling Sites in the Indian Ocean			
	Persian Gulf	**Ceylon**	**Mergui Archipelago**
Product	Large, bright pearls, destined primarily for Bombay then Europe	White seed pearls taken to Bombay via South Indian markets	Mother-of-pearl shell or *nacre* sent primarily to London via Penang
Mode of diving	Free diving	Free diving	Dress diving
Area for pearling	93000 sq mi	4100 sq mi	11000 sq mi
Fishing season	125 days	47 days	70 days
Depth of banks	10 m	16 m	36 m
Persons employed	65212	4870	711
Number of oysters	1,500,000,000	21,223,840	48267

Table 1: Comparative Table of Indian Ocean Pearling Sites (data from 1907)

waves and the tunes of pearl songs mixed with cries of babies.' [5] Four months later came the *quffal,* or return, which, illustrated in the words of Kuwaiti

historian Saif Marzooq al-Shamlan, was '[t]he most important holiday of all, with people of all classes rejoicing.' [6] Outside the pearling season, in houses known as *dar*, divers, captains, and retired sailors joined in *fjeri*, or pearling songs; nineteenth century Bahrain alone had more than one hundred *dar.* [7]

Notably, these views of the pearl fishery reproduce not just maritime activity at sea, but also activity on the shore. Divers and other seafaring men and boys worked on boats out at sea and underwater, subject to the vagaries of the ocean (see Chapter 2,

[5] Recounted to Khuri, *Tribe and State*, 59.
[6] Al-Shamlan, *Pearling in the Arabian Gulf*, 104-5.
[7] Nasser Al-Taee, '"Enough, Enough, Oh Ocean": Music of the Pearl Divers in the Arabian Gulf,' *MESA Bulletin* 39, no. 1 (2016), 24.

Labour). But in all pearling complexes, these same men returned to the shore – to camps, towns, and new urban settlements. In the short term, all fisheries were major employers, creating incomes and new wealth. In the longer-term, the impact of pearling on demography, urbanisation, and growth in Ceylon and Burma was far more limited compared to the Persian Gulf. As outlined in the *Introduction*, this dissertation puts the living ocean itself back into history, alongside human narratives of work and commerce. But it would be an incomplete picture to consider the activities of pearling at sea without recourse to the shore, since they were so intimately tied to one another, as in the examples above.

The relationship between work at sea and shore-based communities and economies can be articulated through the concept of the fishery. Yet environmental and fisheries historians alike are curiously abstruse when it comes to defining a fishery beyond minimally describing it as a space where humans engage with marine species for commercial purposes. Many texts forego a formal definition in favour of implicitly suggesting that 'you know it when you see it.' [8] In most standard accounts, fishing draws in new communities and wealth, who settle in the area and contribute to increasing urbanisation and growth. Instrumentally speaking, of course, pearl fishing was facilitated by the presence of a suitable number of mature oysters at sea, which were harvested for the market. So far, so good. And yet, as Samuel Ostroff has pointed out, defining a fishery, especially before the twentieth century, is not so straightforward. [9] A fishery might refer to a geographic space, a constellation of actors,

[8] Classic works such as McEvoy's or Taylor's texts offer no set definitions, suggesting that the interactions between actors, legal processes, social factors, and ecology involved in the commercial harvesting of marine species come together seamlessly to produce a fishery. McEvoy described a fishery as composed of these features intersecting 'like the pieces of a watch … [which] evince their fully significance only in working relationship to each other.' *Fisherman's Problem*, xi.
[9] Ostroff, 'Beds of Empire,' 9.

or a precise mode of management. [10] Indeed, if fisheries are also - as most historians agree - social, legal, and political entities, then the characteristic of commercial mollusc extraction alone is unhelpful in exploring the varying import and impacts of pearling on the shore.

This chapter sets the stage for the four that follow by distinguishing between the pearl fisheries of the northern Indian Ocean with regard to how the state regulated fishery labour and migration. There was a divergence in the extractive infrastructure of fishing, which explains the varying extents to which pearling shaped the coasts of the Indian Ocean. An exploration of the pearling camp vis-à-vis the pearling town problematizes a singular model of pearling as maritime extraction that can be read across space and time. For in fact, the Ceylon pearling camp borrowed labour, legal, and disciplinary regimes from other terrestrial modes of organising production, especially the plantation. Indigeneity, the state, and seasonality all shaped the extent to which pearling affected the shore.

In the following three sections I trace how the nascent Persian Gulf state emerged *out of* the tribal migrations that accompanied pearling, providing a brief overview of the literature on the emergence of the gulf city from the pearling town. In contrast, those who were involved in pearling in Mergui arrived *after* the establishment of the British state in Tenasserim. Despite this colonial frame, in Mergui, policing maritime labour inflows from elsewhere in Southeast Asia and the Pacific was not a concern, while the nomadic Moken plotted their own itineraries. By contrast, in Ceylon, the nineteenth- and early-twentieth-century colonial state had a longer legacy of exercising strict control over the maritime frontier of Mannar. Here the state chose not

[10] Ibid.

to incorporate the region's fluid and seasonal mobilities but rather to contain these features through a camp, preventing more large-scale interactions on the shore.

Settlement: Pearling Towns in the Persian Gulf

Historians have used archaeological data, demographic statistics, and archival documents to trace the growth of pearling towns concurrent with the rise in the global demand for pearls. The vast majority of towns and settlements along the southern coast of the Persian Gulf had pearling as their main *raison d'être*. They accord with standard histories of fishing leading to settlement, economic growth, and urban development. As historians Nelida Fuccaro, Robert Carter, and other scholars working in the growing field of urban studies in the Gulf have recently argued, new towns in the eighteenth century had as an explicit rationale for their founding the desire to participate in the fishery. These included Kuwait (founded 1716), Abu Dhabi (1762), Zubara (1766), and Manama in Bahrain. [11] Located closest to the richest reefs, Bahrain's sea-facing towns in particular, developed not as caravan stops in the interior of Arabia, but rather as passageways to the pearl banks. [12]

In the period of British imperial oversight and concomitant commercial expansion of pearling, these regional ports refashioned themselves as *mudun al-ghaws* or pearling towns, forming the nascent seeds for the spectacular Gulf urbanisation which is so conspicuous today. [13] It was pearls, not oil, that initially led people to the coast.

In the Gulf, the British did not displace local emirs and tribal elites as they did with the Konbaung and Nayakkar dynasties of Burma and Ceylon. Instead, imperial

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[11] Robert Carter, 'Pearl Fishing, Migration, Globalization in the Persian Gulf, Eighteenth to Twentieth Centuries' in Machado, Mullins and Christensen eds., *Pearls, People, and Power*, 254.
[12] Nelida Fuccaro, *Histories of City and State in the Persian Gulf: Manama since 1800* (Cambridge: Cambridge University Press, 2009), 50.
[13] Fuccaro, *City and State*, 51.

oversight was 'informal' and 'strategic,' and relied on bolstering the power of local tribal rulers, making them *de facto* leaders in a political landscape which was formerly fluid and fractious (see *Introduction*). The aims of capital, political power, and imperial oversight aligned around the pearl trade. As the sociologist K. Aqil has written, 'a profitable pearl industry was important to the British because it ensured the reproduction of the two strata upon which the British relied for the preservation of stability in the Gulf…regional *sheikhs* and Banyan merchants.' [14]

Pearling formed the centrepiece and most dependable source of income for a vast majority of the Gulf population. Importantly, unlike in Burma or Ceylon, the Persian Gulf reefs were not subject to very high volatility, or fragile oyster stocks, leading to an ecological and environmental context which could support harvest year-on-year. The fishery predictably exerted a large migratory draw on persons from both coasts, and also from much further inland in the Arabian Peninsula. This movement was not state sponsored nor facilitated by wealthy capitalists looking for labour. Carter gives the example of the constant migration of Qatari tribes, writing that 'their specialization in the pearl fishery and orientation to the sea freed them of permanent ties to place.' [15] Without agricultural or legal bonds to land, those who migrated required only boats, access to fresh water, and the pearl banks themselves, to take and establish new bases of settlement along the coast. [16]

It may seem like a paradox to argue that the fishery contributed both to migration as well as to sedentarization. The key feature to highlight, however, is the ease of movement between sites in the Gulf, and the way that this predated any forms

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[14] K. Aqil, 'Pearl Industry in the UAE Region in 1869-1938: It's Construction, Reproduction, and Decline,' *RUDN Journal of Sociology* 218, no. 3 (2018): 462, doi.10.22363/2313-2272-2018-18-3-452-469.
[15] Carter, 'Pearl Fishing, Migration, Globalization,' 246.
[16] Hala Fattah, *The Politics of Regional Trade in Iraq, Arabia, and the Gulf 1745-1900* (New York: SUNY Press, 1997), 25-8.

of statecraft to manage that movement. 'The coastline did not constitute a barrier but a permeable border in a region which had a long history of indigenous seafaring supported by an advanced maritime technology,' Fuccaro explains. [17] The Ceylon case below will make clear how maritime boundaries could be more sharply demarcated. Once suitable sites for pearling were found, tribal competition between Hawala and Bedouin merchant seafarers led to sedentarization and town-making, building forts, bastions, and towers to guard harbours, water supplies, and pearl banks. [18] Environment shaped settlement with little hindrance from a strong existing state, as in Ceylon.

To give but one example, on Bahrain island, the settlement of Manama saw a threefold increase in population as labour from Iran, East Africa, al-Ahsa', al-Qatif, and its own agricultural hinterland flooded in. During the last decades of the nineteenth century, this led to 'the transfer of productive activity from the agricultural hinterland to the coast.' [19] The absorption of the workforce of coastal towns into pearling during the season could be as high as ninety five percent of all working-age males. As I will show below, most migration to other Indian Ocean pearling hubs was maritime, but in the Persian Gulf migration was also terrestrial. As a result of this migration to the coast, villages in Bahrain such as al-Diraz and al-Shakurah lay in ruin, with much land laying in waste. Rural depopulation was steady and consistent. [20] Shaykh Isa's agricultural revenue in Bahrain halved between 1873 and 1904. [21]

Further research is needed on the way in which the overwhelmingly male workforce shaped women's patterns of work and settlement on the coast, although

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[17] Fuccaro, 16.
[18] Fuccaro, *City and State*, 52.
[19] Fuccaro, *City and State*, 16, 27.
[20] Fuccaro, 27.
[21] 'Report on the Administration of the Bushehr Residency and Muscat Political Agency for 1873-1874' in *Persian Gulf Administration Reports 1873-1949*, 10 vols. (Gerrards Cross: Archive Editions, 1986), vol. 1, 66.

scholars have indicated that women took on a disproportionately large part of other forms of terrestrial work while the men were away. The trade and revenue-centric nature of the archive makes men's patterns of work at sea much more visible in the archival record than women's patterns of work on shore. [22] To this we must add the role of enslaved populations of Africans in the Persian Gulf, brought there to supplement labour forces for pearling. The relative weight of enslaved populations in this migration compared to persons from the Arabian Peninsula is thus far unexplored.

Regardless, the large-scale and consistent migration of people to work in the annual, remunerative pearl fisheries led to the steady development of towns and cities. As the population of pearling entrepôts like Doha increased, so too did the land area (occupied area in hectares) of the settlement. [23] By the twentieth century, the majority of Bahrain's population was concentrated in maritime outposts which grew as a result of tribal migrations. The largest settlement was Muharraq, the powerhouse of the pearling economy, settled by the ruling Al Khalifa and their tribal allies including the Al Fadhil and Al Jalahimah. [24] The second largest and richest pearling centre was the town of al-Hidd, which was under the Al Ibn 'Ali tribe. In Fuccaro's reading, tribal mercantilism - that is, the involvement of several prominent tribes in pearling was the single largest factor contributing to urbanisation of the coast. [25] The nomadic and subsequently settled and increasingly entrenched power of tribal elites was distinct from the long-distance diasporic capitalists like the South Indian Chettiars who financed much of the pearl fishery in Ceylon, and to some extent, Burma.

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[22] Aqil, 'Pearl Industry,' 452.
[23] Carter, 'Pearl Fishing, Migration, Globalization,' 252.
[24] Ibid., 26; See also Khuri, *Tribe and State*, 25.
[25] Ibid.

These ports were characterised by a 'fluid, transnational character.'[26] In her overview of Bahraini history, Fuccaro insists that the town of Manama was hardly an 'Arab' city before the 1960s.[27] Legal distinctions between citizens (*al-muwatinun*) and foreigners did not emerge in the 1950s; Manama was '*the* frontier society of the Persian Gulf,' straddling Arab and Iranian, Sunni and Shia worlds.[28] As the British Political Resident in the Gulf H.V. Briscoe noted of Bahrain in 1930: 'the population of Bahrain is heterogenous and divided by racial and religious difference – Nejdis, Wahhabis, Persians, Sunnis, Shias and large colonies of Muhammedan and Hindu Indians. Bahrain is a purely commercial centre, its outlook is towards Bombay and the stock markets of the world on which it depends to sell its pearls.'[29] Briscoe's comments echo the heterogeneity of other Indian Ocean sites of pearling, although the limits of this diversity will emerge more clearly when we compare this against Burma and Ceylon.

For the majority of this newly urban population, housing was made of thatched huts constructed from palm branches with stone or mud walls (*barasti* and *'arish*).[30] Pearl wealth transformed the homes of the tribal elites involved in pearling from tents to masonry structures of timber, coral, gypsum, and limestone.[31] This is again a marked departure to the temporary settlements of the pearling camp in Mannar, although the more apt comparison to the pearl mansions would be the lavish Chettiar homes constructed across towns in Madras Presidency.[32] Another reason for the disparate outcomes in terms of urbanisation and settlement between Ceylon and the Persian Gulf was that the latter wealth was re-invested on the same shores that the boats departed

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[26] Fuccaro, *City and State*, 4.
[27] Fuccaro, 13.
[28] Fuccaro, 9.
[29] Fuccaro, 55.
[30] Fuccaro, 35.
[31] Fuccaro.
[32] Fuccaro.

from. Compare this to Ceylon, where it followed merchants back to Travancore, Pondicherry, Kayalpattnam, and elsewhere, just as in Mergui it largely benefitted Australian, Singapore-based, or other South Asian capitalists. This is not to downplay the prominent role of Indian *bania* traders in financing the Gulf pearl trade, particularly in the latter half of the nineteenth-century, but to point to how local elites made vast sums of money when they acted as pearl sellers themselves.

This overview above helps foreground the ways in which pearling profoundly shaped the coasts and urban settlements which arose along the Gulf coastline. As a cursory survey, this is useful as a comparative for how Ceylon's rich reefs were managed, and the differing role of the state in the fishery here.

Containment: The Pearl Fishery Camp in Ceylon

Unlike in the Persian Gulf, where proximity to the reef, a defensible site, and other natural features gave rise organically to the sites of pearling towns and cities, in Ceylon the relationship of work at sea to the shore took place primarily through the pearl fishery camp. From at least the sixteenth century - when we have detailed Portuguese sources - in seasons when there were sufficient oysters at sea, a temporary 'camp' emerged for the duration of the twenty to forty days of fishing. [33] Although this camp may have initially sprung up in an unplanned and spontaneous fashion, by the latter half of the nineteenth century it was entirely centralised, and state planned. It was a temporary urban settlement and bazaar economy configured as one; but also, crucially, an instrument that allowed the state to control migration and settlement patterns, ensuring that the fishery remained not only spectacle but also spectral in its impact. [34]

[33] De Silva, 'Portuguese and Pearl Fishing,' 24-25.
[34] Ostroff, 'Beds of Empire,' 155-6.

This centralisation through the camp, as Ostroff has charted, allowed the state to regulate when boats commenced fishing, where they fished, how long they fished for, and how the day's catch was divided up between the divers and the state. As long as the state dictated the location of the pearling camp and constructed its architecture, the role of fishing communities was carefully regulated. [35]

The Ceylon fishery was not just a site of labour, commerce, and valuable government revenue: it was also a spectacle, and this is evident in surviving documentation, especially the visual archive. [36] In the nineteenth century, building on an older Indian Ocean precedent, travellers to Ceylon were encouraged to observe pearl fishing. [37] Aided by new communication and photographic technologies, the camp became embedded in European visual and racial logics and notions of the 'archaic,' as the art historian Natasha Eaton has pointed out. [38]

Travel guides capitalised on the newly laid railways which criss-crossed island space in the second half of the century. Henry Cave's *The Book of Ceylon* (1908), for example, made a point to extoll how 'few of the world's wonders can lay claim to greater antiquity [than the pearl fishery]' where visitors witnessed 'the true element of the lottery engrafted on a huge picnic which lasts for a month or more and is attended

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[35] Ostroff, 'Beds of Empire,' 67-149.
[36] For visits by colonial governors see for example Diary of James Donnan, 16 March 1874, E.L.Pawsey papers, CSAS; photography see Natasha Eaton, 'A Photobook of the Shimmer: Pearl Fisheries, Photography, and British Colonialism in South Asia,' *British Art Studies* 7 (Nov. 2016): 10; other visitors see Ostroff, 'Beds of Empire,' 155-158.
[37] Donkin, *Beyond Price*, 47-52.
[38] Eaton, 'A Photobook of the Shimmer,' 13.

Figure 2: 'Boats returning from the Pearl Fishery,' 1925, hand coloured photograph, 14.8 x 10.5 cm, author's collection

by forty-five thousand people.' [39] Images of pearling taken on the shore – of sailboats pulling up to the beach, of near-naked brown bodies unloading heavy bags of oysters, and of sand dunes loaded with empty oyster shells – became stock-in-trade images of the picturesque on an island idyll (figure 2). [40] At the same time, writerly accounts were published across journals including *Nature*, *National Geographic*, *Scientific American,* and others. [41] As historian Sanjay Subrahmanyam suggests, these descriptions of the camp fit within a literary tradition which is 'reminiscent in good measure of the gold-mining boom towns of popular fiction.' [42] As a result, the fishery can be 'hard to extricate from its own image.' [43]

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[39] Henry Cave, *The Book of Ceylon: Being a Guide to its Railway System and an Account of Its Varied Attractions for the Visitor and Tourist* (London: Cassel and Company, 1908), 639.
[40] Descriptions of Persian Gulf in English also echoed these orientalist stereotypes. One typical description watching the work of pearl divers describes it as a 'scene right out of the Alhambra…[where] the Moorish setting was emphasized in the quivering forms of the African pearl divers.'. Elise Conklin, 'As Seen by an Indian Missionary,' *Journal of the Arabian Mission* 128 (1923): 10.
[41] Anon., 'Ceylon Pearl Fisheries,' *Nature* (August 1930): 331-2; Bella Sidney Woolf, 'Fishing for Pearls in the Indian Ocean,' *National Geographic Magazine* (February 1926): 161-3; Fred Harvey, 'Pearl Fisheries of Ceylon,' *San Francisco Overland Monthly* (June 1913): 520-30; James Cordiner, 'The Pearl Fishery' *Saturday Magazine* 6 (May 1835): 177-9; Randolph Geare, 'Pearl Fisheries of Ceylon,' *Scientific American* 79 (Jan. 1915): 4-5; Samuel Haughton, 'The Ceylon Pearl Fishery,' *Sport and Travel* (1916): 9-29; For a more extensive bibliography see H.A.I. Goonetileke, *A bibliography of Ceylon (Sri Lanka)* (Zurich: Inter Documentation Co. A.G., 1983), 468-472.
[42] Subrahmanyam, 'Noble Harvest,' 139.
[43] Ibid.

Most visitors cast their gaze on pearling not from the working sail craft of fishers, nor from the bottom of the ocean floor, but instead, from the temporary settlement on the shores of Mannar District.[44] It would appear at first then that the historian is spoilt for choice when it comes to descriptions of the pearling camp. In each of the next chapters, I suggest that in the case of both oysters and divers, from the perspective of the state or capitalists, there was a lack of visibility related to life underwater, which was accessed and translated through the work of divers. Both the oysters' and divers' secrets remained at sea, a medium and material terrain which was harder to domesticate or survey. The shore was different: it appeared, in some guises, amply visible.

To counterbalance this colonial emphasis, in the following sections I read other sources which are more forthcoming on the work of caste, gender, and race in shore-based labour beyond the sepia-hued, palm-fringed beachfront. These include maps, petitions, commercial ephemera, and documents from the bureaucratic, legal, and police archive, all of which are hitherto untapped sources for reading the history of pearling in Ceylon. In the early twentieth century moment of state bureaucratization especially, regimes of paper intersected with labouring lifeworlds at the fishery, meaning that utilising these sources allows a fuller picture of work at the camp to emerge.[45]

If the fishery as concept is historically under-theorised apart from modern resource-centric models, another mode of regulating environment, space, and labour, is amply conceptualised, especially in the literature on South Asia. That is, the plantation.

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[44] Ostroff, 'Beds of Empire,' 155-158.

[45] State paperwork is instructive of lived labouring realities. Here I draw on Bhavani Raman's methodologically innovative work on early East India Company petition and certification regimes to access the 'possibilities opened up by paper.' Bhavani Raman, *Document Raj: Writing and Scribes in Early Colonial India* (Chicago: University of Chicago Press, 2012).

The primary economic institution of nineteenth-century Ceylon (and, indeed, other Indian Ocean and Caribbean islands) was the plantation, growing, in the case of the former, coffee and tea for world markets.[46] Cutting across slavery and subsequently indenture as modes of organising labour, the plantation shared with the fishery its orientation towards commercial, global marketplaces, rather than subsistence cultivation, and the organisation of migrant workforces into ever-more efficient pools of labour.

The 'Planter's Raj' in South Asia was a distinct enclave ruled by its own disciplinary and, crucially, legal regimes.[47] As Arnab Dey writes, 'at least in theory, law permeated every aspect of these plantations and labour life – wages, hours of work, contract terms, and health.'[48] Where the plantation was regulated by law, however, the pearl fishery camp was marked by its absence, although it shared other features of coercive disciplining. The fishery also departed, to some extent, from the regimes of waged work which characterised nineteenth-century plantations after the abolition of slavery, because most Indian Ocean pearl divers operated on a share system. Despite these differences, there is merit to evaluating how far the comparison holds.

In scholarship today, the plantation has gone global. Indeed, its analytic purchase is now perceived to stretch beyond the American South, the Caribbean, or South Asia, to encompass myriad forms of commodity production that shaped - and

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[46] Arnab Dey, *Tea Environments and Plantation Culture: Imperial Disarray in Eastern India* (Cambridge: Cambridge University Press, 2018); Erika Diane Rappaport, *A Thirst for Empire: How Tea Shaped the Modern World* (Princeton: Princeton University Press, 2017); Jayeeta Sharma, *Empire's Garden: Assam and the Making of India* (Durham, NC: Duke University Press, 2011); Sarah Besky, 'The Plantation's Outsides: The Work of Settlement in Kalimpong, India,' *Comparative Studies in Society and History* 63 no. 2 (March 2021): 433-463, doi:10.1017/S0010417521000104.
[47] Sharma, *Empire's Garden*, 14.
[48] Dey, 'Diseased Plantations: Law and the Political Economy of Health in Assam, 1860–1920,' *Modern Asian Studies* 52, no. 2 (March 2018): 645–82, https://doi.org/10.1017/S0026749X16000536, 647.

continue to shape - the modern world.[49] Hence, the contested term 'Plantationocene' and ongoing debates around it. In one recent overview of this literature, Julia Fine reminds us that, 'despite the cultural capital of the capacious term plantationocene, not all commodity production took place on the plantation.'[50] In Fine's definition, the plantation is emphatically tied to *terra*, that is, to land and crops; she helpfully suggests that moving beyond the plantation allows for 'non-crop-based commodity production like fisheries and mines' to come to the fore.[51]

However, fisheries historians have long noted that marine extraction and labour draw on the same language of yield and husbandry (fish 'culture') as agri-culture; historical actors referred to 'crops' of oysters and 'harvests' of pearls, a feature which we will return to in Chapter 5, *Law*. Many who worked the land turned to maritime work during fishery seasons. Structures of taxation and ownership derived from agricultural contexts were applied to the sea.

The following chapters will maintain that by the early twentieth century, the distinction between *terra* and *mare* is not so straightforward in terms of labour pools, the use of science, the regulation of work, systems of taxation and production. The attempt to domesticate the sea involved extending many of these regimes outwards from the land to the sea. Returning to an older strand of scholarship, I think instead about the plantation in terms of power relations, rather than conditions produced out of a specific crop. Here I am indebted also to the scholarship of Kjell Ericson, who has

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[49] Donna Haraway, 'Anthropocene, Capitalocene, Plantationocene, Chthulucene: Making Kin,' *Environmental Humanities* 6, no. 1 (2015): 159–65, https://doi.org/10.1215/22011919-3615934; Janae Davis et al., 'Anthropocene, Capitalocene, … Plantationocene?: A Manifesto for Ecological Justice in an Age of Global Crises,' *Geography Compass* 13, no. 5 (2019): 1-15, https://doi.org/10.1111/gec3.12438; For an important recent critique see Mythri Jegathesan, 'Black Feminist Plots before the Plantationocene and Anthropology's "Regional Closets,"' *Feminist Anthropology* 2, no. 1 (May 2021): 78-93, https://doi.org/10.1002/fea2.12037.
[50] Julia Fine, 'Ecology and Labour in Bengal's Salt Industry 1780 - 1862,' (MPhil diss., Cambridge University, 2021), 10.
[51] Fine, 'Ecology and Labour,' 11.

written on Japanese attempts at cultured pearling through the lens of the plantation. 'Big farming and export cultivation' took place not only on land, but also in coastal waters,' Ericson argues, using Mikimoto's pearl farms in early twentieth century Japan as an example. [52] Especially in disciplinary terms, the pearling camp in Ceylon mirrored many of the coercive, authoritarian structures of the plantation, making Ceylon's pearling camp a corollary to the terrestrial plantation, albeit one limited by the seasonality and fluctuating yield of molluscs.

Although each pearling site was seasonal, with fishing only conducted during certain times of the year, the Ceylon fishery was the shortest of all three, constituting a roughly three-week long event, and a notoriously intermittent one at that. [53] As an event, the fisheries were rare: over a one-hundred-year period, only thirty-two fisheries were held. In years when the oysters *did* lay thickly on the banks at sea, the length of the fishing period was dictated by the colonial state, and by natural constraints. When reefs were 'exhausted' or oysters ran out, the fishery was closed. Oysters, of course, unlike tea or coffee seeds, could not be planted, but we will return to this point in Chapter 4, *Science.*

Fishing took place along the western coast of Mannar, at a distance from the closest major town, Jaffna, which was located in the far northern peninsula of Ceylon. [54] Here it is worth briefly discussing the terrain and ecology of the Gulf of Mannar. The key point is that the broader ecology and landscape of the watery Gulf was uniquely amenable to centralised control. Bounded by the coast on both sides and sheltered by a

[52] Ericson, 'Nature's Helper,' 15.
[53] Fernando, 'Seeing like the Sea,' 16.
[54] Bastiampillai, *Northern Ceylon*, 3, 213.

chain of islands to the north, at around twenty-five kilometres wide, the Gulf of Mannar is, and was, a relatively contained space. [55]

Mannar is a large district on Ceylon's northwest coast which takes its name from Mannar Island, an island off the western shores, from which a chain of limestone shoals and sandy islands spill out across the Palk Bay up to Rameswaram on the Indian side. This 'land bridge', arcing between Ceylon and South India, is rich in both nomenclatures and ecologies, and splits the northern Palk Straits from the more sheltered Gulf of Mannar. It is the closest proximate region to the Indian mainland and is thus often invoked in histories of Indian-Sri Lankan *longue durée* connections. [56]

On the other hand, because it is located far away from the traditional and colonial centres of political or religious power in Kandy or Colombo, Mannar has been largely construed as peripheral to Ceylon's political geography. Anthropologist Dominic Esler has recently recounted how Mannar is often seen primarily as a 'throughfare' rather than a site of historical action; consequently, 'the social and historical context of Mannar remains largely unknown.' [57] The fishery and its economic and labour conditions offer one way to partly recover Mannar's history, albeit one that was contained, seasonal, and limited; the historical forces comprising the fishery in terms of labour and capital were regurgitated by the colonial state back out onto the opposite shores of the Gulf.

The labour history of nineteenth and early twentieth century Ceylon on both the terrestrial plantations as well as their maritime equivalents, was largely powered by migrants. Pearl oyster purchasers, too, were overwhelmingly Indian. At the fishery of

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[55] A.K. Kumaraguru et al., *Scientific Information on the Gulf of Mannar - A Bibliography* (Ramanathapuram: Gulf of Mannar Marine Biosphere Reserve Trust, 2006).
[56] S. Muthiah, *The Indo-Lankans: Their 200-Year Saga: A Pictorial Record of the People of Indian Origin in Lanka from 1796* (Colombo: Indian Heritage Foundation, 2003).
[57] Dominic Esler, 'Under the Giant's Tank: Village, Caste, and Catholicism in Postwar Sri Lanka,' (PhD diss., University College London, 2019), 41.

1904, for instance, twenty-four million oysters were bought by Indian merchants from over ninety towns in Madras Presidency. [58] In the words of one fishery superintendent: 'if a pearl fishery was dependent on the people of Ceylon, it would not make much of a show.' [59] As an economic and social institution then, the fishery was emphatically *trans*-national, linked *across* the natural morphology of the Gulf. It was the question of how to manage this offshore labour and capital which determined the fishery's impact in Ceylon.

The deeper penetration of the state into economic life and the ongoing 'islanding' of Ceylon thus meant that pearling was not able to organically contribute to thriving maritime entrepôts developing along the coast. During a fishery, the shore of Mannar was a frontier where the 'closure' of the partitioned island was opened for a brief, seasonal – and vitally, economically imperative – interlude to labour and capital from the Indian shore. In his account of early nineteenth century politics in the region, historian Sujit Sivasundaram has described the British process of 'islanding' Ceylon from mainland India, although he qualifies this separation by explaining that 'partitioning and islanding do not have linear developmental narratives, nor are these accounts of closure where the partitioned island becomes a final object.' [60] In the following paragraphs, I show how the process Sivasundaram describes as 'separating the sea,' was paused for the duration of the pearl fishery. [61]

One key reason for opening an increasingly separated and territorialised sea was that replacement with local labour or capital from Ceylon for the pearl fishery was not possible. In the case of diving labour, one long-time official wrote that 'I am not aware

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[58] J.P. Lewis, 'Report on the Pearl Fishery of 1904,' 20/801, SLNAK.
[59] Ibid.
[60] Sujit Sivasundaram, *Islanded: Britain, Sri Lanka, and the Bounds of an Indian Ocean Colony* (Chicago: The University of Chicago Press, 2013), 329.
[61] Ibid., 73.

of any Ceylon divers being employed at the fisheries.'[62] In 1881, out of 1000 divers, not even 50 'belonged to Ceylon.'[63] Ostroff has catalogued early-nineteenth-century attempts to settle South Indian divers along Ceylon's northwest coast; these plans were even recommended in the Colebrook-Cameron report of 1833, a set of empire-wide reform initiatives undertaken from the colonial metropole in London.[64] For the most part, however, these settlement plans were never taken up with enthusiasm or applied more broadly, relying instead on fishers' customary, long-term patterns of maritime mobility.

The Gulf of Mannar was the core of Catholic missionary activity under the Portuguese in the sixteenth century, so many in the fishing communities were converts to Roman Catholicism. One nineteenth-century census put the number of Catholics in the district at 10,962, and churches such as St Mary's and St Sebastian's had large congregations.[65] In 1890, Mannar had 'the largest proportion of Christians of any district in the island.'[66] Pearl fishing was, as a rule, paused on Sundays, when divers attended mass at nearby churches. Despite this, a view which reproduces a solely Christian-dominated picture of the shore and its communities would fail to mention the Muslim groups who had shared the coastline for several centuries, often living in close proximity to Catholic fishing settlements and similarly involved in the regional pearl fisheries.[67]

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[62] W.C. Twynam, 'Report on the Pearl Fishery of 1881' in *Ceylon Sessional Papers of 1882* (Colombo: Government Printer, 1882), 153.
[63] Ibid.
[64] Ostroff, 'Beds of Empire,' 98; To some extent, this was similar to ambitions in the 1830s to settle South Indian migrants on the central plantation highland lands, to provide a permanent workforce, see I.H. vanden Driesen, *The Long Walk: Indian Plantation Labour in Sri Lanka in the Nineteenth Century* (New Delhi: Prestige Press, 1995).
[65] Anon., 'General Description and History of Mannar District,' 31/477, SLNA.
[66] Ibid.
[67] M.M. M. Mahroof, *Exploring Sri Lankan Muslims: Selected Writings of M.M.M. Mahroof* (Batticaloa: South Eastern University of Sri Lanka, 2015), 109, 347.

Inhabitants of both sides of the coast shared Tamil as a common language, and local religions, stories, and language bore the marks of this hybrid culture. [68] The author of the 1891 anonymous text *General Description and History of the Mannar District* estimated that sixty-seven percent of the population was Christian, and thirty-one percent was Muslim. [69] The villages on Mannar Island itself – Mannar, Erukalampiddi, Pechalai, and Talaimannar – are useful examples of social and economic context. Many inhabitants were employed in fishing, as well as trading, weaving, and chaya root digging. In 1891, the 3000-strong population of Mannar town included 'Moors and non-Christian Tamils' in addition to the Catholics. [70] They worked as 'dhobies', 'dyers', 'barbers' and 'fishers', whereas the 'entirely Mahommedan' population of Erukkilampiddi, worked as weavers, traders and divers. [71]

The pearl fisheries did not take place from Mannar island itself, but from sites further south along the coast, closest to the pearl-bearing reefs: from Arippo, Silavatturai, and, from 1889 onwards, Marichchukkadi. The region was largely arid, a 'barren wilderness of sand and scrubby thorn jungle.' [72] Although there were scattered coconut and palmyra plantations, land that was not connected to the system of irrigation tanks was not hospitable to cultivation.

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[68] Anas S., 'Islamicate World System and South Indian Muslim Trading Networks in the Medieval Indian Ocean History,' in *Indian Ocean: The New Frontier*, ed. Kousar J. Azam (Oxford: Routledge, 2019); KMA Ahamed Zubair, "The Rise and Decline of ArabuTamil Language for Tamil Muslims," December 2014, http://dspace.iiuc.ac.bd:8080/xmlui/handle/88203/229; Anas S., "Islamicate World System and South Indian Muslim Trading Networks in the Medieval Indian Ocean History," in *Indian Ocean: The New Frontier*, ed. Kousar J. Azam (Routledge, 2019); Dennis B. McGilvray, "Arabs, Moors and Muslims: Sri Lankan Muslim Ethnicity in Regional Perspective," *Contributions to Indian Sociology* 32, no. 2 (November 1, 1998): 433–83, https://doi.org/10.1177/006996679803200213.
[69] Esler, 'Giant's Tank,' 47.
[70] 'Description of Mannar District,' 31/447, SLNA.
[71] Ibid., 33.
[72] J.C. Wolf, *The Life and Adventures of John Christopher Wolf* (London: Robinson: 1785), 269; John Capper, *Old Ceylon: Sketches of Ceylon in the Olden Time* (Colombo: Ceylon Times Press, 1877), 202; Sailing time Colombo to Silavatturai see 'Diary of James Donnan,' 16 Feb 1874 to 20 Feb 1874, E.L.Pawsey papers, CSAS.

Across all three sites of pearling, the lack of land for cultivation explains pearling's outsize importance to the livelihoods of coastal peoples. These are histories that diverge from those centred on well-watered agrarian landscapes. Mannar, for instance, is in a region described by ecologists as Ceylon's 'Dry Zone,' far away from the agricultural plateaus of the south. Burma's richly fertile Irrawaddy delta was similarly many hundreds of miles north from Mergui. Much of the Persian Gulf coastline too, was desert (with the exception of select oases), so pearling likewise provided a vital source of income and employment. Descriptions of Gulf pearling towns often echoed the following account of Doha: 'here in the midst of a hopelessly barren desert, without trees, shrubs, or even signs of grass, stands a city of 10,000 inhabitants or more.' [73]

By the nineteenth-century, in Ceylon, the fishery was not spontaneous, but state-directed in terms of how geographies of undersea ecology and governance intersected. In its reliance on the state for proceeding with fishing, dictating the length of fishing period and the sites of fishing, the Ceylon case departs from the Burmese and Persian Gulf where fishing practices were much more dispersed and never concentrated under a single overseer. The location was announced on notices that were circulated at Paumben, Negapatam, Madurai, Tuticorin, and other South Indian towns, with the expectation that *vallam* (boat) owners or *sammati* and other caste headmen would recruit divers and proceed accordingly to the fishery. [74]

The selection of a suitable site relied thus on a medley of logistical, ecological, and surveillance-related considerations. When the camp was moved to Marichchukaddi in 1889, the long-time Fishery Superintendent William Twynam initially rejected

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[73] G.J. Pennings, 'The First Visit to Doha,' in *Journal of the Arabian Mission of the Reformed Church in America* 108 (Archive Editions, 1998): 14.
[74] 'Notice of a Pearl Fishery,' 23 February 1864, 31/396, SLNA.

another potential location as an 'infected locality,' where 'divers refuse to go,' showing how coastal fishers had some say in the choice of camp location. [75] The chosen site had to support a large temporary population: Chilaw was considered in the late 1870s but rejected for lack of fresh water for drinking. [76] But most importantly, the site had to allow state visibility: in his disdain for a potential camp at Dutch Bay, Twynam wrote that 'the islands in front completely shut out the view of the bay and the sea beyond unless a very efficient guard were kept up.' He warned that divers would toss bags of oysters overboard onto the seafloor which would 'simply [be] removed at night by divers or by the fishermen and others in league with the divers.' [77] Prominent coastal landmarks were important to help fisherfolk to navigate at sea, but more than that, they enabled state visibility over pearling, ensuring the quality of the camp that Eaton has described as a dialectic between opacity and transparency. [78] In a world of state control, visibility of divers' actions was paramount to ensure that they did not undercut the state's share of the profits.

Similar to Mergui and the Persian Gulf, the Ceylon pearl fishery was a nexus of migration, in this case, of labourers and fishers from the Indian side of the Gulf (see map 1). The colonial state did not, however, rely on commercial recruiters to hire divers, trusting that the fishery would prove remunerative enough for divers to want to come. This point bears repeating, especially when compared to Ceylon's plantation economies: for the entire duration of Ceylon's pearling history, divers worked entirely without formal or written contracts from the state, arriving at will and choosing to work owing to the promise of profit. Although some might be impoverished by the endeavour

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[75] Twynam, 'Report to the Colonial Secretary on the Fishery of 1890,' 20/755, SLNAK.
[76] Donnan, Inspection Reports, 5 April 1878, E.L.Pawsey Papers, CSAS.
[77] The early settlements of the fishery camp at Arippo, likewise, hugged high rocky coastal cliffs where the famed Doric bungalow allowed a panoptic view to activity at sea. On Governor North's bungalow at Arippo, see Ostroff's treatment in 'Beds of Empire,' 168-173; see also 20/755, SLNAK.
[78] Eaton 'Photobook of the Shimmer,' 27-8.

of diving, many also earned greater cash income than in other jobs (see Chapter 2, *Labour*). Whereas other historians have highlighted a labour shortage when it comes to pearling, there was no labour or skills-based shortage in the Gulf of Mannar which had to be matched by enslaved persons or skilled divers from further away.

In Mannar, seafaring communities arrived for the fishery on boats which then doubled as working craft. In 1903 one visitor recorded how 'as far as the horizon, over the tropical sea a hundred or so sail-craft raced, fantastic in colour and shape...' [79] Others used the language of the port, exclaiming that: 'The port looked picturesque with 300 boats, steam launches, sailing vessels and occasionally steamers in the harbour.' [80] But unlike in the Persian Gulf contexts, where communities settled nearby the pearling shore, those who attended the Ceylon fishery were making short-term, elastic journeys, and returned to their home villages and towns in South India. [81] Some arrived with their families, including wives and children, but the majority of migrants were male, echoing patterns of oceanic mobility across the globe. [82]

The construction and dismantling of the fishery camp relied on local labour. Authorities in Colombo worked with local *adigars* (headmen) of Mannar, and other neighbouring towns to hire labourers. [83] Buildings were assembled from coconut palm

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[79] Everard Im Thurn, 'Sketch of the Ceylon Pearl Fishery of 1903,' *Spolia Zeylanica* 1 (Colombo: 1903): 188.
[80] 'Report on the Pearl Fishery of 1903,' 20/800, SLNAK.
[81] Eric Meyer, 'Labour Circulation between Sri Lanka and South India in Historical Perspective' in *Society and Circulation: Mobile People and Itinerant Cultures in South Asia, 1750 – 1950* eds., Jacques Pouchepadass Claude Markovits, and Sanjay Subrahmanyam (London: Anthem, 2003), 59.
[82] Cave, *Book of Ceylon*, 644; In 1903, the fishery camp superintendent described the arrival of 'large coast boats…swarming with divers and their families and household goods and coolies.'; General Description of Mannar District, 31/447, SLNA.
[83] Correspondence with Adigar of Mannar, 31/396, SLNA; Twynam, 'Diary kept by the Government Agent, Northern Province, during the Pearl Fishery of 1877,' 7 March 1877, E.L.Pawsey papers, CSAS. The *adigar* were assigned a province under the Kings of Jaffna (similar to the *adikar,* chief officers of state under the kings of kandy) and kept this title as caste headmen above the mudliars. See H.W. Codrington, *Glossary of Native, Foreign and Anglicized Words* (Colombo: Government Printer, 1924), 3.

fronds, clay, and wood from local forest.[84] Mats, olas, and other materials were transported from Jaffna. To erect the camp, the beach-site had to be cleared, levelled, and cleaned, with any seaside roots and underbrush pulled up or burnt out. Next, large numbers of trees were felled for building materials, after which a series of culverts, state buildings, roads, bazaars, and meeting spaces were laid down.

Initially, *uliyam* or compulsory caste-based labour seems to have been used to compel men and women to work constructing the camp.[85] Muslim cultivators and traders in Musali were known for being 'skilful thatchers' and 'builders of the pearl fishery camp.'[86] The willingness of villages to work on camp construction was tied to agriculture: in 1890, those who 'found employment in bringing timber from the jungles and putting up the buildings required,' received much-needed income because of crop failure.[87] These forms of work were increasingly incorporated into waged pay-structures, even if they maintained their association with lower-caste persons.[88]

The camp's housing assignments and street plans separated out divers of different region, caste, and religion, a distinction that divers themselves may have wanted to uphold. A surviving map from 1889 is instructive (figure 3).[89] 'Kilakkarai Muslim divers' were separated from 'Tuticorin divers,' who again lived separately from the 'Jaffna divers.' To some extent, these spatial divisions mirror those found in village communities that anthropologists have catalogued elsewhere in South India and in

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[84] H.A.Blake to Alfred Ayttelton, 'Despatches regarding the Leasing of the Pearl Fisheries of Ceylon' (Colombo: 1906), E.L. Pawsey Papers, CSAS.
[85] In the 1840s, there are records of local people running away to avoid compulsory labour establishing the camp. G.C. Mendis ed. *The Colebrook-Cameron Papers: documents on British colonial policy in Ceylon, 1796 – 1833* (SOAS University of London, 1957).
[86] 'Mannar District,' in *Administrative Report 1903* (Colombo: Government Printer, 1904). I am grateful to Dominic Esler for sharing these sources with me.
[87] 'Mannar District,' in *Administrative Report, 1890* (Colombo: Government Printer, 1891).
[88] For instance, in 1903 the 300 men employed 'bringing in timber and roofing sticks' from the jungle were paid cash wages. See petitions from 'jungle clearing contractors' at the pearl fishery of 1925. 'Applications for Pearl Fishery Employment,' 20/830, SLNAK.
[89] Map of the Pearl Fishery Camp, E.L.Pawsey Papers, CSAS.

Northern Ceylon, and they shaped also the possibilities for collective action which I turn to in the next chapter. [90] In addition, all the basic institutional elements of colonial law and administration were present: courts, medical facilitates, state bureaucracy, police, military force, and a nascent scientific framework. [91]

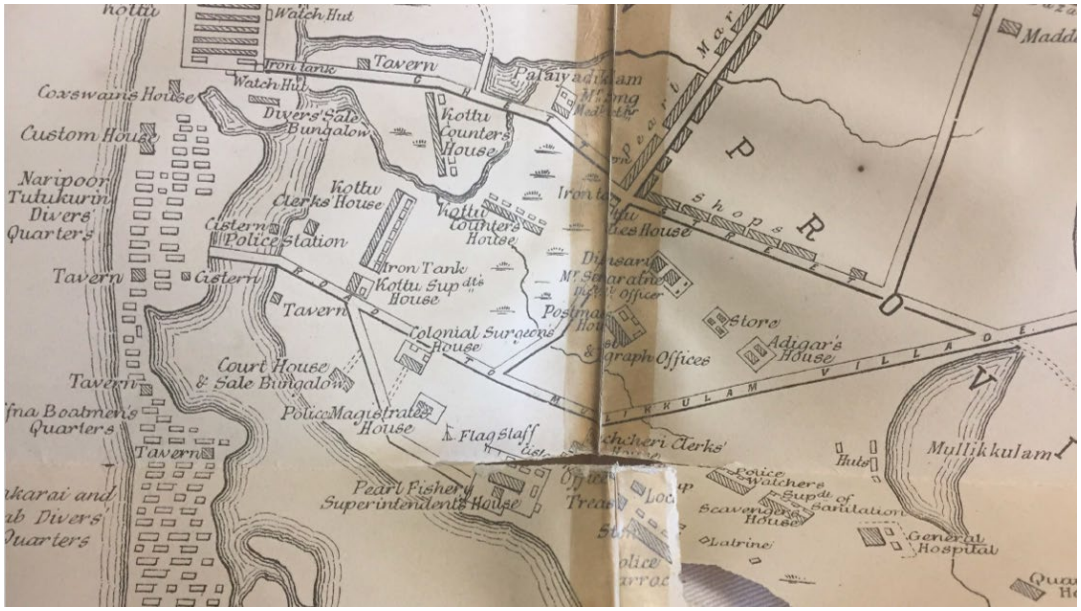

Figure 3: Map of the pearl fishery camp at Marichchikkadi, (1889). E. L. Pawsey Papers, Centre of South Asian Studies, Cambridge.

The camp did not just alter landscapes in its construction, but it left behind changed environments in its wake. The material remains left behind included not just human and animal waste, but also those of several million oysters, whose empty shells were then discarded on the beach. At Silawatturai, a year after a fishery, officials noted that re-using the same campsite was impossible because 'the ground … is thickly covered with such heaps of oyster shells that it is hardly possible to walk.' [92] Thus the

[90] Esler, 'Giant's Tank,' 111-3; E. Valentine Daniel, *Fluid Signs: Being a Person the Tamil Way* (Berkeley: University of California Press, 1984), 1.
[91] Camp attendees also required water for drinking, cooking, and bathing. A system of wells was connected to a large regional tank: in 1880 there were eleven wells in total. Twynam, 'Pearl Fishery of 1880,' 6 March 1880 and 7 March 1880, E.L.Pawsey papers, CSAS.
[92] 'Pearl Fishery Diaries,' 06 Nov 1857, 20/789, SLNAK; The heaps of oyster shells accumulated at Arippo were so vast that merchants proposed establishing lime making plants on the shore to convert discarded shells into agricultural fertiliser; Letter from John Capper, 19 July 1858, 20/768 SLNAK; Trials by Volkart Bros in 20/821 and 'road materials' and other experiments. Schulze Bros and Co. petition for 5 tons of shells see letter, 11 September 1903, 20/821, SLNAK.

camp also had an ecological aspect in terms of how it transformed terrain and landscapes outside of the sea.

In its role as a magnet for migratory labour, Ceylon appears at first to be similar to the Persian Gulf and to Southern Burma, where the promise of gain drew in migrants. The fishery camp seems then to mirror the 'fluid, transnational character' of the Persian Gulf's pearling towns.[93] However, the camp delineated and shaped the experience of foreignness in its excessive policing and surveillance, with the latter increasing in the second half of the nineteenth century.[94] Importantly, the camp was also dismantled at the end of the season, encouraging migrant fishers to return to their home villages, rather than to stay on in Ceylon. The camp prevented successive waves of migrants for the fishery from settling, resulting in the absence of comparable *mudun-al-ghaus* (pearling towns) which arose in the Persian Gulf.

The lack of more permanent settlement on Ceylon's shores is also the result of the fact that migration occurred in a long-established pattern between two very close littorals, and that the fisheries were few and far between. In the Persian Gulf, pearling drew in not just maritime migrants but also those who travelled from great distances over the hinterland: the Bedouin of Zellag, for instance, the furthest south of all Bahrain's villages, spent half the year in the desert but, during pearling season, they settled close to Bahrain and were all 'in some way connected with pearl diving.'[95] This is also true for the large population of enslaved African men and boys who were brought to the Persian Gulf to work in the pearl trade and who subsequently integrated into Gulf

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[93] Fuccaro, *City and State*, 4

[94] In 1836, twenty-five European and Malay officers were sent to the Arippu fishery. By 1892, this number was 154. By 1905, there were 16 sergeants present and 128 constables present, with another six men from the Indian Police sent for further assistance, see G.K. Pippet, *A History of the Ceylon Police* (Colombo: Times of Ceylon, 1969), 62, 296, 399.

[95] *Journal of the Arabian Mission* 82 (July-Sept 1912), 12.

societies.[96] Comparing migration in the Persian Gulf to Ceylon, we can then evaluate the former as including both forced and free migration which increased dramatically in the late-nineteenth century, whereas Ceylon's migratory circuits remained in older models of fluctuating, intermittent, short-term movement.

Although pearling's impact on Ceylon's shores in terms of long-term demographic change was limited, the fishery was a considerable short-term economic boost. For divers and sailors were not the only migrants who attended the pearl fishery camp. The seagoing workforce accounted for – at most – half the total number of persons present at the fishery camp. In 1881, Twynam counted 12,000 attendees.[97] An increasing number of persons seem to have attended the camps as the years went on, especially during the 'boom years' of 1903-1906. Early twentieth century accounts estimated that between 10,000 and 40,000 people were present; another estimate in 1904 counted 20,000 individuals.[98] A credible census count was complicated because 'the influx and outgoing was so continuous.'[99] Although the event of the fishery was short-lived, its magnitude was considerable.

The camp mirrored, as both Eaton and Ostroff have pointed out, the bazaar economies that characterised pre-industrial South Asia. Leonard Woolf, sent to supervise the pearl fishery during his tenure as a colonial official in the Northern Province, underscored its diversity in his descriptions of the camp. These accounts predictably saw the world of South Asian commerce and labour in uncomfortably racial terms: the camp was said to contain 'a little India, Asia almost, even a bit of Africa.

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[96] Hopper, *Slaves of One Master*, 289.
[97] 'By the close of March, I believe there must have been from 10,000-12,000 in the place viz.:- officials and their servants, 500, boatmen, divers, manducks, and their families and attendants, 4000 to 5000, merchants, pearl dealers, traders, boutique keepers and coolies, &c. 6000-7000.' Twynam, 'Report on the Pearl Fishery of 1880.'
[98] Lewis, 'Pearl Fishery of 1904.'
[99] 'Report on the Pearl Fishery of 1903,' 20/800, SLNA.

They came from all districts: Tamils, Telegus, fat Chetties, Parsees, Bombay merchants, Sinhalese from Ceylon, the Arabs and negroes, Somalis probably, who used to be their slaves.' [100] The diversity ranged across religion, caste and language. In 1905 the colonial state put out calls for 'an interpreter who can speak English, Sinhalese, Tamil, Hindustani and Arabic.' [101] In another petition, a merchant demanded that the state should provide separate handpumps for washing and water to avoid caste-pollution: he suggested one tap each for Muslims and Christians, another for brahmins and for 'high caste Hindus' and a fourth for 'other castes.' [102]

Capitalists in Ceylon interested in pearls concentrated on purchase, rather than extraction, because the latter was managed by the state. That is, unlike Sri Lanka's plantation economy, where planters bought their own vast tracts of land to harvest tea or coffee, having a stake in the pearl trade only required South Indian Chettiar merchants or their agents to purchase oysters which had already been fished up and brought ashore. This makes pearling in Ceylon distinct from industrial pearling in Mergui, which required pearlers to make large capital outlays. This meant that merchants did not need to invest in their own labour forces, factories, or land. Instead, capitalists rented pre-made shelters from the government for pearl processing: 'a house ten feet square, consisting only of four walls and a roof made of palm leaves and jungle sticks.' [103] In these enclosures oysters died, decomposed, and their flesh was sorted for pearls. Then, at the conclusion of the fishery, merchants could leave not with bulky bags of oysters but instead with pearls – low in bulk, but high in value.

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[100] Woolfe, *Life and Adventures*, 270; Similarly, 'An enormous crowd of people assembled on the coast…traders came with wares of all kinds; the roadstead was crowded with shipping; drums were beaten, and muskets fired; and everywhere the greatest excitement prevailed.' Edgar Thurston, *Notes on the pearl and chank fisheries and marine fauna in the Gulf of Mannar* (Madras: Government Press,1894), 9-10.
[101] Letter from Government Agent Northern Province to the Colonial Secretary, 01 December 1905, 20/749, SLNA.
[102] Unsigned letter, undated, 20/749, SLNAK.
[103] Cave, *Ceylon*, 644.

These links of capital, credit and commerce tied Ceylon's fishery camp to Bombay, Madras, Madura, Trichinopoly, Ramnad, and other centres in South India. [104] In 1858, for instance, there were representatives of 45 different 'firms' and 180 major merchants (this is without taking into account buyers or speculators who did not bid at the government auction). [105] In addition to pearl merchants, there were also small-scale traders who sold clothing, household items, grain, vegetable and fruit produce, and seafood. Preserved commercial ephemera reveal diverse places of origin for these traders. [106] They range from B.M. Sirisena of Anuradhapura to Mohammed Smail Rawther of Ramnad, suggesting a commercial world open to storekeepers from both the Indian mainland and Ceylon. In one of the less orthodox petitions, Shellar's Royal Circus, a South India-based performance troupe, even bid 'to hold performances for a period of 14 days' inside the camp. [107]

The sale of liquor represented another lucrative opportunity. [108] Vast quantities of alcohol were consumed at the pearl fishery, mostly (but not entirely) by labourers and divers, allowing many renters to make a hefty profit. [109] The alcohol was mostly fermented coconut toddy, or *arrack*, which required a license to be purchased from the government for sale. Preserved memos and receipts give an idea of the scale of this trade. In 1863, 200,008 gallons of arrack were consumed. On a single day, 24 March

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[104] Petition No. 1732, 'Suggestions by Pearl Merchants for the Improvement of the Camp,' 20/749, SLNAK.
[105] 'Accounts,' 20/821, SLNAK.
[106] To give a small sample: Sharif Deen who sold 'sweet meats, sherbert and tea' was from Negombo while Hassid of Malabar and Abubakar of Madura opened similar boutiques. Pearl Fishery Licenses, 20/755, SLNAK.
[107] Letter from Shellar's Royal Circus, 28 February 1925, to the Chairperson, Pearl Fisheries Town, 20/755, SLNAK.
[108] Overview of arrack renting in Ceylon see, Kumari Jayawardena, *Nobodies to Somebodies: The Rise of the Colonial Bourgeoise* (London: Zed Books, 2003).
[109] John D. Rogers, 'Cultural nationalism and social reform: The 1904 Temperance Movement in Sri Lanka,' *Indian Economic and Social History Review* 26, no. 3, (1989), 322.

1864, 1,505 gallons of arrack arrived. [110] Arrack renters petitioned to ask for extensions of service hours, and permissions to sell a more diverse array of beverages including brandy and schnapps gin. [111] It is a well-established fact that on Ceylon's tea and coffee plantations, the large migrant labour force also spurred another enterprise, 'the train of peddlers, tavern keepers and others eager for profit.' [112] The fishery followed a similar pattern.

The boost to regional trades was significant enough that, in 1925, when officials debated the idea of doing away with the camp by having the state take over all operations and directly sell and export pearls, administrators worried that the loss of the economic nexus of the camp would harm regional economies. [113] South Asian merchant capitalists at the pearl fishery differed from European capitalist engaged in Ceylon's export industries, and from pearl merchants in the Persian Gulf and in Mergui. In the Persian Gulf, local sheikhs were often prominent pearl buyers, and important elite actors also acted as pearl merchants, reinvesting the wealth of pearling into urban mansions and religious rituals. In Ceylon, however, pearl buyers operated free of the restraints which were placed on labour (see below) and much of the wealth generated by capitalists in Mannar pearling left Ceylon's shores for villages and temples in Madras Presidency. Pearling in the Gulf of Mannar was unevenly partitioned: capital and labour were common between South India and Ceylon, but the settlement and movement of labourers was tightly controlled.

Indenture

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[110] 'Memos for Cask Arrack for Pearl Fishery,' in 'Outward Letter book of the AGA Mannar,' 31/396, SLNA.
[111] See petitions from arrack tavern owners, in 20/755, SLNAK.
[112] Jayawardena, *Nobodies to Somebodies*, 86.
[113] Joseph Pearson, A.H. Malpas, and J.C. Kerkham, *The Pearl Fishery of 1925* (Colombo, 1926), 21-23.

A view to pearl processing and camp maintenance reveals that, beyond the work of going to sea and diving, other labour processes overlapped significantly with those of the plantation. For one thing, the pearl fishery was also a key site of indenture. That is, the waged labour of men and women (in this case, largely South Indian peasants), looking for contract work across the Indian Ocean world and indeed, far beyond it.[114] Indentured workers served two primary roles at the fishery camp: they were hired by the state as sanitary crews, and they were also hired by private merchants to transport, wash, and sort pearls. The recruitment circuit overlapped considerably with the island's plantations.

Although some migrants seeking work on the terrestrial plantations arrived in Ceylon via ship journey which left them in Colombo, most undertook a 150-mile-long walk to the plantations which began with a maritime crossing from Rameswaram on the Indian side to Mannar island.[115] This journey took migrants through the major pearling sites such as Arippo before cutting inland to Kurunegala and eventually the hills where tea and coffee were grown. It is unsurprising then, that the work of fishing and the pathways of these migrants intersected. Fishery reports from 1857 complained about roads running down to the coast 'crowded with immigrant coolies.'[116] Far before the state attempted intervention into the labour force on the terrestrial plantations, they were directly managing indentured labour at the fishery camp. By 1877 plans of the camp included a 'cooly shed,' and medical assistance to 'sick coolies' was factored into fishery revenue statements as early as the 1860s.[117]

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[114] The literature on indenture is vast. Clare Anderson, 'Convicts and Coolies: Rethinking Indentured Labour in the Nineteenth Century,' *Slavery and Abolition* 30, no. 1 (February 2009): 93-109; Marina Carter, 'Indian Indentured Migration and the Forced Labour Debate,' *Itinerario* 21, no. 1 (1997):52-61; fn. 74 in Introduction.
[115] Vanden Driesen, *The Long Walk*, 19.
[116] Letter, unsigned, Pearl Fishery Diaries of 1858, 20/789, SLNAK.
[117] Twynam, *Report of the Pearl Fishery of 1877* (Colombo: William Henry Herbert, 1877), 7; Vanden Driesen argues that the state avoided interference in matters of indentured workers' transport and

Scattered references make it unclear whether these individuals knew that they were destined for work at the fishery or if they presumed that they would find work on the coffee and tea plantations instead. For example, in late March 1877 a boatman from Paumben brought over forty men, women, and children and landed them south of the pearl fishery in the middle of the night. Officials recorded these individuals 'wandering over the town' without food or shelter, and, it appears, without a notion of where they were being taken and for what kind of work. [118] In another recorded instance, men and women arrived with four *kanganies* [headmen- overseers] to supervise the workers, suggesting similar processes of recruitment and labour oversight. [119] There was further overlap in terms of supervisors: one Mr David Todd who had been a coconut planter in Pallali, for instance, applied for the position of 'Superintendent of Coolies.' [120]

The presence of indentured labour at the fishery camp suggests that while the recruitment of diving and seafaring personnel remained in older circuits of patronage, others were drawn into new regimes of contracted waged labour. [121] The primary task performed by indentured labour was the processing of oysters. Once oysters were fished from the ocean, counted, divided, and sold, the next major job was obtaining pearls from these creatures. Bags were carted out of the main government hall and carried to

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health until the 20th century in the case of the plantations, whereas the fishery caste reveals that it began much earlier. *Long Walk*, 18-66.

[118] They were 'all collected by the police, disinfected, sent to the quarantine ground' with 'a measure of rice having been issued for each man, three-quarters to each woman, and a half and quarter to the children.'

[119] Private recruiters, such as G. Wall and Co., were also noted as assisting in procuring labour.

[120] Letter from David Todd to the Government Agent, Northern Province, 4 February 1924, in 'Pearl Fishery Applications,' 20/830, SLNAK.

[121] Moreover, not all those on indentured contracts were recruited from the South Indian side either. Later petitions evince how the chank industry enlisted as 'coolies' men from 'the islands of Nainativu, Punkuddudum and other islands from Ihenmarachu and Pachchilapady and also Mannar district,' suggesting broader local patterns of hire and recruitment from Mannar's coastal areas and smaller islands. Letter from K.V. Venkadasalam Chettiar and K.W. Karutha Maraikkayar to Mr Robert Chalmers, 3 August 1915, 30/837, SLNA.

private merchant's *kottoos*.[122] The oysters were then left for about a week in the hot sun to die and decompose.

Unlike in Mergui and in the Persian Gulf, where this task was performed by the pearling vessel's crew on board the ship, in Ceylon this was a shore-based activity. The specialization of the workforce and division of this labour of fishing compared to processing of the fished oysters may have emerged out of the early commercialization of the fishery in the sixteenth century and its concentration in a single site. It is unlikely that subsistence economies around diving also had this division of labour.

The mode of processing oysters involved an ecology that transcended the actions of humans alone, involving, crucially, microbes and other creatures who fed on the flesh of dead oysters. Slicing open an oyster, as anyone who has 'shucked' one for eating will know, is complicated because oysters' adductor muscles contract to keep the valves closed. Divers in the Persian Gulf carried a small knife to quickly cut through the creature's muscle. In Ceylon, however, it was not living oysters that were opened, but dead ones, thus relying on natural processes of decomposition to aid in the process of pearl extraction. Rotting flesh attracted 'immense numbers of worms, flies, muskitoes and other vermin' and the camp was described as smelling 'insufferably offensive.'[123] Some camp attendees reported that it was difficult to eat a meal anywhere owing to the vast numbers of flies.[124]

After seven days of rotting, the remains and shells were pooled into vessels known as *ballams* and a row of workers would squat alongside it to wash the flesh out

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[122] In 1880, for instance, *kottoo* number six was given over to the Chettiar merchant P. Ramasamy of Nagapatam. Letter from Twynam to A.R. Supprumanian Chetty, 14 Feb. 1890; Letter from Twynam, to the Colonial Surgeon, 10 January 1890, 20/755, SLNAK.
[123] Henry J. Le Beck, 'An Account of the Pearl Fishery in the Gulph of Manar in March and April 1797,' *Asiatik Researches or Transactions of the Society Instituted in Bengal for Inquiring into the History and Antiquities, the Arts, Sciences and Literature of Asia* 5, no. 4 (London, 1807), 399.
[124] Ibid.

of the shells and sort through this for tiny seed pearls. The task required careful attention. The women of Arippo were renowned as the best pearl sifters in the region. [125] Importantly, this task was gendered differently to sailing or going to sea: it relied largely on women and children's labour, rather than able-bodied men. [126] Both Maarten Bavinck and Richard Stirrat, two anthropologists working on Sri Lankan fishing communities, have highlighted how women are responsible for shore-based activities, while men go out to sea, a practice which recurs in oyster processing. [127] Local associations with working with fish and bad odours may have bolstered prejudices against lower-income groups who performed this work, which Europeans described as 'slow, expensive and the reverse of sanitary.' [128] 'Expensive' is used here because this was waged work: women who washed pearls were paid between fifty cents to one rupee per day. [129]

Apart from washing oysters, sanitary work was essential to maintain the camp. In a site that concentrated several thousands of bodies, the work of cleaning the streets, drains, public marketplace, and housing compounds was important, especially given the concern that state authorities held over the spread of infectious disease. Cholera outbreaks at the camp were common throughout the nineteenth century. [130] A 'Sanitary Officer' was in charge of these tasks, by 1903, over a hundred people worked under this official. These jobs were open to exploitation. In one petition signed by the 'wives

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[125] 'General History of the District of Mannar, 31/447, SLNA.
[126] Ostroff, 'Beds of Empire,' 139.
[127] Stirrat, *On the Beach*, 73.
[128] George Dixon, 'Notes on the Workings of Pearl Separating Machinery,' 11 April 1906, 20/749, SLNAK; Despite these negative associations, it is worth recognising that the work of washing and sifting for pearls may have allowed fisherwomen to bolster household incomes through their own work, offering a glimpse into the economic role of women in the pearling industry. Gayathri Lokuge and Dorothea Hilhorst, 'Outside the net: intersectionality and inequality in the fisheries of Trincomalee, Sri Lanka,' *Asian Journal of Women's Studies* 23, no. 4 (October 2017): 16, doi.10.1080/12259276.2017.1386839.
[129] 'Report on the Pearl Fishery of 1903.'
[130] Tamara Fernando, 'Death at the Pearl Fishery,' *Hypocrite Reader* 95 (July 2020), https://hypocritereader.com/95/tamara-fernando-mannar-pearls-cholera.

of the scavengers of the town and fishery' dated 4 April 1904, five women—Vallie, Karlie, Sinnady, Sinnacully and Somala—argued that 'our said husbands were drawn by Mr Nicholas [Sanitary Superintendent] but he only paid them very little.' [131] The men pointed out that they had not been paid what they asked for (1 rupee per day's labour and given less rice than they were promised) and refused to work. In response, 'a lot of small boys had been taken' to fill their roles instead.

Similar petitions recur throughout the fishery archives. [132] They offer an insight into the substitutability of labour, and how these contracts were very often abused by those in power. The crowded camp may have allowed easy labour substitution if there were many others looking for paid work. In addition to the sanitary crews, pearl washers and sifters, and seagoing workforce, there was a smaller body of Ceylonese and Indians employed in what was known as the 'fishery establishment,' or the state bureaucracy. [133] The highest positions of Pearl Fishery Superintendent and Inspector remained white and European, but at lower levels of the state apparatus we find many local employees. [134] In 1854, the fishery establishment cost £598 to run. [135] By 1925, the number of staff had expanded from ten to thirty one, along with a concomitant rise in the cost of these personnel. [136]

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[131] 'Petition from the Wives of the Scavengers of the Town and Fishery,' 4 April 1904, 20/801, SLNAK.

[132] Even the tom-tom beaters (men hired to sound drums to wake the divers for their departure at midnight). Vainathan and Vryravan Kanthan submitted a petition in 1903 that their pay of 50 cents for the fishery was 'quite inadequate.' See 'Petition of Vainathan and Vyravan Kanthan Criers of Marichch,' 20/800, SLNAK.

[133] As the fishery became more bureaucratized, the number of positions expanded. 'List of Mannar officers at Silavatturai and rates of allowance to be paid to them,' 20/755, SLNAK.

[134] High caste Tamil clerks employed in the pearl fishery administration often had experience working in the Straits Settlements or in India and often spoke Malay, Telegu, Tamil, Sinhalese, and English, see 'Applications for Pearl Fishery Employment,' 20/800, SLNAK; Twynam 'Report on the Pearl Fishery of 1880.'

[135] 'Pearl Fishery Diaries: Payments and Charges for 1854,' 20/789, SLNAK.

[136] The 'fishery establishment' as it was then known, included two katcheri clerks, an immigration clerk, an interpreter, a shroff, a native to write, a treasury watcher, a messenger. In a separate 'Fiscal's Office' there was a messenger, a clerk for the post office, four persons for the court, a clerk for the road committee, and fourteen extra hands including peons, messengers, extra clerks, process servers and other staff.

Managing Migration

The plantations which emerged in nineteenth-century Assam, and which have received the most amount of attention in colonial South Asia, had as their hallmarks coercion, unregulated immigration, and extra-legal authority for planters. [137] In a very different account of the camp, Sunil Purushotham has turned instead to mid-twentieth century India, describing the camps in Telegana known as the 'Rural Welfare Centers,' or 'Tribal Rehabilitation Colonies' run by the Revenue Department in conjunction with the Social Services Department. [138] Here, Purshottam argues, the new nation state would 'control Adivasi bodies in order to protect them.' [139] Certain disciplinary and coercive features of the camp and plantation applied to the Ceylon fishery, but maritime work extracting oysters was not year-round or even annual, preventing the establishment of a permanent workforce, and, to some extent, giving divers more leeway to manage their labour.

In the first place, there were few similar compunctions about the role of worker's bodies at the camp, or the legality of their status. Owing to its shorter duration, the Ceylon fishery never saw the same drive to intervene in matters related to the seagoing workforce's private lives: there were no schools (although there were hundreds of children) in the camps nor checks for the health of divers or their fitness to dive. The hospital existed mostly to quarantine those suspected of cholera, often against their will. [140] The police and courthouse existed largely, again, to try divers for the theft of pearls or to imprison those who challenged the authority of colonial officials or their

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[137] Dey, *Tea Environments*, 5.
[138] Sunil Purushotham, *From Raj to Republic: Sovereignty, Violence and Democracy in India* (Stanford: Stanford University Press, 2021), 226.
[139] Ibid.
[140] On this see Twynam, 'Diary of the Inspector 1877,' 31 March 1877, E.L.Pawsey Papers, CSAS.

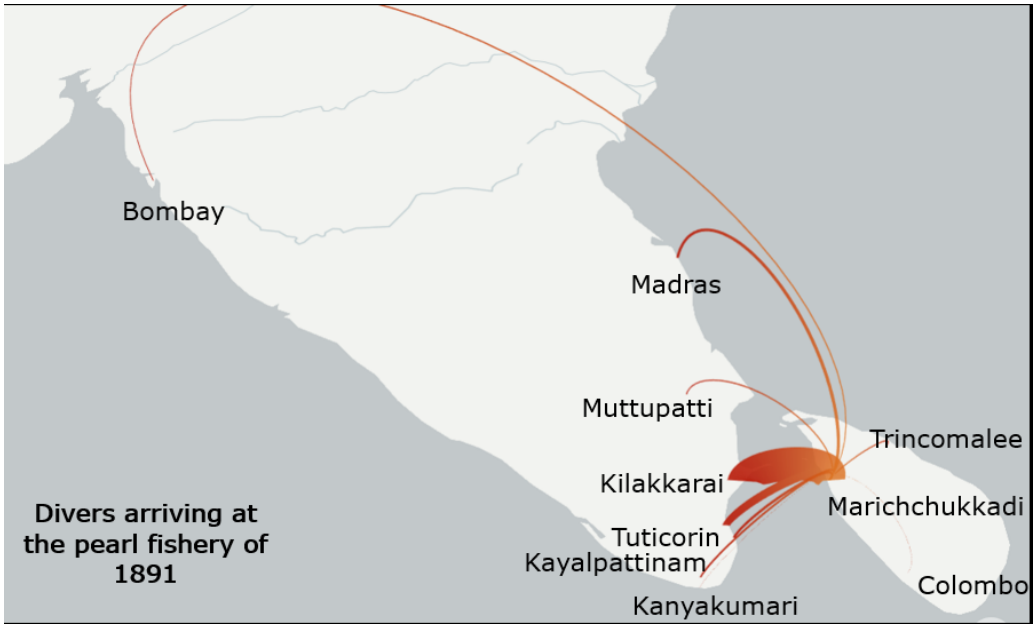

Figure 4: Point of Origin for divers arriving to work at the Ceylon pearl fishery of 1891

subordinates.[141] The camp concentrated monopoly interest and allowed for a tighter security apparatus to be extended over the pearling workforce.

The centuries-long seasonal and cyclical migration of fishers from one littoral to the other for work in pearling was disrupted at the turn of the twentieth century. As we saw above, securing labour for the fishery relied on a different logic to the estates and their 'lazy native' stereotype, which was used to justify importing South Indian labour. In contrast, in the Gulf of Mannar, it was largely acknowledged that specific caste groups with diving and seagoing skills were adept at diving and they continued to perform this function.

Although notions of 'Indian' compared to 'Ceylonese' fishers meant little before the twentieth century, after this point, the journey from one coast to the other was made much more arduous and cumbersome.[142] Already by 1893, boat owners and divers had to obtain passes for Marichchukkadi from Medical Officers and the Superintendent of Immigration at Paumben before voyaging to Ceylon. Divers who

[141] 'Leasing of the Pearl Fisheries of Ceylon,' Governor Sir H.A.Blake to Alfred Lyttelton, 14 June 1905, E.L.Pawsey papers, CSAS.
[142] Lewis, 'Report on the Pearl Fishery of 1904,' 661.

arrived in Colombo by steamer from Bombay (primarily divers from the Persian Gulf) likewise had to be registered and to pay a safety deposit for good behaviour at the fishery.[143] This means that long before Ceylon's citizenship acts of 1948, which are generally taken by historians to be the moment when questions of belonging to the island were cemented using documentary and bureaucratic regimes, those migrating from one coast to the other were subjected by the systems of clearance passes and medical checks to a less free movement across the sea.

Despite this, the magnitude of the fishery as an economic event threatened to overwhelm these controls. In 1903, medical officials in Kilakkarai complained that two days was wholly inadequate to perform health checks: that year, there was a backlog of 125 boats waiting for clearance passes to the pearl fishery.[144] Another immigration official complained of how often 'boats were found to contain many more souls than the number mentioned on the clearance tickets, in one case the number being more than double.'[145] In other instances, infections would break out and the superintendent of immigration would try to withdraw his certificates, only to find that the boats would have already sailed away.[146] Regulating fishery arrivals was additionally challenging because migration overlapped with other geographies, such as sacred geographies of pilgrims travelling to Rameswaram Temple.

Despite state attempts to mitigate unchecked migration, skilled divers were often granted exceptions when it was economically imperative to do so. In 1904, for

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[143] In 1906, over a thousand divers arriving from the Persian Gulf divers were registered and provided with numbered badges. Telegraph from Jaffna to Colombo, 1906, 20/749, SLNAK.
[144] Telegram from Superintendent of Immigration to Kilakkarai, 12 February 1903, 20/800, SLNAK.
[145] Letter from the Superintendent of Immigration, Paumben, to the Government Agent, Northern Province, Ceylon, 16 February 1903, 20/801, SLNAK.
[146] *Ibid.*

instance, '*bona fide* divers' were allowed to proceed to the fishery direct from Kilakkarai instead of requiring them to get clearances at Paumben. [147]

The deep and particular state surveillance of migration across the Gulf of Mannar contrasts with the Mergui Archipelago, where British colonial administrators showed little concern about the presence of 'foreign' divers from Japan, Singapore, and the Indonesian Archipelago working in the pearling industry there until World War Two. Not all maritime boundaries were a concern for the state. Divers did not register with state officials, nor have an excessive police or military presence to regulate their activity. Several of these migrants settled in Mergui and established or joined communities there, moving freely with the stocks of fish, political climate, or other opportunities. Their arrival, residence, and departure were not surveilled or documented with anything close to the degree of scrutiny of the Gulf of Mannar, where the proximity to India marked it as a potential site that had to be clearly partitioned off and managed. [148]

Movement: Itinerant Pathways in Mergui

Pearling in Burma took place from a vast island archipelago abutting the southernmost district, Tenasserim, far away from the old royal strongholds of Mandalay or the emerging colonial capital of Rangoon. Unlike in Ceylon or the Persian Gulf, however, these reefs had only been little exploited by local groups, largely for barter, and never on the same scale as either of the pearling sites described above. The district was separated on the east by a broken, irregular line of hills, on the west by the seacoast, and on the south by the Pak Chan River which separated Burma from Siam. Despite being the first territory to be directly administered by the British after the costly and

[147] Lewis, 'Report on the Pearl Fishery of 1904.'
[148] For the longer legacies of this management see Sivasundaram, *Islanded*, 79.

violent first Anglo-Burmese Wars, Mergui remained one of the most sparsely populated districts of British Burma well into the twentieth century. [149]

In addition to its mountain ranges and valleys, much of Mergui District was covered in dense jungle, both on the mainland and on the islands of the archipelago. Although Mergui had once been a prominent medieval Indian Ocean throughfare, funnelling trade from the western Indian Ocean on its way to the South China Seas, by the middle of the nineteenth century, it was a 'sleepy' place, poorly connected to Rangoon or ports in British India by steam and 'nestling between river and jungle…half hidden, until one comes abreast of it.' [150] A colonial administrator writing in 1905 described the town as demonstrating a 'satisfied, and somewhat stagnant, contentment.' [151] This stagnation was often attributed to Mergui's geographic remoteness, at the 'very extremity of the province.' [152]

Similar to Mannar, Mergui and Tenasserim District more broadly fall out of standard economic or political histories of Burma in the second half of the nineteenth century. The history of this extreme southern archipelagic zone pales especially in comparison to the stunning ecological and demographic transformation of the Irrawaddy Delta into the largest rice exporting region in the world during this period. [153] In addition to rice cultivation, the main industries around Mergui were pearling, fishing, thatch making industries, tin mining, and smallholder cultivation of rubber. In addition to rice, locals cultivated *dani* (a kind of palm tree), *kaing* (beans), and tobacco, although

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[149] Proceedings of the Lieutenant-Governor of Burma, Revenue Department, 3 May 1907, qtd. in *Report on the Settlement Operations in the Mergui District, 1905-1906* (Rangoon: British Burma Press, 1907), 1.
[150] J.C.M., 'Sea Gypsies and Pearls,' *The Sydney Morning Herald,* 12 April 1913, 7.
[151] *Settlement Report Mergui 1905-1906*, 13.
[152] Officials also often attributed the lack of robust population numbers or development to the district's frontier location which meant that it had historically served as a site of war in power struggles between Burmese empires and Siamese. *Settlement Report 1905-1906*.
[153] Brown, *Southeast Asia*, 141-44; Jonathan Saha, 'Fatal associations: racial differentiation and interspecies empire in colonial Myanmar,' (seminar presentation, Centre of South Asian Studies, Cambridge, UK, 06 October 2021).

not on any extensive plantation-scale. [154] To some extent, the development of Mergui mirrors the development of pearling towns in the Persian Gulf, although in the second half of this section, I will argue that the maritime mobility of the Moken again complicates straightforward models of pearl extraction and ensuing settlement and urban growth.

The integration of Mergui into the world's centres of pearl extraction came not from Rangoon or British India, but instead from the settler colony of Australia, although Pedro Machado has recently cautioned that this should not occlude the long-standing role of Asian capitalists in Burma's pearl trade. [155] The pearling industry underwent a major shift in the nineteenth century with the discovery of new banks in northern Australia. Historians Adrian Vickers, Julia Martínez, and Steve Mullins who have studied the Australian industry in detail, date its origins to the mid-1860s. Relative to Ceylon, the Persian Gulf, or the fisheries of South America and the Caribbean, northern Australia was a latecomer, in one historian's appraisal, a 'a new frontier.' [156]

This frontier referred both to the discovery of pearl beds, but also to their exploitation using dress diving, rather than free diving as in Ceylon and the Persian Gulf (see Chapter 2, *Labour*). The first formal survey of the northern Australian pearl banks was conducted in 1861, and within two decades, new pearling towns such as Broome, Darwin, and Thursday Island were well on their way to becoming global centres for mother-of-pearl shell. [157] The expansion spilled over into the northwestern Indian Ocean. In 1888, one Queensland pearler, Mr Chill, ventured further north than was common, and stumbled upon rich banks around Mergui. Investigations soon

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[154] *Mergui Settlement Operations 1905-1906*, 2.
[155] For the only overview of pearling in Mergui see Machado, 'Shell Routes: Exploring Burma's Pearling Histories,' in *Pearls, People, and Power*, 183-231.
[156] Martínez and Vickers, *Pearl Frontier*, 30.
[157] Mullins, 'Australian Pearl Shellers in the Moluccas,' *The Great Circle* 23, no. 2 (2001): 3-23; Martínez and Vickers, *Pearl Frontier*, 33-36.

revealed that pearl oyster banks in the Mergui archipelago spread over an area of 11,000 square miles on a rocky granite bottom. The depths at which these larger oysters lived, however, was meters deeper than Ceylon or the Persian Gulf (see Comparative Table 1). By 1895, newspapers carried news that 'rumours concerning the richness and vast extent of these comparatively new pearling grounds' in Mergui were true. [158]

New fishery legislation passed in British India was brought to bear on the management of the pearl banks. [159] As Machado has recently catalogued, the archipelago was divided up into five blocks. Each block was to be leased by the colonial state in an auction, although this system was suspended in 1902 in favour of renting out individual diving pump licenses, which was thought to be more profitable for the state. [160] Unlike in the Gulf of Mannar, however, here the overhead costs of extraction were considerable, and were outsourced to capitalists, who had to outfit large pearling schooners, buy diving equipment, pay the wages of crew, and upkeep and fuel of the pearling vessel.

The Mergui fishery was financed largely from Singapore and Australia. [161] There were European, Chinese, and Burmese pearlers and the fishery was conducted with full and modern diving equipment akin to Australia, including pumps for breathing underwater. For a period of about twenty years following the discovery of the banks, pearling brought in new wealth, and an influx of new migrants. In order to read migration to Mergui for pearling compared to the Gulf of Mannar, we have to keep in mind that systematic and regular exploitation using new technologies can be dated to

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[158] Anon., 'The Mergui Pearl Fisheries,' 31 May 1895, *Northern Territory Times and Gazette (Darwin, NT)*, 3; For more details on Mr Chill's investment and involvement see Letter from Mergui Pearling Company, Ltd. To the Chief Commissioner, Burma, 22 December 1892, AG 1/7, 1043, YNA.
[159] John MacGuire, Peter Reeves, Rob Pkiant, and John MacGuire, "The Auction Lease System in Lower Burma's Fisheries 1870-1904: Implications for Artisanal Fishers and Lessees," *Journal of Southeast Asian Studies* 302 (September 1999): 249–62.
[160] 'Disposal of Rights to collect pearls and pearl shells in Mergui District,' 1901, AG 1/7, YNA.
[161] 'Mergui Pearl Fisheries,' AG 1/7, 1043, YNA.

the late 1880s, whereas free-diving as it was practiced in Ceylon was a continuation of a centuries-old trade. Apart from the indigenous Moken, the men who arrived to work as divers and pumpers on Mergui's pearl fields were thus migrants from a great distance, coming several hundreds of miles from the banks of northern Australia, with specialised skills in using dress diving suits for exploiting deeper waters. This was a much greater distance to travel than from the coast of South India to Ceylon and represented new migratory patterns uniquely enabled by steamship transport.

Rising prices for mother-of-pearl and increased interest in the industry reflected in new prosperity for Mergui. When the Queensland pearler, Frank Jardine, made his tour of the new pearling grounds in 1894, he described Mergui as 'without hotels or places of accommodation' and lacking a bank so that 'cheques and bank drafts are almost totally useless and unnegotiable.'[162] Poor mail and steam connectivity exacerbated these feelings of remoteness. By contrast, in 1913, Mergui was 'cosmopolitan,' 'thriving' and 'growing year by year.'[163] Observers wrote of a 'glowing panorama' in its streets and markets where 'Chinaman and Burman jostle one another; Madras coolies, Malays and Siamese are all to be seen, each in his native dress; while among them move Japanese and Filipinos […] a few wild-looking Selungs and, least frequently, Europeans.[164] Pearling thus brought to the port of Mergui a similar diversity to that experienced by other maritime entrepôts and pearling centres, albeit one that was limited by seasonality of fishing.

The growth of pearling bears itself out in demographic data. From September to April, officials described a 'large influx of people' owing to the pearling season.[165] Census attempts in 1905 recorded Burmans, Karens, Siamese, Malay and Chinese

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[162] Frank Jardine, 'Report on the Mergui Pearl Fields' (Rangoon, 1894), 1.
[163] J.C.M., 'The Mergui Archipelago'.
[164] Ibid.
[165] Jardine, 'Mergui Pearl Fields,' 476.

living in the district.[166] Intermarriage between different groups was common, but Burmese served as a common language.[167] In 1825, the population was estimated at 10,000; by 1905, that number had increased tenfold and revenue officers in Rangoon were confidently writing that, 'the district has a prosperous future to look forward to.' Demographic change reflected in the urban environment: in 1907, Mergui town was 'rapidly spreading jungle-wards' with its increasing migrant population.[168]

The scale of migration, however, was far smaller in terms of the working labour force, compared to the thousands who arrived in Ceylon and the Persian Gulf (See Comparative Table). This is because industrial dress diving practiced in Mergui was not as labour intensive as free diving. A free diver could pick up twelve oysters per dive, but a diver in a suit could spend a total of three to four hours underwater at a stretch. As a result, the number of migrant divers and seamen in Mergui was far smaller – at most, seven hundred – compared to the 2000 strong maritime workforce at the Ceylon fishery or the 70,000 men working in the Persian Gulf. It also marks pearling as a smaller industry compared to other Southeast Asian trades: consider that, at the same time, tin mining across the Federated Malay States employed over 209,014 'coolies.'[169]

This does not mean that those who migrated to Mergui, such as Japanese divers and fishers, did not form intimate links with local communities and individuals. As late as 1937, in a very different political climate, British authorities described strong links

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[166] In 1905, officials recorded there being 3500 Chinese, 2500 Malays, and 1000 Salons in Mergui district. Scholars have warned that census data for Southeast Asia should be interpreted with caution because of frequent intermarriage which result in 'insuperable difficulties arise in determining ethnicity accurately in parts of Southeast Asia,' see Brown, *Economic Change in Southeast Asia*, 36
[167] *Settlement Report Mergui*,
[168] Rudmose Brown, 'Mergui,' 480.
[169] Brown, *Economic Change in Southeast Asia*, 19.

between Japanese fishers and Moken and Burmese in Mergui, who claimed that the Buddhist Japanese were their 'brothers' who got on especially well with the Moken. [170]

The promise of gain lured regional merchants as well as local capitalists. The cosmopolitan group of merchants and traders is attested to in travelogues and other narratives, since there were no centralised state records for sale of pearls. 'The population is cosmopolitan to a degree, the majority of the inhabitants being Chinamen, although there are also European pearl buyers of all nationalities as well as representatives of nearly every race in the East,' one observer wrote. [171] Machado has traced the presence of Perankan Chinese and Straits Tamil merchants as well. In 1905, the District Commissioner in Mergui complained that, '(t)he ambition of the successful Mergui trader is to become the owner of a pearling boat,' which prevented any interest in cultivating more taxable land. [172] In comparison to agriculture, pearling offered the 'possibility of obtaining great wealth with a comparatively small outlay' compared to the low returns on paddy land. [173] This was surely what led commentators to observe that with the money to pay the state for a pump license, to hire a boat, and employ a crew of four persons, 'it is possible for anyone to become a pearler at Mergui.' [174]

The interference of the state into every day, mundane matters of pearling was minimal. Mergui was a hub of social intercourse around pearling, free of similar policing to Ceylon. This might include which island the oysters were most plentiful or richest in pearls, which boats had had the best hauls, which divers had a large pearl in their possession that they were looking to dispose of, and any dangers or accidents which took place at sea. [175] 'Nothing has so prominent a place in current conversation

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[170] 'Japanese Activities in Southeast Asian Waters,' M/3/63, IOR.
[171] E.A.K. Crossfield, 'Pearl Fishing in Burma,' *Townsville Daily Bulletin*, 17 October 1912, 3.
[172] *Settlement Report Mergui 1905-09,* 12.
[173] Ibid.
[174] Crossfield, 'Pearl Fishing.'
[175] Louis Kornitzer, *The Pearl Trader* (New York: Sheridan House, 1937), 56.

and interest as pearling. Everywhere it is the staple of conversation…' one visitor described.[176] Others wrote how 'above everything else that the archipelago sends to Mergui it is pearls and pearl shell that hold the first place of importance.'[177] He continued that 'the talk and gossip are all of the archipelago, of this or that pearl, of a certain diver's luck or of another's exploits.'

The social and urban fabric of the town facilitated the information which shaped activity at sea: consider how in 1894, all major pearling business was transacted through the Chinese-Burmese merchant Lim Thadoon, who rented Burmese boats, set the terms of payment, supplied provisions and other matters. 'Virtually this one "common" room answers the purposes of shipping office, exchange, and general business meeting place in Mergui,' Jardine reported.[178]

In Southern Burma the structures of oversight and control of labour were offset from the state to the individual capitalist. Mergui authorities made little effort to police the work of pearling. In fact, although pearlers made appeals to the colonial authorities for a greater police force on the banks, these requests were often rejected. The haul of oysters affected capital owners, but it had little bearing on state finances, since the block or pump rental had already been paid. Thus, the involvement of the state in pearling was to facilitate it, not to profit directly from extraction.

Although some predicted that Mergui would 'bid fair in the near future to rival in importance the chief pearl fisheries of the world', one decade into the twentieth century, the pearl-bearing reefs were severely damaged and overfished.[179] This, coupled with the global downturn in demand for pearls during World War One, put a

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[176] Rudmose Brown, 'Mergui,' 481.
[177] Ibid.
[178] Jardine, 'Mergui Pearl Fields,' 1.
[179] Crossfield, 'Pearl fishing.'

stop to Mergui's development as a pearling centre, especially as long-distance migration and investment from Australia ceased with the onset of the war. [180]

Moreover, pearling's profits often left Burma along with the Australian and European capitalists, although there were local buyers who reinvested profits. In a similar manner to the fallow years in Ceylon when there was no fishery and, hence, no migration or economic investment by actors from the opposite coast, by 1913, observers wrote that the Mergui pearl shell was increasingly hard to fish up and 'now only to be found in deeper waters.' [181] One observer writing from Ceylon darkly observed the trend of overfishing, writing in 1910 that 'what the Australian pearlers did to the Mergui fishery has been done to every similar pearl fishery in the world.' [182] Overfishing thus limited the social, cultural, and economic world on the shore as well, particularly when migrant labour and capital came from afar, rather than proximate local regions.

The Moken

The nomadic itineraries of the Moken in Southern Burma and their involvement in pearling complicates an easy teleology that fishing and commercial revenue leads to settlement and urbanisation, as in the Persian Gulf context. Moken fishing patterns were fundamentally altered by the introduction of industrial dress diving into the archipelago, but their relative freedom from integration into urban structures or systems of waged, taxed, agricultural work further problematizes a singular model of pearl extraction. [183] Moken communities worked without diving suits and compressed air, thus entirely in

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[180] Machado, on the other hand, sees continuity into the 1950s and the onset of a cultured pearl industry in Burma Myanmar which continues to date; cf Machado, 'Shell Routes.'
[181] J.C.M., 'The Mergui Archipelago,' 7.
[182] John Solomon, 'Mergui Pearl Fisheries,' 24 December 1910, *Times of Ceylon*.
[183] Letter to the Commissioner Tenasserim Division from the Deputy Commissioner Mergui, 1 July 1895; From the Revenue Department Secretary to the Chief Commissioner to the Secretary to the Government of India, Revenue and Agricultural Department, 14 May 1895, AG 1/7, YNA.

the shallows. Unlike divers from the Indonesian archipelago, the Philippines, or Japan, Moken divers continued to work on a barter exchange system with regional capitalists.

Assessing marine extraction vis-à-vis the town or fishery camp on land reveals a terra-centric bias in terms of how a fishery is read and construed. Harvesting marine species for the market did not always lead to settlement. Failed attempts to 'settle' the Moken in one site was the constant bane of District Commissioners. One official wrote in 1882 that when he appealed to the Moken to establish more permanent settlement patterns in Mergui, he was told that 'they could not, as they would not be happy if tied down to one place.' 'Matha, I should be unhappy', one Moken headmen told him at St Mathew's Harbour. [184] Trying to understand the Moken way of life, colonial authorities frequently repeated the observation of the German naturalist Helfer, who wrote that 'these boats [*kabang*], not longer than 20 feet, are the true homes of the Salones; to it he entrusts his life and property; in it he wanders during his lifetime from island to island; a true ichthyophagist, to whom the Earth has no charm, and whom he neglects so much that he does not entrust to her a single grain of rice.'

These static European ideas of indigenous groups were not true in practice. Even in the nineteenth century, some kinship groups of Moken had established more permanent settlements: on Yaymyitkyee in the 1890s, for example, Moken communities had felled trees and also cleared ground for cultivation. [185] From 1872 to 1882, the number of Moken frequenting Mergui increased, and their visits to Chinese traders' houses were frequently commented upon. [186] Similarly to other fisherfolk, the Moken lived in dynamic relationship with the land. Writing on the eastern fishing town

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[184] Letter from the Deputy Commissioner Mergui to the Commissioner Tenasserim, 21 June 1882, quoted in R.C. Temple, 'Extracts from official documents relating to the Selungs of the Mergui Archipelago,' in *Indian Antiquary* (Bombay: British India Press, April 1890), 89.
[185] Ibid., 86.
[186] Ibid.

of Batticaloa, Sri Lanka, anthropologist Jessica S. Lehman describes shifting, seasonal patterns of work for fisherfolk which 'embody the meeting practices of land and sea.' Lehman writes that land and sea are 'not distinctly oppositional; rather they have the potential to intimately and immanently relate to one another.' [187]

In a similar manner to these fishers on Ceylon's coasts, the Moken too divided the year into a wet (May to October) and dry season (November to April), operating in what one anthropologist terms a 'pendular movement which oscillates between nomadism and sedentariness.' [188] Although they were skilled fishers, they also worked the land, weaving mats, collecting edible birds' nest, honey, and yams from the islands dotted through the archipelago.

The standard relationship presumed between the shore and the sea in most fisheries histories is complicated by the fact that the Moken boat was the basis of the family unit. In the archipelago, a man, woman, and child would have their own boat, from which they would fish, travel, and carry out their life. [189] This contrasts to the Gulf of Mannar where divers returned to their home villages, or the Persian Gulf, where divers returned to shore-based homes. In South India, as we have observed, women were often confined to shore-based labour. In contrast, the Moken saying, *lemoy kabang lemoy binay*, or 'to have a boat is to have a woman,' expresses the way that the boat is the foundation of family life. [190] 'To marry is, above all, to live together on the same boat, travel together within the heart of movement, and within their society.' [191] The Moken compel us to read terrain, work, and gender in different ways.

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[187] Lehman, 'Ocean as Actor,' 492.
[188] Jacques Ivanoff, *The Moken Boat: symbolic technology* (Bangkok: White Lotus Press, 1999), 142.
[189] Ivanoff, 132.
[190] Ivanoff, 127.
[191] Ivanoff, 142.

Moken cosmologies related the shore in dynamic fashion relative to the sea. This may have been particular to the geography of an island archipelago, where there was a unique capacity to intermittently work both on land and at sea. For even when they did make commercial gains from fishing oysters and other species, the Moken continued to live itinerant lives which oscillated in terrain between islands.

The land was not merely a space for the extraction of raw materials to enable work at sea, but instead, one which had a reciprocal relationship with humans and their work and seagoing journeys. Consider the Moken relationship with the forest, where trees were felled to build boats. [192] The guardian spirit of the land or *tchao punga* was present in animals, trees and forests; trees and plants themselves were living beings until they were condemned, as in the opening narrative of 'the Myth of the Feminine Ancestors.' [193] Going into the forest to pick wood for building the boat, for instance, one had to always be mindful of malicious powers and spirits of wood or *katoy kae*. Trees once possessed the power of speech, which they lost, and became plants, losing their formerly equal footing with humans. [194] A tree has a heart (*hlang/nyawa*), the wood (*ken*), the inner bark (*kepi*), and the bark (*kolet*). The tree's soul (*nyawa*) was silenced in order that men might exploit the forest, and the ancestors, *ebab* inhabit the boat after it is put on the water.

The absence of permanent settlement or a straightforward relationship to the exploitation of nature both above and below the waves reconfigures the way that labour, capital, and migration were arranged around pearling.

Conclusion

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[192] Ivanoff, 115.
[193] Ivanoff., 117.
[194] Ivanoff.

This chapter has explored the relationship of the harvest of oysters to patterns of demography, settlement, and urbanisation on the shore to probe the concept of the fishery. Across Ceylon, Burma, and the Persian Gulf, the organisation of labour, gender, capital, and power in the organization of fishing varied. In Ceylon, the architecture of the fishery camp ensured that foreign capital and labour was contained and constrained, returning to the opposite shores of the Gulf of Mannar. In Burma, by contrast, there was little direct regulation of labour, although long-distance foreign capital investments often returned to Australia and Singapore rather than the shores of Mergui. It was only in the Persian Gulf, that the growth of pearling entrenched systems of settlement, demography, and power on the shore, as in most standard accounts of fisheries histories.

In each of the pearling sites surveyed above, the impact of pearling on the shore was considerable, if seasonal and intermittent. Yet statecraft and the management of migration limited the extent to which the fishery transformed local social, urban, and demographic patterns. This exploration of the parameters and definitions of a fishery helps us to think anew about the relationship of the oceanic to the littoral and terrestrial. It gives rise to modes of reading extraction at sea which are not divorced from our accounts of terrestrial modes of organising labour and production, but instead, were very much related to them, as in the case of Ceylon. Alternatively, as with the nomadic Moken, we may require distinct models of extraction and terrain which are neither fully land-bound nor sea-based but that are able to move in dynamic fashion between them. But the fishery as institution was always undergirded by the labour of divers in procuring oysters, so it is to the pearl diver that we turn in the next chapter.

Labour

Enough, enough, oh sea! It has already been two months … are you not afraid of God? Bring them back, bring them back! – Women's song from the Persian Gulf [1]

The hero's chest was drawn out by the beauty of the ladies like his float was drawn in the current of water and moved as the water current moves. -Paripāṭal 11:108

The crab responsible for the tides is an enormous creature who lives at the foot of the magical mango tree…His dwelling place is called the "potchak angin, potchak lamat," or navel of the wind, navel of the waves. - Moken narrative [2]

Introduction

The world underwater is different from that of the air. This would have been clear to the diver, fisher, and mariner Caytan Fonseka in 1867 when he found himself submerged three meters below the waves in the Gulf of Mannar. [3] His diving stone emitted a soft thud as it made contact with the seafloor. Splashes echoed around him as a thousand other men and boys plunged into the water. The currents did not throw up sand to cloud his vision that day, and the high noon light was strong. [4] Looking around, he swam towards some rocks and pried off fifteen large and healthy-looking oysters, each one firmly crusted to a rugged coralline mass. These went into a woven coir bag slung around his waist. Soon, his lungs started to burn; feeling lightheaded, he took hold of his basket and kicked up off back to the surface.

The previous chapter argued that the impacts of pearl extraction on the shore depended on the control which the state exerted over maritime migration, and whether

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[1] Abeer Abu Saud, *Qatari women: Past and Present* (London: Longman, 1984), 29; Al-Taee, 'Enough, Enough, Oh Ocean,'19.
[2] 'The Crab Responsible for the Tides', narrated by Salmah in Ivanoff, *Rings of Coral*, 128-9.
[3] Caytan Fonseka was a Tamil parava fisher who worked as a *tindal* or helmsman for the colonial government of Ceylon 1862-7 on vessels including the schooner *Ceylon*. He was also a diver and mediated between colonial authorities and local fishers. Because he also received payments from the state, Fonseka is one of the few pearl divers who are named in the British colonial archives, see 31/396, 20/769 and 31/394 SLNA and SLNAK.
[4] On currents and sand obstructing divers view underwater, see Revenue G.O. 771, 21 August 1905, TNSA.

these labourers could settle, move freely, or if they were forced to return to other shores. Once divers, sailors or their families arrived, they then got to work, for varying intervals of time. In this chapter I consider how the sea affected this work and the features that characterise diving labour. Oysters did not make their way to the surface of the ocean or onto the fishery shores for sale or science of their own accord. Instead, before the invention of culturing technology, pearling depended on the labour of individuals to mediate with the sea, the seafloor, and its attendant creatures, including – but not limited to – those that produced pearls. How this relation between human divers and oceanic molluscs shaped the relations of work and production are the subject of this chapter.

Breath-hold diving is one of the most ancient ways that humans (not to mention several other animals lacking gills) venture underwater. Divers used a weight made of stone or lead to expedite their descent, looping this around their legs to reach the ocean floor more quickly, and picking up as many oysters as possible before rising to the

Figure 5: Pearl Divers in Ceylon, Figure 1: MS Bodl. 264, pt. iii.

surface.[5] Generally, submersion lasted less than a minute, although it varied with the experience and skill of the diver and decreased with increasing depth.[6] This precise method of reaching the seafloor was already practiced hundreds of years before the nineteenth century, albeit on a far smaller scale, and generally only by the communities living adjacent to reefs. For example, the *Epic of Gilgamesh*, composed around the twelfth century B.C.E., includes a scene where its hero attempts to reach a magical plant located underwater by 'tying heavy stones [to his feet] which pulled him into the deep.'[7] The image was probably drawn from pearling around Bahrain, or Dilmun, as it was known at the time. Proximity, rather than profits, dictated participation in this work. It was the global pearl boom in the late nineteenth century that led to the expansion of diving labour forces across the fisheries.

The image of pearling as an unchanging form of labour has echoed across the centuries – indeed it haunts historians still.[8] One fifteenth-century manuscript of Marco Polo's travels across the Indian Ocean illustrates pearling in Ceylon where '[t]he pearl fishers take their vessels, great and small and proceed into [Mannar] gulf' (figure 1).[9] In the illustration, three clothed, bearded men remain inside a boat at sea, with one holding an open chest. Meanwhile, two other figures, conspicuously unclothed, descend

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[5] On technologies to augment and enhance the body see Linda Hogle, 'Enhancement Technologies and the Body,' *Annual Review of Anthropology* 34 (October 2005): 695-716, https://doi-org.ezp.lib.cam.ac.uk/10.1146/annurev.anthro.33.070203.144020.

[6] In 2008, the longest recorded surface, face-immersed breath-hold dive time was 9 minutes. At greater depths, the total time a diver can spend on the bottom decreases: at 700 feet, for instance, the current record is 4 minutes and 6 seconds. See D.Z.H. Levett and I.L. Millar, 'Bubble Trouble: a review of diving physiology and disease,' *Postgraduate Medical Journal* 84 (2008): 571-578.

[7] Ronald A. Veenker, 'Gilgamesh and the Magic Plant,' *The Biblical Archaeologist* 44, no. 4 (1981): 199–205, https://doi.org/10.2307/3209664.

[8] 'One might suppose that it had worked this way for a very long time, perhaps for the entire 400 years,' Samar K. Datta and Jeffrey B. Nugent, 'Bahrain's Pearling Industry: how it was, why it was that way and its implications,' in *Bahrain and the Gulf: Past, Perspectives and Alternative Futures,* eds., Jeffrey B. Nugent and Theodore H. Thomas (London: Routledge, 1985), 25; 'persistence of the archaic,' see Eaton, 'Photobook of the Shimmer,' 6, 13.

[9] Marco Polo, *Travels in the Land of Serpents and Pearls* trans. Nigel Cliff (London: Penguin Classics, 2015), 3.

into a sea filled with cowries and other scalloped seashells. As the white-crested waves wrap around one diver's body, he proffers up a basket of pearls as his companion continues to forage underwater.[10] Early twentieth-century visitors to the Indian Ocean's major fisheries posited that little had changed over the preceding six and a half centuries.[11] This perception of diving as an unchanging form of work was not neutral. Rather, notions of the archaic served an ideological and cultural function, as I will show.

How then can we understand the livelihoods of divers in the nineteenth century and the changes they endured under empire, the global pearl boom, and scaling up of the fisheries? First, environmental factors related to the distribution and conditions of oysters at sea resulted in income and yield variability across workforces. In other words, a consideration of pearl diving allows the history of the environment to intersect directly with labour history.[12] In contrast to merchant seafarers, who have been the subject of most works on maritime labour, divers immersed themselves in the ocean's depths.[13] That is, they were dependent on its animate lifeforms and material environments for their livelihood and pay. As a result of this dependence on oyster lifecycles and pearl formation, the industry was characterised by extreme income variability across divers,

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[10] Marco Polo MS, c. 1400, MS. Bodl. 264, pt. III, Image 46, Bodleian Library, Oxford. I am grateful to Zoltan Biederman for sharing this image with me.
[11] See fn. 17 in Chapter 1.
[12] Janis Bailey and Ross Gwyther, 'Red and Green: Towards a Cross-Fertilisation of Labour and Environmental History,' *Labour History* 99 (November 2010): 1–16, https://doi.org/10.5263/labourhistory.99.1.0001. Labour historians have been slower to ask the same questions of environments as historians of capitalism who have recently given us theoretical models such as commodity frontiers and others to understand the relationships of capital to environments. There is, of course, a much longer legacy (at least in theoretical terms) of Marxist scholars thinking about the relationship of labour and capital to nature/environment, see John Bellamy Foster, *Marx's Ecology: Materialism and Nature* (New York: NYU Press, 2000); John Bellamy Foster, Brett Clark, and Richard York, *The Ecological Rift: Capitalism's War on the Earth* (New York: NYU Press, 2011).
[13] Bolster, *The Mortal Sea*; Margaret S. Creighton and Lisa Norling, eds., *Iron Men, Wooden Women: Gender and Seafaring in the Atlantic World, 1700-1920* (Baltimore: Johns Hopkins University Press, 1996); Richard Gorski ed. *Maritime Labour: Contributions to the history of work at sea, 1500-2000* (Amsterdam: Aksant, 2007).

boats, and the workforce as a whole. The dispersal of oysters at sea (see also Chapter 3, *Maps*) also required mobile, decentralized labour forces.

This variability was present alongside workforces that were not just larger in terms of the number of employees, but also more heterogenous, as sites of pearling saw new labour entrants whose arrivals were facilitated by steamship transport and trans-oceanic merchant networks. These new divers made journeys from afar: this included Japanese and Filipino divers who travelled to Mergui, and divers from the Persian Gulf who travelled to Ceylon. In the latter half of the nineteenth century, in the eyes of colonial administrators and many capitalists, the two above features resulted in diving being increasingly viewed in cultural and racial terms, with the risks of the industry increasingly seen as intrinsic to the figure of the diver. Culturalising diving, naturalizing risk, and insisting on the primitive status of diving work allowed pearling to exist in a lacuna without laws to manage working conditions. [14]

Although divers continued to have their own ways of making sense of the sea, and their own work within it, the system where those who generated value in the pearl trade received the least compensation went unchallenged. [15] Heterogeneity and income variability also hindered movements for mass worker solidarity; at least until there were dramatic exogenous shocks to the system, as with the Great Depression and global downturn in demand for pearls, as well as the invention of a new, cheaper substitute known as the cultured pearl.

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[14] Culturalisation, see Balmurli Natrajan, *The Culturalization of Caste in India: Identity and Inequality in a Multicultural Age* (London: Routledge, 2011), 8. Natrajan quotes Wendy Brown: 'Culturalization of politics is the assumption that 'every culture has a tangible essence that defines it and explains its politics as a consequence of its essence.'

[15] Primitivisation see for instance Christopher P. Hansen and Dennis Washburn eds., *The Affect of Difference: Representations of Race in East Asian Empire* (Hawaii: University of Hawaii Press, 2016), 119.

Reading Diving Labour

Diving skill was honed over months and years, which partly explains why caste and tribal groups trained family and community members, passing down the skills of diving from father to son, or between uncles and other close kin.[16] Training to dive included not only learning to swim but also other physiological adjustments such as slowing down one's heart rate and conserving energy during and across dives. It also included following informational insights accrued over the years, including how to locate and pry off oysters effectively, which clues to follow for rich oyster beds, and what poisonous or dangerous fish and hazards to avoid.[17] The introduction of dress diving, in turn, required a new set of skills, which I consider below in relation to the Burmese context. Pearl diving was sensuous and immersionary: Tamil poetic verses by the poet Ammūvaṉār explained how, underwater, the ocean's waves sounded like human voices, akin to village gossip.[18]

Before moving onto the structural conditions of work and pay, it is worth establishing that of course, diving labour transcended oppression and abjection alone – although this should not gloss the violence and coercion of the regimes of work discussed below. Success at diving, including the length of time spent underwater, the depth reached, and the number of oysters lifted was often a matter of pride amongst communities. Differences in skill were acknowledged openly on the decks of vessels

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[16] One example of uncles and nephews doing the same kind of work, see Letter from Twynam to Master Attendant, 4 July 1867, 31/394, SLNA; Deputy Commissioner Mergui Diaries, 20 September 1904, AG 1/7, 1111, YNA.

[17] Japanese divers describe this as *kan* or the instinct for finding certain species, see David W. Plath and Jacquetta Hill, 'The Reefs of Rivalry: Expertness and Competition among Japanese Shellfish Divers,' *Ethnology* 26, no. 3 (1987): 151–63, https://doi.org/10.2307/3773654.

[18] *Tamil Love Poetry: The Five Hundred Short Poems of the Ainkurunuru, an Early Third Century Anthology,* trans., Martha Ann Selby. (New York: Columbia University Press, 2011), 51, 71, 74. I borrow 'immersionary experiences' from Kevin Dawson, *Undercurrents of Power: Aquatic Culture in the African Diaspora* (Philadelphia: University of Pennsylvania Press, 2018).

and in labour marketplaces. [19] Moreover, divers' ritual and religious lives structured the processes of going out to sea, casting nets, descending into the water each day, completing shipboard tasks, and accruing a good catch of oysters.

In Patricia Spyer's classic anthropological study of divers' social worlds in the Aru islands of Eastern Indonesia, she describes the presence of mythological creatures in the form of demanding sea wives who compel the divers to continue to find pearl and mother-of-pearl shell, in order to bring them expensive consumer goods purchased on credit. [20] These undersea wives 'provide a crucial site for Aruese to negotiate with and refigure wider processes of globalization,' Spyer explains. [21] This intuition is useful in exploring what spaces, creatures, and imaginaries lie beyond the commercial impetus of empire and capitalism, even in the nineteenth century, when our historical actors cannot partake in similar ethnographic interviews. [22]

Consider the stories told by the Moken, the indigenous communities who were employed in diving for marine produce in the shallow waters of Mergui. [23] In Moken stories, a plural non-human world intersected prominently with daily life, with marriages to fish-princesses and epic battles between creatures of the sea and those of the land. [24] Work at sea drew the Moken into this populated underwater world, interacting with giant clams, dolphins, and whales, who were coded not merely as

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[19] Bavinck, *Coromandel Coast*, 114; David Plath and Jacquetta Hill found that 'For many *ama,* probably the majority, money is secondary to the excitement of the reef environment and the daily gamble one makes with it.'. Plath and Hill, 'Reefs of Rivalry', 15, 5.
[20] Patricia Spyer, 'The Eroticism of Debt: Pearl Divers, Traders, and Sea Wives in the Aru Islands, Eastern Indonesia,' *American Ethnologist* 24, no. 3 (1997): 515–38.
[21] Spyer, 'Pearl Divers,' 515.
[22] Spyer, 516.
[23] I follow Gaynor and McCann's work on oral histories which 'can be read as narratives about human relationships with marine environments and animals,' Andrea Gaynor and Joy McCann, '"I've Had Dolphins…Looking for Abalone for Me": Oral History and the Subjectivities of Marine Engagement,' *The Oral History Review* 44, no. 2 (Sept. 2017): 260–77, https://doi.org/10.1093/ohr/ohx023.
[24] Ivanoff, *Rings of Coral*, 375.

potential sources of commercial value but also cultural, social actors.[25] The songs of the Moken are replete with insights into kinship, labour, and family, showing how the activity of diving was made visible alongside molluscan life underwater.

Similarly, in the Persian Gulf context, narratives or *hikâyat* such as the story of May and Ghilân, which revolves around the invention of the sail, provided cultural scaffolds around the work of diving, touching on themes of seagoing competition, strength, and gender.[26] Diving labour overlapped firmly with other cultural geographies. Traces of a Tamil Queen named Alli Rani, for instance, recur throughout the nineteenth century labour archives in the Gulf of Mannar.[27] There was always room for culture, for the sacred and spiritual, within the prosaic realities of commerce and capitalism.

In addition, divers had their own relationships to the products of the sea, which transcended global supply chains alone. Malay divers, who worked in small numbers in Southern Burma, sometimes described 'an Ancient of the Oysters, who rules the tribe of pearl-givers and who they blindly obey.'[28] This 'ancient' oyster was animated and agential; it could, for instance, 'save' the best oysters, 'pearl-givers', from human hands by burying them deep under sand. Other marine produce intersected with local lifeworlds: coastal communities used bangles, baby bottles, and devotional objects

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[25] Ivanoff, 375.
[26] Anie Montigny, 'La Légende de May et Ghilân, Mythe d'origine de La Pêche Des Perles?' *Techniques et Culture* 43–44 (2004): 159–65.
[27] Transliteration of அல்லி அரசாணி; See Surinder Singh and I. D. Gaur, *Popular Literature and Pre-Modern Societies in South Asia* (Pearson Education India, 2008), 215; Vijaya Ramaswamy, 'From 'Amazonian' Warrior to Submissive Wife: The Taming of Alli,' *Economic and Political Weekly* 41 (April – May 2006): 1661-1668; Building materials repurposed from ancient ruins dating to the reign of 'a certain Tamil Princess Aliarisani.' The unnamed companion explained to this fishery official how 'from this spot [she] superintended some of the greatest fisheries of by-gone days,' Hornell, *Inspection of the Pearl Banks, 1905*, 30 November 1905, 6; 'In the time of the famed Queen Alliarasani the Gulf of Kalpitiya had no opening to the north,' Modder recorded but 'a great flood came, buried her palace under the waves, and burst through a neck of land converting the lake into a gulf, which form it still retains,' see Frank Modder, *Gazetteer of the Puttalam District of the North-Western Province of Ceylon* (Colombo: H.C. Cottle, 1908).
[28] Kornitzer, *Pearl Trader*, 356.

made of the chank shell in South India and the Persian Gulf. One visitor to Burma in 1907 recorded how 'no diver ashore in Mergui considers his outfit complete without a black coral walking stick.' [29]

These cultural worlds were material and affective, and very often served the social function of making sense of and trying to mitigate the varied rhythms of the ocean. In the Persian Gulf, the diving songs or *fdjri*, for instance, often included the singer or *naham* asking 'god, the prophet, or other Islamic spirits for protection,' just as the underlying rhythmic beats of the song structured the activities of rowing, hoisting sails, or cleaning the deck. [30] In a world of uncertainty, appealing to the spirits or religious figures was useful. In the Gulf of Mannar, Tamil fishers referred to the sea as *kadalamma* or sea mother, animating the ocean as female personage who needed to be looked after and appeased. [31] The temperament of the sea and the gods and god-like creatures that controlled it are a 'shadowy part of the [fisherman's] working environment – just as elusive, for that matter, as the fish he chases,' one marine anthropologist summarizes. [32]

It is against these rich socio-cultural worlds that we find European notions of pearl divers' 'primitive' work. This idea of the 'primitive' was embedded in the modern capitalist economy's logic of accumulation because it foreclosed the possibility of greater remuneration or labour protections for divers. Insisting on the primitive or the archaic allowed those in power to posit that divers occupied a timeless world which was not amenable to or requiring of change. Consider how in his short story *Pearls and Swine,* Leonard Woolf, who worked in the administration of Ceylon's Northern

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[29] Rudmose Brown, 'Mergui,' 479.
[30] Ulaby, 'On the Decks of Dhows,' 36.
[31] 'After all, the sea gives us our earnings (*varumaanam*). We must therefore worship it like a God,' one contemporary fisherman explained to the anthropologist Maarten Bavinck, see Bavinck, *Coromandel Coast*,115.
[32] Ibid., 116.

Province in the early twentieth century, identified the labour at the core of the pearling industry: 'How to get 'em [oysters] up, that's the question.' If oysters made pearls, but oysters lived at sea, how would these be retrieved from the ocean floor and brought to shore?

Woolf's narrator continues, highlighting the role of the pearl divers' work:

> You'd think being progressive we'd dredge for them or send down divers in diving dresses. But we don't, not in India. They've been fishing up the oysters and the pearls there ever since the beginning of time, naked brown men diving feet first out of long wooden boats into the blue sea and sweeping the oysters off the bottom of the sea into baskets slung to their sides. [33]

The language of 'naked brown men' working in archaic fashion 'from the beginning of time' recurred across the fisheries in the nineteenth century. Woolf himself was a liberal, so his account of diving veers towards the more progressive, but it still signifies a way of reading diving labour. Importantly, this notion of the 'beginning of time', implying something old and primitive, also crucially masks how efficient human bodies were as an instrument of removal, which I will discuss further below.

Similarly, British officials in the Persian Gulf observed that fishing practices had existed 'from time immemorial.' [34] Diving methods 'have changed very little throughout the ages,' the British advisor to Bahrain, Charles Belgrave, wrote, because 'divers used no mechanical apparatus.' [35] In turn, capitalists using diving technologies derided free diving as 'not satisfactory from any point of view, for the method is

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[33] Leonard Woolf, 'Pearls and Swine' in *Stories from the East: Three Short Stories on Ceylon*, rev. ed. (London: Hogarth Press, 1921; London: Penguin Books, 1963), 269.
[34] 'Secret: Relative to the unauthorized prosecution of pearl fishing on the Arab pearl Banks in the Persian Gulf by a diving company composed of European and Native British subjects,' PD 1862, vol. 27, MSA; Arab pearl fisheries in the Persian Gulf: protection from foreign encroachment, ADM 116/4166, UKNA; on the phrase 'time immemorial' in the context of gem mining, see Michael D. Woost, 'Treasures of the Serendib: Mapping the Global Spectacle of Gem Mining in Sri Lanka,' (conference paper, Annual Conference on South Asia, Madison, WI, 18 October 2013).
[35] Charles Belgrave, *Pirate Coast* (London: G. Bell, 1966), 165.

extremely primitive and always subject to the limitations and delays inseparable from the use of primitive labor.' [36]

The notion of diving as 'primitive,' however, occludes how pearling was a labour-intensive form of capital accumulation that accelerated during the nineteenth century. [37] Diving had not, in fact, proceeded in this way for thousands of years, since the pearling workforces increased sharply alongside this acceleration. Increasing the seagoing workforce was an exceedingly efficient way of collecting more oysters, especially in regions where rich reefs and shoals prevented deeper water dredging vessels from successful operation. In Ceylon, the state allowed and registered a greater number of boats, just as in Mergui they sold a larger number of dive licenses. The increase in slavery in the Persian Gulf too, was tied to the need for labour to meet the global pearl boom. [38] Focusing only on the work itself occludes this scaling up which was deliberate and intentional, although it was rarely framed that way.

The history of pearling thus largely departs from standard technologically driven accounts of the intensification of fisheries across the globe in the late nineteenth century. It does, however, fit with new work in the history of capitalism outside of Europe. Writing recently on nineteenth and early twentieth century tea plantations, for instance, economic historian Andrew Liu has convincingly argued that in the absence of technological advancement, labour intensification can still be a 'distinctively modern, market-driven strategy to raise the productivity of human activity.' [39] Liu's work concerns reading the labour of tea pluckers in India and China, but I argue that diving labour was a comparable and similar case.

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[36] Kornitzer, *Pearl Trader*, 268.
[37] In theory, merchant capital, unlike modern 'industrial capital' did not intervene in production and could not improve it through labour-saving technology.
[38] Hopper, *Slaves of One Master*.
[39] Andrew Liu, *Tea War: A History of Capitalism in China and India* (New Haven: Yale University Press, 2020), 47.

Historians of pearling, including Adrian Vickers, Julia Martinez, Matthew Hopper, Robert Carter, and others have shown, that there was a dramatic increase in the demand for pearling labour across the world's fisheries, which rose concurrently with the yield and harvest of oysters. Each of the Indian Ocean's fisheries scaled up employment during this period. In 1818, the pearl beds of the Persian Gulf were worked by 2300 pearling boats; by 1907 this figure was closer to 4500, with a total working labour force of 74,000 men.[40] The pattern recurs elsewhere: in Ceylon, 1000 divers were present at the fishery of 1887; by 1905 this figure was closer to 3000, and resulted also in the greatest number of oysters harvested.[41] Hopper has catalogued a rise in enslavement in the Persian Gulf to facilitate the vast uptick in the labour force. In the absence of technological innovation, the scale of extraction still increased by orders of several magnitude across the sites of pearling (table. 2 and table 3).[42] More men led to more oysters being harvested.

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[40] The scaling up included not just the number of vessels and divers but also the length of the diving season, which was extended by 30 days and pushed into further, deeper waters. On this scaling up, see Carter, 'The History and Prehistory of Pearling in the Persian Gulf,' 157.

[41] 20/800, SLNAK. The estimate of 74,000 men, more than a quarter of the total Gulf population see J.G. Lorimer, *Gazetteer of the Persian Gulf, 'Oman and Central Arabia,* rev. ed. (Calcutta: Government Printing, 1908-1915; Gerrards Cross: Archive Editions, 1986), 2220.

[42] For comparisons, consider that the largest cotton manufacturing factories in England in the mid-nineteenth century employed between 1000 to 1500 workers. Joshua B. Freeman, *Behemoth: A History of the Factory and the Making of the Modern World* (New York: Norton, 2019), 8, 13; For comparison with other industries: in 1912, the cotton spinning and weaving mills of Bombay employed close to 100,000 workers (making them comparable to the seagoing workforce of the Persian Gulf) but other commodities, such as tea, far surpassed this: in In 1900, the adult labour force on Assamese tea plantations was 247, 760. Chandavarkar, *Origins of Industrial Capitalism*, 78; R.P. Behal, 'Forms of Labour Protest in Assam Valley Tea Plantations, 1900-1930' *Economic and Political Weekly* 20 (1985): 19-26.

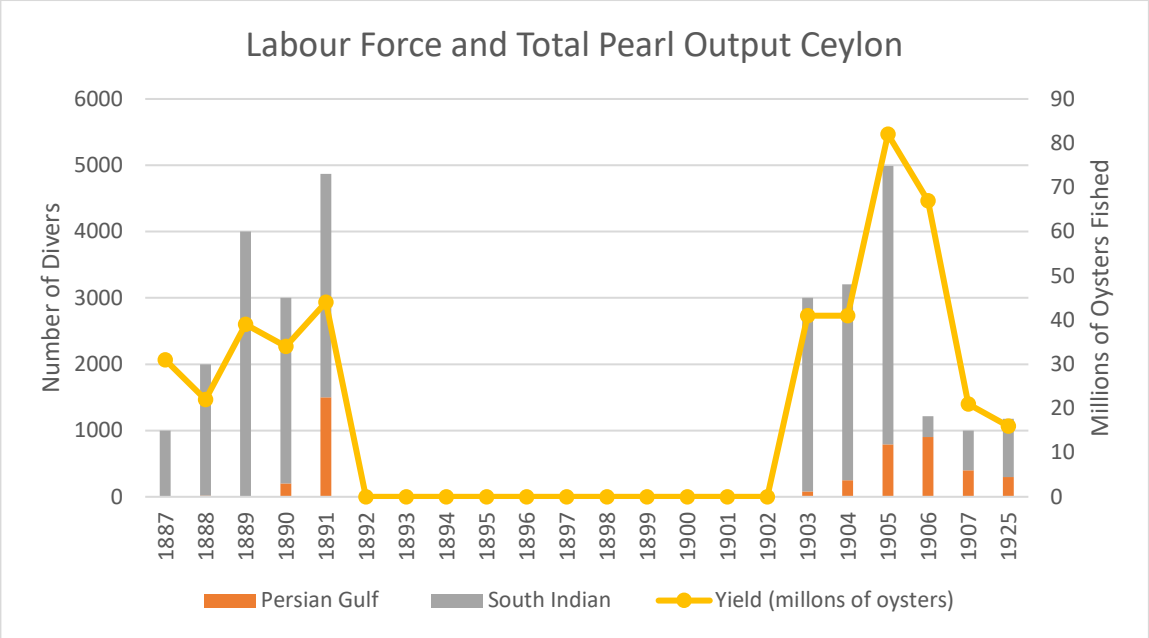

Table 2: Relationship of workforce to oyster harvest in Ceylon, 1887-1925

	Bahrain	Whole Gulf
Taylor 1818	32,000	40,000
Brucks 1824	30,000	
Wellsted 1835		30,000
Whitelock 1836	22,000	29,000
Pelly 1866	50,000	
Durand 1878		35,000
Lorimer 1905	17,633	73,566

Table 3: Robert Carter, 'Table showing counts of men in pearling' from Carter, Sea of Pearls, fig. 6.2, pp. 145.

One feature, however, which did not change, was the system under which divers were remunerated, even as the revenues made from pearls and the overall size of the workforce increased. Divers were unlike workers in a factory, with each worker receiving a set wage. They were not paid by time rate (a daily or hourly wage) or by piece rate (the number of dives or number of oysters retrieved). Instead, to read pearl divers' labour and remuneration we need to understand the economic unit within which they operated: the diving boat, which relied on a system of profit share. [43] The absence of wages or wages tied to time and piece, does not mean that there were no attempts to scale up productivity. Coercion was rife, both on the sea and on the vessel itself, although the structure of authority from where this control flowed was different in each context. In the absence of wages, the uncertainty of the sea passed directly onto those who worked with it.

In all contexts, the work of diving could not take place without the work of helmsmen, sailors, captains, rowers, pumpers, and haulers. These men cleaned ships, unfurled sails, cooked, and managed or assisted the crew and divers. In the Persian Gulf, the system of free diving was comparable to Ceylon, although the duration and extent of the season was much longer in the Persian Gulf. Gulf dhows had a crew of forty to sixty men on board; the largest vessels could hold over 100 men. In Ceylon, sail craft were smaller, less accustomed to the long-distance trading voyages, and usually carried between twelve and thirty-five men, who also had a shorter workday and shorter pearling season. In Ceylon, the season could last for three to four weeks, whereas in the Persian Gulf, it was three to four months. This reflects in the pearling songs sung on the decks of pearling vessels by the *naham*: 'Oh how lucky are the

[43] Datta and Nugent, 'Bahrain's Pearling Industry,' 28.

rich/Who no longer cross the ocean as me.'[44] To be poor was to endure absence.[45] A rest day, dictated by the captain or his second in command, was only granted when the dhow came into a port to sell pearls or obtain water and other supplies.[46]

In both Ceylon and the Persian Gulf, diving was often carried out in relays, where one group of divers alternated with another, and relied on body weight augmented with a stone, but no other equipment.[47] One diver in a pair would then come up to rest for a minute or two as their partner went down. After ten dives in this fashion, all the men in this group would come on deck as a second group descended. During these brief periods, divers would drink coffee, perhaps smoke, drink water, and eat very lightly, or, more often, not at all. The diver was linked intimately to a paired occupation of a hauler (*manduck* in the Gulf of Mannar, from the Tamil *maṇṭakkāḷ*, referring to one who hauls up a diver on a rope, or *seb* in the Persian Gulf) who would lift the diver up out of the water as fast as possible and dump the contents of his bag onto the deck. Stronger men tended to be assigned as haulers and rowers, although in the Gulf of Mannar there is some indication that divers themselves doubled as haulers.

The boat as the central economic unit in pearling could be both a site of collective, shared work, but also a site of authority and control – especially in the Persian Gulf.[48] In the Gulf, crew members were often from the same tribe as the merchant and pilot of their vessel, which has led some to conclude that profit share relied on 'peer group solidarity'; but other historians have challenged this notion, arguing instead that on the boat the authority of the captain or nakhoda (especially if he was also the boat owner) was absolute, and that his relative socio-economic privilege

[44] Al-Taee, 'Enough, Enough, Oh Ocean,' 19.
[45] Al-Taee, 'Enough, Enough, Oh Ocean.'
[46] Datta and Nugent, 30.
[47] Belgrave, *Pirate Coast*, 166.
[48] Khuri, *Tribe and State*, 59-61.

set him apart from the crew.[49] The nakhoda, in other words, was overseer and enforcer, and ensured that divers' work on the ship was strictly regulated: the number of dives before one was entitled to have coffee, the number of dives required to finish daily work, or the timing and allocation of meals. This hierarchical structure of the Persian Gulf pearling vessel contrasts against the Gulf of Mannar's boats, which were much more egalitarian.

Moreover, although a single vessel may have functioned as one economic unit, the proceeds were not equally distributed. In the Persian Gulf, once pearls were sold, the nakhoda first paid off the advance that he may have received to finance the pearling expedition. After this, the remaining proceeds were divided into a set number of shares: if he owned the boat, the captain took one fifth of the profits, then taxes to the ruling sheik were deducted, and the labourers' shares were finally calculated by multiplying the number of individuals in each crew by the number of shares to which each was entitled. A diver was entitled to three shares, a hauler to two, an apprentice to one. Dividing that season's pearling revenue by total number of shares determined each share's monetary value. These calculations were made by the nakhoda, and were set off against each diver's debt, a feature I will discuss more below. Pearling's variable returns were thus factored into the nature of remuneration.

Structures of authority were located differently in Ceylon and the Persian Gulf. In the Persian Gulf context, economic operations were concentrated to the ship: this included work, rest, opening oysters, sorting for pearls, valuation and sale of pearls, and workforce discipline. By contrast, in Ceylon, many of these tasks were relegated to the camp on the shore. The boat, in turn, was a less hierarchical unit. In Ceylon,

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[49] Datta and Nugent, 34; cf. 'the pilot or *nakhoda* was the final authority about the ship; he tried and punished wrongdoers and solved daily problems as they happened,' granting him *de facto* authority on board the vessel,' Khuri, *Tribe and State*, 59.

collective solidarities *did* characterize the fishing boats, since divers generally worked with men from their own village, with whom they shared language, religion, and caste. [50] That fishers' behaviour was conducted along caste-based corporate structures and around 'hamlet communities' is clear from the labour archive, especially in instances of refusal to work.

Here I offer a few examples from the labour archive which demonstrate the importance of caste and religious difference in structuring labour in Ceylon. Consider how on one evening of poor weather in the Gulf of Mannar, when the pearl fishery superintendent decided not to send out any boats, he recorded how 'the Killacarre divers are, I am told, willing to stop and take their chances of favourable change in the weather. It is the Tuticorin divers who are anxious to go.' [51] Here the groups of divers from the towns of Kilakkarai, who were largely Muslim divers, and Tuticorin, who were largely Catholic paravas, made different choices about whether to work. Another telling example took place in 1887, when a Muslim diver was not given a proper burial in line with Islamic burial rights. Subsequently, colonial officials noted that most Kilakkarai divers 'all turned round at once and said we are making no profit and do not earn sufficient for our maintenance. They said let us go away.' [52]

These distinctions were corroborated by the fact that (as explained in the preceding chapter) the spatial divisions of the camp mirrored caste, geographic, and religious divides. In 1889, for instance, Arab divers from the Persian Gulf, were noted as living amongst the Kilakkarai divers, who were also Muslim. Other shared social spaces on the shore reinforced these distinctions. In a gazetteer of 1834, Simon Casie

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[50] 'At fisheries it frequently happens that owing to the sudden changes and cessation of wind, the Boats both going and returning, particularly the latter/are thrown so far aback and out of the consequence as to be unable to reach the shore until midnight', Pearl Fishery Diaries, 25 October 1858 and 6 November 1858, 20/789, SLNAK.
[51] Ibid., entry dated 1 May 1880.
[52] Twynam, 'Diary of the Inspector 1877,' 31 March 1877, E.L.Pawsey Papers, CSAS.

Chitty explained that the pearling town of Arippu contained 'a Roman Catholic church, where the divers and others of the same communion, who are assembled at Condachy during the fishery, resort to hear mass on Sundays and other holy-days which may intervene.' [53] Muslim divers did not partake but had their own spaces of worship and prayer.

This nineteenth-century pearling labour force in Ceylon was distinct from say, the seventeenth century context of pearling, when the Tamil parava community had a firm foothold as the primary clients of the Portuguese as the predominant group involved in diving. [54] Now that there were new entrants, such as migrants from the Persian Gulf, and a greater number of South Indian Muslim communities, caste differences played out more prominently. In some years in the nineteenth century, there were more Muslim divers than there were Catholic parava divers. Another example of the heterogeneity of the workforce in Ceylon and the ways divers acted along caste lines is found in the archives of violence. In 1880, for instance, officials noted 'a fight in the town between the Moorish divers of Killacarre and the Parawa divers of Tuticorin.' This violence was pinned on a man known as 'Kedru Neyna of Killacarre.' Neyna was turned in to the authorities by the parava divers. [55]

The parava community later reported to Twynam that Neyna had 'asked the parawa divers to join with the Moors of Kilacarre in a strike, with a view to getting one-third share of the oysters instead of one-fourth, and it was because they would not join that the riot occurred.' [56] Here again, clearly the 'moors,' or South Indian Muslims and the paravas had no easy alliance. Despite sharing Tamil as a common language, regional

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[53] Simon Casie Chitty, *The Ceylon Gazetteer* (Colombo, 1834, Cotta Church Mission Press), 14.
[54] C.R. de Silva, 'The Portuguese and Pearl Fishing off South India and Sri Lanka,' *South Asia: Journal of South Asian Studies* 1, no. 1 (March 1978): 14–28, https://doi.org/10.1080/00856407808722955.
[55] Twynam, 'Diary kept by the Government Agent, Northern Province, During the Pearl Fishery of 1880,' 20 March 1880, CSAS.
[56] Twynam, Diary attached to 'Report on the Fishery of 1880', entry dated 20 March 1880.

religious differences still had significant power. Modern work on fishing caste *panchayats* sheds light on how caste leaders worked socially with the community to determine when to cease fishing (Tam.: *mariyal*), but traces of these interactions elude the state archive, although it is clear that when community leaders refused to fish, all their divers did too. [57]

In light of the above evidence, when comparing the Persian Gulf and Ceylon, we might observe that in Ceylon, the workspace of the vessel was largely free from the same authority structures that characterized the shore. Many divers on the vessel were equals, there were no enslaved divers, and the power of the helmsman or captain was not absolute. In part, the role of the state as overseer and main profiteer enforced this from above. For example, if a pearling vessel in Ceylon was caught 'stealing' pearls before the counting and division of oysters, all men on the boat were punished equally. [58] If a diver on a Persian Gulf vessel stole pearls (although the lack of clothing made this very difficult), he was individually punished by the nakhoda.

This means that although both Ceylon and the Persian Gulf used systems of profit share, Ceylon's system was flatter than the rigid hierarchies of the Persian Gulf. In Ceylon, power and oversight were located on shore at the pearling camp, whereas in the Persian Gulf, it was located on the decks of the pearling vessel. This hierarchy was also reflected in the mode of dispensing divers' produce. In the Persian Gulf, oysters were opened on deck to search for pearls. Pearls were then handed over to the nakhoda, who kept them in a locked chest. In Ceylon, however, divers returned to shore with their catch and sold the oysters or pearls themselves, without the mediation of a captain.

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[57] Bavinck, *Coromandel Coast*, 340.

[58] 'The divers' share of three boats had been detained in the kotoo by the superintendent till my arrival, on report of guard that one of the divers had opened oysters in boat No. 59 when coming in, and on report of police constable that attempts had been made to conceal oysters in boats Nos. 36 and 73. Made enquiry immediately on landing and forfeited 400 of divers' share of boat no. 59 and 300 of each divers share of boats No. 36 and 73.' Twynam, diary, entry dated 15 March 1880.

This gave them leeway and greater visibility over sale prices. Before 1888, three fourths of the oysters fished were handed over to the state and, after this, two-thirds. The remaining portion of oysters was divided between divers, haulers, and the tindal or helmsman of the vessel. [59]

In Ceylon, because diving expertise varied from person to person, the division of oysters may not have been equal between divers. [60] In one recorded instance, an official explained how 'each diver will not fish the same number of oysters nor oysters of the same quality a day. One diver will fish 15 good oysters and another 50 bad, another 100 good another 500 bad and yet another diver will fish 100 good according to the spot of the pearl bank of oysters which they alight on from the boat.' [61] So although there is some indication that on vessels where all men were from the same village, oysters may have been pooled and divided equally, on more heterogenous boats, divers and haulers seem to have kept their heap of oysters separate.

A major characteristic of diving in the Persian Gulf and other contexts has been the pervasiveness of unfree labour – a fact which corresponded and co-existed along 'modern' forms of global capitalism. Hopper's scholarship in particular has paved the way for thinking about the systemic and thoroughgoing role of slavery in the Persian Gulf pearl trade. [62] In this particular context, at least a third of the total pearling labour force were enslaved African men and boys, who worked alongside 'free' divers on the

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[59] 'Pearl Fishery Bagging of Oyster Correspondence,' 20/753, SLNAK; For a more detailed consideration of intra-boat hierarchies see divers' complaints about exploitation by their boatmen (tindals). 'Several complains have been made to me by divers of neglect on the part of the tindals to start in time at night, so as to reach the bank early in the morning…It was reported to me today by the Beachmaster that boat No. 89 white did not start till 4AM although the divers were all on board at 10 [PM]. She [the vessel] had to put back, and the divers lost their day. I ordered the tindal to pay them ten rupees for the loss of work through his neglect.' Twynam, diary, 16 April 1880, E.L.Pawsey papers, CSAS.

[60] In contrast, in the Gulf, it seems that all divers (unless they were *'azzal* divers) pooled the day's oysters together on deck and so 'no diver knows whether the pearls which are found were his catch, or in some other diver's catch.' Belgrave, *Pirate Coast*, 166

[61] 'Memo from the General Storekeeper,' 22 October 1925, 20/753, SLNAK.

[62] Hopper, *Slaves of One Master*.

same vessel, well into the twentieth century. As the demand for pearls rose globally, so too did the demand for enslaved persons. [63] Many enslaved divers had to give up all of their earnings to their master. This, coupled with the cost of purchase (which was included in their debt), meant that it was often impossible for most enslaved persons to ever earn their freedom. [64] Some men were beaten by their masters for refusing to dive. [65]

Apart from slavery, pearl diving in both the Persian Gulf and the Gulf of Mannar was characterised by pervasive debt. All the pearling contexts surveyed here used a system of advance payments; in large part, this was a response to the seasonal nature of pearling labour, and it also served as a way to ensure continuity of employment and availability of labour for the next season. In the Gulf, the most common system of payment for divers was a system known as *is-salafiyyah.* Under this system of extended loans, on the date that men set out, the captain of the vessel paid the men a beginning-of-season loan, the *salaf*, financed from the previous year's catch. Skilled divers could demand higher advance payments, which meant that they also tended to be the most in debt. [66] This payment ranged from around 80 to 100 rupees and was followed by two other instalments during the year.

A diver's collateral was his labour: a promise to dive for the merchant in the future or to pass the debt along to his son, a practice that was finally abolished in Bahrain in the 1930s. Divers' debts to their captains were recorded in the nakhoda's logbook and historians agree that there was little transparency or accountability about this system. Fuad Khuri has explained how 'a combination of social customs and

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[63] Hopper, 81.
[64] Hopper, 103.
[65] Hopper, 101.
[66] Khuri, *Tribe and State*, 64.

contractual transactions did not allow divers or pullers to free their pledged labor and offer it as a market commodity.' [67] Moreover, in the variable and seasonal trade of pearling, debts ensured some continuity in a world which was otherwise in flux.

In the Persian Gulf, in cases of divers absconding without settling their debts, the case was taken to a local court known as the *sālifa*, which was different to the Islamic religious courts or the rulers *majlis*, which were the two other structures of authority and judgement in the Gulf. [68]

Caeiro's research demonstrates how the *sālifa* were not constituted by any state: a region might have several, or one prominent court, held out of a local coffeehouse. Judges were often former pearling nakhodas. The courts likely had a strong interest in maintaining the status quo and siding with capital owners rather than labourers. [69] In this case, 'law' if defined as the exercise of judgement through the *salifa* court, was of little assistance to divers. It served not to safeguard labour conditions, but rather to ensure adherence to the hierarchies of the Gulf's maritime society.

Pearl divers in Ceylon also do not appear to have signed written labour contracts, but they too entered into agreements with boat owners or local capitalists to finance their pearling trips. Surviving archives make it clear that merchants had personal relationships to boat captains and, through them, to divers. Consider how in 1857, a case was filed in the district court of Mannar by Anthony Santiagopulle against Lebbai Cader, a helmsman from Kayalpatnam. Cader had 'entered into an agreement with the Plaintiff and took in hire a diving boat belonging to the Plaintiff for fifteen

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[67] Khuri, 65.
[68] Khuri, *Tribe and State*, 65.
[69] Alexandre Caeiro's work continues to shed light on how these instruments of Islamic jurisdiction interacted with British law and empire in the nineteenth century, which may have a bearing also on maritime labour, see Caeiro, 'The Islamic Law of Pearling: Ritual Obligation and Economic Practice in the Arabian Gulf (1910-1940s),' *Islamic Law and Society* (forthcoming).

pounds sterling.' [70] He had already paid eight pounds in advance. The boat was used for five days, but no payment was made. Santiagopulle requested, therefore, that Cader 'forfeit all profits.' [71] In the event that this particular pearling trip was not remunerative or adequately successful, this example offers one insight into the spiralling conditions of debt which emerged.

Similarly, in 1915, K.V. Venkadasalam Chettiar and S.W. Karutha Marikkaiyar petitioned that although they had 'engaged local men from the island of Nainativu, Punkududium and other islands' for work in the pearl and chank fisheries, the divers were 'not possessed of property to realise the advance' and had hence, failed to repay their debts. [72] These and other examples in the archive strongly suggest that even in Ceylon, bonds of debt structured the economic activity of pearling, with those at the bottom of the labour hierarchy the most deeply in debt. [73] Fishers' petitions similarly allude to the pervasive debt that they were in, and how they relied on day-to-day or seasonal income to make these payments. [74] In the event that fisheries failed, or when the introduction of new taxation regimes impacted revenues, these communities were severely affected, especially because they were already burdened by debt.

The relationship of merchants to pearl divers in Ceylon also appears in instances when the state attempted to regulate labour. [75] For instance, when migrant divers from the Persian Gulf working in Ceylon were required by the colonial state to formally

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[70] 'District Court of Mannar No 5366 Plantiff Anthony Santiagopulle Croos Fernando of Manelpado against Mena Lebbe Kader Secardy and Nawa Kidoothambi of Kowalapatnam now at Silawattore,' 31 March 1857, 20/789, SLNAK.

[71] See 13,000 oysters which were not supplied in one transaction. Letter to the District Court of Mannar from Mena Lebbe Said, agent of Mohammad Maracair against four defendants who had leased boats from him/

[72] 'Correspondence related to chank fisheries in the Northern Province,' 20/837, SLNAK.

[73] Letter to Mr Robert Chalmers from K.V. Venkadasam Chettyar and S.W. Karutha Marakkayar 04 August 1915, 20/837, SLNAK.

[74] Fishers petitions, see other documents in 20/837, SLNAK.

[75] English transliteration of தோணிமாட்டு, a term which refers to the owner of a vallam/fishing boat.

register, surviving registration documents illustrate for instance how one figure named Mohammed Sabu, a resident of Mannar, sponsored a crew of twenty four men from the Persian Gulf. [76] Similarly, the *sammati*, or boat owner, Rashu Sinnan 'from Jaffna town' sponsored nine Gulf divers named Sathu, Mohamad, Salman, Ameer, Ali, Ibraheem, Adthuasis, Masooth and Ali. [77] In a third example, Persian Gulf divers in 1887 were accompanied by a 'Bombay pearl merchant' named Mohamadu Harees. [78] The motivation of merchants to sponsor divers, especially by providing advance financing, was to purchase any pearls procured at a discounted rate. The stories of Harees, Sinan, and Sabu gesture towards the bonds of credit and informal relationships which bound boat captains and their crew to merchant capitalists. [79]

The nineteenth century saw new entrants into pre-existing regional labour forces. The primary example of this are the hundreds of divers from the Persian Gulf who were now able to make the journey on steamship to work the Ceylon fisheries from 1887 onwards (see table.2), as I have catalogued elsewhere. [80] The number of divers from the Persian Gulf peaked during the fisheries of 1903-1906 and petered out as the Ceylon beds were exhausted, sometimes leaving these same divers stranded and without work on the South Indian coastline. [81] Relations between these newly mixed

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[76] Crew: Rige; Gunavar; Asad; SAtheer; Kamir; Ahamad; Salman; Ahmad; Maneer; Abduldei; Suleiman; Aseei; Asab; Abadu; Abeeruu; Saliin; Gerrup Mahamanl; Abdulsathe; Abdulrahman Ginnasar; Abdulah; Ali; Salman; Lahif; Sabith. Letter from Mohammed Sabu to GA or Supt Pearl Fishery 19 February 1905, 20/749, SLNAK.
[77] Letter from Rashu Sinnan Sammady of Jaffna Town, 13 Feb 1905, 20/749, SLNAK.
[78] Twynam, 'Report on the Pearl Fishery of 1887'; Twynam, Diary, 2 April 1887, E.L.Pawsey Papers, CSAS.
[79] On Indian merchants in the Persian Gulf, see Claude Markovits, *The Global World of Indian Merchants, 1750-1947: Traders of Sind from Bukhara to Panama* (Cambridge: Cambridge University Press, 2000); Pedro Machado, *Ocean of Trade: South Asian Merchants, Africa and the Indian Ocean, c. 1750-1850* (Cambridge: Cambridge University Press, 2014); Ulrike Freitag and W.G. Clarence-Smith eds., *Hadhrami Traders, Scholars and Statesmen in the Indian Ocean, 1750s to 1960s* (Leiden: Brill, 1997) . Letter from the Secretary to the Government of India in the Foreign Department, Simla to the Secretary to the Government of Bombay, Political Department, Bombay, 11 April 1912, L/PS/10/457, IOR.
[80] Fernando, 'Migration of Persian Gulf Pearl Divers to Ceylon.'
[81] *Swadesamitran*, Madras, 8 November 1900, L/R/5/109, IOR.

crews veered between cooperation and competition.[82] To see traces of cooperation, we can consider how in 1905, the 800 divers from the Persian Gulf worked on rented boats as follows: 2 boats from Kilakkarai; 38 from Jaffna; 2 from Tuticorin; 4 from Paumben; 5 from Negapatnam and 4 from Colombo.[83] 'Foreign' Persian Gulf divers thus relied also on the labour of local Tamil haulers and helmsmen, and entered into agreements with local capitalists to rent boats.

Despite these records of shared work, there are also traces of tensions, especially when it came to dividing profits. On 9 March 1925, for instance, a fight broke out 'between the Arab divers and the Tamil manducks and tindal on one of the boats' over the distribution of oysters between divers. In the chaos, one diver drowned because his hauler forgot to pull him up to the surface. Many Tamil divers ended up overboard. The next day no 'Arab' divers went out to work, again suggesting that this group of workers acted collectively.[84] The increasingly heterogenous nature of the workforce may have limited corporate solidarity. Certainly, capitalists were of this opinion. As one pearler in Mergui wrote approvingly, '[t]he lack of a common tongue was sufficient to stop them from hatching rebellion among them.'[85]

An important point to note is that although a pearling vessel and its onboard division of labour may have operated as a single unit - at least when divers were all of the same tribe or caste - competition between boats was rife, particularly as the workforce grew more diverse. With a set number of oysters at sea, molluscs left unfished by one set of divers could be picked up by another. As one pearler wrote about a rich fishing ground around Mergui describing how Japanese-dominated boats were

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[82] Fernando, 'Migration of Persian Gulf Pearl Divers to Ceylon,' 35.
[83] *Ceylon Sessional Papers 1905* (Colombo: Government Printer, 1906), 7.
[84] 'The Pearl Fishery of 1925,' 46.
[85] Kornitzer, *Pearl Trader*, 13.

soon followed by other eager prospectors: 'the seas are free and the sea-bottom too, so the Japs could do nothing but work as fast as the divers could descend and come up.' [86] Similarly in Ceylon, overseers often noted that when one group of divers ceased fishing, the 'Arab' divers would substitute for them, going out to the pearl banks in their stead. [87]

Especially in Ceylon, this meant that overseers were less dependent on appeasing any one community of divers. Poverty was a robust way to ensure adherence to an exploitative labour system. The varied economic gains were also the result of the mercurial nature of the pearl bank: some areas of the sea floor would be rich and crusted with oysters, whereas other regions would have a much scantier covering of oysters. Overseers in Ceylon knew this but did not make an attempt to rotate boats or ensure that every boat had equal access to the richest parts of the oyster bed. The uneven yield of the seafloor may itself have rendered resistance volatile and unpredictable.

Enslavement and Indebtedness

The single most important factor to highlight about oyster extraction is that the returns of pearling were highly variable. This was because of fluctuations in oyster population, random occurrence of pearls in oysters and the variability of each pearl. As a result, there was great income risk. [88] Income variability occurred at the level of the diver, the boat, and year-on-year expectations of work. The closer a diver could get to the pearl itself (in terms of oyster sale, valuation, and bargaining for sale price) the greater their ability to mitigate this risk, but the more anxiety this generated for overseers. The further divers could be kept from the source of value, the better.

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[86] Kornitzer, *Pearl Trader*, 104.
[87] 'The Tamil divers would complain loudly and bitterly that there were no oysters and would move away to a new place, while, on the other hand, the Arabs would continue to dive in the same place though bringing up small numbers,' see 'Report on the Pearl Fishery of 1907.'
[88] 'Relatively high production and income risk,' see Datta and Nugent, 29.

Value was generated around pearls, not around oysters, and thus the literal distance between the diver and the pearl allowed captains and capitalists to ensure that the surplus value from pearl sale did not go to the diver. Keeping the diver away from the pearl ensured that his salary or wages remained low. As one capitalist declared firmly from Southern Burma, 'there is no reason why a diver should ever handle a pearl at all.' [89]

There are few written records which allow us to reconstruct the haul of each boat relative to the incidence of pearls and their value. Nakhoda's transactions with the *tawwawish* or pearl buyers and merchants who visited their ships in the Persian Gulf or who they met on the shore were hidden from the crew. As a result, the crew had little sense of what price the pearls they sourced had been sold for. One of the reforms that British authorities tried to push for in the 1930s was that no nakhoda would make a sale without 'at least three divers present,' but in the nineteenth century, there was no such compulsion. [90] It is popular lore how merchants and nakhodas selling pearls on the decks of vessels used a series of hand gestures under a small cloth, touching knuckles and fingers to gesture at price. Divers were unaware of these transactions. Value could be hidden by human, as well as natural, design.

In fact, variability in value did not cease at the point of harvest, but continued as pearls and shell changed hands. Because pearls could be modified by skilled pearl 'doctors' who shaved off layers from pearls to improve their appearance, the found pearl might be improved or impaired. In Ceylon in 1912, a man identified only as a 'Tamil labourer' was said to have spent his entire savings of 150 rupees on a small pearl with a marked blemish on its surface. Handing the pearl to a pearl driller to peel away

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[89] Police Inspector's report enclosed with letter from the Deputy Commissioner, Mergui to the Deputy Commissioner, Tenasserim, 20 September 1904, AG 1/7, 1110, YNA.
[90] Notes by Mr Belgrave, Financial Advisor to the Bahrain Government, on Bahrain Pearl Fisheries, qtd. in Burdett, *Persian Gulf Pearl Fisheries*.

the layers, he discovered that the lower layers were even more tarnished, and sold his pearl for only 25 rupees. His fortunes were reversed again, however, because the same season he joined with two other speculators to purchase a 75 rupee pearl, which upon peeling and 'improvement' was sold for 700 rupees. [91]

Moreover, it was not just the value of the pearls which was hidden and unclear, but also how many oysters or pearls the sea would yield. Sometimes a crew would work for hours, and the yield of pearls would be pitiful. In one recorded instance, Allan Villiers described a day's work involving thirty-two men making close to one hundred dives each on a pearling *sambuk.* The next morning, when the seven sacks of oysters procured from the seafloor that day were opened, it was found that the oysters 'yielded only a teaspoonful of pearls,' and, to make matters worse, these were pearls of very poor quality. [92] In contrast, that season, the men reported that another vessel had earned '10,000 rupees' worth of pearls already.' [93]

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[91] Hugh M. Smith, 'The Pearl Fisheries of Ceylon,' *National Geographic Magazine* 23, no. 2 (February 1912): 173.
[92] Allan Villiers, *Sons of Sinbad: The Great Tradition of Arab Seamanship in the Indian Ocean*, rev. ed. (1940; New York: Charles Scribner's Sons, 1969), 367.
[93] Ibid.

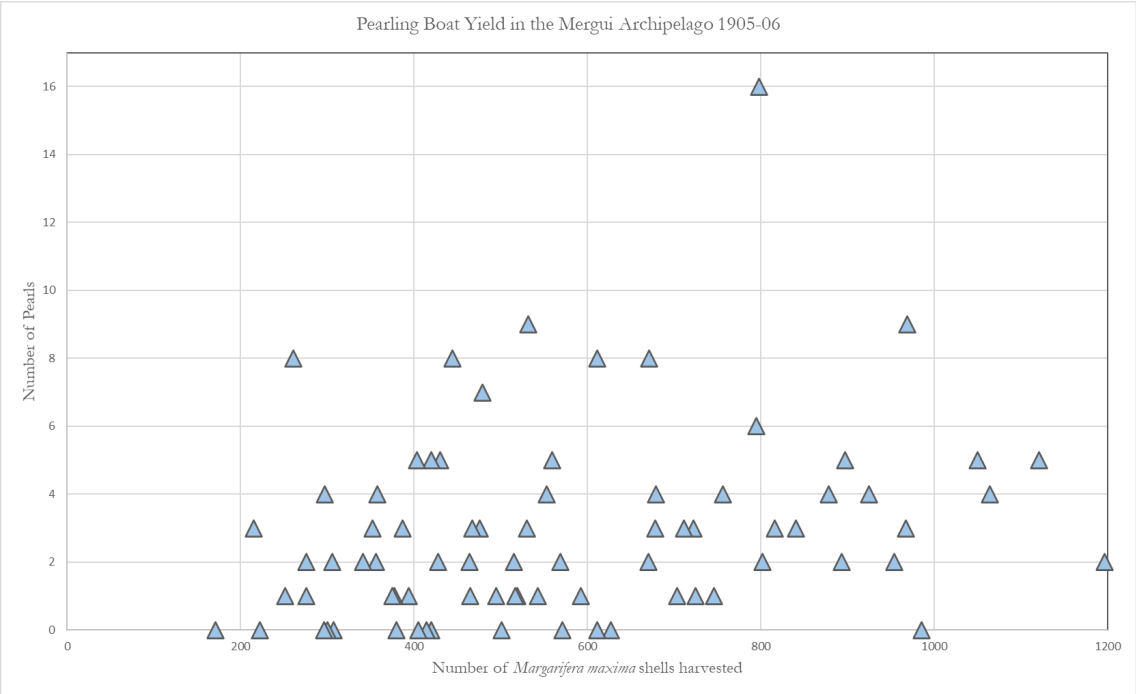

Table 4: Yield of pearls per boat in the Mergui Archipelago 1905-1906

In both the Persian Gulf and the Gulf of Mannar we do not have data for the number of pearls obtained per boat per season, but the incredibly unpredictable occurrence of pearls emerges more clearly from Customs House records of Mergui (table 3). Plotting this data reveals that even when a greater number of oysters was lifted, there is no correlation with the number of pearls found. Working harder, in other words, did not necessarily guarantee greater yield and earnings. Pearling was largely stochastic.

Of course, yield and earnings varied not only across boats but also amongst divers. Officials in Mergui described how '[a]ny day a big pearl may be found: then the fortunate owner is the hero of the hour until another and a better find absorbs all attention.'[94] Another case study is the men who travelled from the Persian Gulf to Ceylon for work at the pearl fishery of 1925. Here we have granular data for each diver, so it is possible to note that of the 300 divers 'from Kuwait' who were employed across

[94] R. N. Rudmose Brown, 'The Mergui Archipelago: Its People and Products,' *Scottish Geographical Magazine* 23, no. 9 (September 1907): 481.

nine or ten vessels, 'only two made any profit at all.' [95] While these two unnamed divers each earned 350 rupees, the remaining men were 'extremely dissatisfied' and 'barely paid their way' back to the Gulf. [96]

An important factor which gave Ceylon's divers far more control over their labour compared to the Persian Gulf was the fact that divers acted as sellers themselves, and that they sold oysters, rather than pearls. The diver was the purveyor of his produce. After the sorting of oysters into shares, the diver exited the state enclosure to an open bazaar where he was said to find 'an immediate sale amongst the merchants and dealers anxiously awaiting him.' [97] Individual bargaining and transactions between divers and merchant were rarely written down, but these prices that divers obtained for their catch set the baseline price for the state auction. Colonial authorities in Ceylon repeatedly observed that divers 'made a good thing of [the fishery],' although in the absence of empirical data, it is harder to verify this. [98] In fact, Ceylonese officials often calculated that on each lot of oysters, the prices which divers' shares fetched was higher than the prices paid for government oysters. [99]

In addition, selling oysters, rather than pearls, meant that there was an element of guesswork on the part of merchants about what price to bid for divers' hauls. The diver could pass off some of the uncertainty to the merchant. When the London pearl merchant Mr G. Klean purchased 'well over 160,000 oysters' he found that he had 'no pearl of great value,' but he had nonetheless paid a handsome price to the divers. [100]

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[95] These men could have been from anywhere in the Gulf, but they arrived and registered in Kuwait to make the journey to Ceylon on the steamer *S.S. Bhadra,* see Letter from J.C. More to the Mesopotamia Persia Corporation, 27 April 1926, L/E/7/1458, IOR.
[96] L/E/7/1458, IOR.
[97] Letter from Stanley Bois to Controller of Revenue, 5 May 1924, 20/753, SLNAK.
[98] Inspection Reports, 20/801, SLNAK.
[99] The divers 'who probably make as good a thing out of the disposal of them as the Government does out of its share; probably a good deal better, if they did as well, they must have made 5 1/4 lacs of rupees between them,' see 20/801, SLNAK.
[100] 'Pearl Fishery Inspection Reports,' 20/800, SLNAK.

The oyster protected the potential value of the pearl, so selling oysters allowed divers to average out the *potential* value of *potential* pearls. There were varying degrees of visibility of pearls by divers once they left the seafloor, with Ceylonese divers having far greater visibility over the price of individual pearls than their Gulf compatriots, who might be able to make educated guesses, but from whom the sale price was hidden by the nature of the pearl dealer and captain's transactions.

The much more direct relationship between the labourer, his produce, and the merchant in Ceylon caused considerable anxiety for colonial overseers because it gave divers more control over the terms of their work. One case study for this is the fishery of 1877, when a group of Chettiar merchants colluded together to only bid very low prices at the state auction, thus depressing sale prices. This was compounded by the refusal of all the divers to go to sea, maintaining a shortage of oysters. In reporting these events, administrators concluded that 'Chetties and some influential Moormen' were 'working through the manducks and divers to force on a sale at a sacrifice.' [101] Agitating against a single overseer (the state) in Ceylon may have allowed moments where a workforce could agree together to withhold their work in an attempt to force up or down the price of oysters. This would have been harder to accomplish in the dispersed workforces of the Persian Gulf or Burma, where there were multiple, rather than a single, source of authority and oversight.

Pearls were small, high-value objects that were non-perishable and easily transported. They changed many hands and tracing their origins was near impossible. A diver might be able to secret away and sell pearls at any point between extraction and sale. Instances where divers were 'caught' suggest a world of private use, sale, and traffic which the official record barely touches. In 1877, an unnamed diver in Ceylon

[101] Ibid.

'was sentenced to one month's imprisonment, and to pay a fine of 10 rupees for opening oysters in the boat.' [102] Here we might think with the work of historian Johan Mathew, who, in his account of smuggling across the Red Sea, asks us to consider whether the failure of the historian to find records might attest to the success of the subaltern in evading documentation. [103] Divers' 'thefts' point us to the world beyond the archive where divers were able to work with others at the pearl fishery, offering a share of their sale price to their captains, counters, or other officials. [104]

On the one hand, we might read this from the perspective of capital and its unsuccessful integration of its full products. But we might alternatively see in this a space for divers to bargain, barter, and sell the proceeds of their own labour. In the Persian Gulf, when divers opened oysters on board the vessel, they did so in a circle with the captain standing over them to prevent their swallowing or 'palming' pearls. In Ceylon, where divers did not have a hierarchical relationship with a captain to whom they had to surrender pearls, they were pitted instead against the state that took the majority share of oysters. This meant that on the way home from the pearl banks, divers might secretly open oysters and retrieve their pearls. Some colonial estimates guessed that 40 percent of pearls were stolen by divers. [105] One British financier of the Ceylon Pearl Fisheries Syndicate wrote of this process in dismay, observing how the sale of

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[102] Twynam, Diary, 7 April 1877, pp. 15, E.L.Pawsey Papers, CSAS.

[103] As Mathew explains, in this instance historians confronts the challenge of 'trying to follow people who wanted to be inconspicuous and transactions that were designed to be opaque', proposing as a solution that we read 'silence not as absence but as an indication of particular kinds of commercial and documentary practice' Johan Mathew, *Margins of the Market: Trafficking and Capitalism across the Arabian Sea* (Oakland, CA: University of California Press, 2016), 15, 18.

[104] In Ceylon in 1877, for instance, two men from Jaffna named Nallatamby and Supper, for instance, employed as 'counters' in the state-run *koottoos* or enclosures were both fined five rupees each in 1877 for 'suspicious miscount.' Twynam, 'Diary of 1877,' 9 March 1877, 8; On boat guards, it was observed 'the divers are mostly their [boat guards'] friends and they will have naturally to connive at their rascality at the best', one official wrote from the Treasury department of Ceylon. Letter from the Vavuniya Treasury [to Mudliar? unclear], 18 December 1904, 'Pearl Fishery Miscellaneous,' 20/749, SLNAK.

[105] For an estimate of 23 percent see Captain Legge's estimate in 20/753, SLNAK.

pearls involved 'a tremendous amount of continuous handling by a large number of potential thieves, into whose hands, or mouths, I have very little doubt most of the best pearls disappeared.' [106] Similarly, one outraged European pearler in Mergui reported to the police that he saw 'his own diver selling a pearl in the street to a Bombay merchant but was unable to do anything.' [107]

Officials in Mergui and Ceylon, however, never passed more draconian legislation to make the sale by divers' illegal, or to put the onus of proof on the seller to show that pearls were not stolen. Instead, because they changed hands so many times in their long transactions around the globe - sold and re-valued and resold again - pearls made it hard to enforce rules to guard against theft. In Mergui, European pearlers wrote that that there was 'a great amount of pilfering that took place in the case of European owned plants,' even though in many cases these accusations turned out to be false. [108] Perhaps this was why, in more controlled settings, some capitalists opined that 'there was no reason why a diver should ever handle a pearl at all.' [109]

The health and condition of the pearl bearing reef also created income variability over the years. When the populations of oysters in the Gulf of Mannar declined, it was observed that the 'Ceylon boatmen decrease through extreme poverty and starvation.' [110] This problem was most acute in Ceylon, where oyster populations were far less robust that in the Persian Gulf. Even in the latter, however, a reef that

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[106] Letter from Sir Stanley Bois to Mr Alexander, Controller of Revenue, 5 May 1924, Lot 20/753, SLNAK.
[107] 'Extracts from Diaries of Visits to the Pearling Grounds [by Deputy Commissioner],' pp. 22, AG 1/7, 1111, YNA.
[108] One European police officer in Mergui even ascertained that 'In fact it is well known that the former [pearl merchants], whenever they get nothing always suspect they are being done deceived by the divers.' 'Mr Leggetts A.S. Police Report on Special Duty Pearling ground for season 1889-99,' AG 1/7, 1060, YNA; Report to the Civil Police, Rangoon, 29 April 1899, by Assistant District Super of Police.
[109] Letter to the Office of the Deputy Commissioner, Mergui, AG 1/7, 1110, YNA.
[110] Letter from A.V. Tamil to Government Agent of Northern Province, 19 December 1923, 20/837, SLNAK.

yielded plentiful oysters and pearls one year might not do so the next: one modern study shows that reefs in the Persian Gulf were overfished and exhausted in 1770, 1790, 1878, 1900, 1905, 1950, and 2001.[111] Each pearl fishery inversely affected the possibility of a healthy and mature community of oysters thriving for the next season.[112] Similarly, by 1907 the shallow waters of the Mergui archipelago were 'practically cleared of shell' and many were forced to conclude that the fisheries 'have in the past proved more remunerative for individuals than they are today.'[113]

Divers' remuneration could also be affected by forces of global supply and demand. A glut of pearls in merchants' stores could push down the prices of pearls, as could a global downturn in demand, even when the reefs were robust. In the Persian Gulf, in good years, the advances that nakhodas made to their divers was higher, but in years where the oyster stock or value of pearls was low, this figure was much less.

The diver and the reef had a relationship of diminishing returns. Victoria Hightower offers a 'lesson in sustainability' by contrasting the harvest of pearls in the Persian Gulf with that in Ceylon, making the argument that seagoing actors in the Persian Gulf had an incentive to maintain a baseline fishing stock, while in Ceylon seafaring communities 'had little incentive to limit the pace of diving' and thus repeatedly exhausted the pearl reef.[114]

This argument echoes those made by colonial administrators in the Gulf in the nineteenth century (indeed, it is based on the same English-language, anecdotal sources). The official E.L. Dorand, for instance, wrote from the Persian Gulf in 1877 that '[local merchants and divers] are too wise to kill the goose with golden eggs and

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[111] David Smyth et al., 'Benthic Surveys of the Historic Pearl Oyster Beds of Qatar Reveal a Dramatic Ecological Change,' *Marine Pollution Bulletin* 113, no. 1 (Dec. 2016): 147–55, https://doi.org/10.1016/j.marpolbul.2016.08.085.
[112] Smyth et al., 'Historic Pearl Oyster Beds,' 153.
[113] Simpson and Brown, *Pearl Oyster Fisheries of the Mergui Archipelago*, 3.
[114] Hightower, 'Pearls and the Southern Persian/Arabian Gulf,' 50.

say, "that will do for another year" when they come upon a small lot of shells.' [115] Pearlers too advanced their own theories about labour and pearl yield. The pearl merchant Louis Kornitzer was of the opinion that only 'invisible oysters cannot be reached by the diver,' attributing the depletion of the reef to the insatiable greed of the diver. [116] There is little mention in these accounts of the structures of authority and coercion discussed earlier which compelled men to keep working.

In fact, the labour archives from Ceylon tell a different story to Hightower's analysis: one where it did *not* pay for divers to fish down to the last oyster. [117] Divers were increasingly reluctant to go out to sea as the catch declined. [118] In 1881, for instance, inspectors reported 'some trouble was experienced in getting the divers out after the expiry of the advertised number of days.' [119] The same year, many divers tried to leave the fishery early. Overseers explained how divers had 'made a good thing of it' and 'refused to dive anymore.' The pattern recurs often: in 1903, officials described how the divers 'worn out by incessant work' had 'got sufficient gain' and so they were anxious to depart. [120] Divers fished to make a livelihood, not to clear the reef. In years where they made adequate revenue, they aimed to stop, rather than continue working, although the coercive and military apparatus of the state often aimed to compel them to continue working.

Because labour was dependent on conditions at sea, the regulation of time and discipline too were ecologically circumscribed. So we must re-consider how David Landes argument that 'the factory was a new kind of prison; the clock a new kind of

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[115] E.L. Dorand, 'Notes on the Pearl Fisheries of the Persian Gulf,' *Persian Gulf Administration Report, 1877-1878* (Calcutta: Superintendent of Government Printing, 1880).
[116] Kornitzer, *Pearl Trader*, 105.
[117] Hightower uses no primary sources from Ceylon to make this assertion. Hightower, 44-59.
[118] *Ceylon Sessional Papers 1881*.
[119] *Ceylon Sessional Papers 1881*, 30.
[120] 'Report on the Pearl Fishery of 1903.'

jailer' applies to this work at sea.[121] With pearling, divers could claim that there were no oysters, that the conditions at sea were unsuitable, or that the oysters were too young. In Ceylon, although the colonial official forced them to keep working, they 'worked listlessly taking no care to secure well grown oysters or oysters of a sufficient quantity.'[122] In 1912, the British master attendant of the Colombo port, John A. Legge, superintending the fishery, claimed that 'from my own personal investigation I know that not more than 60 to 70 percent of the oysters are actually fished at any fishery off any one bank.'[123] In fact, by 1925, marine biologists in Ceylon actually argued against special oyster breeding reserves by claiming that 'as the majority of our divers were Tamils there could be no question of drastic overfishing.'[124]

Essentializing Risk and Re-evaluating Debt

As sites of pearl extraction were increasingly integrated into the world economy, the language of variability at sea was transformed into a naturalized idea of divers as intrinsically responsible for the financial and physical hazards of their trade. Environment, race, and labour intersected, as the burdens of pearl yield became baked into cultural ideas about those who worked with it. 'Arabs have an inclination towards gambling, and it is this which attracted them to the diving industry,' Charles Belgrave wrote, reflecting on his time as Political Advisor in Bahrain.[125] Divers in the Persian Gulf were 'feckless folk who readily allow themselves to drift into debt,' another British Resident wrote in 1934.[126] Describing the declining yield of certain reefs which

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[121] David S. Landes, *The Unbound Prometheus: Technological Change and Industrial Development in Western Europe from 1750 to the Present* (Cambridge: Cambridge University Press, 1969), 269.
[122] 'Report on the Pearl Fishery of 1903, SLNA 20/800.
[123] Letter from John A. Legge to the Colonial Secretary, 17 August 1912, E.L. Pawsey papers, CSAS.
[124] A.H. Malpas, J.C. Kerkham, and Joseph Pearson, 'The Pearl Fishery of 1925' in *Ceylon Sessional Papers 1926* (Colombo: Government Printer, 1926), 13.
[125] Belgrave, *Pirate Coast*, 166.
[126] Letter from T.C. Fowle from the Residency in Bushire to F.H. Humphreys, her Majesty's Ambassador, Bagdad, 12 January 1935, in 'Condition of Divers in Kuwait,' R/15/5/191, IOR.

forced the boats to move into new territory, Frank Jardine described the pearl divers working in Mergui as 'resembling a gold digger in his love of change,' while many others wrote of divers drawn to the gamble of pearling. [127] The language of the gamble elides the complex calculations that fishing communities made about whether to engage in this labour.

Merchants echoed this language. Chettiar merchants in the Gulf of Mannar explained how 'it is an admitted fact that these divers are an ignorant and idle people.' [128] Pushback to potential reforms to diving conditions in the Persian Gulf were thus often couched in terms of how 'the divers themselves' bore responsibility because they had chosen to 'work in a trade which is in the nature of a gamble.' [129] In other words, the increasing racialisation of the figure of the diver in European discourse naturalized this risk to the person of the diver, associating it with personal qualities and characteristics, rather than structural features of environment, ecology, and harvest.

Historians have recently challenged how we think about debt in the Indian Ocean. Fahad Bishara, for instance, has suggested that we discard the moral undertones around debt, to focus on how it structured economic life in deeply uncertain and variable contexts: 'indebtedness was not simply imposed, it was negotiated; it was not an exercise in mercantile muscle flexing, but a response to the demands on commerce in a wildly unpredictable environment.' [130] In another recent article, Bishara and Hollian Wint have suggested that the 'bazaar economy' of the Indian Ocean had at its

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[127] Jardine, 'Mergui Pearl Fields,' 8.
[128] Letter from K.V. Venkadasalam Chettiar and S.W. Karutha Marikkaiyar to Robert Chalmers, 3 August 1915 in SLNAK 20/837.
[129] Fowle to Humphreys, R/15/5/191, IOR.
[130] Fahad A. Bishara, 'A Sea of Debt: Histories of Commerce and Obligation in the Indian Ocean' (PhD diss., Duke University, 2012), 80.

heart bonds of obligation in the form of debt and credit. Debt was 'the fundamental idiom of economic life' upon which commercial activity was built. [131]

These recent re-evaluations of the role of debt across the Indian Ocean force us to ask if and how the coercive element of labour recruitment and employment was intrinsic to pearling. Did indebtedness amongst labourers (and indeed, boat captains and capitalists too) safeguard against uncertainty and also the seasonal nature of the trade? Advances were necessary to support households while divers were away: in Southern Burma, one pearler wrote of how the divers demanded money before the season, 'naturally enough, for they are leaving wives and children on shore,' alluding to the household economies that fall out of the traditional revenue statistics on pearling. [132]

In one petition written by the chank and pearl divers living in Erukkalampiddi in the Mannar district to the Governor of Ceylon, the divers explained that the pearl fishery allowed them to 'earn their bread sumptuously from the Mannar sea and utilize all their energies to save something in every pearl diving so that they may be able to support their family till the beginning of another fishery.' [133] The fishers explained in their petition how they would accrue debt to local merchants 'in the shape of rice, clothing and money for their maintenance.' [134] The problem, however, arose in the way that these conditions of debt were enforced, with merchants increasing interest payments, or passing off state increases in export duties (in this case) to the divers themselves in the form of greater interest.

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[131] Fahad A. Bishara and Hollian Wint, 'Into the Bazaar: Indian Ocean Vernaculars in the Age of Global Capitalism,' *Journal of Global History* 16, no. 1 (March 2021), 52.
[132] Kornitzer, *Pearl Trader*, 106.
[133] Letter from the Residents of Erukkalampiddi in the Mannar District to the Governor of Ceylon, 7 July 1918, 20/837, SLNAK.
[134] 'Correspondence related to Chank Fishing,' 20/837 SLNAK.

To some extent, advance payments *do* seem to have provided income and sustenance in the context of seasonal work. In the Persian Gulf, most economic activity - including maritime trade and agriculture - took place during the summer diving months, so earnings made between June to September had to stretch through the rest of the year.[135] Despite this, in practice, the advances made to divers hardly seem to have actually enabled this division of the year into a period of work and leisure. Although western writers opined that divers tried to make enough money to 'enable them to live during the rest of the year without working,' many divers were forced to take on other occupations and work outside of the pearling season in order to feed and clothe themselves and their families.[136] This might include additional work pearling, such as making the voyage to Ceylon to work in the fishery there, or other occupations including trade, military jobs, or work in date plantations on shore.

The Body, Race, and the Machine

Even at its most routine, diving took a toll on the body.[137] It entailed high physical exertion and risk, including several hours with no food. In Ceylon, medical reports described divers suffering from 'ear-ache and bleeding from the ear' and 'severe pain in the chest'.[138] Another year the divers 'complain[ed] very much of the coral growing on the oysters, which cuts their hands.'[139] Similarly, the American Mission Hospital in Bahrain recorded the prevalence of skin rashes, perforated eardrums, and lung problems.[140] Blindness was a common ailment. After weeks of work in the Gulf

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[135] Datta and Nugent, 'Bahrain's Pearling Industry,' 27.
[136] Belgrave, *Pirate Coast*, 166.
[137] Linda Nash, *Inescapable Ecologies: A History of Environment, Disease, and Knowledge* (Berkeley: University of California Press, 2006), 8.
[138] Medical Officer, 'Statement of the Number of Diseases and Deaths in the Smallpox and General Hospitals at Silavatturai,' February-April 1881, 168; Twynam, 'Report on the Pearl Fishery of 1881.'
[139] Twynam, 'Report on the Pearl Fishery of 1881.'
[140] *Journal of the Arabian Mission*, Field Report 10-11, April-September 1894; *Journal of the Arabian Mission* 88, January-March 1914, 10-11.

of Mannar, divers complained to colonial officials that they could no longer work owing to exhaustion.

Every year fishery records also evinced deaths by drowning.[141] The ill-effects of diving manifested in divers' cultural worlds as well: in the Persian Gulf, divers were often taken hold of by a djinn. When seized by *shayatin* (demons), the diver would stiffen and tremble all over; he might make strange sounds or froth at the mouth, refusing to speak until the *matawwa* [mullah] read the Qur'an over him.[142] The effects of bad luck, poor fate and evil spirits were embroiled with the ill-effects of a specific form of work.

Race science applied to the labour of pearling did ideological work to naturalize the risks of this labour. Inequalities in pearling remuneration, after all, would be less shocking if 'natives' were considered specially apt for labouring underwater. The distinctions of remuneration between capitalists and pearl divers were naturalized away if certain 'classes' of people were only fit for certain kinds of work. The pearl merchant Edwin Streeter wrote about how 'it is customary with the natives [of Ceylon] to use their toes as well as their fingers in working or holding… they can pick up even the smallest object from the ground with their toes, almost as nimbly as a European with his fingers'.[143]

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[141] In 1880 'a diver of boat No. 87 red, had been drowned' in 'Report on the Pearl Fishery of 1880'; In 1889 one diver was reported dead and another was saved but only because 'his comrades rescued him' when he did not surface, see Twynam, 'The Pearl Fishery held at Dutch Bay during March 1889' in *Ceylon Sessional Papers 1890* (Colombo: Government Printer, 1890), 474; In 1925 a 'young boy from Kilakarai' who was 'diving on the same boat with his two uncles' almost drowned, see Kerkham, Malpas and Pearson, 'The Pearl Fishery of 1925,' 47. Mortality among free divers was lower compared to Mergui where the death rate could be as high as 40 percent.

[142] The sociologist K. Aqil cites this as evidence that 'Obviously, the *ghawas* had constructed this affair to escape from diving which was exhausting and would kill him,' see K. Aqil, 'Pearl Industry in the UAE Region in 1869-1938: its Construction, Reproduction and Decline,' *RUDN Journal of Sociology* 18 (2018): 464; Al-Shamlan, *Pearling in the Arabian Gulf*, 134.

[143] Edwin Streeter, *Pearls and Pearling Life* (London: George Bell & Sons, 1886), 190; Robert Percival, *Account of the Island of Ceylon* (London, 1803), 64.

The language of long-standing practice shielded the diver from the standards of the market and waged workforce. Moving from the limbs to the skin, Edward Tennent opined that 'only black skin…protects the divers of the pearl fisheries from accidents with the sharks.'[144] If diving could thus, in this new language, be culturalized, only performed by certain groups with particular aptitudes such as black skin or dextrous toes, then their conditions of work and paltry remuneration were justified.

The growth of racialised comparisons was aided by the increasing diversity of the pearl fishery workforces, which was the result of increasing profits but also the greater ease of migration on steamships. In the nineteenth century, British officials recorded only the towns of origin of divers working in the Ceylon fishery, noting whether men migrated from Paumben, Kilakkarai, Tuticorin or elsewhere. But by 1903, labour at the Ceylon fishery was classed into 'distinct racial types' including 'Coast Tamils', 'Moormen', 'Malayalam men', and 'so-called Arabs.'[145] These racial groupings were often included in scientific reports on the pearl-bearing oyster (see chapter 4, *Science*), reflecting the interests of European marine biologists not just in studying the oyster but also applying newly 'scientific' lenses to pearl fishery labour.[146]

In these emerging notions of race and work in Ceylon, officials espoused a kind of 'Arab-centrism,' collapsing the diverse Persian Gulf boats (which likely included men of African, Baloch, Persian and other origins) into a class of hyper-efficient 'Arab' pearl extractors. James Hornell especially wrote on how 'the Arab divers were much more confident that the Tamil divers and consequently brought in better loads,'

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[144] J. E. Tennent, *Ceylon: An account of the Island* (London: Longman, Green and Roberts, 1859), vol. 2, 560.
[145] 'Report on the Fishery of 1903. '
[146] 'Racial Types amongst Divers' in James Hornell, *The Biological Reports of the Ceylon Pearl Fishery of 1904* (Colombo: Government Printer, 1905).

discussing the 'Arab' type of diver in terms of hair, facial features, skin colour, blood, and other features.[147] Descriptions of African men run through the accounts that we have of Persian Gulf boats (the lists of crew are unhelpful in terms of names identifying whether men were from the Gulf or of African descent). In 1888, Twynam described the 16 migrant divers from the Gulf as 'some woolly-haired Zanzibar and Bussorah [Basra] men.'[148] Similarly, in 1904, Hornell wrote of 'mongrel divers in question were masquerading under the name of "Arabs" at a Ceylon pearl fishery.'

This tendency to attribute diving skill to racial composition — to see not the individual diver's skill but rather the group as a whole defined by particular aptitude — recurred across the Indian Ocean. In Mergui, observers wrote in racial terms of how 'the Burmese do not seem adapted to this form of work and very few are to be found among the divers, and these are exceptionally timid, and seldom descend to deep water.'[149] Japanese divers, by comparison, were described as braving the deepest waters since they were 'more expert than the Filipinos and take greater risks.'[150] Here evaluating one group's fitness to dive included criteria of the depth to which they were capable of descending and the number of oysters brought up. This emphasis on new race science is not to suggest that there were no racial or pejorative ideas about divers and their work before the late nineteenth century, but to suggest how the newly scientific approaches to the fisheries coincided with diverse workforces. As capital investment intensified, science, ecology, and conditions of labour were co-produced.

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[147] R.W. Ievers, 'Report on the Pearl Fishery of 1903,' 20/800, SLNAK.
[148] Hornell, 'Ceylon pearl fishery of 1904', 31.
[149] Their description contrasts Filipino divers 'in the majority' and 'more reliable' compared to the Japanese to whom caution 'was unknown.' They were followed in proficiency by Chinese, Malay and lastly, Burmese. Some Filipino divers who trained in northern Australia preferred to relocate to Mergui, with records of some men staying up to 14 years. Simpson and Brown, *Mergui Archipelago*, 13.
[150] Letter from Deputy Commissioner Mergui to Commissioner Tenasserim Division, 2 June 1905, AG 1/7, 1110, YNA; 'Notes on comparative diving aptitudes,' *Rangoon Times*, interview with Frank Jardine, dated 10 July 1894.

From a purely technology-driven perspective, one might argue, as other economic historians have done, that diving depended on 'relatively static and primitive technology,' that is, the human body. [151] Australian pearlers wrote glowingly of the new advances in dress diving, explaining how 'no longer do men in these parts go down naked into the realm of the shark, the swordfish, and the many-armed squid…Inflated rubber dress and rigid spacious metal helmet protect them against many dangers, and the coupled lengths of rubber hose connecting them with the air pump on the lugger at the surface permit the divers to go to great depths in comparative safety.' But as David Edgerton has convincingly argued, history is 'changed when we put into it the technology that counts: not only the famous spectacular technologies but the low and ubiquitous ones.' [152] What if the coir rope, the wicker basket and human hands and bodies were actually exceedingly efficient, and in fact, safer than Australian dress diving too? And moreover, if the dangers came not from 'shark, swordfish and many-armed squid,' but from depth and pressure and unregulated competition and labour conditions?

One example of a labour-saving technology was the dredge, a tool which held out the promise of eliminating the human diver entirely by dragging a raking net over the seabed. This fit with the intentions of those who sought to separate workers from contact with pearls. As one hopeful entrepreneur wrote: 'the fewer persons that have to handle pearls, the better.' [153] This was not about alleviating the conditions of labour, but rather about assuaging the state's anxiety about divers coming into close contact with the products of their labour. But experimenting with the dredge in Ceylon,

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[151] Datta and Nugent, 'Bahrain's Pearling Industry,' 28.
[152] David Edgerton, *The Shock of the Old: Technology and Global History since 1900* (Oxford: Oxford University Press, 2011), 212.
[153] 'Report on Mr Dixon's Pearl-Separating Machinery', from Government Agent Northern Province to Colonial Secretary, 20/749, SLNAK.

administrators discovered that human divers consistently picked up more oysters than mechanical dredges dragged behind steamships. Two days of dredging in Ceylon in 1904 yielded results that were 'miserably poor': 1522 oysters for the 29 March and 1276 on the next day. These were figures which local divers could exceed in an hour, without any of the cost of coal, maintenance and crew payments, or the salary of a 'dredge master' to operate this expensive technology. [154]

Moreover, the dredge had no ability to distinguish between rock, sand, seaweed, or a pearl-bearing oyster. As one disillusioned pearler put it sarcastically: divers were skilled hunters, but the dredge relied on dumb chance. It seemed to him that 'a man in a balloon floating 2000 feet high in the air and trailing a weighted line and hook would stand a better chance of snatching a hat from the head of a man on top of a bus!' [155] Finally, the dredge had to be suited to particular conditions including depth and absence of obstacles to trawling. It turned out that 'a great part of the Ceylon coast would certainly be very difficult to fish according to European methods' because 'it is practically impossible to trawl because of the coral reefs and other obstacles.' [156] The same was true for much of the Persian Gulf shallows as well.

Pearling's major technological advance occurred in 1860 with the introduction of mechanically powered seagoing vessels, air pumps, and diving dresses. From the 1880s, pearl shell was extracted by hard hat divers on surface supplied air at Roebuck Bay (Broome). [157] This new technology meant that divers could now descend using tubes thirty feet long which connected their helmet to a tank on board the vessel,

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[154] Letter from Hornell to Government Agent of the Northern Province, 31 March 1904, 20/801, SLNAK.
[155] Kornitzer, *Pearl Trader*, 61.
[156] W.A. Herdman, *Report on the Pearl Oyster Fisheries of the Gulf of Mannar, vol. 1* (London: Royal Society, 1903), 30.
[157] Alistair Paterson and Peter Veth, 'The point of pearling: Colonial pearl fisheries and the historical translocation of Aboriginal and Asian workers in Australia's Northwest,' *Journal of Anthropological Archaeology* 57 (March 2020): 1-13, https://doi.org/10.1016/j.jaa.2020.101143.

enabling a single diver to do the work of several free divers. The number of divers required to harvest a given area of the seabed contracted immediately. The use of mechanical dress diving greatly increased the initial outlay required to finance a pearling expedition, concentrating extraction to a few large vessels financed jointly by capitalists. Mergui was fished using what Steve Mullins describes as a 'floating station': a large coal-powered schooner of up to 100 tons, with several attached pearling luggers of 10 to 15 tons each. [158] Each of these smaller craft had five to nine men on board. [159] The schooner centralized the day's diving across vessels as oysters from each were collected and brought onto the main schooner to be opened. [160]

In Marx's *German Ideology*, he famously argued that 'slavery cannot be abolished without the steam engine.' [161] At first glance, a similar logic might appear to apply to pearling: diving technology would alleviate the oppressive conditions of labour, making work safer for the men who ventured to the ocean's depths. Some nineteenth-century observers at Ceylon's and the Persian Gulf's fisheries made this argument, as with Woolf's narrator earlier, or Allan Villiers who famously derided '[t]he infernal *ghaus*, the hellish diving,' arguing instead: '[i]f there must be pearls, let them be dredged.' [162]

In fact, technology in pearl diving did not serve as a labour-saving device nor as a tool to alleviate harsh labour conditions, but rather served to push the frontier of pearling further out to sea. Indeed, by stretching the limits of the human body in the

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[158] Steve Mullins, 'Torres Strait in the Moluccas: The Transformation of Pearling in the Residency of Ambon, Netherlands Indies, 1890-1942,' in *Pearls, People and Power*, 281-310.
[159] R.N. Rudmose Brown, 'Mergui,' *Scottish Geographical Magazine* (1907), 476.
[160] Mullins, 'Pearling in the Residency of Ambon,' 283-6.
[161] Karl Marx and Friedrich Engels, *The German Ideology,* ed. C. J. Arthur (New York: International Publishers, 1974), 61.
[162] Villiers, *Sons of Sinbad*, 347.

ocean, it offered little alleviation of the dangers or mortality rate of diving, although it did usher in the introduction of wages.

Dress divers had to be proficient in using their equipment, including assembly of their suits, upkeep and maintenance of equipment, and decompressing gradually as they ascended from greater depths than free divers. They were paid between £2 to £4 per month, with an additional percentage based on the total quantity of mother-of-pearl shell retrieved, building in some of the same incentives from the Gulf and Ceylon for men to keep working in order to increase their earnings.[163] Moken divers who free dived in the Mergui Archipelago were never brought onto waged salaries, compared to men trained to use diving dresses. Dress diving maintained many of the features which characterized diving including high income variability and risk, dangerous work, and a growing tendency to view this financial and bodily precarity in racialized terms.[164]

In Burma, the new dress divers and tenders migrated over a long distance, following steamship routes from Northern Australia, but akin to Persian Gulf divers who worked in Ceylon, once they arrived in Southern Burma, they would then hire local boats and assistant crew members. In Mergui, akin to the other pearl fisheries, the pearling boat was the basic unit of work, but the hierarchies were more rigidly stratified, especially with migrant divers who spoke a distinct language from the rest of the crew. On these new industrial pearling vessels, the diver received the greatest share of the profits, followed by the 'tender' who manned the diving pump, the helmsman, and the crew. In Mergui crews were allocated an amount of opium, paddy, *ngapi* (fermented fish or shrimp paste), tobacco, and clothes provided to them or loaned from the

[163] In Mergui in 1907 a diver earned Rs. 100-120 per 365 pounds of shell retrieved and a 50 percent commission on pearls. A tender was waged at Rs 60-70 a month and a steersman at Rs 20 per month, while the crew earned Rs 15 each per month.
[164] On Augustus Siebe's invention of diving technology in England in 1839 see W.B. Northrop, 'Diving Adventures,' *The Leisure Hour* (August 1899): 659-663.

capitalist. [165] These food provisions to divers have been characterized by Martínez and Vickers as 'totally inadequate,' insufficient in terms of caloric value, nutritional content, or the amount of food provided for the duration of a fishing trip. [166]

By skilling a single diver, who was now able to do the work that several men on a free diving vessel would, the hierarchy of the boat was inverted. In 1894, renting a Burmese pearling boat cost 105 Indian rupees per month 'for the boat and crew, the latter to find their own provisions.' Split between four men, this amounted to 26 rupees each. In addition, if one of these crew members also worked the diving pump, he would receive extra pay at 1 rupee per day. Without a large team of divers from the same village or caste or tribe, now the individual dress diver in his equipment was paramount. Local Burmese hired as sailors expressed that they had to 'sail or row to any place that the diver may indicate'; other reports show that while the diver was underwater 'both boat and crew are under the absolute control and orders of the tender.' [167]

Working in buoyant suits up to 54 meters underwater, dress divers were even more dependent on the undersea environment than the men who worked in 6-12 meters of water since they were less able to control their movement freely or to return immediately to the surface. Work during the spring tide, for instance, was near impossible because the tidal variation and currents were too strong to allow men to descend; in other sites, diving lines got entangled with rocks or pulled by currents. [168] Nitrogen narcosis, paralysis, and death by drowning were *more* rather than *less* common in pearling sites that relied on dress divers. In a single day in 1905, five

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[165] Jardine, *Mergui Pearl Fields*, 4.
[166] Martinez and Vickers, *Pearl Frontier,* 79.
[167] Jardine, 'Mergui Pearl Fields,' 2.
[168] R.N.Rudmose Brown and Jas. J. Simpson, *Report to the Government of Burma on the Pearl Oyster Fisheries of the Mergui Archipelago and Moskos Islands* (Rangoon: Government Printer, 1907), 12.

Japanese divers died exploring a deep pool to the west of John Malcolm Island, exceeding average mortality in the Persian Gulf and Ceylon fisheries in a season. [169]

An attempt to make diving in colonial Burma safer is instructive of how the language of risk was considered *essential* to the figure of the diver. In 1914, G.P. Andrews, the deputy commissioner of Mergui attempted to make pressure gauges mandatory in Burma. [170] These proposals were designed 'with a view to guard against loss of life.' When officials searched for precedents for this kind of regulation across the British Empire, they found none. [171] 'No instructions have been issued' the commissioner wrote, explaining that in Ceylon 'no occasion has arisen for the making of such rules.' In Mergui it was proposed that divers would need to show 'a reputable certificate of proficiency at their trade' or to 'make such physical demonstration of their proficiency as the Collector shall determine.' Furthermore, every death would require a thorough report, including details of what depth he was diving, how many times he had dived before, and how long he had been down when he gave the signal to be pulled up. Any capitalists and boat owners who took out pump licenses would be required to comply.

Opposition to the diving certificate plan was swift and widespread. Older divers themselves claimed that procuring a certificate was an inconvenience. [172] Moreover, for the colonial state based in Rangoon, it was immediately apparent that making diving safer might reduce the number of investors drawn to pearling. Officials in Rangoon were sceptical of 'whether any of the lives which have been lost recently in the pearling

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[169] On death by drowning or illness relating to dizziness, partial or full paralysis and severe nausea see AG 1/7, 1140; AG 1/7, 1110, YNA.
[170] 'Draft Rules for the guidance of the divers for pearls etc. on the pearling grounds in the Mergui district', 1/7, 1140, 25 June 1914, YNA.
[171] Letter from the Secretary to the Financial Commissioner, Burma to the Deputy Commissioner, Mergui, dated 14 August 1914, 1/7, YNA.
[172] Letter to the Deputy Commissioner Mergui, 1 September 1914, 1/7, 1140, YNA.

industry would probably have been saved if these rules had been in force.' [173] The discourse of risk naturalized the high mortality of divers as intrinsic to the work: 'the danger of the diving is inherent in the occupation, and training does not remove it' opponents argued. [174]

Resistance

What could divers do within the conditions of their work? Divers' maritime mobility meant that they constantly avoided full control or integration as a complete workforce. [175] The Moken divers in Mergui were often praised for being 'expert sea men,' who 'live in the sea in boats and can go about in the worst weather' but 'it is impossible…to catch them because they have no fixed abode.' [176] Similarly, in the Gulf of Mannar, divers frequently sailed away if conditions were unsuitable (provided they could do so before the naval patrols picked them up) or refused to sail in for the fishery. In 1903, colonial officials in Ceylon were outraged that 'the Erukkalampiddi divers went away early and without permission', having sailed away when they had made sufficient gain. [177]

In the Persian Gulf too, maritime mobility meant that divers in debt would often flee to another territory for work until the 1880s when the British enforced prohibitions against divers moving between rival sheikh's territories. Lewis Pelly complained in

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[173] AG 1/7, 1140, IV-II (1914-1915), YNA.
[174] Jardine had proposed that divers should be required to take out certificates of competency and charged an annual fee of £2 for them. Revenue Secy, dated 12 November 1894, AG 1/7, 1050, YNA. ; Consider how differently diving was regulated at this time in other parts of the world: for dress divers in the British Navy, for instance, extensive training was undertaken and there was considerable scientific and administrative investment in ensuring their safety. Robert Henry Davis, *Diving Scientifically and Practically Considered: Being a Manual and Handbook of Submarine Appliances* (London: Siebe, 1908).
[175] Seamen, of course, have been described as 'notoriously free', circumventing the strictures of European-based models of labour relations and regulation. Michael H. Fisher, 'Working across the Seas: Indian Maritime Labourers in India, Britain and in Between, 1600-1857' in *Coolies, Capital, and Colonialism: Studies in Indian Labour History* eds., Rana P. Behal and Marcel van der Linden (Cambridge: Cambridge University Press, 2006), 22.
[176] Note by Subdl. Officer of Victoria Point, 1 October 1926, AG 1/7, 1219, YNA.
[177] Letters from the Treasurer to the Superintendent Pearl Fisheries, April 1903, 20/800, SLNAK.

1868 that those engaged in the pearl fisheries 'receive advances from the Chief of one place, proceed to sea, and afterward, instead of returning to the place where they receive their advance, fly to some other Chieftainship in view of escaping repayment.' [178] Several enslaved divers ran away to British political agencies and demanded manumission, enabling historians like Matthew Hopper to resuscitate stories of divers like the forty-year old Jumah Kanaidish, who appealed for manumission in Muscat in 1936, or Mubarak bin Nar in Dubai or Faraj bin Sa'id, whose master begged him to return and promised to provide him with a wife. [179]

Pearling never concentrated production in one space or site of work. Instead, as above, maritime workforces and seagoing communities had itinerant, mobile patterns of settlement and work. Although this meant that they sometimes avoided integration into harsh, coercive systems, as when they sailed away in the examples above, it also meant that spread across the sea, there was little opportunity for workers to take advantage of this concentration to bargain for better rights. As a result, divers never built an 'autonomous, democratic, multiracial and social order at sea,' as has been described in other maritime labour contexts, such as seafaring. [180]

In Sugata Bose's account of the Indian Ocean, the revolt of pearl divers in Bahrain in 1932 serves as a crucial bookend. [181] On 25 May 1932, following the slump in the pearl market after the great depression and the war, in the wake of agitation around raising the *salaf* advance payment, 1500 divers armed with clubs and sticks stormed the police station in Manama. The force of Indian sepoys was given the order to fire directly into the crowd of divers, injuring many and killing several. Bose calls

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[178] Circular from the Gulf Resident, 16 September 1868, R/15/5/185, IOR.
[179] Hopper, *Slaves of One Master*, 121.
[180] Peter Linebaugh and Marcus Rediker, *The Many-Headed Hydra: The Hidden History of the Revolutionary Atlantic* (London: Verso, 2002), 328.
[181] Sugata Bose, *A Hundred Horizons: The Indian Ocean in the Age of Global Empire* (Cambridge, MA: Harvard University Press, 2009).

this a 'rare instance' of resistance by 'hapless pearl divers' [182] In his telling, this random outburst is a rare occurrence for a poverty-stricken community who generally had little recourse to resistance.

And yet, the archival record is littered with small and large acts of resistance by pearl divers, but never concentrated or significant enough to constitute serious negotiating power against capitalists or overseers. Dispersal harmed negotiation powers. In Kuwait when merchants did not pay divers' advances, the men refused to go out to sea. In Ceylon, routine excuses allowed divers to cease work even when the state insisted that they continue to fish. Divers 'made various excuses that the water was too cold' or refused to dive by noting that 'there were sharks in the sea.' [183] Divers pointing to sharks in the water as cause to stop diving recurred at so many fisheries that colonial administrators dubbed it 'a customary and incontrovertible statement.' [184] Around Mergui, observers wrote that 'there is a great deal of discontent among the crews.' [185] Others wrote about cases of 'feigned illness, and malingering in every form.' [186] Divers' complaints of exhaustion were reported in the press. [187] Desertion amongst pearl divers was very common. [188]

Divers also refused to work in the event of outbreak of epidemic disease. Despite the emphasis on immigration controls and quarantines, British officials were loath to stop pearling, even when traces of the disease appeared amongst divers. Some

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[182] Bose, *A Hundred Horizons*, 89-92.
[183] Lewis, 'Report on the Pearl Fishery of 1904,' 666.
[184] Fernando 'Seeing like the Sea.'
[185] Jardine, *Mergui Pearl Fields*, 9.
[186] Ibid.
[187] 'Pearl Diving in Mergui,' *Singapore Free Press and Mercantile Advertiser,* 31 May 1900.
[188] Jardine, *Mergui Pearl Fields*, 9; Desertion is 'crucial in this respect as it was not only a rejection of one's work and working conditions, but was also related to finding a better future, lying either in a new employment elsewhere or in alternative ways of livelihood, Matthias Van Rossum and Jeannette Kamp, in *A Global History of Runaways: Workers, Mobility and Capitalism, 1600-1850* eds., Marcus Rediker, Titas Chakraborty and Matthias van Rossum (Oakland, CA: UC Press, 2019), 7.

officials looking to get more work out of the divers dismissed incidents of sickness as the 'Cholera Boogie' and attributed it to 'the same fertile imagination that later on conjured up the sharks from the vast deep of the Cheval [a pearl bank in the Gulf of Mannar].' [189]

Religion, weather conditions and the state of the sea were often marshalled by divers to cease work. Catholic parava divers in the Gulf of Mannar and divers in the Mergui archipelago also often refused to work on Sundays, although fishery records indicate that Muslim divers continued to work through Ramadan, even when they were fasting. [190] Requests to cease diving were not received favourably by the state. When Sinhalese and Tamil New Year fell during a fishery in April, overseers were incensed that as a result 'all classes wanted to make a holiday of it,' suggesting rhythms of work and labour which did not coincide with the state's desire to extract the maximum number of oysters. [191]

Divers' acts of resistance ranged from desertion to attempts at mutiny. The Kuwaiti historian Al-Shamlan recalls an episode where several pearl divers 'from British Somaliland' shot his uncle, the nakhoda Saif bin Saif 'Ali Al Saif, and took command of his pearling vessel. [192] In the lead up to the event, Al-Shamlan takes pains to note how the divers 'always talk in their own language.' One night, they used a shotgun to shoot the captain and then sailed to Lengeh on the Persian side of the Gulf. The men were eventually apprehended by the police and British authorities and after a long administrative scramble, returned to Kuwait where they were 'executed by firing

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[189] 'Report on the Pearl Fishery of 1904.'
[190] *Ceylon Sessional Papers 1881*. This is in contrast to the Persian Gulf, as Alex Caeiro's work has shown.
[191] *Ceylon Sessional Papers 1881*.
[192] Al-Shamlan, *Pearling in the Arabian Gulf*, 113.

squad.' [193] We do not have biographical information on these men, only their actions survive in the archive, but we can point to instances of mutiny, revolt, and contestation. Other divers fled to escape their debts – even as far as Ceylon. The Sheikh of Kuwait was displeased in 1925, for instance, when it appeared that several men had enlisted to work in the Gulf of Mannar pearl beds as a way to escape debt in the Persian Gulf.

Ultimately, the ability to stage widespread revolts was limited by the fragmented nature of the work, where each boat functioned as its own economic unit, and where economic fortunes and conditions varied by diver, by boat, and by season. As the thirst for pearls grew, concurrently, a language of risk and precarity around the men who laboured on reefs to procure these pearls was naturalized. And yet, until the oyster was domesticated, human labour could not be regulated either.

Conclusion

In this chapter I have suggested that this highpoint in pearl extraction can still be read through the body of the diver. Pearling's acceleration in the late nineteenth-century was labour-intensive, rather than technologically driven. Although technology did play a role in pushing the frontier of pearling into deeper waters in Mergui, the vast majority of the world's pearls continued to be harvested by free divers working in Ceylon and the Persian Gulf. The concept of visibility and value has been related to divers' labour in terms of where in the sale process divers were positioned. I argued that in the Persian Gulf, and to a large extent in Burma as well, divers were divorced from the products of their labour, since the cost of the fished pearls was hidden from them. This included not just the uncertainty of pearl yield in oysters or the final value of the fished pearls, but often the transactions between merchants and buyers

[193] Al-Shamlan, 115.

themselves were occluded. The closer a diver was to his produce, as in the Ceylon case, the more leeway he had to make a better sale and increase his earnings.

Ultimately, however, if we want to evaluate diving labour in terms of the 'classic' questions of labour history, we have to ask why there were no widespread movements to agitate for better working conditions, higher pay, or safer, more evenly distributed work. Here the environmental frame within which divers laboured is important: pearling required dispersed, decentralized workforces owing to the spread of oysters on the seabed. The core economic unit was the pearling boat, not the workforce as a whole, and each boat enjoyed variable returns. This dispersal of the workforce and the uncertain yield of the seabed made collective solidarities far less likely in the case of pearling. The distribution of oysters at sea was soon, however, made visible in a new way through the technology of submarine mapping, although the drive to create these maps had little to do with alleviating labour conditions. It is to the diver and the state's impetus to chart the seafloor that we turn next.

Maps

Before entering into the sea, the fishermen
Who are taking rest near the punnai tree,
find the favourable wind. – Narriṇai 4:1-4 [1]

Now you go and look for turtles and fish among the coral, very far into the sea, but from now on you must stop doing this. If you really love me, we will live on the land and we will eat nothing that comes from the sea and has eyes. – Tale of Pinang and the Sea Spirit [2]

Who needed charts, when Ahmed [the ship captain] knew every reef and every headland, every strip of beach and every rock by eye, from long and close personal association? – Allan Villers, *c.* 1923

Introduction

Between 1903 and 1907, some of the first maps depicting the seabed of the Indian Ocean were produced across the major sites of pearling. Conceptualising the seabed as a potential source of value for marine extraction involved representing space underwater and the seafloor through particular visual renderings. Historians are well versed in the map as a technology of rule, constitutive of a colonial and state-centric episteme, associated with modernity and bureaucratic legibility. [3] Akin to maps on land, the submarine cartographic practices below 'made visible' molluscan populations to the state in a way that was entirely novel in the early twentieth century.

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[1] Kanalan cirukutik katalmem paratavar
ninirap punnaik kolunila lacaiit
tanperum parappin onpatam nokki
tankan arilvalai unakkum turaivano. Qtd. in Arul Raj and Rajamanickam eds., *Maritime History of South India*, 55. Punnai's common English name is the Alexandrian laurel.
[2] Qtd. in Ivanoff, *Rings of Coral*, 245-252.
[3] Anne Godlewska and Neil Smith, *Geography and Empire* (Oxford: Blackwell Publishers, 1994); Denis Cosgrove, *Apollo's Eye: A Cartographic Genealogy of the Earth in the Western Imagination* (Baltimore: Johns Hopkins University Press, 2001); Denis Wood and John Fels, *The Power of Maps* (New York: Guilford Press, 1992); James Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1999); J.B. Harley, 'Deconstructing the Map,' *Cartographica* 26, no. 2 (1989): 1-20; Matthew H. Edney, *Mapping an Empire: The Geographical Construction of British India, 1765-1843* (Chicago: University of Chicago Press, 1997); Thomas Simpson, 'Bordering and Frontier-Making in Nineteenth-Century British India,' *The Historical Journal* 58, no. 2 (June 2015): 513-542, doi:10.1017/S0018246X14000296.

This state or imperial-centric view abstracted away the terrain of the sea, and the human labour of pearl diving, reducing the underwater world to contours and statistics. In each of the maps, neat circles and lines aimed to pin down the presence of oysters, but as Matthew Farish explains in his analysis of Cold War mapping, 'in the abstraction of a contour map, the space between two lines is homogenous, but this is of course a severe simplification.' [4] This was equally true for lines drawn on maps of the ocean floor.

Living communities of oysters at sea were a unique challenge for mapmakers. Unlike salmon or herring, who were free-swimming fish who moved about the sea and rivers throughout their adult lives, mature oysters were bottom-dwelling, and, crucially, by human standards, largely sedentary. Their spatial distribution at sea could be known, named, and remembered. This seeming fixity in terms of location appeared possible to capture in cartographic form (see also Chapter 5, *Law*).

Yet the pearl bearing reef was a living undersea assemblage, that shifted with the sea's tides, currents, nutrient carrying capacity, and the life cycles of oysters and other creatures. So unlike other extractive industries, such as gold, tin, or jade, where 'X marks the spot,' could hold over a period of several years, and indeed, several decades, the spatialities and temporalities of the oyster reef were shifted on a shorter scale of days, and certainly over months or years. As a result, the maps' promised visibility was often fleeting and illusory, meaning that they had limited application in the daily practice of fishing, which relied instead on anecdotal information from other boats and dynamic practices of pursuit and change. These were the products of the state

[4] Matthew Farish, *The Contours of America's Cold War* (Minneapolis: University of Minnesota Press, 2010), xiii.

seeing like the sea, not necessarily the visibility of sailors, divers, or ship captains. Seeing like the sea was different based on who was looking.

Seeing like a State at Sea

To consider submarine mapping, I turn first to the largest site of pearl extraction: the Persian Gulf. In this region, reefs or *hairat* (singular: *hair*), as they were known in Arabic, concentrated on the southern shore of this warm, semi-enclosed sea. As the British Empire tightened its control on this frontier region, the longstanding regional industry met new imperial impetus to chart and tabulate the seafloor.[5] As discussed previously, in the ambit of Britain's informal empire, here imperial authorities allowed pearling to remain largely in the hands of local sheiks, merchants and crews. This removed perspective of imperial authorities explains why until 1903, there were no colonial documents prepared which charted the positions of pearl-bearing reefs in the waters of the Gulf. Imperial authorities had little use for a cartographic view of the Gulf seabed.

Following the maritime treaties signed with littoral rulers in the mid-nineteenth century, documents and correspondence sent between British political agents in the Persian Gulf and Bombay certainly did describe and provide qualitative overviews of pearling. These reports emerged because of pearling's economic centrality and the colonial imperative to dictate matters of law, citizenship, and sovereignty to secure British control over the western edges of its Indian Empire. In these communications, however, knowledge of the specific names, position, and depth of the reefs at sea was not a concern.[6] Early East India Company surveys of the shore from the 1820s, for

[5] Carter, *Sea of Pearls*; Hopper, *Slaves of One Master*; Bishara et al., 'The Economic Transformation of the Gulf,' in *The Emergence of the Gulf States* ed. Peterson.
[6] There would be no attempt to inquire further into 'The rights and boundaries which particular Tribes and States may severally claim.' Letter from Pelly to the Political Department, Bombay, dated 02 February 1863, PD 1863, Vol 42, Comp 236, 'Re. the unauthorized prosecution of Pearl Fishing by a

example, noted navigational obstacles but made little mention of pearl-bearing reefs. [7] The unspecified view towards the bottom of the sea is evident in the words of the assistant resident in the Persian Gulf, E.L. Durand, who wrote in 1877 that 'the pearl oyster is found in all the waters' and thus 'it is almost unnecessary to specify any localities, as the whole of the shallows are more or less fertile.' [8]

The turn of a twentieth century offers a point of departure. The first imperial attempt to schematize the pearl banks of the Persian Gulf was occasioned by the compilation and publication of the British Indian civil servant John Gordon Lorimer's *Gazetteer of the Persian Gulf, 'Oman, and Central Arabia* (1908-1915). [9] Akin to the production of other gazetteers and reports across empire, the processes of knowledge gathering and bolstering imperial rule were complementary. [10] Lorimer's five thousand-page document includes sections on Arabian Gulf and Persian history, the slave trade, genealogical tables for ruling families, topographical, demographic, and other data on the region. [11] The *Gazetteer* functions – to date – as one of the most comprehensive

company composed of Europeans and Natives,' MSA, 109-214. I am grateful to Fahad Bishara for sharing several sources from MSA with me.

[7] Andrew S. Cook, *Survey of the Shores, and Islands of the Persian Gulf 1820-1829* (Gerrards Cross: Archive Editions, 1990).

[8] E.L.Durand, 'Notes on the Pearl Fisheries of the Persian Gulf,' 35 qtd. in Penelope Tuson, *Records of Bahrain 1820-1960* (Cambridge: Cambridge University Press, 1993), 619. Durand recorded Dehee, Shiltaye, Gumreh and Arfaj as 'famous' banks and added that the reefs 'seem liable to continual change.'

[9] Nelida Fuccaro, 'Knowledge at the Service of the British Empire: The Gazetteer of the Persian Gulf, Oman and Central Arabia,' in *Borders and the Changing Boundaries of Knowledge*, eds., Inga Brandell, Marie Carlson and Önever Cetrez (Stockholm: Swedish Research Institute in Istanbul, 2015), 17–34; Peter Sluglett, 'Lorimer, John Gordon (1870–1914),' *Oxford Dictionary of National Biography*, last modified 06 March 2009, www.oxforddnb.com/view/article/38933.

[10] Christopher A. Bayly, *Empire and Information: Intelligence gathering and social communication in India, 1780-1870* (Cambridge: Cambridge University Press, 1996).

[11] Daniel Lowe, 'Colonial Knowledge: Lorimer's Gazetteer of the Persian Gulf, Oman and Central Arabia,' *Untold Lives, British Library* (blog), 28 January 2015, https://blogs.bl.uk/untoldlives/2015/01/colonial-knowledge-lorimers-gazetteer-of-the-persian-gulf-oman-and-central-arabia.html.

compendia on the history of the Gulf: J.E. Peterson calls it 'an essential reference' while Nelida Fuccaro describes it as 'the *magnum opus* of Gulf imperial knowledge.' [12]

The *Gazetteer* represents a turning point in Gulf history. It 'envisaged the consolidation of the region as the western frontier of British India anticipating a new era of state-building under the aegis of the British Empire,' Fuccaro explains. [13] While the *Gazetteer* is far-ranging and offers plenty of material for analysis, here I am concerned with the view it provides into cartographic renderings of the submerged, shallow continental shelf. [14] The *Gazetteer* devoted a whole appendix to pearling, the 'premier industry' of the region which had 'a political as well as a commercial

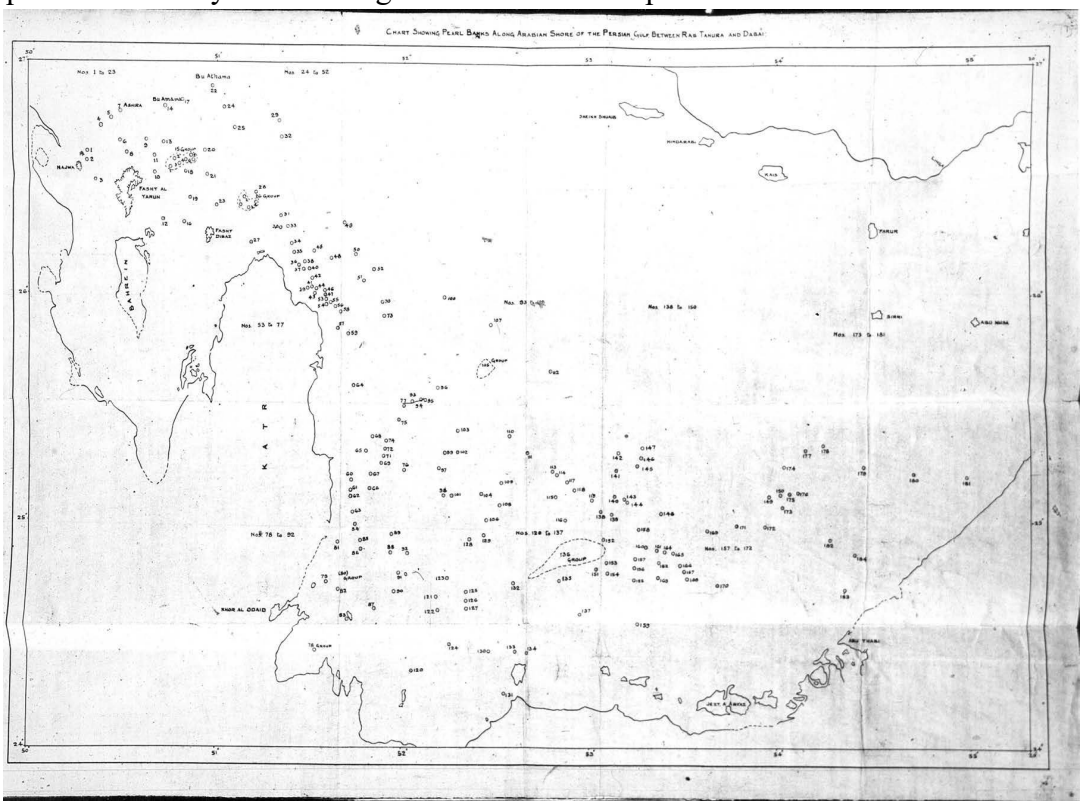

Figure 6: Chart of showing the pearl banks along the Arabian Shore of the Persian Gulf between Ras Tanura and Dubai, 1907, in J.G. Lorimer, The Gazetteer of the Persian Gulf, Oman and Central Arabia (Calcutta: Government of India, 1907-1915), vol. I, section 11.

[12] Peterson, *The Emergence of the Gulf States*, 4; Fuccaro, 'Knowledge at the Service of the British Empire,' 21. For a reading of the *Gazetteer* as 'colonial apologia' see Muhammad Al-Qasimi, *The Myth of Arab Piracy in the Gulf* (London: Croon Helm, 1986), xiii.
[13] Fuccaro, 'Knowledge at the Service of the British Empire', 18.
[14] For more critical treatments of Lorimer, see for example Omar H. AlShehabi, *Contested Modernity: Sectarianism, Nationalism, and Colonialism in Bahrain* (London: OneWorld Academic, 2019), 1-3.

aspect.' [15] Most historians rely heavily on this appendix, with its wealth of trade statistics and other information. [16] In similar fashion, it included the first large-scale cartographic representation of the Gulf region and its seabed with the pearl-bearing reefs marked on it, and a supposedly complete list of over two hundred pearl banks located underwater. [17]

The *Gazetteer*'s mapping of the pearl banks reduced the varied human and nonhuman life at sea to an externalized retina and a particular economy of spatial and statistical perception. The map titled *Chart showing the pearl banks along the Arabian Shore* (fig. 1) shows a single line charting the coastline of the Persian Gulf, and the land is stripped bare of terrain, landscape, and political geography. 'Bahrain' and 'Katr', are marked without boundaries to distinguish them. The sea itself appears as a flat undifferentiated space, filled with identical round markers with an attached number corresponding to a listed pearl bank in the lengthy accompanying table. Each reef or *hair* became the bearer of a numerical code. [18] The table, which runs to 18 pages, lists 271 pearl banks, offering across several columns the 'name' as an English transliteration, 'vernacular' with the Arabic name, latitude, longitude and in some cases, additional remarks on geography and position at sea. [19]

On the map itself there is no shading for depth or currents, although in certain places, one might infer from many clusters of identical circle markers close together that this suggests a rich seabed of reefs. Further away from the coastline, the markers

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[15] Lorimer, *Gazetteer of the Persian Gulf,* 2220.
[16] Lorimer, 'The Pearl and Mother-of-Pearl Fisheries of the Persian Gulf,' Appendix C, *Gazetteer of the Persian Gulf*, 2220-2288. The appendix provides tables listing the number of boats and persons employed from port cities across the Gulf, market rates of pearls, and the various taxation regimes imposed by local rulers.
[17] Fuccaro, 'Knowledge at the Service of the British Empire' 21; Lorimer, *Gazetteer of the Persian Gulf*, 22.
[18] 'Annexure No. 4: TABLE OF THE PEARL BANKS OF THE PERSIAN GULF,' 2262-2280.
[19] Ibid. The group is divided into three: two tables showing pearl banks on the Arabian side and one for the Persian side. 'The numbers shewn against each name correspond with those shown on the chart,' 2263.

reduce in density and the sea is again a flat, empty space. Submarine space was re-organized so that the pearl banks behaved within a geometrical and fixed program.

Before I turn to the omissions and elisions entailed in the composition of this image, it is worth stating that even out of Lorimer's tabulated, statistical list, historians can coax a more volumetric, contoured, material sense of the ocean floor. In fact, the language of the annexure gestures at space underwater and encountered worlds which are anything *but* two-dimensional, as with the flat, neatly organized map. Consider the Arabic names for each *hair* which Lorimer listed in a numerically organized table. The names include references to *wadi* (valley), *khor* (alcove), *harf* (narrow shoreline), *najwah* (elevated land), *hawād* (sharp ridges), *sateh/sutūh* (flatlands), *baten/butun/batin* (stomach or a concave area[?]), *dhaher/dhahur* (back or a flat elevated area), *riqqa* (lush regions), '*umairah* (beehives), *ri'ah* (elevated land), *rās* (head or cape), and other kinds of terrain. [20]

In the annexure the historian meets a world of diverse landscapes and varied encounters which cross the human and material world. Persian words are scattered through the names for *hair*, such as the reefs numbered 6 and 19, which use the Persian word '*khor'* for an alcove or bay. Some of these references, and whether they generated specific memories or humour or dread for local sailors and seafarers, are unclear: what might the name of number 41, *abu kalb*, the father of a dog, been referring to? Although the memory of what these specific place names referred to for certain seafaring groups may be harder to access for the historian, traces of these social elements of encountered worlds where human experience met the seabed's material persist, even in the two-dimensional archive.

[20] I am grateful to Faiq Habash for assistance with the translations.

Before exploring the layers of mediation and translation which went into the compilation of Lorimer's *Chart showing the pearl banks*, we can compare this artefact against similar imperial and colonial attempts to map submarine reefs in the Gulf of Mannar. As noted in Chapter 1, these raised rocky platforms, similar to the Arabic *hair*, were known in Tamil as *paars*.

In contrast to the Persian Gulf, the pearl-bearing reefs in Mannar had a longer history of entanglement with European empire from the sixteenth century onwards. This is evident in the greater definition that imperial or colonial maps offered into the Gulf of Mannar seafloor decades before Lorimer's *Chart showing the pearl banks*. In fact, as Ostroff explains, even before British colonial interest in the region, the Portuguese and the Dutch were also concerned with the positions of the *paars* at sea. [21] One Dutch report from 1682 recorded and named thirty-one *paars* and a decade later, forty-seven, and this divergence in the number of counted reefs gestures at the molluscan mobility which would prove so difficult to pin down, well into the twentieth century, even after the application of more 'scientific' survey techniques. [22]

From the 1850s onwards, administrators in Colombo also aimed to reduce their reliance on local fishers, such as parava and maraikkaiyar caste leaders, whose estimates of oyster yield on the banks had been integrated into the colonial monopoly. [23] As early as 1869 European fishery inspectors argued that 'any new series [of fisheries] can only be worked out successfully to the end…by a reliable plan and record of the position and extent of each patch or bed of oysters of the different ages.' [24]

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[21] Ostroff, 'Beds of Empire,' 8, 10-11.
[22] Ibid.
[23] Ibid.
[24] Letter from James Steuart to the Colonial Secretary, dated Colombo 15 September 1869, E.L. Pawsey Papers, CSAS.

Building on these older precedents as the nineteenth century advanced, an increasingly 'scientific' approach tied to mapping, enumeration, and abstraction from terrestrial contexts was applied to the sea and its submerged reefs. There were, of course, fewer maps made to show the seafloor compared to maps made of the land. But the desire to regulate the pearl fishery sponsored a mapping endeavour to do exactly that: to capture the position of oyster-reefs on the ocean floor, making this the first submarine survey of Ceylon's coastal shelf.

The 1892 chart made up by the long-term administrator and pearl fishery superintendent William Twynam, was the most extensive cartographic endeavour until that point (fig. 2).[25] His *Report on the Pearl Fisheries of Ceylon* (Colombo, 1902) was heralded as the most exhaustive compilation of fishery statistics to be produced.[26] The report included data on the divers, boats, fishery camp arrangements, records from past fisheries, fiscal matters, and other administrative details around the fishery.[27] It also included a map of the seafloor, the *Chart Showing the Banks Fished from Marichchukkaddi*, printed at the lithographic surveyor's office in Colombo.

[25] In addition to being a colonial administrator of Ceylon's Northern Province, Twynam held the post of Fishery Superintendent between 1862 and 1896, see Bastiampillai, *Northern Ceylon*, 3.
[26] Overview of fisheries science and administration see Pearson, Malpas and Kerkham 'The Pearl Fishery of 1925,' *Ceylon Sessional Papers 1925* (Colombo: Government Printer, 1926), 12.
[27] W.C. Twynam, *Report on the Ceylon Pearl Fisheries* (H.C. Cottle: Colombo, 1902).

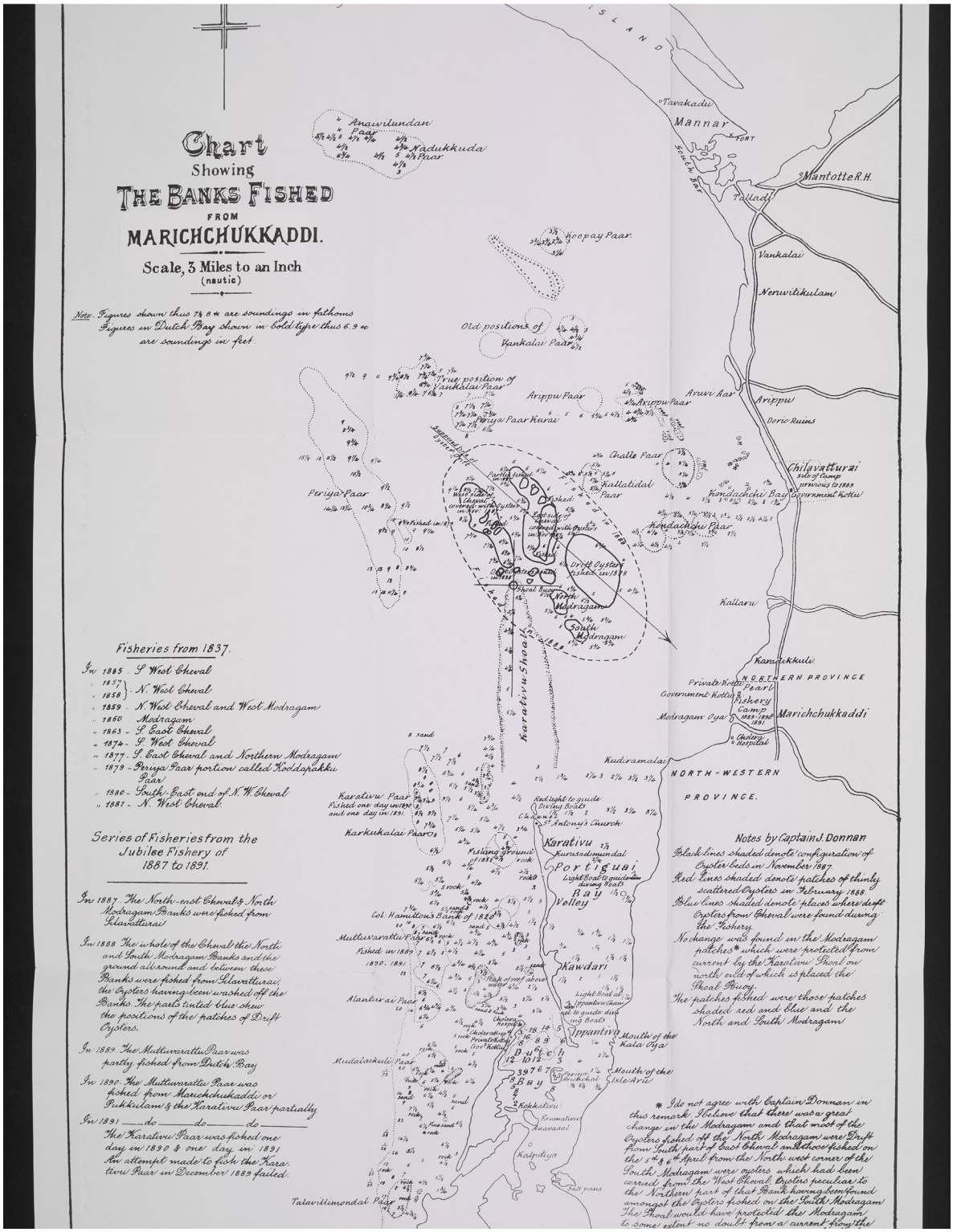

Figure 7: William C. Twynam Chart showing the banks fished off Marichchukkadi, 1889, 1:200000 scale, in Report on the Ceylon pearl fisheries (Colombo: Government Press, 1902).

In *Chart Showing the Banks Fished from Marichchukkaddi*, as with the *Persian Gulf Gazetteer*, rendering the seafloor visible meant stripping away the material realities of the sea and maritime labour. Twynam's chart frames the Ceylon coast from the spit of Kalpitiya up to Mannar island. There is little indication of the topology of the shore, although the towns and rivers are marked with more accuracy than Lorimer's. At sea, by contrast, small, disconnected scratchings are scattered like constellations across the surface to mark the pearl banks, alongside extensive depth soundings labelled in fathoms. These markers, akin to Lorimer's circles, represent beds fished during fisheries conducted from 1837 to 1891, folding layers of history and human extraction into the image of where oysters lay on the seabed.

Although in reality, reaching oysters took place underwater, here on the map, the seafloor was written onto the surface. Thus 'peak of reef above water' is not distinguished from the *paars* on the seafloor and their accompanying terrains, including 'rock', 'sand' or 'fine sand.' Unlike Lorimer, Twynam indicated depth and its variability by marking it on the map, and also demonstrated the various shapes of each *paar* using dotted outlines. Fishers' Tamil names for each *paar* are inscribed, preserving traces of local expertise.

As in the previous map, however, even before we turn to additional sources from the labour and scientific archive to build up a more materialist reading, this two-dimensional representation already preserves traces of animal histories. Consider how uncertainty pervades the purportedly static *Chart Showing the Banks Fished from Marichchukkaddi.* Bivalve locomotive powers emerge in places where 'old positions' of *paars* are given, where the oyster bed had disappeared. In other cases, 'true positions' are labelled (see 'Vankalai') compared with present sites. The 'supposed line of oyster drift' is marked with a sure firm arrow which belies the rambling displacement of the

paars over time. Moreover, alongside Twynam, the fishery inspector, James Donnan, added his own key to the map, informing readers (implicitly) of these shifting oyster geographies. He wrote of how 'black lines shaded denote configuration of Oyster Beds in November 1887,' whereas 'red lines shaded denote patches of thinly scattered oysters in February 1888.'

A closer temporal equivalent from Ceylon to compare against Lorimer's *Chart showing the pearl banks* is the definitive mapping and list of *paars* produced between 1903 and 1906 as part of the Royal Society-sponsored scientific expedition to research Ceylon's pearl banks. This project took place under the authority of Liverpool-based zoologist William Herdman, who we will meet again in the next chapter on science. [28] This expedition and its ensuing report were heralded as the first application of 'practical biology' which would bring 'some degree of regularity in future in the fishery returns.' [29] Herdman and his assistant, James Hornell, conducted scientific research on the pearl banks and their associated biota and compiled a systematic list of the *paars*, which continues to be cited by marine biologists up to the present. [30]

To assess the condition of the *paars*, Herdman, unlike Lorimer, who relied on political agents to obtain information from nakhodas, aimed to access the seafloor himself. To do this, he used a dredge but also 'lines of dives' from an inspection vessel, the *Serendib*. [31] In his published reports, two plates divided the Gulf of Mannar into *Chart of the Northern Paars*, and *Chart of the Southern Paars*. On the hand-drawn map, dotted lines show loose outlines with the name of each *paar*: 'West Cheval', 'Periya

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[28] William A. Herdman, *Report to the Government of Ceylon on the Pearl Oyster Fisheries in the Gulf of Mannar*, 5 vols., (London: Royal Society 1903-1906).
[29] Joseph West Ridgeway, *Administration of the Affairs of Ceylon 1896 to 1903* (George J.A. Skeen: Colombo, 1903), 111.
[30] See K. Alagarswami, 'Larval Transport and Settlement of Pearl Oysters (Genus *Pinctada*) in the Gulf of Mannar,' *Central Marine Fisheries Research Institute, Tuticorin* (Proceedings of the Symposium on Warm Water Zooplankton, 1977): 678-686; S. Sivalingam, 'Survey of the Pearl Banks, Gulf of Mannar,' *Indian Journal of Fisheries* 5 (1958): 308-325.
[31] Herdman, *Pearl Oyster Fisheries of Ceylon*, vol. 1, (1903), 17.

Paar', 'Dutch Paar', 'Inner Vankalai', 'Twynam's Paar', and so on. The very history of varied imperial control meeting a local landscape was writ large on the names of the reefs which held traces of these intertwined histories, mingling Tamil names with the names of colonial officials.

Conducting this underwater survey involved a vast human effort, provided by local divers, whose names are elided from finished scientific publications, but who are amply visible in Hornell's photographic archive which contains images of these men diving, surfacing, sorting shell, and examining oysters. [32] In some cases, more than 100 dives were made on a single 'inspection site' to enable Herdman's compilation.

The third and final example of a map of the seafloor comes from the opposite end of the Bay of Bengal. As the last volume of Herdman's five-part *Report on the Pearl Oyster Fisheries of Ceylon* was published, another survey was underway in Burma. As colonial administrators considered which management system for the Burmese pearl banks would be most suitable (and indeed, profitable), the question of how to manage the nascent industry was foremost in administrators' minds. [33] In order to make these calculations, knowledge of the seabed was required. R.N. Rudmose Brown and James Simpson's *Report on the Pearl Oyster Fisheries of the Mergui Archipelago* (Rangoon, 1907) was commissioned by colonial authorities in Rangoon, and echoes other prospecting operations for tin, gold, jade, and other valuable commodities. [34]

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[32] See for example Photographs of Divers on Inspection Vessel (1903), DSC08086, James Hornell Collection, Museum of Archaeology and Anthropology, Cambridge, UK.
[33] Machado, 'Shell Routes: Exploring Burma's Pearling Histories,' in *Pearls, People and Power*, 183-231.
[34] R. N. Rudmose Brown and Jas. J. Simpson, *Report to the Government of Burma on the Pearl Oyster Fisheries of the Mergui Archipelago and Moskos Islands* (Rangoon: Government Printer, 1907); Myint-U, *Hidden History of Burma*, 23.

Similar to Herdman, the appointment of Simpson and Rudmose Brown drew on nascent oceanographic and marine research in the colonial metropole, which was then coupled with the expertise of local seamen and sailors. Rudmose Brown was a naturalist at the Scottish Oceanographical Laboratory in Edinburgh, who had formerly accompanied the Scottish National Antarctic Expedition, and was now sent to survey the bottom of the sea, only he would rely on Burmese and Filipino divers to access this terrain. [35]

Predictably, and in line with other prospecting operations on land, Rudmose Brown and Simpson's report was an exhortation to intensify pearling, further north and south of the town of Mergui where there were 'exceedingly valuable beds, better than most in the Archipelago' still untapped. [36] Together with their report, Rudmose Brown and Simpson included a large hand-drawn map, *Sketch Map to Illustrate the Pearl Oyster Banks of the Mergui Archipelago & Moskos Islands* (figure 3) to accompany six pages of description on over fifty island and reef candidates. This map runs several feet in length, tracing oceanic space from the Moskos islands past the mouth of the Tavoy river, through the rich archipelago around Mergui. It terminates at the mouth of the Pak Chan River where a rough hand-drawn blue line marks the 'boundary between Burma and Siam.'

[35] A. Garnett, 'Obituary for Robert Neal Rudmose Brown,' *University of Sheffield Gazette*, No. 28, March 1957.
[36] Brown and Simpson, *Pearl Oyster Fisheries*, 2.

Figure 8: Sketch map to Illustrate the Pearl Oyster Banks of the Mergui Archipelago & Moskos Islands, 1907, 160 × 30 cm, in James J. Simpson and Robert R. N. Brown, Report to the Government of Burma on the Pearl Oyster Fisheries (Rangoon: Government Printer, 1907).

The *Sketch Map to Illustrate the Pearl Oyster Banks* aggregated the ocean floor into commercially viable space by offering three demarcations: a solid red line for '[pearling] ground workable throughout'; a thinner line to show 'area with scattered but workable grounds'; and a dotted line to show 'banks of minor importance or not examined in detail.' These inscriptions against the world of multiple islands and reefs draw the eye in – the focus is not on the landscape of the islands or coasts, but on what lies between them – in this case the shading referring to animal habitat. But this was a selective gaze, which showed only those of a specific animal: the pearl and mother-of-pearl bearing oyster.

Similar to Lorimer's, Twynam's and Herdman's maps, Rudmose Brown and Simpson's *Sketch Map to Illustrate the Pearl Oyster Banks* represents what Denis Cosgrove called the 'Apollonian Eye': it offers a systematic view from above, which renders the seafloor, normally submerged by a material and turbulent sea, into knowable terrain.[37] But this was a particular kind of inscription which reproduced, as I will show in the next two sections, a kind of visibility that privileged revenue from a single species above all else. Rudmose Brown and Simpson contrasted their findings against a memo filed by the Deputy Commissioner of Mergui in 1903 which listed only ten pearl banks.[38] This discrepancy is revealing: forty new pearling grounds did not appear between 1903 and 1907 – seafloor ecologies, animal habitat, and ecological niches were not assembled *ex nihilo* in the five-year interim – instead, Simpson and Rudmose Brown *wrote into being* certain sites on the ocean floor as commercially viable. But to enact these inscriptions, other forms of local labour and expertise were necessary.

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[37] Cosgrove, *Apollo's Eye*, x.
[38] These were Ravenshaw Island; Sir John Malcolm Islands; High Island; Sullivan's Island or Lamp; Ross Island Passage, Port Maria, Maingy Island, and French Bay, King Island.

Human Mobility

In order for found environments to be translated into two-dimensional images, in the nineteenth-century, without any kind of satellite technology, a panoptic view 'from above' of the pearl bearing reefs at sea required a view 'from below.' That is, human bodies had to descend to the seafloor. Here the shallow pearl-bearing reef was distinct: most histories of the human engagement with the seas and the seabed narrate increasing knowledge as tied to technological advances – new equipment that allowed ocean-going vessels to dredge or sample the bottom of the ocean hundreds of meters down.[39] But the shallow continental shelf did not require these new technologies to allow the seafloor to come into view.

Instead, human labourers had to venture down to the ocean floor in order to send reports about the position and extent of oyster communities. In fact, the uncluttered appearance of the maps belies the submarine world that divers encountered, which was textured, varied, dynamic and rich with other submarine life. Moreover, it ignores the experience of diving to retrieve this information. Folded into these finished cartographic projects, then, is the haptic, the olfactory, the visual, embodied, and cultural experiences of divers and other beings which will be discussed in the next two sections.

To explore the construction of Lorimer's *Chart showing the pearl banks* we can turn to extant India Office correspondence which fleshes out the process by which this information about the seafloor was collected. Lorimer assigned the task of collating information to British officials stationed across the Gulf. In Bahrain in 1906, for example, the agent Francis Prideaux was 'trying to get the positions of the Pearl banks

[39] Helen M. Rozwadowski, *Fathoming the Ocean: The Discovery and Exploration of the Deep Sea* (Cambridge, MA: Harvard University Press, 2005); Margaret Deacon, *Scientists and the Sea, 1650-1900: A Study of Marine Science* (London: Ashgate, 1997).

on our side of the Gulf marked down on the Chart.' He reported that he had successfully 'identified practically all of those which lie South of Ras Tamura.' [40] This success at mapping was derived entirely from the knowledge of local nakhodas or ship captains who had a 'wonderfully correct knowledge of the depths of all the Banks.' Only a few of the names of these interlocutors survive, such as one nakhoda named Saleh in Kuwait. [41] Over the next months, at Bahrain, Kuwait, Sharjah and Lingeh, information was transferred from local nakhodas to colonial officials.

Of course, the maritime worlds into which colonial knowledge of the sea intruded had long-established traditions of both navigation and cartography. That is, ways of making sense at and of the sea were hardly invented by the high imperial moment. Seafaring expertise in the Persian Gulf had long circulated in texts including works by al-Idrisi, Ibn-Battuta, Ibn Majid, and Kātib Çelebī. [42] The nakhoda who passed along Arab navigational information to the British orientalist James Prinsep in 1836 also included a book, an object so valuable to its sea-faring owner that 'without [it] he would doubtless have been greatly at a loss on his return voyage.' [43]

In addition to these texts, experience also mattered. Robert Carter writes that knowledge of how to reach the pearl banks was 'stored only in the transmitted memories of the amirs and nakhodas of the fleets and gained by experience.' [44] Similarly, in Mannar, before these definitive lists of pearl banks, officials such as James Steuart described the Tamil adapannars who 'appear to read the compass, and to have the same fixed courses, as steered by their ancestors, from *Arippo* to their variously

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[40] Letter from Prideaux to Knox, dated 20 October 1906, R/15/5/91, IOR.
[41] Ibid., 3.
[42] Marina Tolmacheva, 'On the Arab System of Nautical Orientation,' *Arabica* 27, no. 2 (June 1980): 180-192.
[43] James Prinsep, 'Notes on the Nautical Instruments of the Arabs,' *Journal of the Asiatic Society of Bengal* (1836): 788.
[44] Carter, *Sea of Pearls*, 186.

named pearl banks,' indicating lifetimes of experience locating reefs.[45] In the same fashion, early prospecting of Mergui drew on regional seamen: a Filipino man named Fernandez guided the Queensland pearler Frank Jardine through the archipelago in 1894.[46]

Translation is a term which will be familiar to historians of science as well as historians of the Indian Ocean, with its myriad vernaculars.[47] When historians of science discuss translation, they usually take this to be linguistic, focusing on translation between languages; there is also increasingly attention to cultural translation.[48] In the above section, both of these processes were certainly at work: divers passed information in Arabic, Malay, or Tamil onto intermediaries who translated this into English for printed colonial documents. There was cultural translation too, as paravar headmen, the *jati talaivan*, in the Gulf of Mannar or pearling nakhodas and sheikhs in the Persian Gulf gave information to British political residents. But, as I pointed out in the *Introduction*, pearling requires us to move beyond translation operating purely at the level of text, language, and discourse. In Sven Dupré's review, 'translation is thus, the process by which science and knowledge are transferred from one place to another, more often than not being altered in the process.'[49] Dupré's use of 'place' can be interpreted liberally, to include terrains such as the ocean and the underwater.

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[45] Steuart, *Pearl Fisheries of Ceylon*, 459.
[46] Frank Jardine, 'Report on the Mergui Pearl Fields,' (Rangoon, 1894), 1.
[47] 'Languages and Literature Roundtable' at *The Indian Ocean World: Taking Stock, Looking Ahead,* (Conference Proceedings, online, January 28-30), https://iowconference.org/.
[48] Michael Gordin, *Scientific Babel: The Language of Science* (Chicago: University of Chicago Press, 2015); Peter Burke and R. Po-chia Hsia eds. *Cultural Translation in Early Modern Europe* (Cambridge: Cambridge University press, 2007); Scott L. Montgomery, *Science in Translation: Movements of Knowledge through Cultures and Time* (Chicago: University of Chicago Press, 2000).
[49] Sven Dupré, 'Introduction: Science and Practices of Translation,' *Isis* 109, no. 2 (June 2018): 302–7, https://doi.org/10.1086/698234.

Listing and plotting the pearl banks, then, included layers of mediation across hierarchies, as captains and headmen passed on information to colonial authorities. But already in this process of twentieth-century cartographic translation, as the pearl-bearing oyster and reef at sea was made increasingly visible, other elements of seaborne navigation and material worlds were lost. Nakhodas, for instance, captained dhows, baggalas or sambuks, and navigated using wind, sail, and the force of human rowers. At night, they used the stars and constellations. When the Bahraini nakhoda and poet Rashid bin Fadil Al Bin 'Ali published *Majari al-Hidaya* [Routes of Guidance], describing the positions of the pearl banks in 1920, he provided information on the stars, shore-based landmarks, and other sailing instructions.[50] In the Gulf of Mannar, experienced sailors and helmsman used the colour of the ocean and the sky and even the smell of mud from the ocean floor.[51] These sensory elements of navigation are absent in the finished maps. The sea is flat and colourless, the stars are hidden, and the waves are silent.

When the historian reads the fixed, bounded contours of the pearl banks on the map, we might consider how divers' submarine journeys and spatial understandings depart from this. Arabic-language texts, for instance, explained that 'there are no clear geographical boundaries between these [pearl] banks. They exist only in the minds of the divers and in the nature of the seabed.'[52] As described in the previous chapter, divers knew the underwater world to be dynamic and variable and used their senses to detect quarry.[53] In Mergui, for instance, divers knew to follow sites with 'an abundance

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[50] Rashid bin Fadil Al Bin 'Ali, مجاري الهداية [*Majari al-Hidaya: A Pearl-divers guide to the oyster beds*] (Arab Gulf Folklore Centre: Doha, 1988).
[51] Lehman, 'Relating to the Sea,' 492; Moti Chandra, *Trade and Trade Routes in Ancient India* (New Delhi: Abhinav Publications, 1977), 205.
[52] Abd al-Wahab bin 'Isa al-Qatami, *Al-Said wa'l Tanaqqul wa'l-Tijara fi'l-Bihar* [Fishing, Transportation and Trade on the Seas] qtd. in al-Shamlan, *Pearling in the Arabian Gulf*, 61-2.
[53] Plath and Hill, 'The Reefs of Rivalry,' 156.

of gorgoniid, black corals,' or heavy currents, since these were a 'prerequisite' for oysters. [54]

Terrain is a relational concept that is *produced* and *performed*, and therefore must include human bodies and labour. [55] Attending to the sensory experience of diving, as detailed also in the previous chapter, reveals that phenomenological readings of the maps are possible; that there is a 'bodiliness' in them. [56] Traces of the impact of diving and the ocean on the body are evident across the pearl fisheries: assisting Jardine with his survey, one diver working around Russel Island in Mergui found that the ground was so muddy that he 'sank to the tops of [his] thighs.' [57] In other places, the seafloor these men encountered was deep enough to be as 'dark as night.'

If the maps surveyed above resulted from the labour of diving in order to assess where oysters lay, and transition between air and water, surface and submarine, then the labour and medical archive especially helps illustrate, in Donna Haraway's phrasing, what happens when species touch in fraught zones of intercourse. [58] Water's density is approximately 1000 times that of sea level air. [59] Each dive to reach oysters resulted in significant changes in the body including vasoconstriction, carbon dioxide retention and trouble with temperature regulation. Divers were stung by stingrays and had their fingers and feet cut by coral (see also Chapter 2, *Labour*). [60] In other words, the matter of the ocean was not bounded by the surface of the skin but permeated to the

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[54] Rudmose Brown and Simpson, *Pearl Oyster Fisheries,* 13.
[55] Rachael Squire, 'Immersive Terrain: The US Navy, Sealab and Cold War Undersea Geopolitics,' *Area* 48, no. 3 (September 2016): 335, https://doi.org/10.1111/area.12265.
[56] Eva Hayward, "FINGERYEYES: Impressions of Cup Corals," *Cultural Anthropology* 25, no. 4 (2010): 582, https://doi.org/10.1111/j.1548-1360.2010.01070.x.
[57] Jardine, 'Mergui Pearl Fields,' 5, 17.
[58] Donna Haraway, *When Species Meet* (Minneapolis: University of Minnesota Press, 2008), 205.
[59] Ibid., 571-578.
[60] Twynam, 'Report on the Pearl Fishery of 1881,' in *Ceylon Sessional Papers* (Colombo: Government Printer, 1882).

level of the bloodstream and the body's gases, crossing medium, body, blood vessel, boundary, and barrier.

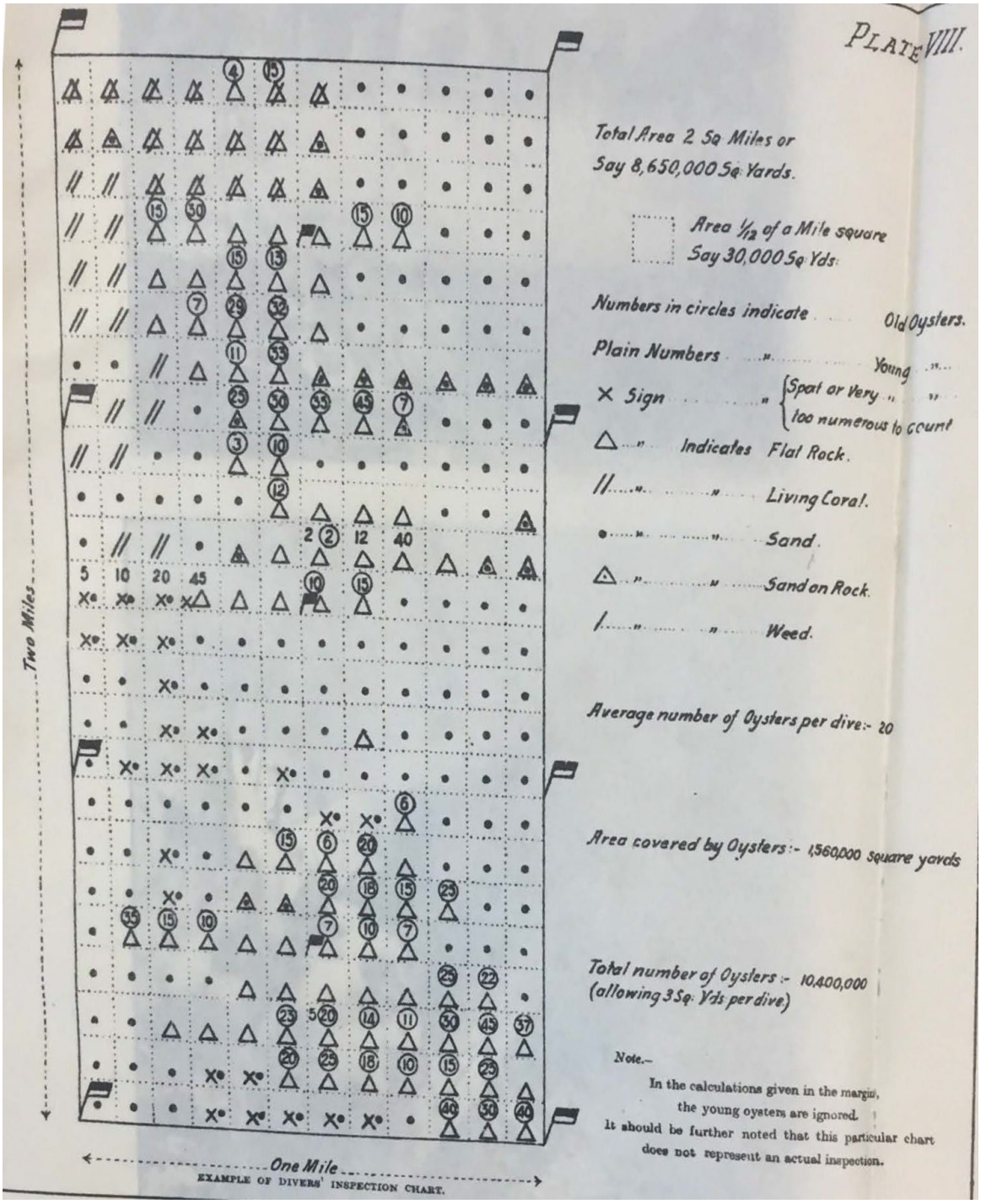

Figure 9: A typical example of an inspection chart showing the method of recording the divers' reports by signs and numbers in Joseph Pearson, A.H. Malpas and J.C. Kerkham, 'The Pearl Fishery of 1925', Ceylon Journal of Science (Colombo: Colombo Museum), section C, vol iii, Plate VIII.

In the previous paragraphs I traced how the production of a frozen image of the seafloor and its animal inhabitants was contingent on the embodied human experiences of descending underwater, and then translating these experiences to enable visibility. The most explicit rendering of the elisions entailed by translation between terrain, species, language, and experience entailed in reporting on the substrate of the ocean floor comes from the fisheries bulletins of the *Ceylon Journal of Science*.[61] In 1925, the bulletin reproduced the standard inspection sheet used by divers, titled "EXAMPLE OF DIVERS" INSPECTION CHART." This document can be used as an exemplar for any of the three sites surveyed above, since they all entailed similar processes in their making.

The Chart is a sample of the papers that were distributed amongst helmsmen on boats when the colonial state went out to survey the reefs. These were then collected and collated into finished reports. Each boat might have five or six divers and one helmsman who was responsible for filling the chart. The INSPECTION CHART shows an area of 2 square miles. Four flags set off each corner of a grid that is divided up into a matrix. The key, meanwhile, offers six symbols to choose from: a cross, x, to denote 'spat [young oysters] too numerous to count'; a triangle for 'flat rock'; two backward slashes // 'living coral'; a dot • 'sand'; a single backward slash / 'weed.' Some quadrants contain numbers in circles to show old oysters.

Thinking with the inspection chart, and envisioning it in use, the layers of translation emerge clearly. First, divers descended into an ocean space, rolling with waves and currents, bringing up twenty oysters per dive, which were counted and written down by the helmsman of the boat. The environment they observed, seeing with

[61] Plate VIII, 'A typical example of an inspection chart showing the method of recording the divers' reports by signs and numbers' in Joseph Pearson, A.H. Malpas and J.C. Kerkham, *Ceylon Journal of Science*, section C [Fisheries], vol iii (Colombo, 1925).

their eyes but also felt with bare feet and hands including broken shell, rock, weeds, and living coral, was then transferred orally to the helmsman. Knowledge in the body thus became performed as spoken language, and once it was received it was converted again into corresponding symbols. Translation occurs between water to air; between languages (primarily) Tamil to English; between action and words; worlds and text; language and symbol, //, x, •, as the sea and the realities of labour were stripped away to produce an abstracted schema.

Animal & Ocean Mobilities

Thus far we have explored the lives and experiences of the divers and sailors who helped to bridge the gap between the seafloor, the materiality of the ocean, and the waiting hands and eyes of colonial scientists, surveyors, or administrators. But can we approach this process from the bottom of the ocean itself? After all, as non-human geographers remind us, 'terrain are, before any human intervention, always already inhabited,' and of course, this is especially true in the ocean, a space from which permanent human settlement is absent.[62] As I pointed out in the *Introduction*, while human mobility has been central to the framing of Indian Ocean studies, animal mobility has been almost entirely absent.[63] Traders, scholars, pilgrims, and labourers may have moved across the Indian Ocean's waters, but there is virtually no consideration of other species moving.

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[62] Squire, 'theories of terrain,' 210.
[63] The full list of historical works on Indian Ocean mobility is long, see for example: Edward Alpers and Chhaya Goswami, *Transregional Trade and Traders: Situating Gujrat in the Indian Ocean from Early Times to 1900* (Oxford: Oxford University Press, 2019); Engseng Ho, *The Graves of Tarim: Genealogy and Mobility across the Indian Ocean* (Berkeley, CA.: University of California Press, 2006); Sunil S. Amrith, *Crossing the Bay of Bengal: The Furies of Nature and the Fortunes of Migrants* (Cambridge, Massachusetts: Harvard University Press, 2013).

The work of non-human geographers is instructive here. Timothy Hodgetts and Jamie Lorimer, for instance, have called on scholars to adopt approaches that 'prioritize the lived patterns and embodied experiences of animals.'[64] They also prefer the term 'mobilities' instead of 'movement,' writing that this 'recognizes that animal movements are always produced within (and are productive of) relations of power between various actors.'[65] So if oceanic mobilities transcend the human, where can traces of these other movements be accessed?

Unlike extractive sites such as diamond or gold mines, the location of a pearl bed shifted frequently. Oyster movement resulted from variability in seabed, ocean currents, storms, and tidal patterns. Attending to how the maps aimed to grapple with the problem of oyster mobility allows historians to reach for what Christopher Bear calls 'aquatic liveliness.'[66] As Bear and Sally Eden write in the context of contemporary fisheries certifications, designating fixed areas at sea is complicated by the fact that 'the utility of areal boundaries is rendered problematic by the materiality of the seas: coastlines change, fish swim, water moves, and ships travel.'[67] They suggest instead a model of 'hybrid geographies' which would attend to a 'multiplicity of spatialities,' including animals' own patterns of mobility.

In each map surveyed above, attempting to pin down the distribution of a living organism, or several hundred thousand of them, was near-impossible. In other words, even if the geography of a pearl bank, defined by humans as a dense cluster of oysters,

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[64] Timothy Hodgetts and Jamie Lorimer, 'Animals' Mobilities,' *Progress in Human Geography* 44, no. 1 (February 2020): 2, https://doi.org/10.1177/0309132518817829.
[65] Ibid., 5.
[66] Christopher Bear, 'Assembling ocean life: more-than-human entanglements in the Blue economy,' *Dialogues in Human Geography* 7, no. 1 (2017): 27-31, 10.1177/2043820617691635.
[67] C. Bear and S. Eden, 'Making space for fish: the regional, network and fluid spaces of fisheries certification,' *Social & Cultural Geography* 9, no. 5 (2008): 487-505, https://doi.10.1080/14649360802224358.

was imposed upon oysters from without, oysters themselves influenced this from within, by living or dying, migrating, and settling in various sites over time.[68]

Oysters moved because they were killed or eaten, because they could not find an appropriate substrate to attach to, or did not have sufficient food, because they were smothered by sand, or were overcrowded by other species.[69] Crucially, they died because they were lifted off in the order of several million or billion from the ocean floor, thus also reducing the likelihood of a successful population of oysters in the next year or months. The maps above had no way of accounting for change over time, as reefs grew, shrank, and disappeared after a harvest. There were no cartographic keys for oyster death, at sea or on land. Reefs in the Persian Gulf 'failed' in 1770, 1790, 1878, 1900, 1905, 1950 and 2001—that is, there were not enough oysters on the ocean floor and some reefs had no oysters at all.[70] By 1907, the shallow waters in Mergui were 'practically cleared of shell.'[71] Ceylon's fishery was so intermittent that sometimes a decade could pass before there was a sufficient number of oysters on the reef to allow a successful harvest to take place.[72] The *hairat*, *paars* or reefs and oysters were anything but stable and guaranteed in the way the maps presented them.

Adult oysters on the ocean floor were made legible to divers who translated this to overseers. But other stages of the oyster evaded humans altogether. Bear's work on Atlantic salmon alerts us to the 'complex spatialities of salmonid life' which include many different life stages each lived in separate parts of rivers, streams, or the sea.[73]

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[68] Chris Philo, 'Animals, geography, and the city: notes on inclusions and exclusions,' *Environment and Planning D: Society and Space* 13 (1995): 656.
[69] Herdman, *Pearl Oyster Fisheries of Ceylon*, vol. 1 (1903), 26.
[70] D. Smyth et al., 'Historic Pearl Oyster Beds,' 148.
[71]Rudmose Brown and Simpson, *Pearl Oyster Fisheries*, 3.
[72] Fernando, 'Seeing like the Sea.'
[73] Bear, 'The ocean exceeded: fish, flows and forces,' *Dialogues in Human Geography* 9, no.3 (2019): 329, https://doi.org/10.1177/2043820619878567; in Indian Ocean studies see Nethra Samarawickrema's work on gem mining which follows the trails of oceanic history deep underground. Samarawickrema, 'Elsewheres in the Indian Ocean: Spatio-temporal encounters and imaginaries beyond the sea,' in Srinivas, Ng'weno, and Jeyachandran eds. *Reimagining Indian Ocean Worlds*, 92.

Oysters, of course, are less mobile than salmon: they are bottom dwelling, rather than free-swimming. However, even in an ordinary life cycle, the oyster passes through two stages: one mobile and one sedentary. In their mobile stage, they drift as eggs or sperm, then once fertilised, as free-swimming young until they choose a place to settle down. Traces of these other life-stages are fleeting: one observer in Ceylon in 1799 described fertilised spawn on the sea surface 'connected together by a slimy substance; this seed is deposited in great quantities.' [74] Recognizing that oysters had lives beyond the map asks us where to locate microscopic larvae, tiny free-floating fertilised creatures whose shells had not yet developed, or young oysters that landed and disappeared from reefs?

Intimations of these unseen, untraceable oysters sometimes emerge through absence. In Mannar officials speculated about oyster stocks on the opposite coast restocking the banks with young spawn. [75] Similarly, in the Persian Gulf, divers and nakhodas advanced the view that there were oysters living in deeper waters, beyond where divers could descend, hence 'the local belief that the spoliation of the deeper beds would injure the shallow sea.' [76] Although the question of whether 'it is possible that such deep-sea pearl beds exist' was entirely unknown, there was a possibility of it, alluding to animal life and mobility *beyond* the scope of the map. [77]

In terms of animal mobilities, one might also consider the other animals besides humans who also hunted and killed oysters. Twynam's report included comments on other molluscs, rays, trigger fish, and sponges who ate or competed with oysters for submarine space, labelling these creatures as 'enemies' of the oyster (see Chapter 4,

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[74] Wolf, *Life and Adventures*, 208.
[75] Correspondence respecting the Ceylon Pearl Fisheries Lease, pp. 4, CO 1073/56, UNKA.
[76] Letter dated 11 Oct 1938, ADM 116/4166, UKNA; Lorimer, *Gazetteer of the Persian Gulf,* 2244.
[77] Foreign Office dated 15 October 1938, ADM 116, UKNA.

Science).[78] Starfish and sea urchins ate oysters, 'submarine borers and grubs' wore through the shells of oysters, and sharks fed on the fish who showed up to eat oysters.[79] Although these animals' experiences largely fall out of the purview of the textual archive, we can still find traces of them: Moken divers in Mergui told stories about whales and sea turtles, while the Tamil parava divers of the Gulf of Mannar both dreaded and fought against sharks.[80] Jellyfish were universally feared.[81] Other creatures made inadvertent entries to the archive, such as the barnacles that so frequently attached to fishery vessels that some boat owners complained that there was hardly a single hull that was 'clean and unfouled.'[82] In these foul and feared patterns which peek out throughout the fishery archive, the historian is made alert to a more populous seascape than the maps allow.

Mobility applied not just to creatures, but also to the sea itself. Just as oysters moved, so too, did the ocean, rising and falling with the tides, having different current patterns, storms, and undersea sand movements. As Rachel Squire has explained in her work on the underwater US Sealab experiments in the 1960s, 'terrain cannot be understood without first paying due attention to the water in which it is immersed and inseparable from.'[83] And indeed, the ocean affected pearling directly. In Ceylon there were two distinct times of the year when oysters would spawn, coinciding with warmer sea temperature. The monsoon was frequently thought to throw up sand underwater which suffocated oysters. In Mergui, work during the spring tide was near impossible

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[78] Twynam, 'Enemies of the Pearl Oysters' in *Report on the Ceylon Pearl Fisheries*, 4-7; Leah M. Gibbs, 'Animal Geographies I: Hearing the Cry and Extending Beyond,' *Progress in Human Geography* 44, no. 4 (August 2020): 769–77, https://doi.org/10.1177/0309132519863483.
[79] Starfish see Rudmose Brown and Simpson, *Pearl Oyster Fisheries,* 21; Boring parasitic worms see Jardine, 'Mergui pearl fields', 6; sharks see 'Pearl Fishery Diaries of 1858' 20/789, SLNAK.
[80] Fernando, 'Seeing like the Sea.'
[81] Al-Shamlan, *Pearling in the Arabian Gulf*, 116-118.
[82] James Hornell, 'The Pearling Fleets of South India and Ceylon,' *Mariner's Mirror* (Cambridge: University Press, 1945), 218.
[83] Squire, 'Immersive Terrain,' 334.

and pearlers' had to consider 'the exposure to the ocean swell' and 'force of these currents.' [84] River runoff affected oysters in all three pearling sites, as outflow from the Pak Chan River in Burma/Siam, the Man Aru in Mannar and the Tigris, Euphrates, and Karun in the Persian Gulf changed the composition of the sea. Atmospheric features and ocean currents shaped where a pearl-bearing shoal of oysters would settle and grow.

In fact, although historians may shy from the attribution of 'agency' to nature, pearlers had few similar compunctions. Hornell wrote of the *paars* in the Gulf of Mannar, 'the controlling factors are many, but it is certain that the most important are the character of the weather and the direction and strength of the currents at the time [oyster] spawning takes place.' [85] Likewise, Jardine wrote on pearling seasons in Mergui, 'nature in her climatic arrangements had provided a "close" season herself.' [86] 'Nature' was very much conspicuous and present at the fisheries, both during their heyday but also in the historic archive.

Conclusion

In the high imperial moment, long-standing local navigation practices at sea were folded into new, global projections of the seafloor which aimed to fix the position of submarine oyster reefs in cartographic form. To do this, in each of the three examples above, the materiality of the sea, its creatures and the beings that inhabited it was removed entirely, as pearling territory was constructed as a clearly visible strategic environment, oriented towards the state or capitalists. This colonial and imperial ordering of the seafloor and ocean space around the oyster aimed to make particular habitats named, mathematical, calculable, although this attempt to isolate and hold stable the oyster-as-object often failed. These pearling maps then certainly accord with

[84] Rudmose Brown and Simpson, *Pearl Oyster Fisheries*, 12.
[85] Hornell, 'Pearling Fleets,' 215.
[86] Jardine, 'Mergui Pearl Fields,' 18.

Kimberley Peters and Philip Steinberg's observation that the 'cartographic logic of stasis and control, points and lines,' fails when applied 'to an ocean whose biogeophysical properties…are resistant to terrestrial ontology of bounded zones and emplaced points of power and knowledge.' [87]

Scholars writing on cartography have asked, 'do maps find the world or do they make it up?' [88] This is a good question, but I suggest that we might frame it differently. Using the oyster reef at sea, I have aimed to show that maps both encounter and make-up the world they find. In the first instance, the oyster was rendered visible in its *encounter* with the diver. Each circle or mark on the charts represents a site that was *knowable* and thus translated through the interactions of the state, capitalists, and divers. Each *paar* or *hair* or 'workable area' thus represented an inscription of the human body and oyster ecology at a particular moment in time. In their making up, they affected the world, through fishing or further investments in capital or sovereign control, which led to more harvesting and reefs becoming exhausted. This in turn, again altered the same agents depicted on the map.

If, as this dissertation has maintained, humans were *constitutive of* and co-produced alongside terrain and ecology, rather than external to them, then maps, as I have shown, can be read creatively against and with other kinds of archival materials which gesture to animal and human social and cultural worlds which together bound and created oceans historically. But these animal worlds would, in the late nineteenth century, receive new attention from a nascent oceanographic scientific enterprise, and thus it is to oyster science that we turn in the next chapter.

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[87] Kimberley Peters and Philip Steinberg, 'The Ocean in Excess: Towards a More-than-Wet Ontology,' *Dialogues in Human Geography* 9, no. 3 (November 2019): 253, https://doi.org/10.1177/2043820619872886.

[88] Doug Specht, 'Did you find the world or did you make it up? Media, communications and geography in the digital age,' *Westminster Papers in Communication and Culture* 13, no. 2 (2018): 1–13.

Science

'Placing the censured young Ganga atop the dreadlocks, turning lovely Matanan to ash and resurrecting him before his wife as implored, the Pure One, with feet like lotuses, where the roaring fertile ocean swells with pearls, fine gold and oysters, wafting ashore on waves and uniting, at Konama Malai, dwells in desire.'-Campantar, 700

'The tomb of a parasitic worm is not really a pleasant object with which to bedeck a fair neck' -Du Bois 1912

'The work which is the forming of the pearl is entirely done by the oyster in both cases'-Kōkichi Mikimoto, 1925

Introduction

By 1903, the Galle Fort – a sturdy bastion at the southern end of the island of Ceylon – had held forth against the waves of the Indian Ocean for four centuries: a silent witness to the approach of empires, merchants, and pilgrims from afar. Not all visitors, however, spoke in human tongues. That year, a line of tubing passed inconspicuously, snaking up from the sea across a shallow rock pool and over the ramparts (figure 1). Every few days, a man who was paid a meagre salary, and whose name and identity elude the archive, pumped seawater up the pipe, bringing the ocean into the man-made fortification which was designed to keep it out. Powered by human effort, this 'seawater mixture' travelled up and over the stone walls to flow into six 8-inch-deep trays. [1] In each tray, hundreds of pearl oysters fed, grew, reproduced, lived, and died at great remove from their home reefs along the north-western littoral of the island.

[1] James Hornell, 'A lecture delivered before the Presidency College Natural History Association in Madras, on 23 February 1921' in Haddon Papers 10053, University Library, Cambridge, UK. The laboratory was supplied 'by an intake pipe carried from the drums to a rock pool at the foot of the bastion' which functioned owing to the labour of a man described only as 'a cooly [who] pumped the tanks full as was necessary.'

Figure 10: Oyster observation shed at Galle Marine Biological Laboratory. Hornell Collections, Museum of Anthropology and Archaeology, Cambridge. C716_013.

In captivity, the oysters grew to various stages.[2] They ranged from translucent larvae who were just a few hours old to young oysters developing a delicate, hinged shell three days later. Some would settle on the bottom of their tanks and grow out a bundle of short, tough fibres to anchor themselves in place. Others attached themselves to coral or sponges. Some burrowed under sand; others climbed up aquaria walls.[3] But oysters were not the only beings with agency in these contexts; instead, their lives were also influenced by human hands. As a result, still more oysters were pried open and held between two plates of glass to be photographed, while others had their sexual and other organs removed for study. Several were passed under microscopes and measured daily with instruments known as micrometers. By chipping away at their shells, the processes of healing and new shell growth were carefully tracked. Almost all the oysters were guaranteed death: they were removed from their tanks, opened, dissected, and, in the case of the pearls which were sometimes found inside them, decalcified.

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[2] Lori Marino, 'Captivity,' in Lori Gruen, ed., *Critical Terms for Animal Studies* (Chicago: University of Chicago Press, 2018), 99-111.
[3] Hornell, 'Observations and Experiments on the Life-History and Habits of the Pearl Oyster,' in Herdman ed., *Pearl Oyster Fisheries of Ceylon*, vol. 1 (1903), 125-146.

'Pearl oysters live in tropic [*sic*] waters, and till the present century, opportunities to study them in their natural habitat were wanting or not taken advantage of,' the fisheries official James Hornell explained, surveying the preceding decades of work, in a lecture given to the Natural History Society in Madras in 1921.[4] Oyster death in the course of the human harvesting of pearls was not new, but death in the service of nascent marine science in the Indian Ocean was, by contrast, novel. The late nineteenth century saw the oyster transformed into a subject for science and the fisheries into sites of marine biological research, as in the case of Ceylon's first marine biological laboratory at Galle, described above.

Pearling, as Chapter 1 demonstrated, was a commercial endeavour, but in its entanglement with the British colonial state in Ceylon it also became a scientific one. The introduction of science resulted in pearling being traced back to its molluscan hosts. Oysters and their internal biological processes were newly visible in print and scientific discourse, just as they were also made increasingly visible in legal terms (Chapter 5, *Law*). In Japan, the scientific attention to oysters had successful industrial applications which completely changed the nature of the trade; science removed the unreliability of the sea in contributing to pearl-formation.[5] Oyster 'work,' as in Mikimoto's quote above, was made to fit into schemes of human capital. But how did the oyster come to be construed as a worker in the first place?

In the Indian Ocean, colonial science on oysters was viewed with optimism for fifty years, but ultimately had little bearing on the trade in pearls. In the following sections I turn to published and unpublished archival material from the labour and scientific archive in Ceylon to trace the development of marine science and oyster

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[4] Hornell, 'lecture,' Haddon 10053.
[5] Ericson, 'Nature's Helper,' 6.

culture in the Gulf of Mannar. This is the story of how pearling was turned inside out: beginning not with pearls but with internal processes in molluscs, although the view to what the oyster was, and how best to understand it, was constantly changing. This fact, in itself, constitutes a story about knowledge; one about its unsettling, and the failure of science and technological regimes to improve the revenues of pearling. The oyster was a slippery being. The application of marine science resulted in diverse visions of the oyster: the creature went from being a statistical resource at sea to an individual animal with organs, sex, a lifecycle, 'friends' and 'enemies,' related to parasitic worms, microbial communities, material environments, and food-webs in the sea.

To understand the new scientific visibilities around oysters we can ground these new approaches in two concepts: terrain and scale. Changes in terrain included lifting oysters out of the sea and onto the decks of ships or onto the shore for scientific work, thus seemingly removing the variable, dynamic material of the ocean which we encountered in Chapters 1, 2 and 3. The oyster thus moved from the diver's encounter on the seabed to a live specimen in the tank, who could be viewed through a naturalist's, rather than a labourer's gaze. New scopic regimes of the microscope and camera aided these processes of vision. Scale, in turn, expanded and contracted in the course of the nineteenth and early twentieth century. The scientific gaze zoomed in by moving from a view of oysters as an inchoate collective to the study of single animals, but also further still to the level of the microscopic, what Marina Benjamin calls 'the world of the small.' [6]

But just as some actors zoomed in to reveal the unicellular and multicellular marine world that moved through the ocean and into oysters (and thus into pearls),

[6] Marina Benjamin, 'Sliding Scales: Microphotography and the Victorian Obsession with the Minuscule,' in *Cultural Babbage: Technology, Time and Invention*, eds. Francis Spufford and Jennifer S. Uglow (New York: Faber & Faber, 1996), 99–122.

others zoomed out, seeing the place of the oyster in broader material or ecological relations. Terrain and scale operated as interlocking gears, working in concert, in the same way that one rotates the wheels of a pair of binoculars to bring a subject into and out of focus. But, kaleidoscope-like, these shifting visions never settled on one version of the oyster and thus one mode of intervening in the natural, material, and ecological dynamics of the sea. Ultimately, the nineteenth-century's significant increases in tropical oyster knowledge in Ceylon amounted to little. By the 1920s, despite the promise of science, the oyster was relegated to the terrain of the ocean once more.

Oysters as Work and Revenue

Historians of science and empire have worked hard to undo and complicate the category of colonial science. Helen Tilly has explained how terms like 'colonial science' reify and isolate both 'western science' and 'indigenous knowledge,' suggesting that these are hermetic containers that are place-bound and immobile.[7] These neat categories tend to break down when we study the production of knowledge in colonized spaces, as the now vast and ample literature on go-betweens, intermediaries, and translation within the history of science shows.[8] In this vein, in a seminal essay on methods for global histories of science, Sujit Sivasundaram has suggested, instead, that a process of 'cross-contextualizing' can move us beyond these simple dichotomies. Sivasundaram calls instead for reading alternative sources together

[7] Helen Tilley, *Africa as Living Laboratory: Empire, Development and the Problem of Scientific Knowledge, 1870-1950* (Chicago: University of Chicago Press, 2011), 10.
[8] Simon Schaffer, et al., eds., *The Brokered World: Go-Betweens and Global Intelligence, 1770-1820* (Sagamore Beach, MA: Science History Pubns, 2009); Kapil Raj, 'When Human Travellers Become Instruments: The Indo-British Exploration of Central Asia in the 19th Century,' in *Instruments, Travel and Science: Itineraries of Precision from the Seventeenth to the Twentieth Century*, eds. Marie-Noëlle Bourguet, Otto Sibum, and Christian Licoppe (London: Routledge, 2002), 156–88.

– *ola* [palm] leaf manuscripts alongside botanical publications in London, for instance – to suggest ways to move between those vexed scales of the local and the global.[9]

When doing this work of cross-contextualizing, historians' empirical demands for neatly dated archival materials sometimes conflicts with the use of indigenous material. Certainly, in the Gulf of Mannar, many much older literary traditions ran through the colonial encounter, even if it is hard or impossible to date them to the nineteenth century. How littoral communities on both sides of the Gulf of Mannar encountered oysters before the colonial period is interspersed through the following paragraphs so as to avoid repeating stories of western techno-scientific dominance and diffusion.

The processes related to the oyster which I chart below can be read more in keeping with changes in nineteenth-century fishery management which increasingly turned to science to improve yield.[10] Histories of malacology, or the study of molluscs, usually outline predictably Eurocentric intellectual genealogies, beginning with Pliny the Elder and proceeding through a series of French, Swiss, German, and English naturalists culminating in a story of Japanese modernity's triumph at domesticating the oyster.[11] This chapter should not be read in a similar vein, as an argument for the intrusion of European science into a *terra* (or, more precisely, *mare*) *nullis*.

Setting the context for reading indigenous and colonial knowledge around oysters, it is worth repeating what I outlined in the Introduction, that the pearl fishery of Ceylon saw a deep and thoroughgoing legacy of colonialism. This was a site, after

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[9] Sujit Sivasundaram, 'Sciences and the Global: On Methods, Questions and Theory,' *Isis* 101, no. 1 (March 2010): 146.

[10] Similar narratives about the introduction of science have been charted for other industrializing fisheries: Atlantic cod in Newfoundland; otter and seal fisheries in the Pacific; halibut in the Gulf of St Lawrence, and so on. See Helen M. Rozwadowski, *Vast Expanses: A History of the Oceans* (London: Reaktion Books, 2018), 130–135.

[11] David Heppel, 'The long dawn of malacology: a brief history of malacology from prehistory to the year 1800' *Archives of Natural History* 22, no. 3 (1995): 301-319.

all, that had seen four centuries, rather than a few decades, of colonial interference. Indeed, Dutch and Portuguese sources before the British documents that follow below had already pondered the question of the oyster and oyster biology. Indigenous Tamil knowledge on pearl weights, types, and oysters existed alongside colonial practices of management and sale as other local knowledge practices of surveying and naming, for instance, as we saw in the previous chapter, were increasingly integrated into the state. [12]

Before the introduction of marine science to the pearl fisheries of Ceylon, knowledge of oysters was inextricably entangled with the work of fishing. It was practical knowledge which lived with seafaring men and divers along the coasts. These Muslim and Tamil communities fished for chanks, sea cucumbers, oysters, and fish, making and sewing nets and fish traps, and selling their wares at local markets. When the British took over the pearl banks in the Gulf of Mannar, they initially relied on this expertise, gathered from years at sea, to understand oysters.

If the state 'saw' oysters at all, during this time, it was through the reports provided by local men paid to run bi-annual pearl bank inspections of the reefs of Ceylon. Parava and Marikkaiyar caste group leaders accompanied a state 'inspection' vessel and, by sending down divers, determined an estimate for the quantity and quality of oysters to be fished. Local fishers very literally steered the state to the oysters. [13] Historians working on medieval Tamil or Arab navigation have stressed the plant and animal knowledge and expertise in currents, winds, and ocean depth which these communities possessed, passed down and honed through their experiences. [14] At the fishery inspection of 1879 the coxswain Joachim 'returned with the head fisherman

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[12] Babu and Prakash, *Muttukkanakku*.
[13] 'Memo: Adigar of Mannar to be ready at Silavatturai with inspection boatmen,' in 'Outward Letterbook of the Assistant Government Agent, Mannar,' 31/396, SLNA.
[14] Arul Raj and Rajamanickam, *Maritime History of South India*, 31, 149, 239.

who said he knew there were some rocks further north of Illekal and that he would come with us in the morning to show them.'[15] This was repeated off Mullativu, where the *Adapan* of Chenmalai 'brought a fisherman today who said could point us to some rocky patches along the coast from Chundi Coolum to Kokaly.'[16]

Partly owing to the long commercial history of pearling, most nineteenth century records portray oysters as resources, rather than animals. The oyster was comparable to wheat, jute, or cotton, weighed up in terms of the prices which could be fetched for them. Consider the archives around inspections, based on the reports brought up by divers in the procedure described earlier. In 1879, official records noted that 'the coxswains estimate of oysters on the large bed is the same as mine but they say 10 days fishing for 25 *dhonies* [boats].'[17] The year before: 'the coxswains estimate a fishery next year of 50 boats for 8 days with average loads of 3000 oysters each, which is equal to 1,200,000 oysters on the whole bed.'[18] The oyster appears as revenue estimate: 'today the coxswains gave me their estimate of the *Kooddopakku* paar, which is, eight days fishing for 50 boats with average loads of 4000 oysters each.' This view translated the oysters at sea in terms of the length of time of fishing and number of boats, two measures for the economic activity which could be facilitated by them. Oysters in the early and mid-nineteenth century were known as statistics, abstracted away from the ocean and its lifecycles or ecologies into statements of profit and viability.

Local literary traditions also, to some extent, took the lifecycles, habits, or reproduction of oysters for granted. Consider a verse from Cēkkiḻār's twelfth-century text, the *Periya Puraṇām*, which includes numerous references to pearls threaded

[15] Twynam, Diaries of the Pearl Fishery, 11 June 1879, pp. 197, 31/394, SLNA.
[16] Twynam, Diary, 8 June 1879, pp. 195, 31/396, SLNA.
[17] Letter from Twynam, 28 February 1879, 31/396, SLNA .

through a bountiful Chola landscape embedded within stories of the Saiva saints. 'Bright pearls of the sea, pearls from sugarcanes/ That grow in the fields, cool pearls of bamboos / And lustrous pearls that fall from the tusks of tuskers; / These were cunningly threaded into garlands / By damsels whose white teeth were rows of pearls,' the verse continues.[18] Pearls come easily into being from a variety of sources.[19] There is no reference to specific ecologies or an attempt to parse out the seascape or reef as distinct, nor to attend to modes of pearl-production by the bivalve. The oyster's secrets were taken for granted and remained far out at sea, although their by-products were, by contrast, highly visible.

As argued in Chapter 2, pearl oysters do not make their way to the surface for sale or science of their own accord. And so, if the sea remained outside of the remit of the colonial state – inaccessible based on terrain – then divers' embodied labour was required to bridge this divide. As outlined in the previous chapter, by the 1880s, the process of inspecting the seafloor in order to prospect for a future fishery was systematized, reducing human labour to a series of abstracted tasks:

> The inspection barque is anchored in a position fixed on the chart by bearings from the shore. The steam tub, towing a boat with buoys bearing flags on board, first lays our buoys in the north, south, east and west at distances of ¼, ½, and ¾ of a mile from the barque… Four diving boats, each with a coxswain in charge, 5 rowers, 3 divers, and 2 manducks are arranged in a line…the distance being equally divided between the boats. The rowers work round in a circle, and the divers make frequent divers in search of oysters until the starting point is reached…. this circle is completed, each boat has described three circles with the inspection barque as a centre. And in this way, twelve circles in all are described by the four boats…The coxswain of each boat records on a diagram, provided by the Inspector, the approximate position of each dive which is made, the nature of the bottom (A triangle=rock, a circle=sand, and a cross=oysters) and the number of oysters lifted.[20]

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[18] Cēkkilār, 'The Puranam of Viran Mindar' in *St Sekkizhar's Periya Puranam*, trans. T.N. Ramachandran (Thanjavur, 1990), 115.
[19] For Queen Alli Rani see Fernando, '"Secret Histories" of the Sea,' *Environmental History Now,* blog post, last modified 9 March 2020, online, https://envhistnow.com/2020/03/09/secret-histories-of-the-sea/.
[20] Edgar Thurston, *Pearl and Chank Fisheries in the Gulf of Mannar* (Madras, 1894), 103.

Here the sensuous experience of the underwater and the labour of forty men's work rowing, diving, navigating, transcribing/translating is reduced to 'twelve circles.' This inspection chart is quoted in detail above to show how work became abstraction in the same process that oysters and their submarine environment became viability statistics for colonial revenue estimates.

Labour was a mode of knowing nature, albeit one distinct from the laboratory and metropole-based textual practices which would soon result. Divers knew the lifespan of oysters (roughly eight years in the Gulf of Mannar), that they tended to be richest in pearls around the three-to-four-year mark, that the oysters had different genders, becoming either male or female at a certain age, and which predators ate oysters, both young and old.[21] Even the smell of a bottom sample was enough for some fishermen to deduce the condition of the ocean-floor.[22] Divers' reports frequently contained descriptions of coral and seaweed, types of shells, and other maritime occupants.[23] But at the level of the state, how did these abstracted revenue sources become animate, dynamic creatures with life cycles?

Well into the mid-nineteenth century, the oyster remained a mystery to those who were responsible for accounting for fishery proceeds. In part, this was a result of colonial bureaucratic organization: management of pearling was the responsibility of administrative officials in the Northern Province, who fulfilled the role of Pearl Fishery Superintendent, managing labour and affairs on shore, while a Pearl Fishery Inspector (generally an officer from the port in Colombo) was responsible for matters at sea.[24]

These were administrators, not naturalists, bureaucrats and mariners rather than underwater workers. It is then unsurprising that one such fishery inspector, James

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[21] Pearl Fishery Inspection Diaries, 20/789, SLNA.
[22] Lehman, 'Relating to the Sea,' xxi; Chandra, *Trade and Trade Routes*, 205.
[23] Tywnam, Diary No 42, 5 March 1874, E.L.Pawsey Papers, CSAS.
[24] Bastiampillai, *Northern Ceylon*, 213.

Steuart, observed in 1833 that he had 'very little time to bestow on the natural history of habits of the animal in question.'[25] Little had changed three decades later, when officials expressed the view that 'so little is known about the habits of the pearl oyster in its early stage of growth.'[26] Specifically, the lacuna referred to texts in European languages on the Ceylon pearl-bearing oyster, although there was a considerable and growing literature on European molluscs.

Discounting the daily, mundane expertise of local fishers, British imperial administrators confronting oysters repeatedly expressed how little was known about them. In the Persian Gulf, although imperial officials searched for the 'laws which govern the growth of oysters', they were forced to concede that *hair* or *hairat* are living assemblages, and thus, mutable.[27] In 1911, Lorimer had conceded that 'the movements of the oyster are entirely uncertain, defying forecast.'[28] In Ceylon in 1860, the superintendent of fisheries George Vane, bemoaned how 'so little is known or recollected on a subject so generally interesting, and particularly so in the interests of the colony,' as the disappearance of oysters.[29] In Burma, one exasperated official in 1905 complained that 'I am not even able to give a definitive opinion as to whether the mollusc is in danger of extermination.'[30] The conditions of the mollusc were fast turning out to be inseparable from commerce.

In the Gulf of Mannar, as long as the fishery turned a profit, the state was happy for the oyster to remain at sea and to rely on divers' expertise. The problem, however, was that oysters did not always procure themselves up for the taking. The Ceylon pearl

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[25] James Steuart, 'Account of the Pearl Fisheries of the North-West Coast of the Island of Ceylon,' *Transactions of the Royal Asiatic Society of Great Britain and Ireland* 3 (London, 1834): 452.
[26] Letter from James Steuart to the Colonial Secretary, 25 Sept. 1868, E.L.Pawsey Papers, CSAS.
[27] Lorimer, *Gazetteer*, 2223.
[28] Ibid, 2224.
[29] George Vane, 'Report on the Pearl Banks of Ceylon and the Fisheries from 1855 to 1860,' 20/769, SLNAK.
[30] Letter from Mergui to Commissioner Tenasserim Division, 2 June 1905, AG 1/7, 1110, YNA.

fisheries were plagued by 'the periodical disappearance of oysters from certain banks.'[31] Oysters' disappearances meant that they evaded full rationalisation into chains of profit and commodity-making. In 1888, the fishery inspector James Donnan wrote that an estimated 156 million oysters were 'swept from the Cheval *paar*' leaving only their broken anchoring fibres behind. In 1894 he wrote of the oysters on *periya paar* that 'they had simply vanished from that bank leaving no trace behind.'[32]

Medium or large adult oysters, however, were less troublesome than young oysters. Young oysters could settle at will depending on ecological conditions. 'Oysters of that age [six months] cannot be relied upon to remain on the bank,' 'oysters of that young age are quite unreliable' fishery inspectors grumbled, complaining about how these young frequently confounded expectations for where they would settle and grow.[33]

As a result, although a single fishery might generate more revenue than any other cash crop (including coffee, tea, or cinnamon), the years when the banks were thickly crusted with pearliferous oysters were few and far between. It was not the case that the decline of the fishery was pending, in slow steady fashion. Instead, the fishery had collapsed several times already. Under both the Portuguese in the sixteenth century and the Dutch the following century, there were moments when the stock of oysters collapsed entirely. The Jesuits, who were heavily involved in fishery administration during the Portuguese period, claimed that the fallow periods of 1543 to 1552, 1574,

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[31] Oliver Collett, 'Pearl Oysters and Pearl Fisheries,' *Journal of the Royal Asiatic Society*, *Ceylon branch* 14, no. 51 (1900): 165.
[32] Donnan, 'Report on the Pearl Banks Inspection,' 16 April 1894, E.L.Pawsey Papers, CSAS.
[33] Ibid., entry dated 15 Apr. 1896.

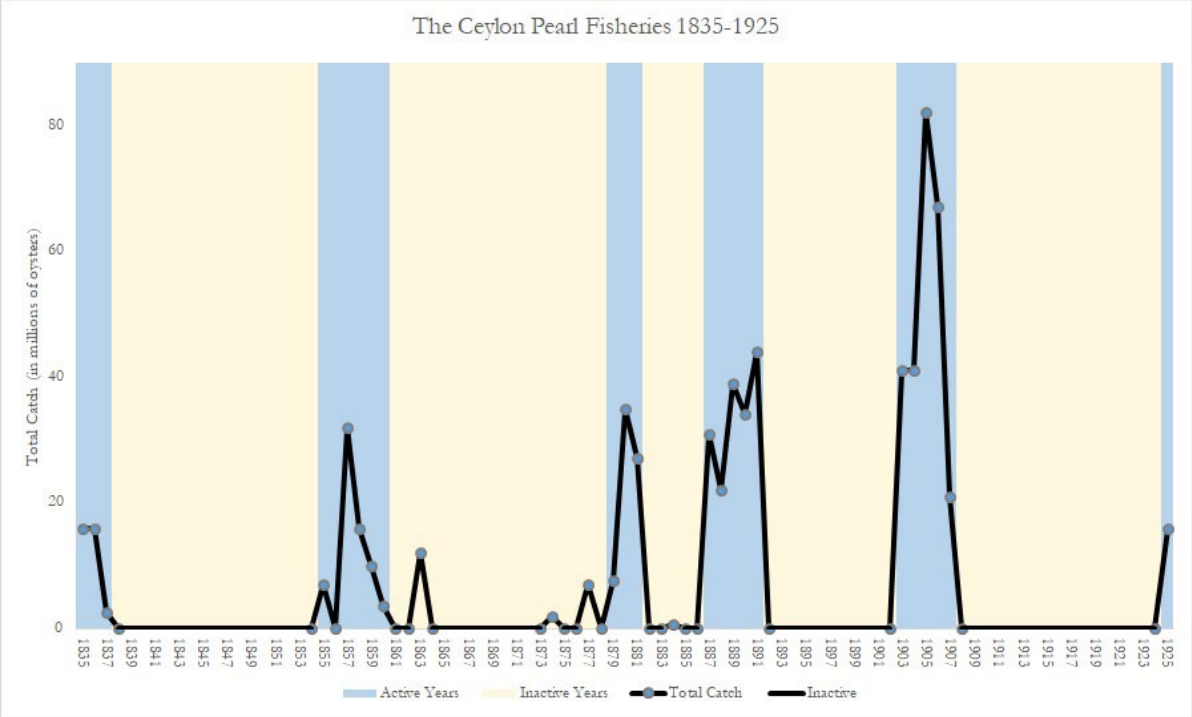

Table 5: The intermittency of the Ceylon pearl fisheries 1830-1925. Data from Ceylon Sessional Papers.

and 1581 respectively, were the result of the oyster beds not being ripe.[34] Under the Dutch, so many years were unviable for the fishery that their administration has been described as 'an annual ritual exercise in futility.'[35] In his *longue durée* history of the Ceylon pearl fishery, Subrahmanyam appraises this pattern, writing that in the Gulf of Mannar 'there was no pre-1750 Golden Age to be contrasted with what came afterwards.'[36] What *was* new to the nineteenth century was the introduction of science and the possibilities that it offered to remedy this.

The growth of oyster science around the tropical pearl fisheries was in response to the absence of sufficient numbers of oysters at sea. Events such as the following in 1864 were not uncommon, when a rapid telegram was distributed throughout South India: 'please circulate information that there will be no Pearl Fishery at Arippo Ceylon

[34] Subrahmanyam, 'Noble Harvest,' 143.
[35] Ibid., 152.
[36] Ibid., 171-2.

this year: Oysters all dead.'[37] Until 1906, most writers concurred that the cause of the disappearance was unknown, the result of 'some mysterious and hitherto unexplained reason.'[38] Oyster death and disappearance ushered in a particular form of 'applied' science to remedy this. From the perspective of the state, this unreliability prevented the regular extraction of revenue; from the perspective of oysters, a range of conditions affected whether they would settle and thrive in large numbers including availability of nutrients, suitable substrate for landing and attaching, water temperature, and salinity.

Colonial scientific practitioners of the early twentieth century – naturalists, physicians, and zoologists – had a dim view of existing science on the topic of pearl fisheries. But officials working with divers on the pearl banks had long trialled their own theories and methods for intervention in the lifecycles of oysters. In the 1860s, Vane speculated on the role of weather and currents leading to the disappearance of oysters. Others aimed to isolate oysters from the ocean by rearing them in ersatz natural habitats. In 1885, Donnan tried to establish an oyster nursery on a reef three miles from shore by having divers dig into the coral and line the enclosure with stone, creating 'a very snug place to preserve oysters in, the water being quite clear, and having a depth of about three feet at low tide and five at high tide.' Although 12,000 oysters were transplanted to his makeshift sanctuary, none survived.[39] In 1894 he hatched new plans for a nursery on Karaitivu Island, 'the only sufficiently sheltered place for a nursery on the whole Western coast of Ceylon' and far enough out that 'water pouring into the sea during the rainy season' would not be 'fatal' to the oysters.[40] The nursery failed again. Finding hospitable sites for rearing oysters at sea was not straightforward.

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[37] Letter from Pearl Fishery Superintendent to Phillips, copied also to Tuticorin, Paumben, Negapatnam, Madura, 31/396, SLNA; See also telegram from master attendant of pearl fishery, 3 February 1864, 30/396, SLNA.
[38] Im Thurn, 'Ceylon Pearl Fishery of 1903,' 182.
[39] Donnan, 'Report,' 16 Apr. 1894.
[40] Ibid.

Oysters for Science

The new scientific attention given to the oceans around the crown colony of Ceylon cannot neatly be parsed apart from developments in the history of oceanography in Britain. The latter half of the nineteenth century was a favourable time for marine science.[41] The prestige of the circumglobal *Challenger* Expedition of 1872-76, the global fame of the Stazione Zoologica opened by Anton Dohrn at Naples in 1874, and the interest in the International Fisheries Exhibition held in London in 1883 made the climate ripe for marine biological research.[42] A series of biological stations across the world aimed to link fisheries yield to scientific research, including in colonized sites. In India, for instance, the early twentieth century saw the opening of the Marine Experimental Station at Ennore in 1908, the Madras Aquarium in 1909, and the Field Collection Station at Krusadi in 1928. Many of these developments followed the example and impetus originally set by the pearl oyster fisheries of Ceylon.[43] The science of the sea in this part of the world emerged firmly from the meeting point of commerce and empire.

The first 'scientific' attempt to study the Ceylon oyster came in 1856. Following an eighteen-year period in which no fishery was viable, Governor Henry Ward commissioned the first report explicitly on the oyster from the Ceylonese Burgher surgeon-naturalist Edward Frederick Kelaart (1819-1860). Kelaart's 1857 report 'On the Natural History of the Pearl Oyster of Ceylon,' was followed by three more.[44] Note

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[41] Antony Adler, *Neptune's Laboratory: Fantasy, Fear, and Science at Sea* (Cambridge, Massachusetts: Harvard University Press, 2019); Rozwadowski, *Fathoming the Ocean*.
[42] David Heppel, 'Hornell and the Jersey Marine Biological Station,' *Societe Jersiaise* 25, no. 1 (1989), 76.
[43] This observation on the 'real impetus' for marine science in India deriving from Ceylon is from N. Kesava Panikkar, 'Marine Fisheries Research in India,' in *Progress of Fisheries Development in India* (1956).
[44] Kelaart, 'Introductory Report on the Natural History of the Pearl Oysters of Ceylon'; Idem., 'Report on the Tamblegam Pearl Oyster Fishery'; Idem., 'Report on the Pearl Banks of Arippo for the Season 1858'; Idem., 'Report on the Natural History of the Pearl Oyster for Season 1858-59'; 'Report of the Commissioners Appointed to Inquire into the Sea Fisheries of Ceylon' (1867).

that this was not a report on the fishery, that is, its commerce, revenue, and labour conditions, which existed under the British and certainly also under the Dutch and Portuguese. Rather, it was a commission which disaggregated the oyster from the fishery, isolating it as an object of study. The aim of these works over the latter half of the nineteenth century was to make discernible the habits of the inscrutable and recalcitrant oysters: how did oysters move, reproduce, feed, and, most importantly, produce pearls? For the first time, attention shifted from a *found resource* at sea to one that could be brought to shore as an individual animal and studied.

Kelaart hailed from a family of Dutch-German paternal origin that had settled in Ceylon in the eighteenth century. He completed his medical training in Edinburgh between 1838 and 1841 and returned to Ceylon as a Lieutenant Colonel in the Army Medical Service.[45] He was passionate about naturalistic inquiry from a young age: during his time as a medical student in Edinburgh, his father sent him specimens (birds, for example) from Ceylon to study. He saw himself as making known the 'fauna so extensive and so little known as that of [Ceylon],' and wrote works on entomology, herpetology, ornithology, and other branches of natural history.[46] 'I felt that I could not employ my leisure hours on a worthier object, or in a more interesting pursuit, than the study of the Fauna of my native country,' he explained.[47]

Before his death at the age of forty-one, Kelaart corresponded with scientific men in India and Britain, keeping up close correspondence with figures such as Edward Blyth (1810-1873) at the Royal Asiatic Society of Bengal in Calcutta.[48] Retroactively speaking, this commitment to Ceylon's flora and fauna has paid dividends for Kelaart's

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[45] D.V. Altendorff, 'Genealogy of the Family of Kelaart of Ceylon,' *The Journal of the Dutch Burger Union*, 67-8.
[46] E.F. Kelaart, *Prodromus Faunae Zeylanicae being contributions to the Zoology of Ceylon* (Ceylon: Observer Press, 1852), 1
[47] Ibid.
[48] Ibid., vii.

legacy: in one recent appraisal, Rohan Pethiyagoda and Kelum Manamendra-Arachchi describe him as the 'father of formal natural history study in Sri Lanka.' [49]

The first 'official,' that is, state-funded appointment, for the so-called 'father of natural history' in Ceylon concerned the oyster. Appointed to the post of government naturalist, he first travelled to the eastern, rather than the western, coast of Ceylon, conducting fieldwork on the oysters that lived in the bay of the coastal town known as Trincomalee. He chose this site rather than the north-western Arippo fishery because he felt the latter was severely depleted. Working with local fishermen, he studied the marine flora and fauna more generally, producing several beautiful watercolours of marine gastropods, anemones and turbellarians from living specimens in glass jars. By asking fishermen to bring him live specimens, Kelaart would observe and make detailed observations on creatures normally resident only on the seafloor.

Once delivered to him from the context of the ocean, Kelaart kept oysters 'partly in tubs and other vessels, partly in perforated wooden boxes and old canoes sunk at various depths in the sea, and partly in aquaria with glass fronts, to the usefulness of which in facilitating observations.' [50] He stressed the virtues of this unique visibility: 'no naturalist has perhaps ever had the same opportunities of observing the habits of the Pearly mollusk as I have at present,' he proudly declared, thus also subtly casting aspersions on those who might study pearls or pearl-oyster shells from dead specimens in London. [51]

Kelaart himself used the term 'science' writing that his own research comprised the first 'scientific' approach to the study of the oyster. This involved, crucially, lifting

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[49] Rohan Pethiyagoda and Kelum Manamendra-Arachchi, 'The life and work of Edward Fredric Kelaart,' *Journal of South Asian Natural History* 2, no. 2 (March 1997), 217.
[50] W.S. Dallas, 'On the Natural History of the Cingalese Pearl Oyster and on the Production of Pearls' *The Annals and Magazine of Natural History* 2, (February 1858), 82.
[51] Kelaart, 'Pearl Oyster of Ceylon,' xx.

off pearl oysters, both dead and alive, from the medium of the ocean. Science, at this point in time, did not take place in the sea. And so, in 1859 the superintendent of the fishery sent 100 oysters 'saturated with arrack' from Arripo to Kelaart in Colombo.[52] Similarly, other dead oyster specimens made longer-distance journeys around this time: in 1868, a box of Ceylon oysters of varying ages was sent to the British Museum in London by the former fishery inspector James Steuart for the same purposes of scientific study.[53] Once they arrived in London, these specimens, leaving Ceylon's shores and seas, became embroiled in new taxonomic projects of naming and classification. The majority of these shells were labelled '*Avicula fucata* Gould, Pearl Oysters of various ages from the Gulf of Manaar.'[54]

Kelaart maintained that the study of the Ceylon oyster had no precedent. The only exception was a late eighteenth-century account by the German naturalist Henry LeBeck, who visited the Gulf of Mannar in 1799.[55] Of this earlier text, Kelaart was gently condescending, writing that it 'excites a smile in the modern naturalist' to read that LeBeck misattributed spots on the oysters foot as 'eyes' (oysters have none) and 'lungs' (which were in fact, ovaria), casting himself as the modern, medically-trained naturalist, able to pay careful attention to animal anatomy.[56]

Oyster processes could now be observed, described, shared, and reproduced. Kelaart began by highlighting oyster anatomy, 'as it is of the greatest importance, that a correct knowledge be first obtained of the animal structure, before a physiological

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[52] Kelaart, 14.
[53] Letter from James Steuart to Mr Adderley, 24 June 1868, Lot 20/796, SLNA. The box contains 12 compartments, and 11 of these contain oyster shells. 1868.5.29.1, NMNH, UK.
[54] Another compartment contains adults and juveniles of a smaller species labelled as '*A. vexillum* Rve' (neither of these names are currently used). 1868.5.29.1. Natural History Museum, London, UK. In 1885, another sample of spat or young oysters followed the same route. Letter from Donnan, 22 April 1885, CSAS.
[55] LeBeck, 'Pearl Fishery,' 5.
[56] Kelaart, 'Introductory Report,' 62.

account of its habits can be properly understood.'[57] He observed oysters' ova; mouth; stomach; heart; liver; foot; oesophagus and 'palps' which gave the creature a sense of touch.[58] This emphasis reflects changes in medical training around anatomy which Kelaart would have imbibed in Edinburgh. He explained to his readers that the membrano-muscular covering was called the 'mantle' or 'skin', and that this was the only organ the animal has for 'the formation of the shell, the increase of the lateral dimensions of which, and the formation of the pearly nacre and pearls.'

He also focused on oyster reproduction. For instance, he described how 'through the same opening between the mantle that I observed on one occasion the ova escaped in a cloudy stream, which continued to pass into the water for fifteen minutes.' Kelaart's research in Colombo with fished and transported oysters displaced the primacy of the diver's experiences, although most of the specimens were dead by the time they reached him. Previously, encountering oysters involved blurred vision on a seafloor churned up by sand and currents, with eyes open in the salty water on a timed exercise, until one's lungs burned, or fatigue kicked in (Chapter 2, *Labour*). The bodily experience of observing oysters was entirely transformed.

Borrowing equipment from the Naval Stores in Colombo, Kelaart kept live oysters in glass tanks. The use of these makeshift aquaria with 'glass fronts' allowed *looking at* oysters at leisure in a room where one could breathe. The observer's position was transformed through the transfer of the oyster from the medium of the ocean to that of the tank. Since diving was no longer a pre-requisite to come into contact with oysters, Kelaart could make real-time observations of oyster behaviour. This new access allowed him to describe how despite its lack of eyes, oysters were responsive,

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[57] Kelaart., 3.
[58] Kelaart., 65.

suggesting a system of nerves: 'an oyster will be observed to rapidly close its valves on the approach to the aquarium of a lighted candle, or even the approach of a hand, or the shadow of a person near the glass sides of a vessel in which it is confined.'[59]

Kelaart's ideas about oysters' anatomy, reproduction, and locomotion, were not entirely novel. In the Persian Gulf and the Gulf of Mannar, fishers argued that oysters rose to the surface of the sea at night, opened their valves, and absorbed a rain or dew drop, which, in turn, was transformed into a pearl.[60] Officials in the Persian Gulf were still recording in 1878 that 'the drop of dew will continue to cement itself as a theory till science has laid its final veto on the cherished illusion, and even that will not shake the faith of the sons of Oman.'[61] Fifty years earlier, Steuart made a similar observation in Ceylon when he expressed his frustration at the 'ridiculous opinion' which was that 'the natives of this country [Ceylon] have an idea that pearl oysters are rained from the clouds.'[62] Kelaart was able to transcribe his experiences first-hand, making them 'verifiable'. The laboratory had an authority that divers' accounts at sea did not.

Oysters from the Inside-Out or Outside-In?

A major development which allowed Kelaart to construe the oyster as animal in greater detail was the development of nineteenth-century microscopy. L.S. Jacyna, writing on the history of medicine, estimates that the 1830s were the turning point for microscopy, and that students from Edinburgh, excited by these new technologies, spread these techniques elsewhere across Europe – even, apparently, to sites like Ceylon.[63] As Tom Grant's work highlights, microscopic observation was considered suspect by scientific communities in London but had popularity amongst certain

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[59] Kelaart, 'Pearl Oyster,' xi.
[60] Donkin, *Beyond Price*, 282
[61] Dorand, 'Pearl Fisheries of the Persian Gulf,' 37.
[62] Steuart, 'Pearl Fisheries,' 452.
[63] L.S. Jacyna, '"A Host of Experienced Microscopists": The Establishment of Histology in Nineteenth-Century Edinburgh' *Bulletin of the History of Medicine* 75, no. 2 (2001): 226.

reformist Edinburgh communities. Kelaart's training in the 1840s would surely have included microscopic anatomy.[64]

The ocean and its creatures were now visible on a new scale. Through the microscope, Kelaart was also able to ascertain other unseen features of the oceans. This research took place at the Ceylon Medical College in Colombo, which likely had an achromatic microscope. Kelaart documented how 'the kind of food Pearl Oysters live on consists of minute algae or weeds, animacules and shells, called Foraminifera.'[65] He also observed how the mantle organ secreted a 'pearly matter' which might grow over sand or other irritating particles, forming pearls. In addition, he described how each pear-shaped ovum, measured at 3/1000 of an inch using a micrometre, contained 'not less than twelve million' eggs.

Pre-colonial texts had themselves made occasional (sometimes oblique) references to oyster biology. Abu Zaid as-Sirafi's revisions of a ninth-century text describe how pearls originate with a floating substance (probably oyster larvae) 'rather like the seed of the plant known as *ankudan*' which would cover the sea, fall to the seabed, and then become a pearl. For the first time, oyster processes such as reproduction and shell formation, could be observed close up, and at increasingly small scales. In other words, zooming in was necessary to understand broader processes like shell formation and oyster reproduction.

In praise of the microscope, Edwin Lankester, editor of the *Quarterly Journal of Microscopy* wrote in his *Half-Hours with the Microscope* (1859) that 'what eyes would be to the man who is born blind, the Microscope is to the man who has eyes.' Here a quote like Lankester's ignores the ways in which two kinds of men with eyes,

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[64] Ibid.
[65] Kelaart, 'Pearl Oyster,' 7.

some ‘black’, others European, had different access to the underwater. Moreover, the realities of oysters’ bodies - decomposing, fleshy, messy, composed of various parts useful and not useful - had, for centuries, been familiar to littoral people who sorted, cleaned, washed, and utilized their constituent parts. Now, new eyes turned to the oyster with a view to understanding different processes, searching for answers that were distinct from the haptic, olfactory, or other experiences of divers and labourers who worked with oysters.

After the question of how an oyster’s body was composed was settled, the next question was how the composition of the pearl was related to the oyster’s body. These logical steps are significant. Where previously, pearls led the state to oysters, now the oyster, from within, would point to how a pearl was formed. Pearls were not to be discovered, but deciphered.

Early nineteenth-century writers had speculated on the origins of pearl formation, presuming, for the most part, that the pearl was the result of operations which took place purely within the oyster and that its surrounding ecosystem had little or nothing to do with this process. But in 1857, Kelaart, in his dissections, happened to come across two embedded cysts of parasitic tapeworm larvae inside an oyster. Around the larvae were rings of nacre, the shiny calcareous stuff of the shell which produces pearls. Consistent with pearliculture experiments in Europe, Kelaart suggested that pearl formation was triggered by a minute parasitic tapeworm: ‘worms play an important part in the formation of pearls; and it may yet be found possible to infect oysters in other beds with these works and thus increase the quantity of these gems.’

Although Kelaart himself did not conduct any studies on worms or pearls, the composition (anatomy) of a single oyster’s body soon became related to the composition of the pearl. How did the two questions relate to one another? In particular,

was the precise position in which a pearl was formed within the oyster's body related to modes of pearl formation? Many authors soon seemed to think so. In turning towards the oyster, then, the previous distinctions of sea and land, inside and outside, macro and micro scales, broke down. Configuring the role of oysters at the fishery – and their role as pearl producers – pushed against the disciplinary bounds of animal anatomy, parasitology, invertebrate studies, and physical oceanography.

Just as strides in oyster science narrated the oyster from the inside out, they also spoke to the oyster from the outside in: situating the place of the oyster in broader undersea ecologies. Consider the next report on oysters, undertaken by Edgar Thurston, the director of the Madras Museum in the 1880s. Thurston's work on marine species began incidentally, on a tour of the lighthouses in the region, but grew in importance as he inquired further into the workings of the pearl fishery. He set up a station working primarily from Paumben, at the tip of the Indian side of Adam's Bridge, the dotted limestone shoals between Ceylon and India. Unlike Kelaart's work, which zoomed in to the individual oyster, Thurston confronted the problem of how to extract the oyster from its animate and inanimate surroundings. That is, the oyster brought a host of other creatures into the ambit of science: 'I found the surface of a large number of [oyster] shells, both dead and living, covered, and frequently entirely hidden from view' by corals, he explained in one instance. [66]

Thurston's interest intersected with an increased drive to catalogue specimens for new museums and aquaria in Madras, displaying, labelling, and identifying species. In reading this act of taxonomic translation, we might consider how the world of the reef and shore was entangled: take for instance the following example where Thurston recorded an 'edible turtle (*Chelone mydas*) which I have seen carrying the cirrhiped

[66] Thurston, *Pearl Oyster*, 17.

[barnacle] *Chelonobia testudinaria* and the pearl oyster attached by its bysses to the carapace [shell].'[67] Coral fragments could be attached to oysters and oysters could have anchored on to sea turtles. This maritime world, enmeshed and inter-linked, was then parsed apart into neat Linnaean classification schemes in print, pen, and ink.

These arrangements of Linnean taxonomic ordering entered a world where pre-colonial indigenous texts had their own ways of organising landscape and ecology. Alex McKinley's work on early modern and medieval Tamil texts argues convincingly that *tirtha* [pilgrimage]-centred *purāṇic* theology is rife with watery landscapes, literary devices that he describes as constituting an 'oceanic devotion.'[68] Although these sources tend to fall out of the ambit of modern conceptions of ecological science, close readings of these texts suggest pre-colonial modes of reading landscapes. For example, McKinley explains how the seventh century *Tevaram* poet Campantar, whose quote opens this chapter, listed botanical elements around the seashore in his writings: 'spread growing is wild jasmine, *mātavi* lianas, mastwood, kino trees, fertile gold ochna, champak, and jasmine vines with fresh shoots spreading in the garden surrounding Kōṇamā Malai.'[69] Poetry served as inventory, and lyric as repository of natural knowledge.

In Madras, however, enmeshed in nascent colonial scientific institutions, Thurston's professional and administrative position privileged him with technological and institutional capacities, including, like Kelaart, microscopes, but also photographic technology. Thurston's report included, three reproduced photographic plates showing pearl oysters. The first showed an oyster with a single shell valve removed, allowing

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[67] Thurston, *Pearl Oyster*, 22.
[68] Alexander McKinley, 'Making Lanka the Tamil Way: A Temple History at the Crossroads of Landscapes & Watersheds,' *South Asian History and Culture* 11, no. 3 (July 2020): 254-276, http://www.tandfonline.com/doi/abs/10.1080/19472498.2020.1797359.
[69] *Tēvāram* 3:123, v.6, qtd. in McKinley, 'Making Lanka the Tamil Way,' fn. 38.

him to demonstrate the presence of tough byssus filaments which allowed the oyster to anchor in place (to rocks or sea turtles, as in the above example), as well as the role of the adductor muscle in controlling mobility. In addition, Thurston annotated and labelled the oyster's 'ovarium' and mantle. The second plate magnified the oyster to show the filaments of the byssus as well as 'encysted' parasites within the shell, while the third plate showed a less highly magnified oyster to show the 'byssus gland with its laminae, invested by muscular and connective tissue.' These debates on oyster anatomy and the locations of particular organs, especially how these placements related to the production of pearls, would grow in scientific interest.

Thurston's work on the Ceylon oyster, which I have only discussed briefly here, serves to highlight a tension in approaches to the oyster – the precise ways of configuring between two scales – in the ways that Thurston had to try to navigate between the oyster in its environment (attached to coral, sea turtles, and other shells) and the internal world of the oyster, captured in his photographic plates. This tension between the two scales of analysis would continue into the twentieth century and through the scientific projects that followed.

Oyster failure (or recalcitrance) was generative. Ceylon was linked to metropolitan elites and scientific networks in London. In 1903, the most ambitious iteration of this was a Royal Society-sponsored investigation into the pearl oyster fisheries of Ceylon by Professor William Herdman and his assistant, James Hornell. The Royal Society was an independent body funded largely by a Parliamentary grant, although the cost of printing the reports and paying the salaries of Herdman and Hornell was borne by the Ceylon government.[70] 'The whole thing is at last about to change' the

[70] Telegram from Ridgeway to Colonial Office, 17 Jan 1901, CO 54/669; West Ridgeway's Despatches, 13 December 1902, CO54/678; Letter from Herdman to Governor Ceylon, 06 March 1903, CO 54/678 UKNA.

Colonial Secretary Everard Im Thurn (himself a naturalist) remarked.[71] He continued: 'the thing [infrequency] has been going on in the same way for centuries, and would so continue if the busy Western mind were not now turning to thoughts of how to improve on this old system, to make the harvest of the sea more regular in its occurrence.'[72] Upon Herdman's appointment, the bilingual Jaffna newspaper, the *Morning Star*, reprinted the Governor's Report which explained how although thus far 'we had no scientific data to go upon', the new results of Herdman's inquiry would at last remedy the problem of the Ceylon pearl banks' infrequency.[73]

Based on four years of research in Ceylon and in Liverpool, Herdman's five-volume *Report on the Pearl Oyster Fisheries of Ceylon* went on to become a definitive text for the Indian Ocean's oysters and marine fauna. In the decades after 1906, there was no text more authoritative than Herdman's on the Indian Ocean's oysters. Well into the 1930s, colonial officials concerned with Persian Gulf reef ecology were directed by the British Museum to Herdman's reports on Ceylon.[74]

William Abbott Herdman (1858-1924) was the son of an artist, Robert Herdman (1828-1888), and was educated at the University of Edinburgh.[75] After graduating in 1879 he became attached to Professor Charles Wyville Thomson, assisting Thomson with deep-sea research based on the *HMS Challenger* voyages, thus entering directly into oceanographic research in Britain. Herdman's career was smooth and illustrious, and he features in many key analyses of the history of oceanography as a discipline;

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[71] Im Thurn, 'Ceylon Pearl Fishery,' 192.
[72] Ibid.
[73] 'Pearl Fisheries,' *The Morning Star, Utayatārakai* 62, no. 25, 12 Aril 1904.
[74] Letter from T.C. Fowle, Resident in the Persian Gulf, to the Secretary of State for India, 20 March 1939; Letter from India Office to the Secretary, British Museum of Natural History, 19 April 1939, ADM 116/4166, UKNA.
[75] Margaret Deacon, 'Sir William Abbott Herdman (1858-1924),' in *Oxford Dictionary of National Biography*, Oxford University Press, 2004, online ed., https://doi-org.ezp.lib.cam.ac.uk/10.1093/ref:odnb/33832.

indeed, he was instrumental to its conception *as* a discipline of itself.[76] After a short stint at Edinburgh, he was appointed professor of natural history at the University of Liverpool. His early work was on the Firth of Forth, but he eventually became particularly vested in fisheries. He founded the Liverpool Marine Biology Committee and set up laboratories at Port Erin (1892) and at Piel Island off Lancashire. He was elected to the Royal Society in 1892 where he continued to serve for the next three decades. From 1904 to 1908 he was also president of the Linnean Society.

Herdman was accompanied to Ceylon by an assistant, James Hornell, a more unusual candidate for a figure of colonial science. Born in Manchester, Hornell was initially destined for a medical career in Scotland. Although he developed an interest in natural history collecting as a child, his father died young, and poverty forced him to leave school and work 'in the soul-destroying atmosphere of a scrivener's office' and other apprenticeships. Although he never graduated from the University of Liverpool, he may have attended night classes after work and met Herdman there. One Ceylon colonial official, John Legge, derided Hornell for being 'somewhat low on the social scale' and lacking the 'years of training to acquire nautical knowledge and especially that of marine surveying'; he was a man with 'moderate scientific acquirements' whose employment could only be disastrous.'[77]

Despite Legge's snobbery, Hornell had extensive experience in marine microbiology and fisheries science. He had been an active member of the Liverpool Microscopical Society and had a strong interest in invertebrates and geology - two fields that he would use and elaborate upon as he travelled through empire. Hornell was elected a member of Herdman's Liverpool Biological Society in 1886 and worked on

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[76] Adler, *Neptune's Laboratory*; Sam Robinson, 'Early Twentieth-Century Ocean Science Diplomacy: Competition and Cooperation among North Sea Nations,' *Historical Studies in the Natural Sciences* 50, no. 4 (2020): 384-410, https://doi.org/10.1525/hsns.2020.50.4.384.
[77] Letter from John A. Legge to the Colonial Secretary, 17 August 1912, E.L.Pawsey Papers, CSAS.

the fauna of Liverpool Bay, which was based on a series of dredging expeditions. Before Ceylon, Hornell worked on another island rich with marine life: Jersey, the largest island in the English Channel. Here he worked with his father-in-law, the naturalist Joseph Sinel, on a host of marine problems. In Jersey, amongst other things, he studied the island's oyster fisheries, where between 200 to 600 million oysters were dredged annually. His father-in-law had set up the Jersey Oyster Culture Company Limited in 1894 with some private backing to explore the possibilities of oyster culture for Jersey. Hornell also had experience in fish taxidermy and experience preparing scientific lantern slides.

If one significant shift in the approach to Ceylon's oysters was their study at more minute scales, then Hornell's appointment was significant, for he too was described as a 'devotee of the microscope.' [78] From 1893 onwards, for instance, he and Sinel published the *Journal of Marine Zoology and Microscopy*, producing several enlarged details of minute sea life such as lobster larvae. In 1904, he was elected a Fellow of the Linnean Society for a zoological paper on marine worms. After his work in Ceylon, he was eventually made Director of Fisheries in Madras, and between 1926 and 1935 he wrote reports on the fisheries of Mauritius, Seychelles, Sierra Leone, Cyprus, Malta, and Palestine.

Herdman arrived in Colombo in January 1902 and proceeded by steamer, the S.S. *Lady Havelock,* to the Gulf of Mannar and all around the island. These voyages, 'two successive cruises of three or four weeks each,' allowed for extensive dredging all around Ceylon's coast. However, they soon discovered that the reef and coral cover proved an obstacle to dredging. [79] While previous studies on oysters were conducted in

[78] Heppel, 'Hornell and the Jersey Biological Station,' 75.
[79] Herdman, *Pearl Oyster Fisheries of Ceylon,* vol. 1, 5.

isolated tanks or from the shore, Herdman insisted that the secrets of the oyster had to be gleaned at sea. 'Any Natural History work on the pearl banks must be done not from the shore, but, as we did, at sea from a ship during the inspections,' he concluded.[80]

Despite three weeks on the *Lady Havelock* conducting 'natural history' at sea, Herdman soon discovered that the monsoon prevented extensive time doing research; moreover, the sparsely populated and arid shores of Mannar were unsuitable for a marine laboratory. A shore-based laboratory was needed, but it would not be situated on the northwest coast. However, the tension between the study of individual oysters at micro-scales, and their examination in the broader oceanic environment, was not resolved.

Herdman and Hornell's early work was undertaken at the Medical College of Colombo, but eventually moved to Ceylon's first marine biological laboratory in Galle. The laboratory was set up on Herdman's recommendation with Hornell installed as its director. Herdman was ambitious about the laboratory's future: it would 'render signal service to the pearl, sponge, trepang, and other marine fisheries of the colony' he extolled.[81] The laboratory ran for four years working on Ceylon's oysters and was shut when the Ceylon Pearl Fisheries Syndicate went bankrupt in 1912. This was largely a function of funding through the syndicate running out, rather than a lack of use for practical knowledge on fisheries and oysters.

Work on oysters involved studying specimens, collecting, naming, describing, classifying, microscopy and photography in observation tanks (since there were no successful underwater/submarine cameras until the 1920s). In the Galle Marine Biological Laboratory, work could be done by a single scientist and could be made

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[80] Ibid., 8
[81] Herdman, *Pearl Oyster Fisheries*, vol. 1, 97.

mobile using photography, print and letters. Close proximity to the sea and seawater where oysters grew was essential.

As early sections of this chapter have argued, the study of Ceylon oysters was greatly aided by the twin technologies of the nineteenth century: the microscope and the camera. In the four years after Herdman visited Ceylon, Hornell carefully observed oysters removed by divers from the reefs in Mannar and transported by steamer to tanks in the glass aquaria at Galle. Consider his observations on oyster shell formation, captured over time by photographs. By purposely damaging the shells and harming the oysters, their regrowth process could be observed as follows: 'two other oysters of this same series (D.) were photographed on March 10th. Within 10 days, one had formed 6 millims. of new solid shell and 15 millims. in all including the "fingers," the other (fig. 47) had formed 11 ½ millims. of shell and 16 ½ millims to the end of the "fingers."'[82] The corresponding photographs were often included in Herdman's reports and other materials published by Hornell, showing an isolated oyster close up in a tank, and marked up to demonstrate changes in growth.

These changes were observed at multiple scales; those that were visible to the naked eye and those that needed minute vision. Consider the detail with which Hornell was able to observe oyster feeding habits also relying on the microscope. Describing the aperture between the oyster's two valves, Hornell wrote that 'through this sieve-like slit, guarded by these sensitive branched processes, an indraught of water is carried by the constant lashing of the cilia covering the gill surfaces… a constant stream of small particles, diatoms, spores, protozoa, and other microscopic organisms, is carried

[82] Herdman, *Pearl Oyster Fisheries*, 144.

in with the water flowing towards the brachiae, which function as very fine strainers, able to sift out and arrest every particle from the incoming current.' [83]

Vision was sharpened by the microscope but fixed by the camera. In the Galle laboratory, Hornell took dozens of photographs of oysters. These images capture oysters arranged by Hornell neatly in a row with valves open and shut. These close-up studies are used to demonstrate shell growth and byssal growth, or attachment to other species. Several photographs are taken immediately after one shell valve was ripped off, meaning the oyster would soon die, to show the internal anatomy of the oyster. Hornell's photographs were taken between 1903-06. Perhaps due to financial constraints, far fewer of his collection make it into Herdman's printed reports, but several were reproduced or copied from photographs as drawings or line etchings.

[83] Herdman, *Pearl Oyster Fisheries*, 135.

In Anne Elias's account on the role of underwater coral reef photography from the 1920s in the Bahamas and Australia, she explains how new visual technologies 'produced coral reefs and the underwater as modern spectacle.'[84] In Elias's account, the underwater world is constituted as 'a wild zone at the margins of the modernizing world,' an 'invisible domain' that film photography and art rendered visible, albeit in mediated, stylized ways that belied the objective realities they claimed to depict.[85] Hornell's photographs are different in this regard. Black-and-white captures of solitary oysters with softly pulsating gills in a tank did not have the popular appeal of J.E. Williamson's 1925 photographs of the Bahamas coral reefs. Hornell's aquarium

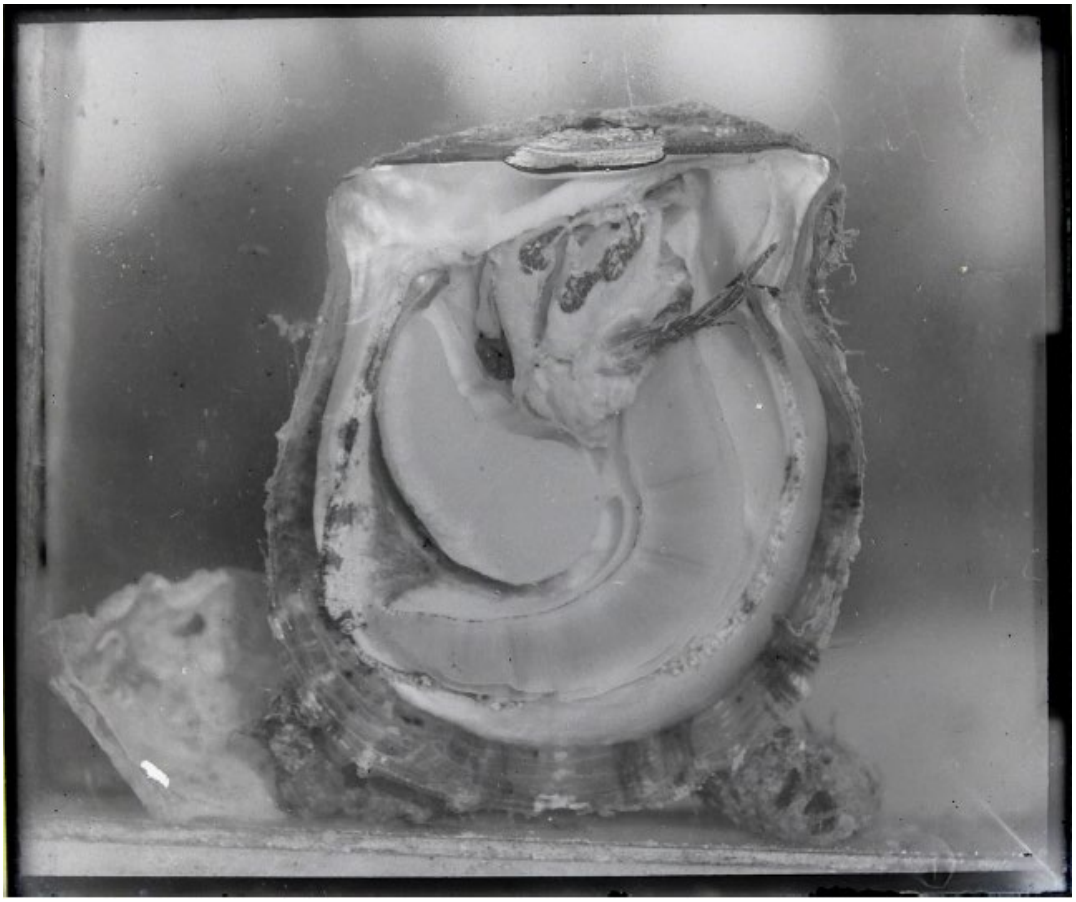

Figure 11: James Hornell, photograph from the Galle Marine Biological Laboratory showing town byssus (attachment) fibres just beginning to re-grow. Cambridge Museum of Archaeology and Anthropology, MAA 7950.

[84] Ann Elias, *Coral Empire: Underwater Oceans, Colonial Tropics, Visual Modernity* (Durham, NC: Duke University Press, 2019).
[85] Elias, *Coral Empire*, 24.

photographs are about isolating oysters from the reef and placing them in controlled environments where single variables (such as new shell growth) could be carefully observed and calibrated. It was as much about the *removal* from the world of the ocean as the immersion in it, as in Elias's example of Williamson.

Like the microscope, Hornell's photographs attest to a fidelity of the real, making the observation of the oyster concrete for learned scientific communities, where previously they had remained at sea with divers and on shore with labourers who sorted, washed, and cleaned the dead and rotting oyster shells. Writing on vision in a very different context, Marina Benjamin has explored the 'scopic cultures' of microscopy in Victorian Britain, writing that it was 'preoccupied with seeing into and through things, with defining the field of vision with depth, accuracy, measurement, and corroboration.'[86] In particular, Hornell was concerned to mark out where pearl production occurred within oysters' tissues. In Hornell's dissections he marked where 'in one [oyster] the pearl lies in the ventral pallial region, in the other in the pallial tissue of the posterior dorsal region.' His photographs helped this identification. Fig. E., reproduced from a photograph showed 'a large botryoidal mass of partially fused muscle pearls below the scar of the posterior levator muscle;' precise placements of pearls built on work conducted on oyster anatomy.

Studying oysters required a constant shifting between inside and outside, individual and the collective, oyster and environment. Consider how before 1903, authors had only been able to speculate on the effect on oysters of different locations at sea. Now, Herdman and Hornell moved oysters between sites and opened and inspected them before and after transplantation. When some small and 'unhealthy looking' Mannar oysters from the *muttuvaratu paar* where they were found 'along with various

[86] Benjamin, 'Sliding Scales,' 113.

other animals, chiefly corals, which were both on and around the oyster' were moved to good water at Galle and suspended in wire-mesh cages at 3 ½ fathoms, it was discovered that 'an abundance of food with which the stomach and intestine of species examined were found to be crammed. The internal parts had undergone a corresponding increase, and the tissues from being thin and shrunken had now become plump and healthy in appearance.'[87] In other words, transplanting oysters from one environment to another changed the oyster. These transformations, a result of a change in the broader environment, were evident *within* the oyster, visible with the aid of the micrometer, microscope and photography. These technologies then allowed an unprecedented vision *inside* the oyster, based on conditions *external* to it.

The problem of oyster and environment is evident if we look at Herdman's reports as a whole. Herdman's study of the oyster became a study of Ceylon's marine flora and fauna more generally. In the Palk Bay, Herdman's dredge pulled up catfish, sand eels, bass, soles, pomfret, plaice, and mackerel. At other places, the net was full of coloured sponges. In 37 supplementary reports, Herdman elaborated on the many organisms which are associated with the pearl oyster on the banks, and which are 'inter-related with it in various ways and undoubtedly influence its life and prosperity.'[88] Herdman's reports on copepods, nematodes and trematodes consist of lists of species, described in terms of their anatomy, sex, and habitat. Suddenly, the waters around Mannar were not read in terms of physical oceanography but rather in terms of histology. The study of very small organisms, like rhizopoda and flagellates, from the waters around Ceylon was wholly new.

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[87] Herdman, *Pearl Oyster Fisheries of Ceylon*, vol. 1, 138.
[88] Herdman, *Pearl Oyster Fisheries of Ceylon*, vol. 1, 1.

Some were disparaging of the way Herdman's reports spiralled out to the broader fauna and flora of the island's waters. Writing in 1912, Henry Jameson decried that the funds and human expertise were 'largely dissipated on general faunistic work, such as the description of new crabs and tapeworms' which might be valuable from a 'scientific standpoint' but had 'only a secondary bearing on the problem of increasing and rendering more reliable the supply of pearl oysters and pearls.'[89] So too, were marine biologists in the 1920s.[90] More interestingly, Herdman's reports break from Kelaart and Thurston's earlier work, which studied oysters independent of their ecologies. In contrast, Herdman's reports show how the oyster became visible in the material and ecological contexts of its existence – closer, in some sense, to what divers encountered on the reef. *Report on the Pearl Oyster of Ceylon* began with a sketch of the continental shelf around Ceylon and its depth and geological conditions before proceeding through several other faunistic reports, with sections on the oyster interspersed within other chapters on calcretes, sponges, foraminifera, seaweeds, or jellyfish. Rather than seeing oysters as relatively stable resources to be mined, now they became dynamic and responsive, entangled in webs of material, animate, parasitic, and trophic relations.

One of the key findings of Herdman's report was that the oysters were eaten by other fish. In the course of their research, by applying techniques of stomach content analysis, Herdman and Hornell cast maritime occupants into enemies and allies. 'The pearl oyster has many enemies, such as Star-fishes, boring Sponges which destroy the shell, boring Molluscs which suck out the animal, internal Protozoan and Vermean parasites, and carnivorous Fishes, all of which cause some destruction, and may on

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[89] Jameson, 'Pearl Oysters', 265.
[90] Joseph Pearson, A.H. Malpas and J.C. Kerkham, *Ceylon Journal of Science*, section C [Fisheries], vol. iii (Colombo, 1925), 12.

occasions conspire to ruin a bed and change the prospects of a fishery.'[91] The normative language of commerce still seeped into 'ecological' and scientific work as well.

But it was not just the animate components of the ocean that affected oysters: so too, did the other physical components of the ocean. Herdman called urgently for 'further exact knowledge of the movements of the water over the pearl banks in the Gulf of Mannar.'[92] The most important cause of mortality was 'the shifting of sand due to the strong currents, to the south-west monsoon and no doubt occasionally to storms.'[93] Local traditions had long held the idea that oysters' capacity for pearl production was linked with broader environmental phenomena. As Richard Donkin has explained, these theories are consistent with other older ideas of rain as generative, such as lines in the *Bhagavadgita* which describe how 'food is the life of things [and] rain is the birth of food.'[94] These notions diffused across traditions: a Marathi proverb of medieval origin observed that 'if the *Svati* [October] rain falls there will be a crop of rubies and pearls, but you will not get cotton enough for a lamp-wick.'[95] *Hadith* in the Qu'ran echo similar notions of pearls and corn as mirror halves of the gifts bestowed by rain.[96]

By 1904-05, Hornell was taking daily measurements of sea surface temperatures three times a day and measuring the temperature of the air. From 1 March to 31 March 1904, records were made at 7:30AM, at noon, and at 5:30PM. The seawater temperature was taken two feet below the surface, plotting the way the water temperature changed throughout the day and over the months of February and March.[97]

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[91] Herdman, *Pearl Oyster Fisheries of Ceylon,* vol. 1 (1903), 7.
[92] Ibid., 123.
[93] Ibid., 120.
[94] Donkin, *Beyond Price*, 1.
[95] Ibid.
[96] Al-Shamlan, *Pearling in the Arabian Gulf*, 30.
[97] Hornell, 'The Biological Results of the Ceylon Pearl Fishery of 1904' in *Reports from the Ceylon Marine Biological Laboratory* (Colombo: Georges J.A. Skeen, 1905), plates 10-15.

Physical and meteorological observations now took up a section of the work, as did the 'biological results', meaning the number, distribution and size of oysters.

Pearls as Assemblage

Getting at oysters was always about getting at (more) pearls. This section explores how the theory of parasitic pearl formation took hold in Ceylon and the ways that once again, oysters and their environments were linked at different scales, ranging from their broader ecologies and climate patterns, to miniscule, microscopic, and parasitic interactions. The combination of these factors made the pearl process difficult to regulate or standardize. The nineteenth century saw both an exploration of the constitution and makeup of oysters, and also a similar exploration of the chemical and physical makeup of pearls.

In order to fully appreciate how the oyster was studied, we need to briefly turn to developments in the organic and inorganic study of pearls, both of which made great strides in the nineteenth century. In 1888, by decalcifying British, Australian and Ceylonese pearls, H.S. Harley and G. Harley gave a paper at the Royal Society where they described the organic composition of pearls as comprised mostly of carbonate of lime (92 percent) and other organic matter and water. But knowing a pearl's chemical composition alone did not explain how and why pearls formed.

To determine pearl formation, one needed to get at the centre of a pearl. Or, as it turned out, to the centre of an oyster. In Bavarian waters (where riverine mussels produce freshwater pearls), Theodor von Hessling opened 40,000 pearls with a chisel and found no trace of a parasite or egg. Similarly, Dr Karl Mobius ground down pearls with a chisel and saw and treated them with organic and inorganic acids. Herdman and Hornell were familiar with these studies. One of the key takeaways, based on sections of sea pearls from America and the East Indies, was Mobius's conclusion that pearl and

molluscan shells were comprised of the same substance. 'In the shell, the nacreous layer forms the *innermost* coat; in the pearl, on the contrary, it constitutes the shining outer coat; so that the pearl, as it were, only represents a reversed pearly shell, and consequently possess all the chemical and physical properties of the latter, except those for which it is indebted to its round form,' Mobius had explained. [98]

If pearl formation was an extension of shell formation, what triggered this process? This was a key area of debate into the early twentieth century. In the mid nineteenth century authors suggested various nuclei of the pearl, including grains of sand, microscopic algae, ova, embryos, parasites, and other organic nuclei. As a result, the study of oyster anatomy intersected directly with the study of pearl formation. Hornell and Herdman studied closely where in oysters' bodies pearls developed, taking measurements and descriptions of where 'calcerous nodules' formed and what the relative positions of these nascent pearls said about the causes of pearl formation.

Each cubic metre of the ocean teems with other life – life which is not immediately visible to the human eye, but which is hooked, fished, sucked up or filtered by a host of filter-feeders, including oysters. These include minute algae known as diatoms, and other single-celled foraminifera teemed in each handful of surface waters who convert solar energy into organic material, producing oxygen and sugar for the coral polyps to grow and move through oyster, coral, fish, shark, and human bodies. Also found among the minute plankton, crabs, copepods, diatoms, and foraminifera are several kinds of marine parasites. Parasites are common in marine communities and 'common if not ubiquitous' in invertebrates. [99]

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[98] Karl Mobius, 'Die echten Perlen, ein Beitrag zur…Geschichte derselben'
[99] Gregory M. Ruiz, 'Consequences of Parasitism to Marine Invertebrates: Host Evolution?' *American Zoologist* 31, no. 6 (December 1991): 831-839.

The role of parasites at the Ceylon fishery changed over the course of the nineteenth and early twentieth century. In 1902, on trawling voyages, Hornell recorded tiny marine parasitic larvae:

> These larvae first attracted attention during the second cruise of the 'Lady Havelock' on 06 March 1902, when numbers of the early globular stage were dissected out from the livers of oysters dredged from the West Cheval Paar. Subsequently, during the investigation carried out at the Galle Biological Laboratory, a second and more advanced stage of a *Tetrarhynchus* larva was found in the same material. Details of the morphology and histology were then worked out, and the relationship which the larvae bear to pearl formation was investigated.

Hornell had also written that it was 'not unusual in molluscs' to find parasites within them. Parasites were only interesting when they became pearly.

Over the next months, Hornell dissected oysters and decalcified hundreds of pearls. Herdman took several samples of oysters and pearls from Ceylon back to the laboratory in Liverpool in order to undertake further research. Together they decided that 'orient' pearls had at their centre the species of *Tetrarhynchus unionfactor*, a marine parasite that we now know by a different name, but which is a type of cestode, or tapeworm.

The theory of parasitic origins for pearls is attributed often to the Italian Filipo de Filippi, who worked on the freshwater pearl mussel *Anodonta cygnea* from 1852 to 1859. He found a relationship between the trematode parasite *Distomum duplicatum* and pearls. For the next fifty years, the parasite-origin theory had much traction. Tapeworm bodies are generally long, segmented and flattened, with a head attached to the host allowing nutrients to be absorbed. Oysters were intermediate hosts, hosting the larval stage of the parasite. That is, the tapeworm has what scientists now call an 'indirect life cycle' as it moves through different hosts through its egg, larva, and adult stages. The tapeworms surveyed could range from a single millimetre to 130 feet in

whale sharks.[100] Tapeworms are endoparasites, that is, they require living hosts, which could include humans, fish, cats, or dogs. It has what parasitologists now call intermediate (non-sexual phases) and definite hosts (sexual phases). The latter were sharks and rays and other large vertebrates, but the larvae floating in the sea after reproduction in the sharks or rays' intestines, would then enter oysters.

Pearl production was thus conclusively settled for Herdman and Hornell as an 'abnormal process' and a 'disease.' Herdman and Hornell observed in 1903 that it was 'when cutting up oysters from the western part of the Cheval Paar, that we first became convinced that the opaque white globular larvae we were finding encysted in the liver belonged to Cestode worms.'[101]Ultimately, they concluded that by burrowing into the mantle and carrying epidermal cells 'the nucleus of the pearl is really organic, being an encapsulated parasite.'[102] Pearls constituted an assemblage: 'the stimulation which leads to the formation of an "orient" pearl is, as has been suggested by various writers in the past, due to the presence of a minute parasitic worm.'[103]

The English zoologist Henry L. Jameson also worked on pearl formation through his association with Herdman. Educated at Trinity College Dublin, Jameson wrote his dissertation in 1898 on a species of spoon worms. He initially worked on pearling at a station in British New Guinea, continuing at Lancashire Sea Fisheries Station.[104] Writing in *Nature* (the leading scientific publication at the time) in 1903, Jameson was frustrated by Herdman's Cestode Theory. He described the 'meagre experiments' conducted in Ceylon as based on 'insufficient evidence.'[105] Unlike

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[100] Bruce Hofkin and Eric Loker, *Parasitology: A Conceptual Approach* (New York: Garland Science, 2015), 87.
[101] Herdman, *Pearl Oyster Fisheries of Ceylon*, 127.
[102] Herdman, *Pearl Oyster Fisheries of Ceylon*, 6
[103] Herdman, *Pearl Oyster Fisheries of Ceylon,* 128.
[104] H.L. Jameson, 'Studies on pearl-oysters and pearls … with an examination of the cestode theory of pearl-production,' *Proceedings of the Zoological Society of Londo*n (1901).
[105] Jameson, 'Studies on Pearl Oysters and Pearls,' *Proceedings of the Zoological Society of London* (1912): 261.

Herdman and Hornell, Jameson argued that the nucleus of the pearl was irrelevant – rather, what mattered was the pearl oyster's organs themselves; specifically, the pearl-sac around which conchiolin and carbonate of lime were secreted.[106]

The Cestode Theory of Pearl production is interesting because of how it linked the components of the sea together. Unlike the determination of friend and foe of the oyster in the Gulf of Mannar, regulating parasites proved more difficult. If oysters were sensitive to a host of material and environmental factors, then parasitic worms were even more so, reacting strongly to climatic fluctuations affecting ocean salinity.[107]As three doleful fishery officials wrote in 1925: 'if we exterminate the rays, we do away with the source from which the cestode larvae [parasite] which form the nuclei of the pearls are drawn. On the other hand, if we permit the rays to increase and flourish, they will devour millions of oysters, each of which is a potential pearl producer. No rays, no pearls; abundance of rays, no oysters; which is it to be?'[108] Natural ecologies, as it turned out, were impossible to 'straighten out' along the lines of profit and extraction, with multi-dimensional relationships which criss-crossed and bolstered one another in fragile balance, capitalist rationalisation was impossible.

Parasites, like the trophic chains studied earlier, or the movements of the sea itself, linked oysters to their environments. When colonial officials in India became concerned about the depletion of the Persian Gulf beds in 1911, Hornell observed that although the locations of the pearl banks were carefully charted (thanks to Lorimer's *Gazetteer*), 'there is no real or exact knowledge of the life history of the pearl oyster

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[106] Jameson, 'On the identity and distribution of mother-of-pearl oysters: with a revision of the subgenus Margaritifera' *Proceedings of the Zoological Society of London* (1902).
[107] Thomas M. Soniat et al., 'Understanding the Success and Failure of Oyster Populations: Periodicities of *Perkinsus marinus,* and Oyster Recruitment, Mortality, and Size,' *Journal of Shellfish Research* 31 (2012).
[108] Kerkham, Malpas, and Pearson, 'The Pearl Fishery of 1925,' in *Ceylon Sessional Papers XV* (Colombo: Government Printer, 1926), 12.

itself nor the environment under which it exists.'[109] Advising officials in the Persian Gulf, Hornell maintained that in order to ensure plentiful yield in the future, the species of oyster in the Gulf would need to be identified. Once the oyster was known, further details were required on 'the habitual or normal environment of these species' and the 'principal dangers which beset the oyster in the course of its life.' Finally, if pearls were also formed by a larva of a parasitic worm, then 'an investigation of this parasite in the Persian Gulf becomes *of supreme importance*.' Hornell's four-month stay in the Gulf did not materialize, but it is indicative of the ways in which oysters had come to be viewed not as an isolated species, but as parts of a wider environment and web of ecology.

In the nineteenth century in scientific discourse, bolstered by an administration intent on 'practical' and useful science, pearls were turned inside out. For state-level and scientific actors, then, pearls were no longer found, but deciphered. In this telling, they were not discovered but diagnosed. Pearls and their molluscan hosts were broken down into organs and substances, both material and immaterial, visible, and invisible, tied now by microscopic links to other planktonic matter, parasitical agents and other creatures of the sea. It is important to offer a footnote here that this hardly seems to have touched the daily labouring realities of fishing communities who extracted oysters. Other than for those who assisted government inspection vessels, whether pearls were parasitic or not, or what they were comprised of, did not alter the daily realities of pearl extraction or sale. For science which emerged as a 'practical' handmaiden to commerce, the results of these projects seem to have remained at the level of scientific, rather than practical, interest and application.

[109] Letter from Hornell to Frederick Nicholson, dated 11 July 1911, L/PS/457, IOR.

From a scientific perspective, however, where pearls used to be products, now they became processes. In a recent monograph, the philosopher Samantha Frost argues that species can be read as 'energy in transition and interchange with habitat,' explaining that 'a living organism is not much more than – and is possibly reducible to – its interactions with its habitat.' [110] She proposes that we read species not as 'discrete organisms' but rather as 'effects of the environmental relationships and dynamics in which they live.' [111] A similar process took place with the oysters in the Gulf of Mannar as attempts to regulate them failed. In 1925, fisheries officials in Ceylon wrote that 'we have never taken the view that the application of scientific methods (disguised under the name of Marine Biology) to the pearl fisheries would produce miracles or would be productive of any startling results.' [112] 'Like most other problems of the pearl oyster we are forced to leave the issue to nature,' they concluded darkly. Oysters became relegated to the environment once more, as they had been before the middle of the nineteenth century.

Conclusion

Pearl-production could be left up to the sea as long as it was guaranteed: but without oysters there were no pearls, so studying oysters was key to fishing pearls. This chapter has explored how pearl-bearing reefs became what Frederick Nicholson of the Indian Fisheries Department described in 1909 as central nodes undertaking 'special scientific work on the culture of marine animals,' and how these fisheries, in turn,

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[110] Samantha Frost, *Biocultural Creatures: Towards a New Theory of the Human* (Durham, NC: Duke University Press, 2016), 28.
[111] Frost, 29.
[112] Pearson, Malpas and Kerkham, 'The Pearl Fishery of 1925,' 2.

produced work that was predicted to be 'indispensable in discussing any biological problem in that part of the Indian Ocean.' [113]

Herdman's research on Ceylon's oysters then became a template for reading oysters in the Indian Ocean. Consider how Lorimer constructed the life of Persian Gulf oysters based on Herdman's research. Lorimer used the Ceylon *paars* as a proxy for the Persian Gulf *hairat*. He observed, for instance, that since a *paar* constituted 'a bunch of Ceylon oysters [which] may consist of 3 to 16 individuals', *a hair* was likely to be similar. [114] The *Gazetteer* excerpted from Herdman on oyster gender and reproduction, 'the pearl oyster is not hermaphroditic'; life cycle, 'the young oyster exists at first in free-swimming conditions'; food, 'microscopic organisms, both animal and vegetable'; anatomy, 'by means of this "foot" [byssus] the oyster is able to travel'; predators; pearl formation, 'the intrusion of a minute parasite' and mortality. The co-production of knowledge around oysters in Ceylon, contingent on a specific scientific-bureaucratic and labour complex, was thus imported and shaped the presentation of oyster reefs elsewhere. Despite this borrowing, Lorimer too was cautious to note that it was not clear 'how far [the facts about Ceylon] hold good of the pearl oyster of the Persian Gulf.' [115]

Similarly, Rudmose Brown and Simpson, creating their maps of Mergui, also read Herdman. [116] They excerpted from his notes and included references to Ceylon's oysters throughout their report on Mergui. [117] The circulation of scientific knowledge through the empire is hardly a new story. However, what I want to attend to here is how particular intra-actions of bodies, beings and knowledge shaped other sites of

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[113] Letter from Nicholson to the Commissioners of Land Revenue, dated 25 January 1909, G.O. 601, TNSA.
[114] Lorimer, *Gazetteer of the Persian Gulf,* Appendix C, 2220.
[115] Ibid., 2223.
[116] Rudmose Brown and Simpson, *Pearl Oyster Fisheries*, 20.
[117]Ibid.

extraction too. This was not a perfect example of copy-paste: although Rudmose Brown and Simpson agreed with Herdman that the Mergui oyster too relied on deep-water repopulation and that it had the same natural 'enemies' and anatomy of the Ceylon oyster, they warned against extending the comparison too far.[118] There was an 'essential difference' between the Mergui mother-of-pearl bearing oysters and Ceylon oysters in terms of 'the depths and conditions in which they live.'[119] They stressed that 'the Mergui fisheries are of a quite different nature from those of Ceylon' and while faunal commonalities extended between them, the nature of the sea bed, the strength of the currents, the depth of the ocean floor, and the prevalence of hundreds of small rocky islands distinguished Mergui from Ceylon.[120]

The way that oysters and different Indian Ocean sites fit together continued to crop up over the next decades. In 1939, in an attempt to prove that foreign encroachment into deeper Persian Gulf waters would hurt the oyster beds, colonial officials in the Gulf wrote to the British Museum in London for confirmation.[121] The museum responded with five recommendations, lifted directly from Herdman's work on Ceylon. Once again, however, those with working expertise in the region disagreed. 'The habits of these two species I found very different,' one figure involved with the Red Sea fishery protested at the comparison between Ceylon and the Persian Gulf.[122] Material conditions in the Gulf 'differ completely' from Ceylon, Cyrill Crossland argued, because the oyster in Ceylon, in response to its surroundings, possessed a 'constitutional delicacy.'[123]

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[118] Ibid., 21, 17.
[119] Ibid.
[120] Ibid., 20.
[121] Letter from T.C. Fowle to the Secretary of State for India, dated 20 March 1939; Letter from India Office to the Secretary, British Museum of Natural History, 19 April 1939, ADM 116/4166, UKNA.
[122] Letter from Cyrill Crossland to the British Museum of Natural History, ADM 116/4166, UKNA.
[123] Ibid.

At the level of science and empire then, local ecology intruded into attempts to apply scientific knowledge uncritically from one colonial site to another. While Ceylon became a template for the Indian Ocean's oysters, owing to its crown colony status, this comparison could not be extended too far. The same process was also true for the law of the sea, and the ways that ownership and sovereignty over the pearl bearing reef was delineated, which I turn to in the next chapter.

Law

The bone of the gods turned into pearl; that, animated, swells in the waters. That do I fasten upon thee unto life, luster, strength, longevity, unto a life lasting a hundred autumns. May the amulet of pearl protect you! – Atharva Veda, 1000 BC [1]

Is He [not best] who guides you through the darkness of the land and at sea [Fi al-barr was fi al-bahr] and who sends the winds as good tidings before his mercy? –Qu'ran, 27:63 [2]

Who can doubt that the pearl fisheries of Bahrain and Ceylon may lawfully become property? - Emer de Vattel, 1758

Introduction

As the previous two chapters demonstrated, before culturing technologies brought the oyster onto land, pearl-bearing oysters had their own patterns of growth and settlement on the ocean floor. This was a specific kind of terrain which generated challenges for science and surveying. The distribution of oysters in the ocean had legal implications too; harvesting pearls at sea was unlike working with millet, wheat, or corn, where long traditions of enclosure and property rights stipulated who owned the land and who was thus entitled to farm it. Historically speaking, the enclosure of the oceans came much later. This chapter recounts how in the nineteenth century the pearl-oyster bearing reef in the Indian Ocean – a found source of human wealth, a space of ritual, magic and luck, as described by the Vedas and Qu'ran above – became, as in Emer de Vattel's words, 'property' at sea. [3]

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[1] Maurice Bloomfield trans., अथर्ववेद *Atharvaveda* in *A Vedic Word Concordance*, rev. ed., (1906; repr., Cambridge, MA: Harvard University Press, 2008), 35.

[2] On Indian Ocean mariners thinking through Quranic injunctions and the nascent laws of the sea, see Fahad A. Bishara, '"No Country but the Ocean": Reading International Law from the Deck of an Indian Ocean Dhow, ca. 1900,' *Comparative Studies in Society and History* 60, no. 2 (April 2018): 338–66, https://doi.org/10.1017/S0010417518000075.

[3] This perspective on law, space, and the sea is state-centric. For fishers' ways of negotiating space, separate from the law, the literature in anthropology on 'sea tenures' is helpful; cf. Bavinck, *Coromandel Coast*, 27.

Concurrent with the expansion of empire, submerged oyster reefs became an object over which state sovereignty and ownership could 'lawfully' be extended. The nineteenth-century history of pearling across our three sites offers a sporadic, yet still revealing, pre-history to the modern laws of the sea, allowing this chapter to put pearling into dialogue with histories of law and empire.[4] In an increasingly globalized world understood in common international juridical terms, the desire to articulate universal rights to the seabed intensified.[5] Pearling, which had been previously regulated by local custom, was now increasingly managed through law which was issued from a colonial state or imperial power.

Each of the major pearl fisheries in the Indian Ocean came loosely under the purview of the British Empire: Ceylon in 1796, the Persian Gulf from the 1850s onwards, and Mergui from the 1880s, although the character of imperial rule differed in each case.[6] In the nineteenth century the British Empire was being reordered 'through law developed in multiple registers on a global scale'[7] together with the 'juridification of the sea.'[8] This imperial 'rage for order' was, in Lauren Benton and

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[4] On pearling as the pre-cursor to seafloor engagements growing into oil, minerals, and other commodities see Surabhi Ranganathan, 'The Legal Construction of the Ocean,' (Lecture, Earl Snyder in International Law at Indiana University Maurer School of Law, Bloomington, Indiana, 09 April 2018); On the law of the sea see D.P. O'Connel, *The International Law of the Sea,* ed. I.A. Shearer (Oxford: Clarendon Press, 1988); Elizabeth Mancke, 'Oceanic Space and the Creation of a Global International System, 1450-1800' in *Maritime History as World History* ed. D. Finamore (Gainsville, FL.,: University Press of Florida, 2004), 149-66; Hugo Grotius, *The Free Sea*, ed. David Armitage, trans., Richard Hakluyt (Indianapolis: Liberty Fund, 2004), xi; Lilian del Castillo, *Law of the Sea: from Grotius to the International Tribunal for the Law of the Sea* (Leiden: Brill, 2015).

[5] Surabhi Ranganathan, 'Ocean Floor Grab: International Law and the Making of an Extractive Imaginary,' *European Journal of International Law* 30, no. 2 (July 22, 2019): 573–600, https://doi.org/10.1093/ejil/chz027; Ranganathan, 'Decolonization and International Law: Putting the Ocean on the Map,' *Journal of the History of International Law* 23, no. 1 (December 2020): 161–83, https://doi-org.ezp.lib.cam.ac.uk/10.1163/15718050-12340168.

[6] Technically speaking, Mergui or the province of Tenasserim came under British imperial control after the first Anglo-Burmese wars in 1926, but I have used the date of industrial pearling and the colonial state's involvement in it.

[7] Lauren Benton and Lisa Ford, *Rage for Order: The British Empire and the Origins of International Law, 1800-1850* (Cambridge, MA: Harvard University Press, 2016), 1.

[8] Renisa Mawani, *Across Oceans of Law: The Komagata Maru and Jurisdiction in the Time of Empire* (Durham, NC: Duke University Press, 2018), 35.

Lisa Ford's characterization, 'promiscuous in its borrowings and haphazard in its instantiation.'[9] The pearl bed was, in Pedro Machado's words, a 'fluid frontier' with a 'lateral and vertical dimension' which came to bear on questions of maritime jurisdiction.[10] By attending to how fishing rights were regulated, we can explore the legal and territorial bounds of pearl extraction.[11]

This chapter shows that each pearl fishery received 'haphazard,' varied treatment in the law, ranging from the determination of protected state territory to the designation of a closed sea, or a block that might be leased to private capitalists. This process of determining rights was contingent on local territory, ecologies, and long-standing practice.[12] The case of ownership and law in the Indian Ocean's pearl fisheries shows that the laws of the sea as they pertained to the pearl fisheries were uneven and non-standardized as the pearl-bearing reef came differently into view in each context.

The ocean has long posed unique challenges and prompts to sovereignty and law-making.[13] Fisheries, in certain cases, have been central to debates about the law of the sea.[14] As lawyer and legal scholar Surabhi Ranganathan reminds us in a series of short essays on the shifting interfaces between land and sea, the presence of resources at sea – and crucially the depth at which they are located – has historically pushed

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[9] Benton and Ford, *Rage for Order*, 7.
[10] Machado, *Pearls, People, and Power*, 12.
[11] Ranganathan 'Legal Construction of the Ocean,' 10:54.
[12] Macke, 'Oceanic Space,' 162.
[13] As Benton explains in her influential book on the subject: 'By its very nature, the ocean has seemed to demand the mutual recognition of legal norms derived from natural law or other law standing outside the control of polities,' Lauren Benton, *A Search for Sovereignty: Law and Geography in European Empires, 1400-1900* (Cambridge: Cambridge University Press, 2014), 105.
[14] For the ancient and classical period see Annalisa Marzano's discussion on antiquity and *res communis gentium* in *Harvesting the Sea: The Exploitation of Marine Resources in the Roman Mediterranean* (Oxford: Oxford University Press, 2013), 301; early modern see Renaud Morieux, 'Anglo-French Fishing Disputes and Maritime Boundaries in the North Atlantic, 1700-1850,' in *Governing the Sea in the Early Modern Era* eds., Peter Mancall and Carole Shammas (Los Angeles: Huntingdon Library, 2015), 43.

territorial boundaries and claims of sovereignty further into the ocean.[15] Law, in this telling, diffuses outwards from the land into a space which is seen then before this time to be free of claim-making and territorial contests.

This chapter explores ownership, ecology, and politics, relating them to this dissertation's interest in visibility and translation between the terrain of the underwater and human artefacts such as law. Instead of an intellectual history of law, or one that radiates outwards from Europe, I propose that reading this law as it emerged from the fisheries themselves, suggests the role played by the material of the ocean, and of local traditions of use.[16] McEvoy's seminal work on fisheries history, after all, held at its core the conviction that 'confronting the problem of environment, then, requires analysis of the interaction among three elements – ecology, production, and legal process – each of which changes on its own while interacting with the other two.'[17] In short, the insights of fisheries histories force us to move down from the abstracted world of legal doctrine to ask, what did the law *do* at the level of ecology, but crucially, to flip

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[15] If we consider the case of oil, it is clear how pressure from companies which capacities to extract it in deeper waters encouraged states to bring larger stretches of the continental shelf under national jurisdiction. Ranganathan, 'Legal Construction of the Ocean.'

[16] In much of the scholarship, maritime law (like international law more generally) radiates *outwards* from Europe, driven by texts authored by European jurists writing in the context of expanding empires. In this telling, the Treaty of Tordesillas (1494) ushers in a centuries-long process of European contests over jurisdictional authority over the seas. Hugo Grotius, John Seldon, and other jurists serve as as protagonists. See Martine van Ittersum, *Profit and Principle*; Percy Thomas Fenn 'Justinian and the Freedom of the Sea' *American Journal of International Law* 717 (1925): 724; General overview of international law as Eurocentric see Bardo Fassbender and Anne Peters, 'Introduction: Towards A Global History of International Law' in *The Oxford Handbook of the History of International Law eds.* Fassbender and Peters (Oxford: Oxford University Press, 2012); For a less Eurocentric vision; cf. R.P. Anand 'Maritime Practice in Southeast Asia until 1600 A.D. and the Modern Law of the Sea' *International and Comparative Law Quarterly* 30, no. 2 (April 1981); The growing field of legal history in the Indian Ocean departs entirely from this, see Fahad A. Bishara, *A Sea of Debt: Law and Economic Life in the Western Indian Ocean, 1780-1950* (Cambridge: Cambridge University Press, 2017); Bishara, ''No Country but the Ocean'; Iza R. Hussin, *The Politics of Islamic Law: Local Elites, Colonial Authority, and the Making of the Muslim State* (Chicago: University of Chicago Press, 2016); Kalyani Ramnath, 'Intertwined Itineraries: Debt, Decolonization, and International Law in Post-World War II South Asia,' *Law and History Review* 38, no. 1 (February 2020): 1–24, https://doi.org/10.1017/S0738248020000012; Renisa Mawani, *Across Oceans of Law: The Komagata Maru and Jurisdiction in the Time of Empire* (Durham, NC: Duke University Press, 2018).

[17] McEvoy, *Fisherman's Problem*, 13.

this question around and ask how the materiality of the reef and oysters at sea shaped the laws that emerged. [18]

Braiding methods from fisheries and legal histories, this chapter begins with the pearl fishery of Ceylon. I explore modes of management and regulation around pearling in the early nineteenth century, revealing how models inherited from South Indian polities met autocratic colonial governors in the early nineteenth century, enabling a unique extension of state sovereignty for more than twenty miles from the coastline. The Ceylon government's Act of 1811 thus became a precedent in international maritime law. I contrast Ceylon to the British imperial designation of the Persian Gulf as a *mare clausum* or closed sea in 1862. Here imperial authorities deliberately elided the specific geographies of the pearl banks, choosing instead to see one closed body of water that all within its bounds might exploit.

To some extent, when these laws respected the 'natural' morphologies of pearl banks on the ocean floor, as in Ceylon, they contravened international norms derived from inter-state military contests. On the other hand, *any* attempt to define the shifting boundaries of the pearl banks was a vexed endeavor, owing to the kinds of oyster mobilities explored in Chapter 3, *Maps*. The final section compares both these to the reefs in Mergui, where precise notions of distance from the shore and state sovereignty were left ill-defined until the mid-1930s. As with other chapters, the language of visibility serves as a heuristic as I consider to what degree the precise geographies of the pearl banks were *made visible* in the laws and legal imaginary, and the implications of this for ownership and extraction.

[18] Bhattacharyya, *Empire and Ecology*, 5, 15.

His Majesty's Property: Protected Reefs in the Gulf of Mannar

Until the first decades of the nineteenth century, from the perspective of any kind of law of the sea, the reef and oyster at sea was largely invisible. Under British occupation, there was an altogether new visibility of the reef and its produce in legal terms. Before this, control over the reefs in the Gulf of Mannar did not draw legal legitimacy from a nascent and emerging doctrine of the laws of the sea, but rather from models of agrarian revenue generation and forms of land-based political economy and rule in South India. The reef and oyster were legally invisible to the British, despite being within reach, and could not continue to be exploited until a legal framework around state sovereignty at sea was developed to defend the state's monopoly over them. Although this may not have been a causal factor for the scaling up of exploitation of the reefs, it helped safeguard the monopoly over the proceeds of the ocean floor.

In the medieval period and before, control of the pearl fisheries was a vaunted asset in the world of South Indian and Ceylonese polities (see *Introduction*). And yet, it was not specifically maritime; it required no explicit legal claims over particular portions of the seabed at given distances from the shore.[19] When the Dutch gained control from the Portuguese over Ceylon in 1658 they continued to collect revenue from pearling through a tax on individual diving stones and to juggle the rights of the claims of the rulers of Madurai, Ramnad, and local religious institutions.[20] There was remarkable continuity in these European entanglements, as management of the fishery

[19] This early modern evidence is important because it provides clues as to how sovereignty over the pearl bearing reef was conceived before European powers entered the region. It also helps to nuance the popular argument that the Indian Ocean's local rulers, unlike Europeans, had no interest in maritime space (one Raja of Gujrat famously claimed that 'wars by sea are merchants' affairs, and of no concern to the prestige of kings') quoted in C.R. Boxer, *The Portuguese Seaborne Empire, 1415-1825* (London: Hutchinson, 1969), 50.

[20] In 1658 the Dutch VOC drove the Portuguese from Ceylon's maritime coast and claimed rights to the fishery. Markus P. M. Vink, 'Church and State in Seventeenth-Century Colonial Asia: Dutch-Parava Relations in Southeast India in a Comparative Perspective,' *Journal of Early Modern History* 4, no. 1 (January 2000): 1–43, https://doi.org/10.1163/157006500X00123.

drew on models developed out of agrarian systems: oysters comprised a 'harvest' and divers paid a tax to work, just like agricultural workers.

Pearling mirrored the systems (legal, managerial, and otherwise) used for land-based high-value items such as cinnamon.[21] This continued when the British took over the pearl banks in 1796. That management was initially modeled on terrestrial revenue settlements is evident in their reliance on *ryotwari,* an agrarian collection system implemented in 1820 by Governor Thomas Munro in South India to remove local intermediaries and allow the state to collect revenue directly from the cultivator.[22] That a given territory was located in the sea was secondary to its role as a source of taxation; an incidental fact, rather than a legal terrain that required its own kinds of theorizations or laws. [23]

Pearling and law in the Gulf of Mannar breaks down the dichotomy between land and sea which has been so central to western epistemology: land as historical/sea as ahistorical, land as sovereign/sea as free.[24] Instead of seeing land and sea as sharply divided and distinct historical, legal, and epistemological zones, Benton and Perl-Rosenthal make the useful suggestion that we read instead 'shared and cross cutting processes: the production of partial and divided sovereignty on land and sea; the fitful thrust of landed legal authority onto the seas; interwoven practices of violence and

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[21] Subrahmanyam explains that this process was 'more or less in keeping with the manner in which [all other] revenue administration in general was conducted during these years.' Subrahmanyam, 'Noble Harvest,' 155

[22] For more on *ryotwari* see Eugene F. Irschick, *Dialogue and History: Constructing South India, 1795-1895* (Berkeley: University of California Press, 1994); Pandian, *Crooked Stalks*.

[23] Molly Warsh's work demonstrates that this is similar to the pearl-bearing reefs in the Caribbean, where pearls were defined by the Spanish crown as patrimony (*realengo*) of the state, drawing on precedents developed around forests and salt mines; alternatively, they might be classed as treasure or the spoils of war. Early modern Iberian traditions drew on models developed around precious metals and gems, so pearls were akin to mines and deposits of gold, silver, zinc, lead, sulfur, tin, coal, iron, and mercury. Warsh, *American Baroque*, 23-26, 30.

[24] Lauren Benton and Nathan Perl-Rosenthal eds., *A World at Sea: Maritime Practices and Global History* (Philadelphia: University of Pennsylvania Press, 2020), 194.

protection; and social and cultural representations of vast, uneven and contested terrestrial and maritime geographies.'[25] This 'shared and cross-cutting' process was certainly the case for the longer history of the pearl fishery of Ceylon.

Law came into force to preempt and ensure exclusive access by the state over the pearl-bearing reefs. The primary concern was not competition from other European powers but concerns about ensuring monopoly control. It was the fear of 'illicit' fishing on the pearl banks which would deprive the state of a full and ample yield of pearling proceeds. To make this activity 'illicit', however, lines needed to be drawn at sea. Fishers' patterns of mobility were always hard to police: it was exceedingly difficult to tell if vessels were at sea on routine fishing trips or secretly fishing for pearls. The submarine world is not neatly divided into oysters and other creatures, although it was common knowledge where the pearl banks lay. The justification of being on alternative fishing business, therefore, was always available to local fishers.

As a result, the punitive apparatus of the state came down with full force on those fishing the banks without permission, meaning that the submerged pearl reef acquired new salience in the context of military resources, which were reapportioned to preventing this activity. As Ostroff explains, violence accompanied the earliest entanglements of the British Crown with the Ceylon fishery, mimicking Dutch efforts before this.[26] Military arms, naval patrol vessels and a system of taxes including fines, whipping, hard labour, and even the death penalty were used as punishments to ensure compliance of local fisherfolk with European oversight. One proclamation from 1800 announced that 'the donies which begin fishing before the signal is given, and those

[25] Benton and Pearl-Rosenthal, 195.
[26] Ostroff, 'Beds of Empire,' 130.

that continue to fish after the signal is shown for leaving off shall be fired into from the Guard sloop or otherwise punished.'[27]

Despite this directed state violence, littoral communities continued to fish for pearls and chank shells outside of the European-run fisheries. Dutch records include events such as the following: on 28 May 1665, 'certain Parrawa people had dared with a great number of Moormen publicly to dive for pearls both at the banks before Tutucoryn with thirty or forty boats and also at the Manaar banks.'[28] Divers had entered into agreements with Muslim financiers and merchants and conducted their own fishery, depriving the state of revenue. Other records detailed the 'habit of the Moormen [fishing] at the banks of Manaar under pretense of navigating to Calpentyn,' pointing to how cycles of fisher mobility, navigation and labour never mapped on perfectly against the state's designs over reefs.[29] 'Pretense' was always an option.

Most histories of the extension of state territoriality beyond the shoreline trace this to the establishment and acceptance in the seventeenth-century of what is known as 'the 3-mile limit.'[30] This distance is taken to be the length of a cannon shot from the coast and emerges out of the context of European military jockeying (occasionally around fisheries) and coastal defense. In the Ceylon case, the extension of state sovereignty beyond the coast pertained not to shoreline military capacity but rather to the placement of *paars* out at sea.

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[27] Ibid., 130-1.
[28] In this case, six vessels were captured at Tuticorin, and commanders taken into custody.
[29] The Dutch proclamation preventing 'covetous persons dive by night and at unseasonable times on the pearl and chank reefs' to 'plunder the same to the great prejudice of the company' on pain of punishment by 'whipping and brand marking in addition to life-long labour in chains in the Company's public works at the Cape (of Good Hope)' is evidence of the way that the reef continued to be harvested even after its ostensible ownership by the VOC.
[30] The cannon-shot rule, or 3-mile limit, as it was known, was generally believed to have originated from a fishing dispute between the Dutch and British in 1610, see H.S.K.Kent, 'The Historical Origins of the Three-Mile Limit,' *American Journal of International Law* 48, no. 4 (October 1954): 554.

As discussed previously, to harvest pearls, divers worked on *paars* dotted throughout the Gulf. Several of these were located as far as twenty miles away from the coast. Geography, revenue and law-making intersected.[31] In the wake of Ceylon's steep early-nineteenth-century fiscal deficit, protecting sources of revenue was a high priority. The decisive legal moment took place under the Governor of Ceylon Thomas Maitland, in 1811 in the form of an act passed in Colombo for 'The protection of His Majesty's Pearl Banks of Ceylon.'[32] This was framed as a response to 'depredations committed' on the pearl banks by vessels 'frequenting those places [the *paars*] in the calm season.' It prohibited non-authorized vessels to 'hover or anchor' in waters of between four and twelve fathoms (coinciding with the depths at which oysters lived), in a band running adjacent to the Mannar coast. Within this territory, boats could be seized, searched, and brought to shore for punishment.[33] The violence of the state now had a language of law and territory at sea to back it up.

The language of this act specified depth at sea, that is, between four and twelve fathoms, but not distance from the coast. Whether this use of depth rather than distance was deliberate is unclear based on the transcript of the act. Despite the lack of specific vocabulary around distance from the coast, the act allowed state purview to stretch

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[31] Surprisingly, although C.R. De Silva's *Ceylon under British Occupation* considers the revenues of the fishery in considerable detail, there is no mention of the act of 1811 or its significance, 526.

[32] 'That if any Boat or other Vessel shall hereafter between the 10th of January and the end of April, or between the 1st of October and the end of November, in any Year be found within the limits of the Pearl Banks as described in the Schedule hereunto annexed anchoring or hovering and not proceeding to her proper destination as Wind and Weather may permit it shall be lawful for any person or persons holding a Commission or Warant from His Excellency the Governor for the purposes of this Regulation to enter and seize such Boat or other Vessel and carry the same to some convenient Port or Place in this Island for persecution. And every such Boat or other Vessel is hereby declared liable to forfeiture by Sentence of any Court having Revenue Jurisdiction of sufficient Amount and shall be condemned accordingly two thirds thereof to the use of His Majesty and one third to the Persons seizing or prosecuting unless such Boat or other Vessel shall have been forced into the Situation aforesaid by accident or other necessary cause the proof whereof to be on the party alleging such defence.' *A Collection of Legislative Acts of the Ceylon Government from 1796* (Colombo: Government Press, 1853-4), 130.

[33] Regulation No. 3 of 1811, *Legislative Acts*, 130.

several tens of miles out from the coastline to where the richest *paars* were found. The act also only came into effect during pearling seasons between March and April and in October, tailored around the monsoon and patterns of oyster spawning.

In bringing this stretch of the ocean into legal purview – fishers found on the pearl banks could now be tried and convicted in court – the act effectively converted all the pearl banks off the coast of northwest Ceylon into sovereign territory and enabled their defense legally by the state. The contents of these Acts were probably never directly communicated to the fishers themselves, but the implementation of the punishments likely served as an announcement to local fishers. In light of the violence around the pearl banks a decade before the act was passed, it was unlikely that this legal stipulation made a real difference to fishers, to whom the weight of the military apparatus of the state was present both before and also after the act. It did, however, protect the state, giving it legal grounds for its actions.

Maitland is known for his reform of Ceylon's legal system, in particular the establishment of the Ceylon Supreme Court, rather than his contribution to the territorialization of the sea. His tenure was authoritarian and effective, returning Ceylon to a period of stability (by reducing its budgetary deficits) following the unstable and crisis-plagued legacy of his predecessor Frederick North. [34] The passing of the 1811 Act to bring the pearl fishery reefs under state sovereignty was likely part of this drive to standardize and enshrine in law the practices of the state, such as the arbitrary use of violence in the Gulf of Mannar since the first British-sanctioned fishery took place in 1796. Maitland's act established a precedent for envisioning the oversight of sea and state, which up until this point had been governed and run almost entirely by the rules

[34] See De Silva, *Ceylon under British Occupation*, 526.

of agricultural revenue management. By writing law, British colonial administrators reworked the pearl fishery from a source of revenue collection into a distinct object at sea.

Maitland's protection of Ceylon's reefs can only be understood in the context of a crown colony, an island without serious political contenders to oppose the act (at the time the interior Kingdom of Kandy was embroiled in a series of internal conflicts and impending wars against the British), and virtually unchecked power given to a Governor. The twenty-one-mile extension of sovereignty was, globally and comparatively speaking, unprecedented. For instance, in the English Channel, despite attempts to fix territorial boundaries in the waters between Britain and France, any extension of state sovereignty (including the right to seize vessels) were roundly disputed well into the 1830s. Several attempts to extend territorial claims (again, reasoning on the basis of fish stocks in deeper water) failed.[35] Moreover, the act of 1811 was not aimed at 'foreign' fishers from another nation, but against littoral fishing communities from the Gulf of Mannar itself.

The Act of 1811 was not concerned with outlining the boundaries between states, in this case, between Ceylon and India. For it is a notable omission that the act made no distinctions in terms of labour. It made no reference to whether the vessels and fishers arrested were from the Gulf of Mannar, Indian or Ceylonese; their point of origin or affiliation and belonging was entirely irrelevant. I will show below how this contrasts

[35] Morieux, 'Anglo-French Fishing Disputes' catalogues incidents from 1817 through the 1830s on altercations between French and English fishers until a treaty was signed on 2 August 1839 to demarcate a limit. Unlike in channel where the 'silence of the law' dictated those customary understandings could triumph, space was explicitly delineated in Ceylon three centuries prior. Morieux, 47.

to the Persian Gulf context. The labourers could continue to move easily, but rights to the proceeds of the reefs were guaranteed to the state in Ceylon.

In the extractive, colonial context of Ceylon, the pearl fishery was 'made' into an object by international maritime law: beginning with the reefs at sea in the Gulf of Mannar fished by customary and corporate caste-groups, the precedent moved (as laws do) into international legal language and debates. [36]

To some extent, the extension of state sovereignty out to sea was similar to contemporary legal frameworks for declaring possessions on land. Maps became increasingly important, since the positions of the reefs mattered. Moreover, the act of conquest was important, that is, having taken land *from* a group and becoming the legitimate owner of an already-defined parcel. There was little notion that the pearl fishing reefs were an 'empty sea,' that nobody lived there, or that there were no pre-existing claims. Instead, it was the fact that people *had* harvested the reefs for so long which bolstered British claims to take over rights to the reef from local rulers.

As the nineteenth century progressed, extending state sovereignty out to sea was no longer motivated by the individual needs of colonial governors. Emerging notions of international maritime law and the sea transformed this into routine due diligence for colonial law making. To track this change, we can stay in Ceylon but shift our gaze to the end of the same century. By 1891, the legal and imperial context looks radically distinct from Maitland's unchecked authoritarianism. There was, for one thing, much tighter control on the colonies compared to the power given to Governors at the start of

[36] Consider that when the British jurist Thomas Fulton wrote in an account of the development of sovereignty over the seas in 1911, he remarked on the 1811 Act in a section titled the 'inadequacy of the three-mile limit for fishery regulations.' In other words, Maitland's act became a decisive moment in alternatives beyond the 3-mile limit in part in retrospect, see Thomas W. Fulton, *The Sovereignty of the Sea: A Historical Account of the Claims of England to the Dominion of the British Seas, and of the Evolution of the Territorial Waters* (London: W. Blackwood and Sons, 1911), 694-5.

the nineteenth century, and new questions of the Ceylon government's rights at sea had to be approved by London. This took place alongside an increasing awareness of the international ramifications of these decisions in terms of precedents for the law of the sea.

A useful example to illustrate changes in thinking about state sovereignty at sea is the Ceylon Government's proposed ordinance of 1891, "An Ordinance Related to Chanks," to regulate the trade in whorled chank shells, produced by another bottom-dwelling Turbo mollusc.[37] Chank molluscs lived alongside pearl-bearing oysters on many of the same reefs, and the community of divers who harvested them was often the same. Diving for chanks, however, took place all year round. The creature was far less sensitive to environmental change and more robust in the face of human harvesting; as a result, hundreds of molluscs continued to live on the ocean floor in the Gulf of Mannar and a thriving export market to India was built around the creature's shells, which were turned into bangles, devotional ornaments and other objects.[38] On 8 April 1891, the Legislative Council of Ceylon, under Governor Arthur E. Havelock, passed an act to better protect the stocks of chank shells and improve government revenue through tighter control on export duties.[39]

To guarantee the ability to enforce protection and force over the seabed where chanks were fished, the act 'claim[ed] for the Government of Ceylon exclusive right of fishery within a distance of 6 miles' between Mannar and Chilaw. In addition to the extension of the protected area six miles out to sea, this line would extend between two

[37] 'Correspondence respecting the Ceylon Pearl Fisheries 1891-92,' FO 412/52, UKNA. The act repealed and updated two earlier acts Ordinance No. 4 of 1842, 'An Ordinance for the Protection of Her Majesty's Rights in the Digging for Dead Chanks' and Ordinance No. 5 of 1842, 'An Ordinance for the Protection of Her Majesty's Chank Fishery.'
[38] Act No. 18 of 1890. *Ceylon Legislative Acts*.
[39] 'An Ordinance Related to Chanks,' FO 412/52, UKNA.

points, for a length of about sixty miles.[40] Within this zone, anyone who fished for chanks, sea cucumber, coral or shells without express government permission was liable to six months simple or rigorous imprisonment or a 100 rupee fine.[41] Now, without the freedom of a heavy-handed authoritarian governor, questions of jurisdiction at sea had to pass the requirements of the Foreign Office in London, which was concerned and unenthusiastic.

When the act was presented to the Prime Minister of Britain Lord Salisbury, the act was rejected on the grounds that the Ceylon Government could claim 'exclusive right of fishing within a distance of 3 – not 6 miles.'[42] The act was a 'dangerous precedent' because it constituted a 'departure from the recognized rules about maritime jurisdiction.'[43] If we compare this response from London to Maitland's powers in 1811, we find that Ceylon's pearl-bearing reefs were no longer read in the same way as forests, mines, or cinnamon plantations, but rather now had to be read against the 'rules about maritime jurisdiction' that is, they were explicitly related to the specific geographic-legal regime of the sea.

The Ceylon government, in turn, protested the prohibition, so the Foreign Office was forced to do more research to support their claims. 'International law writers have a great deal to say on the rights of the sea,' the librarian in the Foreign Office wrote on the question to Ceylon, noting that 'this Ordinance will not pass unobserved, and that the United States Government may quote it against us in connection with the Behring Sea question.'[44] It is very clear from this correspondence how in the interval between

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[40] Officials tried to use the legal loophole of defining the distance between these two promontories as a bay (it is hardly a bay, and legally, a bay required a mouth of 10 miles in width as in the case of fishery conventions between Britain and France in 1839 and 1867.
[41] Act no. 18 of 1890, 'An Ordinance Related to Chanks,' Inclosure No. 1, FO 412/52, UKNA.
[42] Ibid.
[43] Letter from T.H. Sanderson, Foreign Office to Colonial Office, 22 April 1891, FO 412/52, UKNA.
[44] Memo from E. Hertslet, 01 October 1891, FO 412/52, UKNA.

1811 and 1891 attempts to delineate rights to the seafloor now had to draw legitimacy from a European juridical tradition on the law of the sea, which was not the case in 1811.

Authorities in London argued that the Ceylon claim to the pearl fisheries rested only on 'use which has never been questioned, and which existed before international limits of coast were fixed.'[45] Now 'international limits' would come into the frame and the Ceylon government's extension of sovereignty in 1811 was written off as belonging to a previous era which did not stand up to the demands of the present international context or its legal strictures.

Ceylonese officials, however, claimed that they had 'historical title' to 'submerged lands' beyond the 3-mile limit, arguing that the reefs could be managed in the same way as other possessions acquired by terrestrial conquest.[46] Local rulers had exercised this right long before the British entered this space, they argued.[47] Drawing on an older tradition of natural law, Ceylon officials explained how 'the Portuguese claimed and used the greater number of the productive banks of the Manaar Gulf by right over conquest over their former possessor, the Naick of Madura…the Kings of Highland Kingdom of Kandy claimed against the Dutch the right to fish certain of the banks known as the banks of Chilaw…whatever right he may have had must now be considered to be vested in Her Majesty the Queen by virtue of the British conquest of

[45] Edward Hertslet, memo, 25 September 1891, in 'Correspondence respecting the Ceylon Pearl Fisheries October 1892' FO 412/52, UKNA.
[46] '…Proprietary right in the products of certain submerged portions of land which have been regarded from time immemorial by the native and European rulers of that part of the world as the subjects of property and jurisdiction,' see Letter from John Bramston, Colonial Office, to Foreign Office, dated 25 Sept. 1891, FO 412/52, UKNA.
[47] For enforcement of state sovereignty, colonial officials in Colombo demonstrated earlier Dutch precedents, setting officers across South India and Ceylon the task of searching for precedents during the Portuguese time or from Dutch records.' FO 412/52, UKNA.

the Kandyan Kingdom.'[48] Older traditions of natural law thus ran up against the new laws of the sea.

Finally, the Secretary of State Henry Holland conceded, writing that 'the claim of the Ceylon Government is not to an exceptional extent of water forming part of the high seas, as incidental to the territorial sovereignty of the Island of Ceylon, but that it is a proprietary right in the products of certain submerged portions of land which have been regarded from time immemorial by the native and European rulers of that part of the world as the subjects of property and jurisdiction.'[49] Ceylon's extension of sovereignty was approved, then, on the grounds that it was a right to 'submerged land' and not the waters of the 'high seas.' In a sense, the fishery remained part terrestrial, rather than fully maritime. The act was allowed to pass but Ceylonese officials were warned that this type of extension of sovereignty at sea would need to be very carefully considered in the future and should certainly not be publicized for fear of the criticism that it would open the British Government up to.[50]

The Foreign Office's attempt to stall the Chank Fishery Act emerged out of growing concern that the delimitation of sovereignty and rights in Ceylon would have consequences in other international disputes. The assertion of state sovereignty was 'distinctly open to attack.'[51] In this fear, they were justified. The core question of whether a state could legitimately extend its sovereignty beyond the 3-mile mark, was

[48] Letter from Bramston to Foreign Office, 25 September 1891, FO 412/52, UKNA.
[49] Bramston to Foreign Office.
[50] Ibid.
[51] Letter from Government Agent Northern Province to the Colonial Secretary, 20 June 1917, 20/837, SLNAK.

one that came into view during maritime disputes between nations.[52] Consider the most prominent example: the Bering Sea Arbitration in 1891.[53]

Several thousands of miles further north and away from the Gulf of Mannar, the United States purchased Alaska and an associated set of islands from Russia in 1867. The Pribilov Islands, in particular, were rich sites for the hunting of northern fur seals, whose pelts supplied most of London's fur markets. In 1870 the US leased the islands to an American firm and passed a law to make it illegal to kill seals on the islands outside of the formally stipulated hunting season. It is in this context, eighty years after Maitland's ordinance was passed, that British ships ventured on hunting expeditions for sea otters and seals. These 'transgressions' resulted in American attempts to enforce a monopoly over these rich hunting waters, and so, in 1886, US ships seized several British vessels that were sailing 70, 75, and 115 miles from US land, fining the captains and imprisoning the crews for illegal seal hunting.

The British were outraged, expressing in retaliation and defense that the sealing vessels had been far beyond the American coastline of Alaska – no state would be allowed to exercise its sovereign jurisdiction so far out from the coastline. A treaty was eventually signed between the United States and Great Britain on 19 February 1892, but this was submitted following further disputes to a Tribunal of Arbitration in Paris.[54]At the trial there were seven arbitrators, two from the US, two from the UK and one French, Italian, Swedish and Norwegian representative respectively.[55] The US

[52] This is also a transformation, because in fact the initial act of 1811 made no provision for distance, mentioning only depth at which the pearl banks were located, again showing how legal contexts were transmuted across time and space.
[53] Herslet memo, FO 412/52.
[54] J. Stanley Brown, 'Fur Seals and the Bering Sea Arbitration' *Journal of the American Geographical Society of New York* 26, no. 1 (1894): 326-372; Charles S. Campbell Jr., 'The Bering Sea Settlements of 1892' *Pacific History Review* 32, no. 4 (Nov. 1963): 374-367.
[55] 15 August 1893.

claimed that it held sovereignty over the waters of the strait, insisting that the Behring Sea was a *mare clausum*, or closed sea.[56] The tribunal eventually ruled that the US did not have this right to protection of the seal stock 'when such seals are found outside the ordinary three-mile limit.'

Although the tribunal finally concluded that the Behring Sea was part of the high seas and could not be claimed by the US, the use of the Ceylon precedent in this case is instructive. In their debates, American lawyers repeatedly claimed that the 'Ceylon Precedent' justified the territorial and military extension of state power beyond the 3-mile limit. U.S. Secretary of State, James G. Blaine, for instance, brought up Britain's protection of Ceylon's pearl bearing reef to suggest that marine regulations frequently already extended three miles. He also cited the 1890 Chank Protection Ordinance among other examples from Italy, Panama, and Algiers as 'foreign statues' which were presented in 'support of [the US] claim to a right of jurisdiction in the Behring Sea.'[57]

Correspondence between London and Ceylon at this time on the chank fishery act shows how the Behring Strait debates weighed heavily on the minds of those in the metropole, inflecting how the reef and chank in Ceylon would be regulated or protected. 'Vattel's "*Droit de Gens*" through favourable to the claim of jurisdiction over the pearl fisheries, has a somewhat unfavourable bearing on the contention of Her Majesty's Government in regard to the Behring Sea fishery,' officials in the Foreign Office wrote back to Ceylon, cautioning them about the rights of the state at sea, conceding that the laws of nations did not square neatly with the emergent laws of the sea.[58] By the 1890s

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[56] Fulton, *Sovereignty of the Sea*, 697.
[57] 'The Decision of the Behring Sea Arbitrators' in *The American Law Register and Review* (October 1893), 913.
[58] Letter from Foreign Office to Colonial Office, 21 October 1891, FO 412/52, UKNA.

then, debates about the pearl and chank fisheries were read in the context of other fisheries including for species such as seals and otters. Pearls and chank shells were no longer comparable with cinnamon, but with other marine creatures and the terrain of the sea, the shallow continental shelf, and the status of particular waters. The fishery and state sovereignty over its reefs had become oceanic and globalised.

Arab Property: The Persian Gulf as *Mare Clausum*

Until the British in the mid-nineteenth century, there had never been one consistent power in the Persian Gulf, and the lucrative pearl reefs, particularly around Bahrain, had attracted the attention of powerful tribes, rulers, and empires.[59] The history of warfare between the Qawasim, the Bani Yas, and competing regional powers evinces this process of jockeying for control over the pearl banks. Upon the inauguration of British control of the Persian Gulf, the juridical status of the Gulf's pearl beds came to the fore, as British Indian authorities were confronted with what their status would be in law. Customary law (*al-'urf)* was increasingly only in force among tribes in the villages while sharia and British Indian law came to be important in towns.[60] What, then, of the law of the sea?

The Gulf context was one of informal, strategic imperial oversight compared to Ceylon's direct colonial rule. Most importantly, questions over pearling rights did not concern the protection of a state monopoly, but rather focused upon the successful maintenance of Britain's role as a 'maritime protector.'[61] This related to the politics of

[59] The exceptions here are the Kingdom of Hormuz in the 1300s and 1400s and the Sassanians in the pre-Islamic period, but neither had total control of the Gulf as a single unit. Port cities generally rose and fell in importance over the decades—in contrast to other land-based dynasties of the Middle East.
[60] Fuccaro, *City and State*, 28.
[61] Aqil, 'Pearl Industry,' 462.

maintaining the frontiers of empire, rather than a commercial interest in pearling itself. To begin to determine how to regulate access to the reefs in the Persian Gulf, British officials first acknowledged the absolute centrality of pearling to Gulf economies. To ensure 'stability', the British would aim to maintain this status quo.

One particularly central issue as imperial presence expanded through the Gulf was the flood of new pearling aspirants from outside. The profits of pearling brought interested merchants from all over, but the most pressing concern to sort out was those who came from within British colonial territories. These merchants, moreover, expected to have access to the pearl-bearing reef as British subjects. One of the earliest cases for this took place in July 1862, when a steamer, the *Johnston Castle,* arrived in the Gulf carrying 'British subjects' from Karachi aiming to fish the rich banks around Bahrain because they had heard that these reefs were 'open to all'. Even more concerning to imperial authorities, the new entrants often arrived with diving equipment, in contrast to the free-diving system which was widely practiced in the Gulf.[62]

The *Johnston Castle* case prompted authorities in British India to set limits on participation, concerned that undue competition would be economically disastrous to the nascent Gulf powers on whose cooperation they were dependent.[63] Reaching a decision around delimiting access took some discussion. Officials stationed in the Gulf recognized that 'upon the Pearl Fishery the Arab Tribes of the Persian Gulf are mainly,

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[62] The Ottoman vessel *Johnstone Castle* sailed into the Persian Gulf in 1863 with a Mr Plunkett from Karachi who claimed 'the banks were free to all' he too wished to fish in the Persian Gulf. Letter from Felix Jones, Political Agent and Resident, Persian Gulf to H.L. Anderson, Secretary to the Government of Bombay, dated Bushire, 16 June 1857. Burdett ed., *Persian Gulf Pearl Fisheries*,

[63] 'Secret: Relative to the unauthorised prosecution of pearl fishing on the Arab pearl Banks in the Persian Gulf by a diving company composed of European and Native British subjects,' PD 1862, vol. 27, MSA. I am grateful to Fahad Bishara for sharing several of these files with me.

if not solely, dependent for subsistence.'[64] Already in 1857 the Resident in the Gulf Felix Jones argued, 'so far as I can ascertain the sole fishers on the Gulf Pearl Banks have, from time immemorial, been the Gulf Arabs.'[65] Jones also made an explicit link to property, writing that 'the fishing grounds may lawfully be accounted Arab property.'[66]

The recourse to 'Arabs' working in the same way from time immemorial occludes many of the historical changes which took place in the late nineteenth century as the labour force increased, as outlined in Chapter 2, *Labour.* The crude description of ahistoricity ('time immemorial') has no way to account for the increasing number of African men and boys from the Swahili Coast, or Balochis, or those from inland Arabia, Iraq and Persia who were increasingly integrated into Persian Gulf workforces. This colonial gaze of 'all Arabs' reflects a pre-occupation with their new agreements with local Arab tribal elites.

In the mid-nineteenth century, the question of ownership and sovereignty over the Persian Gulf's reefs was met with an understanding of how international fishery disputes were managed and the conventions around coasts and territorial water at the time. This stands as a sharp difference from Maitland's Act of 1811 in Ceylon. In contrast, officials in British India were much more cautious. Some asked: 'may not the limits be defined in the same manner as the bounds were formerly, and are perhaps still, conventionally established to the common Fisheries on the French and English Coasts at a specified distance from either shore'? Others warned that this would necessitate constant military presence on the banks: 'we have examples of the contentions on coasts

[64] Letter from Lieut. Kemball to Govt. Bombay, dated Baghdad, 07 August 1862, PD 1862, MSA.
[65] Felix Jones, quoted in Disbrowe to Acting Secretary to Government of Bombay, 11 July 1862, PD 1862, MSA.
[66] Ibid.

inhabited by civilized people in regard to fisheries, and I need hardly point out that if pursued amongst tribes always at feud with each other, grave difficulties must arise which may call for our armed interference at all times.' [67]

Others drew on pre-established intellectual precedents from the law of nations asking how these might relate to the sea. Colonial officials in Bombay formally turned in particular to the ideas of the Swiss jurist Emer de Vattel, searching for a way to understand rights over the fisheries in terms of natural law. [68] Letters from Bombay to the Resident in the Persian Gulf included references to Vattel's comment in the *Law of Nations*: 'who can doubt that the Pearl Fisheries of Bahrain and Ceylon may lawfully become property?' [69] Vattel's own remarks, dating to the eighteenth century, retained elements of naturalist thinking but marked a shift towards positivist thinking, suggesting that that the sovereign state was the foundation of the legal system. [70]

Despite this, officials in British India were loath to apply Vattel's premise of thinking of the fishery as property without additional deliberation and wrote that the matter 'obviously calls for further enquiry.' [71] They needed to know what the extent of the fishing grounds were? Which rules or customs were used? How were disputes generally settled? The recourse to Vattel would help if the British needed to fend off challenges from other colonial powers who might intervene in pearling in the Gulf, but also so that their rules would appear morally legitimate.

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[67] Letter from Felix Jones, Political Agent and Resident, Persian Gulf to H.L. Anderson, Secretary to the Government of Bombay, dated Bushire, 16 June 1857, MSA.
[68] Note from Secret Dept, Bombay, to Pelly, 08 December 1862, MSA.
[69] Ibid.
[70] Antony Anghie, *Imperialism, Sovereignty and the Making of International Law* (Cambridge: Cambridge University Press, 2012), 42-3.
[71] M. Vattel, *Le Droit des Gens* (Leiden, 1758), cited in 'Unauthorized prosecution of Pearl Fishing on the Arab banks,' PD 1862, MSA.

This definition of the fishing grounds as 'Arab property' was derived from use and custom, not legal records or written documents, which the British were unable to source. This is a marked departure from the Ceylon case, where officials mined Dutch and Portuguese precedents, for which they possessed (and indeed actively sourced) documentary evidence. With the Persian Gulf, however, colonial officials in British India vouched that customary practice could not be documented: 'no doubt, the origin, and the laws of the growth of the Pearl Tenures are involved in obscurity,' acting Gulf Resident Lewis Pelly wrote in 1863.[72] He continued, 'where written law does not obtain, and where all rights and boundaries have from time immemorial been determined by an appeal to custom, to rough occupancy, or to arms, the definition of rights and boundaries in the sense in which we understand definition must be a delicate proceeding.'[73]

The outcome of these debates came in 1862, when British imperial authorities designated the waters of the Persian Gulf to be a *mare clausum* or a closed sea. This decision was reached in private, and not broadcast as public proclamation or formal law. It was instead a guideline for administrators in the Gulf on how to enforce fishing rights in practice. The designation made the British liable to ensure 'reparation' for 'injury' between parties, to 'prevent the prosecution of intertribal feuds at sea', and to maintain maritime peace and stamp out piracy.[74]

The British decision on how to divide up sovereignty on the seabed opted instead for a catch-all to which local powers were unlikely to object, and one which would not unseat the primacy of the Indian *bania* in the Gulf. In its original iteration,

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[72] 'Re. the unauthorized prosecution of Pearl Fishing by a company composed of Europeans and Natives,' PD 1863, vol. 42, Comp 236, MSA.
[73] Letter from Pelly to Political Dept., Bombay, 02 February 1863, MSA.
[74] Letter from Kemball to Secretary to the Govt., Bombay, 07 August 1862, MSA.

the decision stipulated that 'for purposes of Pearl Diving to all parties coming from Ports or Coasts beyond its limits' would be barred entry and refused protection 'whatever their nationality.'[75] The produce from the Gulf was expressly declared to be 'open to all inhabitants of the Gulf' with 'Arabs… possessed of exclusive rights of fishing.'[76] Colonial authorities referred to the pearl banks in abstract: 'these pearl banks belong to the maritime Arabs or others on the Persian Gulf shores as a whole' officials wrote, continuing that there was no 'boundary which particular Tribes and States may severally claim.'[77]

In other words, the British chose *not* to focus on the specific geographies of each pearl-bank in the Persian Gulf, unlike in Ceylon, where protecting the sea above the reef and policing activity on it was imperative. This undifferentiated geography facilitated by the designation of a *mare clausum* contrasts with the rich world of divers and merchants, where each locality of pearling had its own attributes, names, and cultural history (see Chapter 3, *Maps*).[78] Just as pearl merchants claimed to be able to tell the 'birthplace' of any pearl to a reef in the Gulf, divers and seamen also occupied particular regions: 'Kuweit boats fish as far south as Jezirat Abu Ali, the Bahrain boats from thence to Arzana island, the Abu Thabi [Abu Dhabi] and Sharja boats to the south and east of that island.'[79]

In fact, British administrators did not merely refrain from interference in the classification of pearl banks, they actually preferred that their location, size, and rights

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[75] 'Secret: Relative to the unauthorized prosecution of pearl fishing on the Arab pearl Banks in the Persian Gulf by a diving company composed of European and Native British subjects.'
[76] Secret Dept, Bombay, to Pelly.
[77] 'Re. the unauthorized prosecution of Pearl Fishing by a company composed of Europeans and Natives,' PD 1863, vol. 42, Comp 236, pp 109-214, MSA.
[78] Consider Dorand's comments in 1866 that 'A good merchant will assert his ability to tell you, not only what depth of water any particular specimen [of pearl] has come, but also the very name of the bank in the Gulf which has been its birthplace.'
[79] *Persian Gulf Pilot*, vol. 4, 1897, qtd. in Burdett, *Pearl Fisheries of the Persian Gulf*, 94.

remain obscure, once again marking a contrast with their approach in Ceylon. Officials approved of Pelly's decision not to investigate the bounds of the pearl banks.[80] British agents wrote that locally the banks were distinguished only by deep or shallow, and exclusion 'formerly enforced by the strong against the weaker,' again aiming to fit the customary rights to the fisheries into some version of natural law.[81] Bombay wrote to the Gulf to state that they confirm that 'no attempt should be made to systematize the customs, privileges and rights connected with the pearl fishery.'[82]

The richest pearl beds were found around Bahrain, and although many vessels stuck closest to their home reefs, longer voyages were common. Officials cautioned that several pearl banks lie in a 'doubtful category' and if the British were to enforce a 3-mile limit, this would lead to bitter disputes. In fact, until Lorimer's attempt to map the pearl banks in 1906, administrators had little view of the geography of the pearl banks. 'Our position in reference to the pearl fisheries is preferable under present circumstances to any we could hope to arrive at by an analytical enquiry into their rights and boundaries.'[83] Further investigation would lead to 'complications' because 'there would be no want of claimants' to each reef.[84] British policy in the Gulf was therefore deliberately aimed at simplifying the contested world of maritime activity in the Gulf.

The designation of *mare clausum* succeeded in closing off the pearl banks of the Persian Gulf to foreign boat-owners and labourers for the next five decades – a

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[80] Political Dept to Pelly, June 1863, MSA.
[81] Kemball to Chief Secretary of Govt, Bombay, 15 June 1863, MSA.
[82] There would be no attempt to inquire further into 'The rights and boundaries which particular Tribes and States may severally claim.' Letter from Pelly, acting Resident in the Gulf to the Political Department, Bombay, 2 February 1863, MSA.
[83] Letter from Pelly to Political Department Bombay, dated 02 February 1863, MSA.
[84] Ibid.

marked contrast to a frontier like Mergui, where the intensification of pearling was entirely driven by foreign capital, boats, and labour.

Moreover, the designation of a closed sea regulated exploitation and fishing, but not purchase. The boundaries of the *mare clausum,* of course, applied to the pearl banks and to the material space of the sea, but not to the pearl trade itself in its market abstractions. This was a crucial difference, particularly because so many of the actors involved in the pearl trade were Great Britain's subjects, the Indian *baniyas* who provided loans, financing, and markets for pearls. As the latter half of the nineteenth century saw the growing integration and economic dependence of the Persian Gulf on India, the prominence of *banias* meant that '[t]he pearl trade is directly or indirectly in the hands of Great Britain's subjects.'

The cursory glosses that the British gave to the Persian Gulf, rendering it a sea where 'Arabs possessed exclusive rights of fishing,' occluded a long history of Islamic customary practice that treated the seas as open. Hassan Khalilieh has pointed out the striking fact that in much of the scholarship, the laws of the sea are seen purely as a European invention: this is doubly shocking when one considers that 'on the eve of the great discoveries, Muslims dominated more than half of the world's maritime possessions.' [85]

References to the sea predominate across the Qur'ān, hadith, and Islamic theological, jurisprudential, geographical and scientific literature from as early the ninth century. Islamic customary laws of the sea insisted that no one was entitled to the dominion of the high seas or their resources. [86] Before 1492, Muslim authorities and

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[85] Hassan S. Khalilieh, *Islamic Law of the Sea: Freedom of Navigation and Passage Rights in Islamic Thought* (Cambridge: Cambridge University Press, 2019), viii.
[86] Abdul Aziz Said, 'Precept and Practice of Human Rights in Islam,' *Universal Human Rights* 1, no. 1 (January – March 1979): 71, 73-75, https://doi-org.ezp.lib.cam.ac.uk/10.2307/761831.

jurists made a distinction between the high seas and the territorial sea: the Arab *mu'allim* Ahmad Ibn Mājid wrote in the fifteenth century that although 'every man knows his own coast best,' despite this, '[t]he sea is not peculiar to anyone of these people.' [87]

In Islamic customary laws of the sea, all individuals, communities, and nations have an inherent right to navigate the seas and to take advantage of its resources. A passage of the Qur'ān explains, 'it is He Who has made the sea subject, that you may eat thereof flesh that is fresh and tender, and that you may extract therefrom ornaments to wear; and thou seest the ships therein that plough the waves, that you may (thus) seek the bounty of God and that you may be grateful.' [88] Islamic law more broadly touched on issues of rights and obligation, refusing to draw a distinction between obligations on land and sea. [89] Similar strands of legal thought and practice may have threaded across the Persian Gulf sheikdoms.

Despite this freedom to navigate and sail on the open sea, Islamic rulers and jurists had long been preoccupied with the question of whether non-Muslims could physically enter the Sea of Hijaz and be entitled to do so. Islamic law also had a practice of creating protected *harim* zones around natural resources to protect them from overexploitation. Lake Burullus on the western Mediterranean, for instance, was protected by a caliphal degree by the Fatimid caliph al-Hafiz in the twelfth century. To

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[87] Khalileh, *Islamic Law of the Sea*, 103. This is similar to ideas elsewhere in the Indian Ocean, such as Sultan Ala'uddin of Makassar's comments that god intended the seas to be common to all and so it was 'unheard of that anyone should be forbidden to sail the seas,' see John Villers, 'Makassar: the Rise and Fall of an East Indonesian Trading State, 1512-1669,' in *Southeast Asian Port and Polity,* eds., J. Kathirithamby-Wells and John Villiers (Singapore: Singapore University Press, 1990), 154.

[88] وَهُوَ الَّذِي سَخَّرَ الْبَحْرَ لِتَأْكُلُواْ مِنْهُ لَحْمًا طَرِيًّا وَتَسْتَخْرِجُواْ مِنْهُ حِلْيَةً تَلْبَسُونَهَا وَتَرَى الْفُلْكَ مَوَاخِرَ فِيهِ وَلِتَبْتَغُواْ مِن فَضْلِهِ وَلَعَلَّكُمْ تَشْكُرُونَ . Qur'an, 16:14 qtd. in Khalileh, *Islamic Law of the Sea*, 13.

[89] Hassan S. Khalilieh, *Admiralty and Maritime Laws in the Mediterranean (ca 800-1050): The Kitab Akroyat al-Sufun vis-à-vis the Nomos Rhodion Nautikos* (Leiden: Brill, 2006); Khalilieh, *Islamic Maritime Law: An Introduction* (Leiden: Brill, 1998); Khalilieh, 'Legal Aspects from a Cairo Geniza *Responsum* on the Islamic Law of the Sea,' *The Jewish Quarterly Review* 96 (2006): 180-202.

the best of my knowledge, no similar *harim* declarations have been found for the Persian Gulf's reefs.[90]

Foreign Office and Indian Office correspondence, of course, make little effort to explicate customary law in any detail. They bear little reference to how the Islamic Law of Nature and Nations (*siyar*) inflect these ideas, yet if the success of Britain's informal empire in the Gulf was 'the extent to which its infrastructure worked *within* the indigenous political systems of the Gulf,' then hints of this may have been preserved in *mare clausum*.[91]

Four decades after the signing of the maritime truces, colonial authorities in the Gulf returned to the question of who had the right to fish for pearls, or *mare clausum*. If the imperial authorities looking to maintain informal empire in the Persian Gulf in the 1860s could refer to an emerging conception of the laws concerning sovereignty and territoriality at sea, then this prohibition on participation became complicated with the invention and rising popularity of diving technology.

The latter half of the nineteenth century saw a sharp rise in the market value of pearls, which explains the concomitant increase in the number of international aspirants to join the pearl trade. In the Persian Gulf, Belgian steam vessels, Japanese trawlers, and German steamships all tried to obtain permissions from local sheiks to fish for pearls (and other marine produce).[92] These included a Mr Muhammad bin Abdul Wahab Mushari, an Indian merchant, who proposed working with diving suits and divers from Ceylon; Messrs Tritonia Ltd of Glasgow, who applied for a 'license to use

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[90] Khalileh, *Law of the Sea*, 118.
[91] James Onley, 'Britain's Native Agents in Arabia and Persia in the Nineteenth Century,' *Comparative Studies of South Asia, Africa and the Middle East* 24, no. 1, (2004): 129.
[92] Lorimer, *Gazetteer*, vol. I, 2247, 2604.

deep sea diving dress on the deeper pearl beds of the Persian Gulf'; or the bid of Edward Headlam to try pearling in the Gulf and Gulf of Oman.[93]

The limits of *mare clausum* was challenged by depth and new technology. In response to this new flurry of applications to harvest pearls in the early twentieth century, the conception of maritime space and law had changed. Now the sea was seen in three-dimensional relief in legal terms, especially as new aspirants to Gulf pearling argued that they would leave shallow beds untouched and only work in deeper waters.

In 1905 the question of access to the pearl banks was forwarded by Gulf agents to Law Officers in London. Assessing the past fifty years, these law officers observed that rights to the pearl banks 'has raised difficult questions on several occasions in the past when European and other non-residents of the Gulf have attempted to participate in the fishery.'[94] In 1905 as in 1962, officials rehearsed the claim that rights to fish were contingent on identity and affiliation: 'those members of the tribes of the Arab Coast' were designated exclusive stakeholders and the pearl banks 'free to the pearl fishers of Arabia and Persia without distinction of race or nationality.'[95] Contrast this with the absence of any similar provision for the fishers of the Gulf of Mannar, or, as we will see below, Mergui.

In their 1905 reasoning, the Law Officers in London referred to the Ceylon Act of 1811.[96] To bolster the legitimacy of environmental protection as a justification to prevent deep-water fishing, administrators turned to 'the case of the protection of the Ceylon pearl banks' which offered a 'striking illustration of the assertion of this right

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[93] Burdett, *Pearl Fisheries of the Persian Gulf*, 193-225.
[94] 'Minute sheet no. 1', dated 1936 in 'Arab Pearl Fisheries in the Persian Gulf,' ADM 116/4166, UKNA.
[95] Ibid.
[96] Letter from Curzon et. al. to Secretary of State for India, dated 10 March 1904, R/15/2/3, IOR.

in practice,' referring to the extension of sovereignty beyond the 3-mile rule.[97] But technology and terrain both complicated the justification for prohibiting foreign entrants based on economic concerns over livelihoods of local seaside communities. Previously, the ban on foreign incursion was justified on the grounds that it would materially reduce the size of the catch and cause harm to the livelihoods of those who depended on pearling all along the Arabian coast. Now, however, new international aspirants proposed that they would avoid the shallow reefs frequented by the local *dhows* and free divers but work instead the deeper waters further away from the land. These petitions were made with an awareness of the arguments that the imperial authorities had used to prohibit foreign entrants, to find a loophole in the definition of *mare clausum*.

Although the bids were all eventually rejected, the question of deeper waters threw up a significant challenge to the legal designation and justification of a closed sea.[98] Law Officers in 1905 were forced to concede that 'a distinction must be drawn between the *banks* where the tribes have practiced pearl fishing and the *deep waters* in which no such fishery has been carried on by them.'[99] They were confronted with the reality that 'with regard to the deep waters in which pearl fishing has not been carried on…There is here no defined area at the bottom of the sea over which the right of fishing has been exercised to the exclusion of other nations.' As one concerned official bemoaned: 'the [deeper water] banks have never been exploited by the Trucial Sheiks

[97] Letter from the Law Officers of the Crown to the Foreign Office, dated 11 February 1905.
[98] Political Residents letter No 2976, 14 Nov 1912 to Govt of India; Indian Office letter No P.Z.4956/31; L/P/S/F 193-N/31 dated Nov 1931. For a full list of foreign attempts to fish in the Persian Gulf see Lorimer's 'History of Attempts at Encroachment' between 1857 and 1907, *Gazetteer*, pp x-xx.
[99] Letter from the Law Officers of the Crown to the Foreign Office, dated 11 February 1905, IOR

or Bahrain' and thus 'there would apparently be no possibility of claiming or proving proprietary rights.'[100]

One way around the problem posed by the absence of long-standing fishing practice in the deep was to make an argument about ecology. By demonstrating a relationship between the shallows and the deep through the ecology, it could be argued that deep-water exploitation would harm shallow water oyster reefs. Officials in the Persian Gulf had previously dismissed proposals to use dredging equipment in the Gulf in 1905 and 1911 based on 'the local belief that the spoilation of the deeper beds would injure the shallow sea.'[101] Lorimer, similarly, had recorded in his *Gazetteer* that 'the effect of deep-sea dredging would be to destroy the colonies from which the oysters upon the shallow beds accessible to the native divers are recruited.'[102] Divers themselves had often ventured the same argument, explaining that the pearl-bearing reef was restocked by oysters unseen and undisturbed, living in deeper waters. Fears of ecological degradation, based mostly on fishing communities' expertise, was enough to deter further incursions in deep water until the late 1930s.[103]

Colonial officials eagerly looked for a link between the pearl reef in shallow waters and mysterious and hidden oysters in deeper waters as justification for an embargo on dredging and mechanized pearling in the deep. Legally, proving the existence of deep-water stocks of pearl-bearing oysters promised to silence the new challenges to *mare clausum* which claimed that the deep sea was outside of the purview of livelihood and customary usage. The Foreign Office was concerned that if 'it is

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[100] Letter from the Secretary to the Government of India, External Affairs to the Secretary of State for India, Political Dept, 27 July 1938, ADM 116, UKNA.
[101] Reference to earlier memos in letter dated 11 Oct 1938, ADM 116/4166, UKNA.
[102] Lorimer, *Gazetteer,* 2244.
[103] Letter from the Secy. To the Govt of India to Political Department, dated 27 July 1938, ADM 116, UKNA.

possible that such deep-sea pearl beds exist', the waters were so deep that free divers could not venture down, so 'even now very few people share this knowledge.' [104] Others speculated optimistically that, 'there might be some local knowledge based on the explorations of some particularly adventurous or skillful divers available in the Gulf which is not known in London.' [105] In an attempt to settle the question of depth and the restocking of oysters, administrators in the Persian Gulf wrote to the Museum of Natural History. [106] Colonial officials bemoaned that this ecological argument might not hold weight given that 'the Persian Gulf fisheries have never been studied from this point of view by a competent marine biologist.' [107] The matter was never definitively solved because the only scientific proof for restocking oyster banks was derived from Ceylon, rather than the Persian Gulf.

Officials were unable to prove a link between the deep and the shallows of a kind which would demonstrate restocking oyster beds or permanent damage to their ecology. The mere hint of such a causal relationship, however, was sufficient for imperial authorities in the Gulf to continue to block foreign incursions into Gulf pearling. The search for an ecological reason to tie the deep sea to the shallows in response to the new demands and petitions of aspirant pearlers reveals the ways that imaginaries of the seascape and sovereignty and rights at sea were continually re-worked to serve new ends. Previously, in 1860, imperial authorities had studiously avoided attending to the pearl banks in too much detail, as they were concerned with delimiting all the reefs together. When the threat of new technology arose, however,

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[104] Foreign Office, 15 October 1938, ADM 116, UKNA.
[105] Letter from the Foreign Office dated 15 October 1938, ADM 116, UKNA.
[106] Letter from T.C. Fowle, Resident in the Persian Gulf, to Secretary of State for India, London, 20 March 1939; Letter from Indian Office to Secretary, British Museum of Natural History, 19 April 1939, ADM 116, UKNA.
[107] Letter from Cyril Crossland to British Museum, ADM 116, UKNA.

new arguments had to be sought which extended the sovereignty and rights of Gulf Arabs to the fisheries even in deeper waters.

Open to the World: Burma and the High Seas

Unlike the enclosed sea of the Persian Gulf, or the Gulf of Mannar, enclosed again between two landmasses, the sprawling archipelago of Mergui had no centuries long history of large-scale exploitation. The island archipelago was sparsely populated, and there was no equivalent to the *parava* community who obviously controlled labour relations, nor was there an established system of local sheikhs reliant on the income from taxing pearls or taking a share of them, or a large littoral community whose livelihood depended on pearling. Although rulers of Arakan and other Buddhist sites of worship on the mainland had historically received payment and tribute in pearls, these tended to come via long distance routes, changing hands many times from traders who worked with moken divers. The Moken, in colonial eyes, did not constitute a pre-existing community with customary rights who the British had to contend with.

In addition to the choice to ignore Moken patterns of fishing, the approach to Mergui pearling and law of the sea is also explained by a technology and environment. The creatures who supplied mother-of-pearl shell lived as deep as fifty-four meters underwater, and several tens of kilometers away from Mergui's coast. The pre-existing ecology of Mergui was not amenable to a vast pearling complex in the absence of pearling technology before the 1880s, so British administrators tasked with enacting regulation and sovereignty in Mergui had no historical precedents with which to contend.

In British eyes, there were no European empires with documentary paper trails or powerful local customary arrangements to contend with. In debates over how to

regulate pearling in the archipelago in the late nineteenth century, Albert Fytche, the Chief Commissioner in Rangoon, proposed the updated 'Ceylon model' which replaced renting in the mid-nineteenth century. Fytche proposed direct state management and a fixed share of the proceeds to be accrued to the state, such as the two thirds or three fourths share that the government in Ceylon was able to take for itself. Fytche met his opponent in India's first Inspector-General of Fisheries, Francis Day, who suggested a system of leasing out the fisheries in private 'blocks' to the highest bidder instead. [108]

In Mergui, the state's regulation of pearling was dictated by revenue generation. The state was unwilling to impose a full-scale monopoly as in Ceylon and opted instead to rent out parcels of the sea to private capitalists, replacing this system in 1902 with a method of selling individual diving pump licenses. The choice of blocks versus diving pumps paid little attention to questions of rule and sovereignty at sea and instead to the finances of the Deputy Commissioners Office in Mergui. Rules of management would be applied, but the labour force and capital would arrive from private capitalists, freeing the state of the need for direct intervention in terms of managing labour, counting and selling oysters, setting prices and regulating merchant activity. These tasks were all displaced to pearlers, with the state taking an overview role, taxing each capitalist, but doing no more. There was also a marked absence of military oversight as in Ceylon or the Persian Gulf.

It is still worth attending to the legal vocabulary that historical actors in Mergui drew upon, especially with reference to sovereignty and territoriality at sea. [109] Consider the very early years of pearling, and the moves capitalists made to defend their right to

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[108] He explained: 'The Government demand being fixed at a percentage of the net produce, perhaps about 1/3 of that produce ought to be looked on as the proper Government share.' P/753, India Foreign (Revenue-Irrigation) 'Memorandum on a revised Revenue Settlement for British Burma…dated 1 October 1870' quoted in Reeves et al., 'Auction Lease System,' 256.
[109] 'Mergui Pearl Fisheries,' AG 1/7, 1043, YNA.

fish. In 1892, one early pearler, a Mr Loveridge, was conducting exploratory and commercial work in the Mergui archipelago. His maritime work, however, was taking place within the jurisdiction of Block III, which had already been leased on behalf of the Mergui Pearling Company by their agent, Mr Chill. Chill encountered Loveridge fishing on 'his' block numerous times and complained to local authorities. When Chill made his first complaint, he was informed by authorities in Mergui 'that it was no business of mine, and that if I liked I could fish also,' invoking an idea of the seas as open to all and not liable to be delimited. [110]

Chill escalated his protests through the colonial bureaucracy. [111] Loveridge was finally warned by authorities in Rangoon that he was not permitted 'to fish for shells within territorial limits without a license.' [112] Loveridge, however, was not content to let the matter rest, nor to submit to the ostensible right of the colonial state to determine where he might fish. He hired legal representatives Moylan and Eddis, who argued a strong case for why territory in Mergui did not accord with the 3-mile limit. The region where he had infringed on Chill's territory constituted the 'open sea', being as it were 'many miles out' from the coast. [113] Despite the British Government's lease of Block III to Chill's firm, Loveridge could enjoy pearling here because of his 'rights as one of the public to fish in the sea.' The lawyers argued in particular that 'We don't admit the right of the Government to grant monopolies in the sea, even within the three-mile limit.'

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[110] Ibid.
[111] Ibid
[112] Letter from the Secretary to the Financial Commissioner Burma to Tenasserim Division, 17 February 1893, AG 1/7, 1043, YNA.
[113] Letter from the Chief Commissioner of Burmah to the Government of India, 11 November 1891, FO 414/118, 96-97, UKNA.

In fact, Moylan and Eddies claimed, 'the rights now claimed to exercise territorial jurisdiction over the whole sea included within the Mergui archipelago' were 'unsupported by authority or precedent.' They then adduced a list of international maritime precedents, citing the actions of 'the Dutch Government in Batavia'; 'the Government in Singapore'; and other maritime actors in the Sulu archipelago. They also discussed the Gulf of Mannar, explaining that even in the Ceylon case, 'we have never heard, however, of any attempt being made to enforce over those fisheries, rights such as are now claimed by the Government of Burma,' with the distinction presumably being one of distance from the coastline. [114] The arguments advanced by Moylan and Eddies are evidence, if anything, of the increasing sensitization in the 1890s to the role of the state and its rights (and the limitations of those rights) at sea, especially when compared to the early nineteenth-century period of colonial rule.

The openness of the reefs of Mergui to Australian, Chinese, and other capitalists marked it out in contrast to the rights of fishing in Ceylon or the Persian Gulf. As one newspaper report put it in 1912, 'it is possible for anyone to become a pearler in Mergui' with adequate capital. [115] This lack of a specific law about *who* could fish (compare this to the 'Arabs' in the Persian Gulf) resulted in the incorporation of a large number of foreign syndicates based in Rangoon or Singapore. The openness of the bidding enabled Asian actors, primarily Chinese capitalists, to take advantage of the rights to bid for pearls. This generated much consternation, particularly among European and Australian pearlers. As the *Rangoon Gazette* asked in 1898, have 'the groans of Britons' or the Australians reached you?' for the latest auction had sold the licenses to collect

[114] Letter from Mr Doylan and Eddies, Barristers-at-law to the Secretary to the Chief Commissioner, Burma, 10 November 1892, in AG 1/7, 1043, YNA.
[115] Crossfield, 'Pearl Fishing in Burma,' 3.

pearls and mother-of-pearls to Chinese.[116] Australian newspapers reported this as 'hasty and ill-considered grasping for revenue' which 'for the sake of a few extra rupees sends out own colonist sons adrift in favour of the heathen Chinese.'[117] Despite European pearler's complaints, there was no favoured treatment granted to one group over others to exploit the reefs.

The debates over the rights of the government of Burma to grant pearlers exclusive access to reefs at sea found an eager audience in newspapers. In July 1894, editors at the *Singapore Free Press* chided that the 'the Government of India is a slow one,' poking fun at the delimitation of sovereignty at sea around the Mergui pearl fisheries.[118] They asked the Queensland pearler, Frank Jardine, who was surveying the banks around Mergui, whether he approved of the way British sovereignty at sea was being exercised. The journalists interviewing Jardine, aware that this was a contested issue, suggested that the Deputy Commissioner of Mergui initially 'had no law to guide him' they asked if 'there are no laws by which the revenue is properly apportioned?'[119] Jardine was firm: 'neither the Indian nor any other Government has any more claim to that portion of the seas than you or I have'. The distance of the banks from the coast meant that Mergui's pearl reefs were on the high seas, 'a highway open to the world' which were not amenable to the 'laws of the land.'[120]

In fact, in Mergui, the '3-mile limit' and state territoriality did not arise as a concern until the late 1930s, in the context of British fears about Japanese activity in Southeast Asian waters. In the 1930s, administrators described a total 'absence of any

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[116] Chinese bidders also took all the leases in 1892, see Anon., 'Pearling in Mergui', *Queenslander*, 27 Jan 1894, 148.
[117] Anon., 'Pearling in Mergui,' *Coolgardie Miner*, 24 Sept 1898, 6.
[118] Anon., 'The Pearl King of the Torres Strait is Interviewed', *Singapore Free Press and Mercantile Advisor,* dated 10 July 1894, 4.
[119] Anon., 'Pearl King', *Singapore Free Press,* 10 July 1894.
[120] Advertisement, 19 May 1898, *Straits Times*, 3.

definite knowledge of where the three mile limit of Burma's territorial waters is drawn.'[121] The archipelago's waters were said to be 'unexamined in legal aspects.'[122] By this point, administrators in Mergui noted that there was a large 'difficulty in determining the three-mile limit of territorial waters in the Mergui Archipelago' primarily because the island archipelago spilled out beyond three miles from the shore.[123] At this point in time, one potential solution was to draw the 3-mile limit not from the coastline of Burma but instead from 'three miles west of the archipelago.'[124]

Conclusion

Describing the post-war period which saw the sustained codification of the laws of the sea, Ranganathan explains how 'within a span of half a century, the seabed passed from a space governed by the principle of freedom to one enclosed within national or international regimes' which 'fostered an extractive imaginary of the ocean floor.'[125] In this chapter I have sought to shift the temporal lens backwards in time, to the period from 1811 to the late 1930s, using pearling as a case study. By studying the varying regimes of enclosure from Ceylon, where sovereignty over the reef was guaranteed in 1811, to the 'closed sea' of the Persian Gulf and the 'open highway' of Burma, I have shown that resources at sea received differing treatment in law, as regards the extent of state involvement in extraction.

The ways in which the different pearl banks in the Indian Ocean were brought into the ambit of international maritime law, with different structures of rules designed in each case to determine who was entitled to their produce, and to what boundary and

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[121] Letter from the Admiralty to the Under Secretary of State, Burma Office, 24 July 1937, M/3/63, IOR.
[122] Letter from Defence Dept., Burma, to Undersecretary of State, Burma Office, 28 April 1937, IOR.
[123] Letter from Political Dept. to Secy. Of State, Burma Office, 27 July 1937, M/3/63, IOR.
[124] Ibid.
[125] Ranganathan, 'Ocean floor grab,' 576.

to what extent state sovereignty was extended received varied answers in the nineteenth century. In Ceylon, the pearl fishery where state intervention was tightest and most involved (in the form of a colonial monopoly which aided with revenue generation), state rights to the seabed extended from the land, in an extension of the forms of territorial sovereignty. In contrast, we saw that in the Persian Gulf, designating rights and sovereignty over the reefs in the 1850s and 1860s was already phrased in terms of existing maritime law and practice, considering Vattel's theories alongside other models for fishery administration from the English Channel and elsewhere.

The designation of *mare clausum,* which closed the Persian Gulf to 'foreign fishers' and made the proceeds the exclusive right of 'Arabs of the Gulf', served to advance the British aims of maintaining stability and preventing violence and rebellion in the Gulf. In contrast to both of these approaches, in Mergui, there was no practice of systematic pearling before the 1880s, primarily owing to the depth at which many of the molluscs lived. With only the nomadic Moken community to contend with, the British administrators of Lower Burma were able to parcel off vast tracks of the sea into 'blocks' which were leased to individual capitalists. This drew criticism both in the press and from individual pearlers, who, as in the Persian Gulf and the Gulf of Mannar, claimed that the seas were 'open' and should be free for anyone to fish, without the British enforcing exclusive rights.

In each of the above case studies, the distance, depth, density of reef, sea creatures habitats and political history shaped the divergent approaches that lawfare had to take with regard to the reef and therefore the conceptualization of territory at sea. There was no single way to approach a pearl-bearing reef at sea. While contemporary histories of maritime law may collapse all of the world's pearling sites into footnotes in the history of the development of territoriality at sea, reading the historical record of

each of these fisheries reveals the divergent ways in which a pearl-reef could be governed and delimited in law.

Conclusion

Nacreous Histories

In the opening paragraphs of this dissertation, I eschewed the pearl-encrusted objects of elite accumulation which are prominently displayed across national and private collections.[1] Instead of turning to the isolated object – which was once a commodity-in-motion on global sojourns and was now an item bathed in the glow of incandescent museum lights – I searched for stories which extended to fuller accounts of undersea environments in history and their engagement with humans. I asked how within an account of pearling, the historian could assemble her archives and methods to write from the sea. And so, in the preceding five chapters I worked backwards from pearls to the 'stuff' of production, beginning with the fleshy insides of molluscs, their closed, brittle valves, the rocky limestone shoals on which they were found, and the turbulent, changing waters into which divers plunged, asking how these intersected with traditionally human-centric concerns of regulation, labour, cartography, science, and law.

In the archives surveyed, the human and non-human operated in relation to one another. That is, sharks appeared in labour archives and petitions to strike, just as the shape of the bay or the distance and extent of a reef became embroiled in legal contests. Scientific studies on marine fauna and flora were enabled by the increasingly racialised immersive labour of pearl divers.[2] Starfish became 'enemies' and in some racist

[1] See the National Museum Qatar, Doha, Qatar; Dubai Pearl Museum, Emirates National Bank, Dubai, UAE. Of course, studies of consumption patterns deduced from objects and portraiture too have much to teach us. Warsh, Hopper and Ostroff all use visual and material culture around tastes and fashion in their studies of pearl production. For a recent visual approach, see Joseph Litts, 'An (un)Natural History of Pearls, Slavery, and Portraiture in the Eighteenth Century' (seminar presentation, Colonial Americas Workshop, Princeton University, 26 October 2021).

[2] For a similar account in the early modern Caribbean see, James Delbourgo, 'Divers Things: Collecting the World under Water,' *History of Science* 49, no. 2 (June 1, 2011): 149–85, https://doi.org/10.1177/007327531104900202.

accounts of underwater work, divers became 'fish.' All of this is to insist that reefs were populated, shifting, (sometimes) peopled, political, racial, social, and legal spaces.

To access these narratives beyond deracinated trade statistics required expanding the history of pearling also to the insights of history of science, animal history, and environmental history. Undersea worlds were plural, dynamic, and, importantly, related to one another in distinct ways in the late nineteenth century. Attempts to intervene and domesticate this space were often confounded by the presence of forces beyond the human. As a result, this dissertation did not follow a linear timeline, nor one where the 'human' and the 'non-human' were neatly parsed apart. Instead, each chapter layered animals, labour, the ocean, bodies, knowledge, and artefacts of colonial and imperial rule. In other words, the chapters were analytically 'pearl-like,' or nacreous, in their concentric, interlocking structure: the parts in relation to one another comprised the whole – humans did not stand apart from ecology and environment, but were constitutive of and with it.

Historians, however, are concerned not only with how different actors relate to one another but also with change over time. The late nineteenth century represented a high point in terms of *visibility* of the oyster and pearl-bearing reef. This was related to the creeping codification and standardisation of the laws of the sea, the growth of marine biology, and newly heterogenous pearling workforces across the global sites of pearl extraction. I began by explaining that while pearls were visible on *terra firma*, as one approached their molluscan hosts and submarine environments, this ability to perceive, legislate, regulate and control became more obscure. Within the medium of the ocean, which humans did not easily or permanently occupy, the oyster reef and submarine environment were occluded from the eyes of the state or capitalists. The

ocean and reef were *site of potential value,* which were rendered legible through the work of pearling labour.

In the case of natural pearling, however, making the reef visible involved translation on multiple scales and between various actors.[3] Referring primarily to the work of the diver, who crossed thresholds from air into the waves, I traced the role of *translation* on a sensory, embodied, linguistic, cartographic, and scientific level across language, culture, terrain, sites of imperial and colonial control, and species. Work, as many environmental historians have noted, was a mode of knowing nature, but it was also a medium through which the sea was translated for shore-based actors. As a result of this visibility, in the early twentieth century, it might have appeared that the reef and oyster was firmly brought into the realm of human affairs in law and science and that it could be regulated, made more productive and efficient, and safeguarded in terms of sovereignty.

On this point of visibility, it is important to highlight that despite my disavowal of the pearl-as-object, a kind of material and visual history has run through the preceding chapters.[4] That is, in place of diadems, tiaras, or tapestries, this dissertation featured statistical appendices, maps, oyster specimens, photographs, and legal treatises. This history of pearling is thus nonetheless an account of *ways of seeing*, and how material culture (including, of course, archival documents, which are also objects) shapes interactions with historic environments, in this case, with the shallow continental shelf where oysters lived.

In contrast to the prominently displayed pearl-object, my sources came from the legal and scientific archive, rather than the vaults of elite jewellers or royal palaces.

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[3] I am grateful to the anonymous reviewer at *Comparative Studies in Society and History* for this insight.
[4] I am grateful to Sujit Sivasundaram for this insight.

Extraction leaves myriad traces, very often apart from the commodity itself. These artefacts of making sense of the seafloor, including scientific reports, maps, and laws suggest how humans historically bounded and extended webs of ocean life in the late nineteenth and early twentieth century. As method, this approach also recontextualises standard histories of law and labour, which are traditionally read as being set apart from the material and animate components of the sea.

But these artefacts of visibility were far from complete. For despite rendering the oyster and reef more clearly in cartographic, scientific, and legal terms, by the early twentieth century, the success of the attempt to protect and preserve the interests of the state and capital was partial. Maps aimed to plot oysters but provided only fleeting glimpses into the terrain of the seafloor; tabulated accounts of racial groups' comparative abilities to work underwater did not prevent strikes, theft, and violence; science promised to 'remedy' the problem of oyster mortality but was unable to do so. Whether affected by seasonal variation, animal predation, or natural population fluctuations, many of the tools used to approximate the seafloor at this point in time were of limited use. Another takeaway then, is about limits of human intervention in nature, related to these specific regimes of the early twentieth century at sea.

Rather than enforcing some form of nature-culture binary, we can see this instead as an exercise in the *limits of translation*, which is another way of discussing the relationship of humans and environments as mediated through scientific intervention, knowledge, lawfare and capital. These failures or frictions, as Anna Lowenhaupt Tsing has memorably written in another context, are important because they 'refuse the lie that global power operates as a well-oiled machine.' [5] Indeed, we

[5] Anna Lowenhaupt Tsing, *Friction: An Ethnography of Global Connection* (Princeton: Princeton University Press, 2004).

might argue that friction (or perhaps the more apposite term in the context of the water is resistance) was greater when humans met the sea, compared to when they met, engaged with, and constituted land.

The failure of these artefacts of visibility helps to frame the limits of these intra-actions between humans and non-human beings and environments, specifically, the medium of the open ocean. And if we were to very quickly fast forward through the history of pearling in the century which follows from where this dissertation leaves off in the 1930s, it was precisely this relation to the open sea which was altered. The five chapters of this dissertation have pertained to 'natural' pearling, that is, to a form of extraction dependent on oysters' patterns of pearl formation at sea. The process which replaced natural pearling, known as pearl culture, signalled a death knell for this mode of knowing the sea by removing an element of the pearling process which was hidden out at sea: pearl formation. This brought about new approaches to terrain, oyster work, and human labour, which I cover very briefly below.

'Cultured' Pearls and the Culture of Pearling

The apogee of natural pearling in terms of extraction and revenue took place in the first decade of the twentieth century, a period which also ushered in its slow decline, as natural pearls steadily lost market share to the new cheaper products known as 'cultured pearls.' This process took several decades, continuing into the mid-twentieth century. But in London and Paris in 1911, certain classes of natural pearls still cost more than diamonds and sold easily, reflecting the continued rise in the price of pearls.[6] In fact, during these boom decades, intensive extraction was inversely related to price: as the oyster reefs became increasingly depleted, this pushed up the prices of pearls

[6] Special Correspondent, 'Costlier than Diamonds: Pearls not Most Precious Gem after Rubies and Emeralds,' *New York Times*, 12 February 1911, C2.

further. By 1902, commentators were observing that Mergui's reefs were 'declining,' and ten years later, that the oyster was almost extinct.[7] By 1908, a series of fisheries in Ceylon exhausted the oyster reefs so thoroughly that fish of all kinds were scant; it took eighteen years for oyster stocks to recover.

This was also a period when there was a growing awareness of the global decimation of oyster reefs, although this certainly does not seem to have dampened consumers' interest in buying pearls. As a *Times of Ceylon* columnist put it, 'what the Australian pearlers did to the Mergui fishery has been done to *every similar pearl fishery in the world*' (my emphasis).[8] At the major sites of pearl consumption, the increase in price was cause for alarm. Newspapers in New York sensationalised the rise in price, describing how the 'Oriental Hoard is About Exhausted.'[9] Others took a more sober approach. The gem expert George Kunz explained to readers in 1909 that '[t]he advance in the price of pearls, which has been going on for twenty years, is due to the fact that pearls are not being found in numbers to meet the demand which has come with the great increase in the wealth of the world.'[10]

Global markets, however, are vulnerable to global events. The optimism during the first decade of the twentieth century when '[t]he gems now command double the price they had not long ago' ground to a halt upon the onset of the first world war.[11] As consumers' purchasing power dropped, so too did the prices of pearls and pearl shell. The value of mother-of-pearl exported from Mergui and Northern Australia to the United States dropped from $1150 to $550; pearlers claimed that their earnings failed

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[7] Anon., *Singapore Free Press,* 26 July 1900; E.A.K. Crossfield, 'Pearl Fishing in Burma', *Townsville Daily Bulletin*, 17 October 1912, 3.
[8] John Solomon, *Times of Ceylon*, dated 24 December 1910, 22, reprod. In *Western Mail* (Australia).
[9] Ibid.; See also exhausted supply mentioned in Anon, 'Demand for Pearls Larger than Supply,' *New York Times*, 11 Sept 1912, 12.
[10] Kunz, *The Book of the Pearl*, 6.
[11] Paris correspondent, 'Corner in Pearls is Raising Prices,' *New York Times*, 10 March 1912, C4.

to cover even the most basic overhead costs.[12] After the war, pearling appeared briefly to recover, but this process was dampened by unsold pearls: because pearls do not rot or decay, accumulated stores tended to keep prices low.[13]

The global downturn in demand adversely affected merchants and labourers, especially in regions where pearling was the primary source of income and employment such as the Persian Gulf. The inability to sell pearls meant that merchants were unable to procure cash, and divers did not receive wages. Those stationed in the Gulf reported that diving communities did not have the funds to cover even basic medical expenses or food.[14] As one missionary stationed in the Persian Gulf chastised Western readers in 1908, 'when you people at home don't buy pearls, we missionaries can't get our fees!'[15] This is the period which led to the oft-quoted line from the sheikh of Qatar, 'we are all, from the lowest to the highest, slaves of one master: the pearl.' Ties of dependence linked local actors not just to one another, but also very firmly now, to the world market. 'The global forces which had created new fortunes and driven the demand for slave labour would also help destroy the slave-based pearling economy,' Hopper summarizes in his account of this history.[16]

Despite these ebbs and flows in global demand and supply, the outsize causal factor which transformed the pearling industry did not come from shorter-term economic fluctuations. Instead, it was the result of the invention, mass production, and highly successful marketing campaign around a far cheaper way to produce the gems: pearl culture. Demand for pearls remained, but the processes of procurement were transformed entirely.

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[12] Anon., 'Pearl Fisheries Suffer from War,' *New York Times*, 21 August 1916, 9.
[13] *Journal of the Arabian Mission*, no. 93, April-June 1915.
[14] *Arabian Mission*, no. 93.
[15] *Journal of the Arabian Mission*, no. 67, October-December 1908.
[16] Hopper, *Slaves of One Master*, 104.

Cultured pearls ushered in a new relationship of humans to pearl-bearing oysters. 'Oceanic histories require the equivalent consideration of marine and maritime actors in all their complex relations with each other,' the editors of a recent edited volume on oceanic histories tell us.[17] The process of culturing reshaped these 'complex relations,' by moving the process of oysters' pearl formation from taking place spontaneously and at random (by human standards) in the open ocean onto the shore, in a process that humans could control.

To understand this shift, we need to briefly describe pearl culture. 'Vegetarians should not wear pearls,' the writer Victoria Finlay forwards in her public-facing account of the history of jewels, describing the emergence of pearl culture. 'Few outside the trade are aware that almost every pearl on sale today was born of the planned sexual violation of a small creature, and that considerable suffering hands on those necklace strings,' she warns.[18] The suffering and 'planned sexual violation' refers to is the process of artificially breeding oysters in captivity, growing them in controlled settings, and crucially, stimulating pearl production by insertion of a foreign nucleus and donor mantle tissue into the living mollusc, thus 'jump starting' the process of the depositing nacre to produce a pearl.

Here is one account of the culturing process as it is practiced today:

> Making cultured pearls involved forcing a piece of polished shell into the oyster's gonads or reproductive organs…[this involves] relaxing the two-year-old oysters by placing them in a warm bath. When the shells open, they insert a thin, sharp instrument, developed by dentists, and use it to make a small cut

[17] Armitage, Bashford and Sivasundaram eds., *Oceanic Histories*, 13-4.
[18] Victoria Finlay, *Jewels: A Secret History* (London: Sceptre, 2005), 81.

> in the animal's sexual organs…oysters need at least three months to recover from the trauma. Many die.[19]

Environments, both within and outside oysters, are carefully regulated. Oysters are treated with 'hormones, activating agents, anaesthetics, and minerals.' Their watery environments are controlled in terms of temperature, water quality and the presence of other creatures.[20] Oysters still die in large numbers, with many ejecting the foreign nucleus and unable to recover from the 'operation' that should stimulate pearling. As industrial and human waste outputs into the sea increase, rates of disease and death amongst oyster populations has skyrocketed.

Culturing eliminated the diver in the open sea. Although some pearl farms still use divers to retrieve oysters, there is no concern over divers being in close contact with pearls, purveying this valuable produce, as now divers interact only with oysters, not with potential sites of pearls. And yet, human work remains central to cultured pearling. Instead of arguing for the elimination of labour in pearling, we can observe how it was transformed and transferred to new terrains, such as the laboratory, or the shore-bound oyster farm, drawing on new regimes of gender, expertise, and skill. Culturing is labour intensive and gendered. Mimicking natural pearling, gender divisions follow terrain: in the water, where oysters are reared until they reach an age where they can be inserted, their cages are routinely cleaned by hundreds of men and boys.[21]

While this work at sea cleaning the oysters' baskets and nurseries is gendered as male, in Japan the *tamaire-san* or 'pearl pushers' are generally female. These women and girls work to insert between 300 to 1000 pearl nuclei per day. Their bodies and skills are now part of a new interrelation between woman, oyster, nucleus, and

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[19] Finlay, *Jewels*, 106.
[20] Shohei Shirai, *The Story of Pearls* (Tokyo: Japan Publications, 1970), 63.
[21] These teams 'remove plankton and any other millions of creatures inhabiting seawater that find the oysters or their basket homes attractive and convenient anchorages,' see Shirai, *Pearls*, 75.

environment. Surveillance and security remain features of the industry. One writer explains how 'each grafter's work, like that of each diver, is carefully tracked; in the end each pearl literally bears a pedigree of who handled it and when.'[22] The assembly of human and non-human in the production of pearls is far from eliminated or redundant, simply transformed and enacted in new terrains such as the laboratory.

Culturing transformed the terrain where intra-action between humans and molluscs took place. The work of oysters supplanted the work of divers – when one agent was domesticated, another could be dispensed with. There is no longer danger in divers associating closely with oysters, since pearl formation itself is no longer stochastic but rather designed-to-order. In one recent study of Japanese pearl culture, Kjell Ericson astutely points out that 'Japanese pearl cultivation and the products of pearl cultivation redrew distinctions between nature and culture in the twentieth century world.'[23] The central figure in narratives of the emergence and eventual dominance of pearl culture is Kokichi Mikimoto, the Japanese noodle-maker-turned-'Pearl-King' who is credited with filing the patent for cultured pearling in 1896.[24] These accounts tend towards the nationalistic, with culturing technology progressing apace with Japan's spectacular Meiji restoration.[25]

In fact, attempts to 'culture' the oyster took place across both old and new centres of pearling. Despite this, it was Mikimoto's success that drives this story, and historical actors in the early twentieth century themselves used these terms, worrying about the threat to natural pearls posed by the new 'Japanese pearls.' By 1924 Mikimoto

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[22] Landman, *Pearls*, 164.
[23] Ericson, 'Nature's Helper,' 1.
[24] The patent was based on methods pioneered by Tokichi Nishikawa at the Misaki Marine Biological Laboratory. Finlay, *Jewels*, 99; Public Relations Section, 'Kokichi Mikimoto Cultured Pearls', Japan Patent Office, 07 October 2002, https://www.jpo.go.jp/e/introduction/rekishi/10hatsumeika/kokichi_mikimoto.html; On patents and science see Tal Golan, *Laws of Men and Laws of Nature: the history of Scientific Expert Testimony in England and America* (Cambridge, MA: Harvard University Press, 2004).
[25] Shirai, *Pearls*, 27.

had stores in Tokyo, Osaka, London, and Paris.[26] A decade later, there were 350 pearl farms in Japan producing more than 10 million pearls annually; Mikimoto's methods were featured at the Chicago Exhibition of 1933 and his products soon gained traction in just about every pearl market in the world.

The death of natural pearling was not initially perceived to be certain. For several years after cultured pearls were introduced onto world markets, those in favour of natural pearls held out hope. In 1929, Harold Dickson wrote from the Persian Gulf that a 'permanent revival of the [natural pearling] industry is at last in sight.'[27] The ruler of Bahrain Hamad bin Isa, was still insisting in 1947 that 'there will always be a market for pearls.'[28] He was right, but the real question was which pearls consumers would buy. Dickson himself dismissed fears of market encroachment by explaining how 'the Japanese culture pearl can never really oust the real pearl of the Persian Gulf, firstly because the culture-pearl can never compare with the best rose-pink pearl of the Gulf, and its manufacturers cannot as yet control colour, and secondly because the culture pearl is at best like silver plate compared to the solid silver of natural pearls.'[29] The idea that cultured pearls were second-rate – akin to a coating of silver, compared to 'solid silver' of pearls – was based on initial defects in roundness and colour, as well as the key fact of 'inauthenticity.' The former was fixed over time by trial-and-error on the part of Japanese marine biologists and industrialists, and the latter could only be detected by X-ray. Although in bad times people settle for 'second-class article,' as soon as they were in better economic straits, they would return to 'solid silver once more,' Dickson wrote reassuringly.[30]

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[26] Diamond House, Hatton Garden; L.Pohl, 4 Rue d'Hautville, Paris.
[27] Dickson, *Arab of the Desert*, 483.
[28] Memo from Major Tandy, 1947.
[29] Dickon, 484.
[30] Ibid. He did however, bemoan changing consumption patterns, explaining how 'a girl to-day asks for a car, where formerly she craved a pearl necklace.' Dickson, *Arab of the Desert*, 485

Once again, consumption and value hinged on the question of visibility. Once culturists in Japan perfected the shape and lustre of their pearls, it was clearly evident that with the naked eye (or any other non-technologically assisted means), cultured pearls were virtually indistinguishable from natural. Unlike diamonds or emeralds, pearls were not transparent or semi-transparent to the gaze. Only an X-ray, which would see past the opacity of the pearl, would reveal that at the centre of the pearl there was a manufactured rounded nucleus, rather than an organic or inorganic oceanic particle from the sea. This time around, the regime of visibility and value was embedded within pearls themselves.

Attempts to domesticate the oyster, however, were by no means exclusive to Japan. In fact, the archives of the Indian Ocean's pearl fisheries reveal that knowledge of pearl culture methods circulated across sites of natural pearling. As explored in *Chapter 4*, attempts to rear oysters in ersatz natural habitats, to control their breeding, to work on their transplantation and improve their undersea ecologies had long legacies stretching into the nineteenth century, and indeed, even earlier, as Samuel Ostroff's work demonstrates. By 1904, officials in Mergui were carefully reading copies of a news reports describing Japanese pearl culture.[31] These administrators also paid close attention to similar experiments with 'artificial breeding of oysters' in the Gulf of California and in France.[32]

Knowledge about oysters and how humans might domesticate them travelled in new global circuits of expertise. As Hannah Eastham has catalogued, James Hornell, for instance, travelled as the 'Scientific Manager of Pearl Fishing Company Ceylon,'

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[31] Annotated extract from the *St Louis Globe—Democrat* in 'Breeding of Pearl Oysters', AG 1/7, 1109 (1904), YNA. Officials explained how 'the ingenious Japanese have shown the way. In their country the Bay of Ago, a long and narrow reach of calm water has afforded considerable supplies of pearls for centuries past. The fishery having become to some extent depleted, artificial propaganda was tried, and in fifteen years the production has been augmented nearly twentyfold.'
[32] Ibid.

to Japan in 1909. Here he met Kamikichi Kishinoue, the Director of the Marine Products Bureau, who, he explained in his diaries was 'well acquainted with my work.'[33] The fact that Kishinoue followed Hornell's publications on Ceylon oysters reveals that the science of oysters and the cultivation of pearls did not take place in isolated national frames. Hornell visited the Marine Biological Laboratory at Tokyo University and Mikimoto's pearl farm, meeting Mikimoto himself and taking a tour, although the sites into which he was permitted to enter and observe were tightly regulated.[34] Two years after this visit, working for the Indian Fisheries Department, Hornell continued to pursue scientific operations.[35] He soon believed that he too, had cracked the code for producing synthetic pearls. In 1909, the Director of Fisheries Department, Frederick Nicholson, announced triumphantly that 'Hornell has been successful in obtaining spherical detached pearls, in every respect pearls of the ordinary character,' although the potential funding for a cultured pearl farm in South India seems to have been cut short by the first world war.[36]

Similarly, in Burma, by 1912, a private corporation, the Burma Shell Company had success with oyster culture. One visitor described the process of using suspended cages to rear oysters at eighteen to twenty feet below the surface. 'Here they are kept until they have grown strong and fat, when they are taken to the operating room, very carefully opened just enough to admit the operation being performed and returned to the cages for one year,' he explained.[37] These connections owed much also to older imperial circuits: John Solomon, who joined the Burma Shell Company to work on artificial shell culture, for instance, had also been scientific adviser to the Ceylon Pearl

[33] Hornell, visit to Japan via Saigon, 11 June 1907, 44. Haddon Papers, UL.
[34] Hannah Eastham's unpublished work on this is instructive here.
[35] Letter from F. Nicholson, Director of Fisheries to the Secretary of the Commissioners of Land Revenue, 25 January 1909, Revenue G.O. 601, TNSA.
[36] Letter from Frederick Nicholson, 2 August 1906, in G.O. 1736, Revenue Department, TNSA.
[37] Ibid.

Fishery Syndicate of 1904-1912.[38] Once again, these processes and their applications are harder to trace in the archive since the 'secret' of culturing methods was 'very carefully guarded.'[39] Attempts to domesticate the oyster were by no means exclusively Japanese.

More Certain Futures: The City, Waged Work and Oil

Changes in market conditions and the availability of cheaper substitutes changed the relationship of technology to labour. In former sites of free diving, one outcome of this was a greater allowance for the use of mechanical dress. By the 1940s, British authorities in the Persian Gulf suggested that the Gulf's restrictions on 'mechanical modes of diving' should be abolished – the same prohibitions they had insisted on codifying formally one decade prior.[40] The rulers of Kuwait and Qatar allowed diving suits to be used for pearling, agreeing with British administrators appraisal that '[divers] ought to be allowed to make what they can out of the local pearl while there is a market left.'[41] The question of labour and the impacts of mechanisation, remained, however. In Bahrain, for instance, Sheikh Isa was firm that the use of diving suits would result in a situation where 'very few men could scour the bed of the sea.' This may have been an astute political judgement in a nascent state where the majority of the adult male population was employed in the trade, and the prohibition on diving suits around Bahrain was maintained and persisted into the 1950s.[42]

By the mid-twentieth century, Indian pearl merchants had almost entirely changed their sources of supply to Japanese pearls, which were one tenth the price of

[38] Anon, 'Big Prices for Pearls,' *The West Australian*, 25 December 1913, 5; 'Pearls, rubber, tea,' *Times of Ceylon,* 24 December 1910, 22.
[39] E.A.K. Crossfield, 'Pearl Fishing in Burma,' *Townsville Daily Bulletin,* 17 Oct 1912, 3.
[40] Ban on diving suits see correspondence with Tritonia Limited, dated 15 May 1931, R/15/2/122, IOR.
[41] Letter from J. Pelly, Agent in Bahrain, to the Persian Gulf Resident, Bahrain, dated 27 March 1947.
[42] Tandy memo; 'Control of Pearl Fishing in the Persian Gulf,' (1950), FO 371/114690.

Persian Gulf pearls.[43] Despite legal challenges in Paris, Mikimoto was able to sell his pearls in the same forums as natural pearler dealers, and to market these as comparable commodities. Although merchants in Bahrain applied for special allowance for a quota of imports to be allocated specifically to the natural pearls of the Gulf over Japanese produce, these older imperial relationships no longer held power to prompt British authorities to intervene in the twentieth century.[44]

And yet, it was not just consumption patterns, but also supply-side factors that eventually crippled the pearling industry. In particular, the discovery and growth of oil in the Persian Gulf offered new, steady waged labour to the formerly seagoing workforce.[45] But crucially, oil offered contract, waged work for the hundreds and thousands of men who had formerly laboured on the pearl banks. For one articulation of how the arrival of new forms of employment contrasted to the preexisting pearling industry, we can turn to an Arabic language poem written by 'Atiyyah ibn 'Ali in mid-1930s Bahrain titled 'Debate of Pearl-Diving and Oil-Wells.' Over one hundred lines, two characters, 'Oil Wells' and 'Pearl Banks,' argue. The poem offers a useful way to read the contradictory, new anxieties and opportunities posed by oil. The text proceeds as follows:

Oil Wells (gendered as feminine) begins, speaking to the Pearl Fields:

> Please don't go on like that! It's really rather rich,
> To brag about your faults, indeed! Your men are black as pitch!
> For food you give them year-old dates in which the maggots diver;
> They eat, and from their mouths there flows a sticky oozing river.
> And as for all your loans and cash, of which you boast and prate,
> Pipe down a bit, and on that score please don't expatriate!
> Ten or twenty's all you give—if forced—to those brave hearts;
> That doesn't buy a cotton cloth to hide their private parts!

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[43] Letter from E.P. Wiltshire, Political Agent, Bahrain, to High Commissioner, Delhi, 29 January 1962, FO 371/162830.
[44] 'Pearl Fishing in Bahrain,' FO 271/162830.
[45] The discovery of oil, in the words of some Gulf dwellers, meant that 'our world turned upside down,' see, *Honour is Contentment*, 1.

Here the personification of oil makes accusations made against the labouring conditions on the pearl banks around malnutrition ('year-old dates') and paltry remuneration. Debt is central to the critique here, with the reference to 'loans' or the *salaf* system under which divers were paid advances. Already then, the normative framework around indebtedness was changing in response to the possibility of steady, waged work. The cultural idea of the diver too is changing, already remembered nostalgically as a 'brave heart', to whom the proceeds of pearling are denied, in contrast to British administrator's and some former pearling captain's views of divers as lazy, risk-taking, idle folk.

The opportunities of oil, however, were equally elusive. Consider pearl-diving's response:

> I am that shining orb, the pearl! My throne is glittering gold,
>
> Inlaid in royal diadems, a beauty to behold!
>
> God fashioned me to be the cure for every ill (the best!)
>
> I glean and shine in necklaces on every lady's breast.
>
> But you, formed out of filth and dirt and maladies galore,
>
> All smell your stink from miles away; it makes their heads feel sore!
>
> From the bowels of the earth you come, like shit, and ruin folks!
>
> Hell's very depths are your domain, whose fires the Devil stokes!

The notion of associations of particular commodities comes to the fore, of pearls allure tied to elites, beauty, and luxury, 'inlaid in royal diadems' and a 'beauty to behold,' compared to the perceived dirt and pollution of oil. A primary line of attack against the oil fields is the issue of depth and the subterranean, where to draw oil is to reach into hell. The olfactory is powerfully summoned as an invective against oil. Its origins are

dirtied and tainted, not a thing of beauty but of 'filth and dirt' compared to the purity of the pearl.

'Atiyyah ibn 'Ali offers a story centred on labour and modes of production, and the sensory, associative, affective, and material comparisons of two kinds of work. Regardless of the posited filth and stink of working with oil, pearl divers left in thousands to work the oil fields. There is much more work to be done on teasing out precisely how these managements and organisations of labour forces compared.[46] It is difficult to say to what extent this draining of labour from pearling would have taken place if pearling revenues continued to rise, but certainly the prospect of regular wages, rather than the bonds of debt and repayment and variable returns offered a boon to divers. As one diver was recorded explaining to missionaries in the Gulf, in the face of alternative sources of employment, 'pearl diving is not a fine way to make a living.'[47] Similarly in the Gulf of Mannar, parava divers frequently turned to waged work, *kuli toleil*, rather than older caste-based forms of maritime work, *jati toleil*, based on share systems of profits. Increasing urbanisation loosened the bonds of former corporate caste solidarities, especially as the cities offered more steady ways of making personal incomes.

Sexual Divisions of Labour between Sea and Land

Another theme which could be built out further in additional work is that of gender. 'Gender is a fundamental component of seafaring, as it is of all human society,' Margaret Creighton and Lisa Norling remind us.[48] It is a striking fact of global pearling labour that the sexual divisions of work in terms of pearling vary based on region: in the Indian Ocean, both the Gulf of Mannar and the Persian Gulf saw entirely male

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[46] For starting work on this see Aqil, 'Mode of Production.'
[47] Paul J. Harrison, 'Monday Mejlis,' *Arabian Mission* 166 (Oct-Dec 1933), 13-15.
[48] *Iron Men, Wooden Women*, vii.

workforces. There are virtually no records of women divers working on any considerable scale in either of the Indian Ocean's major fisheries. In contrast, sites like Korea and Japan have long-standing, celebrated traditions of female divers. The core question, then, is why is Indian Ocean diving gendered as male, whereas diving in the north-western Pacific is predominantly gendered as female?

In both Japan and Korea, diving is an almost exclusively female occupation. This includes the famed female *ama* divers of Japan or the *honyo* or *chomsu* divers of Korea. For centuries these women went out to sea to dive and retrieve maritime produce including abalone, coral, seaweed, oysters, mussels, and other bottom-dwelling creatures. These women were also free divers, worked comparable depths to those of the Indian Ocean, and used no equipment save for a weighted stone, and by the late nineteenth century, also diving googles in some cases. In colder waters, garments for swimming provided insulation. The prominence of the woman diver in Japanese and Korean coastal communities forces us to ask structural questions about the organisations of maritime labour, its relationship to broader social patterns, financing and global markets.

In maritime history more generally, the accepted pattern is that men go to sea while women stay on the shore. The sea is gendered as a male exploratory space, full of risk and adventure, while the shore – and by extension, the home and family – are the female domain, stable, safe, and domestic. Of course, fisheries and marine anthropologists have long argued that in economic terms, the work of women on the shore has long been critical to coastal economies.[49] Women are tasked with repairing nets, preparing food, looking after children, curing fish, selling fish in the market, and

[49] K.P.G.L. Sandaruwan, 'Daily routine activities of the fisherwomen in the North-Western Province of Sri Lanka,' *Proceedings of the National Aquatic Resources Research and Development Agency (NARA), Scientific Sessions* 2016, 161-163.

managing household accounts to keep coastal economies afloat. Although men's work at sea may be more visible, women's labour on shore was, and is, an intrinsic part of many sea-based economies.

In addition to these direct contributions to economic reproduction, we might also add social and sexual reproduction. That is, women bore children, and long weeks at sea were, upon first glance, not conducive to giving birth or raising children, tasks which required a land-based home. And yet, these neat divisions of sex between sea and land do not hold for all case studies. The example of the Moken divers surveyed in this dissertation, for instance, clearly challenges this notion that the home had to be shore-bound. For the Moken, kin or family unit moved with the boat as home between the land and sea. Rather than seeing particular terrain as gendered and exclusively male or female, here wives, children and husbands moved across the water and worked together to fish, dive, and procure food. It should be pointed out that even in Moken societies, certain tasks, such as weaving mats, were still gendered as female, the domain of wives and daughters, rather than men, who felled trees and carved boats during this time.

Whereas in contrast to South India and the Persian Gulf, the Moken notions of home stretch shared familial space between sea and land, in the Pacific context, the Indian Ocean's organisation of diving work was inverted. That is, in diving towns and villages, the shore was gendered as a space for male leisure, while the sea was a space of female work. Describing women divers in Kuzaki, Japan in the mid-1980s, Dolorez Martinez describes the affective registers of companionship, joy and friendship that characterise the work of female divers, who sing songs, make conversation, and spend

'hours by the fire after diving, full of food and gossip.'[50] Diving endowed women with economic power through their earnings, which enables them to keep their households afloat.[51] The woman was still responsible for the household, and for important tasks such as ancestor worship, but she was also capable of working seasonally at sea to raise cash income for her family.

Several hundred kilometres further west, writing on Cheju Island in South Korea, the anthropologist Hae-Joang Cho has sketched the centrality of diving to female cash income, which results in a 'tremendous economic advantage' to women.[52] These accounts of female diving transcend economics. Instead, both Cho and Martinez highlight emotive, affective social states, emphasizing 'joyful labour,' the 'pleasure of being in the sea,' and the warmth of close, intergenerational female companionship facilitated by time on the shore, on the boat, in the sea and in other shared social spaces. In the case of the *ama* and the *honyo*/*chomsu* we find the equivalents of the autonomy and fraternity of male shipboard cultures familiar from other maritime contexts but performed and enjoyed in this case by women.[53]

Gender and associations of domesticity and suitability for child-rearing were not, then, antithetical to work at sea, but conducive to it. As one of Martinez's informants summarizes: 'Women can deal with the wild, the unfettered; after all, they socialize children.'[54] Working in unreliable nature and working with temperamental children were mutually reinforcing experiences. The majority of these women continued to dive during their menstrual periods and pregnancies.[55] During the season,

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[50] D.P.Martinez, *Identity and Ritual in a Japanese Diving Village: The Making and Becoming of Person and Place* (Hawaii: University of Hawaii Press, 2004), 105.
[51] Martinez, *Japanese Diving Village*, 100.
[52] Hae-Joang Cho, 'Internal Colonisation and the Fate of Female Divers in Cheju Island, South Korea,' 152.
[53] Margaret S. Creighton and Lisa Norling ed., *Iron Men, Wooden Women: Gender and Seafaring in the Atlantic World, 1700-1920* (Baltimore: Johns Hopkins University Press, 1996), 55.
[54] Ibid.
[55] Ibid. 153.

men took on the tasks of housework and childcare. Stereotypes about the diligence of women and the idleness of men abound, as in the following song from Cheju Island:

> Leaving behind a crying baby
> Leaving behind a loving husband,
> I've come here to dive
> Since money makes a better life
> Working hard and making money
> To support children. [56]

'Working hard and making money' as in this song were not divorced from 'support[ing] children' but rather better equipped women to perform their roles are caregivers. To dive could also be to devote oneself to the care of the domestic and kinship unit.

But there are key differences between the Indian Ocean's divers and these women divers in the Pacific. Primarily the fact that the *honyo* and *ama* worked for lower value, smaller-scale local seafood economies, rather than sites integrated into long-distance global markets. There were divers who worked on a variety of edible maritime produce, rather than being occupationally specialised only around a luxury, high-value community, like pearls. Pearls were incidental to other kinds of fishing activity, not the primary reason to go to sea. Although these were eventually cash-based, rather than subsistence economies, they nonetheless operated on smaller, local circuits compared with the exposure of pearling sites to empire, political violence and jockeying, and foreign capital. The money to be made from pearling acted as a magnet for political conquest and control in a way that these lower-value seafood markets did not. They remained, for the most part, outside of the world economy.

There were also seasonal and spatial elements to consider. Most women divers worked reefs which could be reached in daily journeys from their coastal home villages, whereas the migratory and seasonal circuits for divers working in Mergui, Mannar or the Persian Gulf could stretch into several weeks or months. Thus, time away from

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[56] Chi Soon Lee, 1974, qtd. in Cho, 'Female Divers,' 160.

home working at sea may have been uniquely facilitated by the close distance of the sea and the reef to women's homes. Diving could be a daily activity, instead of a task that took women away for months at a time, as in the Persian Gulf, or other Asian divers and sailors working in Australia and Burma.

Despite these caveats, the case of the *ama* and *honyo* make it clear that there is nothing deterministically biological such as menstruation, childbearing, or lung capacity which gendered one job as male and another as female. Other features of work were common across contexts despite the fact that they were differently gendered. One primary example is the fact that diving skill and knowledge was passed down inter-generationally, and within communities, in both the Indian and Pacific Oceans. And as a corollary to this, in both cases, seniority often implied skill, and boats had relatively fixed and strict hierarchies. Groups acted collectively and socially, which helped minimize the risks inherent to the work, and had rich ritual and cultural lives. In contrast to biologically deterministic arguments which favour male divers in terms of stamina, capacity to withstand hardship or the depth to which they can dive, the most prized skills for diving included not brute strength or weight but rather stamina, pace, and intuition for detecting and hunting submarine creatures. In socio-cultural contexts where it was acceptable for women to work and to go to sea, then they too, could perform as exceedingly efficient divers.

In future work, it would be useful to build out this element of gender and maritime work by exploring the related theme of the household and household economies, which has not featured centrally in this dissertation. What the relationship of the pearl diver to the home economy? Did men working in Southern Burma send home remittances? How did women manage for several months while men went to sea? An approach to the entire family/kinship unit would require consulting different

archives –district and administrative reports for instance – from regions where men were absent, rather than the fishery archives, where the men laboured. In a sense, by following the fishery archive, I have inadvertently reproduced the idea of the diver as worker/economic actor, whereas different sources might also reveal the diver as father, husband, or participant in other cultural, domestic, and economic zones and the other actors associated with the household economy such as women and children.

The Future of Pearling: New Mollusc-Human Interfaces?

For Mikimoto to win the day for his far cheaper products, he had to foreground the work of the oyster. In one pamphlet, he explained that the pearls produced by process of culturing are 'deposited in concentric layers upon a tiny nucleus, just as the finest specimens of pearls from other Oriental seas' (Fig. 1).[57] He hired scientific experts – men including William Herdman, who we met in Chapter 4, *Science* – to corroborate that these pearls were, in every sense, produced by the oyster. That is, if pearls were valued because they were organic and oceanic, cultured pearls did not lose their appeal, primarily because they were still the products of internal processes occurring in molluscs, even if humans had been drawn into a more dramatic inter-relation to this process by introducing the nucleus themselves, apart from the random activities of the ocean (random by human metrics of understanding the world, at least).

Today, industry standards for gemstones such as diamonds, emeralds and pearls are guaranteed and sanctioned by global gemmological institutes. These cooperative associations did not yet exist in the early twentieth century, but Mikimoto's new pearls were challenged in the premier pearl importing nation of France. The emblematic case here is that of the French importer of cultured pearls, Lucien Pohl, who was sued by the *Chambre Syndicate des Perles* in Paris in the 1920s. The *Chambre* was an association

[57] K. Mikimoto, *The Pearl* (Leon Ullman, Paris, 1924).

of jewellers who maintained a monopoly on the import of pearls. The final outcome off this contest was the resolution that 'culture pearls produced by scientific stimulation of the oyster are in no sense false or imitation pearls, and they can be sold as real pearls without any indication of their origin.'[58] In other words, by maintaining the place of the oyster in the pearl-production process, the 'real'-ness of the pearl was preserved.

Today, China has surpassed Japan's early world dominance and is the largest producer of cultured pearls in the world.[59] Many of the former pearl-bearing oyster reefs have disappeared entirely or are a fraction of their former size. This is both a legacy of intensive overfishing but also of broader environmental change and human activity at sea. In some regions, natural pearls are retrieved as biproducts of the seafood industry.[60] Even in Australia, at a site described as 'the only wild fishery of its type in the world,' those who dive for pearls do so not on wild oyster reefs but on a 'remote network of farms stretching more than 1,000 kilometres across the northwest coast of Australia.'[61] Pearl 'farms' to procure cultured pearls stretch from Abu Dhabi to Mexico to the Philippines, although global warming is an increasing threat.[62]

In the Gulf of Mannar, the memory of pearling has mostly faded into oblivion, although small-scale fishers continue to dive for other lucrative sea produce such as sea cucumber, and occasionally encounter pearls. The Tuticorin branch of the Central Marine Fisheries Research Institute in India is working on pearl culture methods as well

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[58] Mikimoto, *Pearl*; See 2/G-18 'Culture Pearls of Japan' at National Museum Library, Colombo; Jacqueline Viruega, 'Les entreprises de bijouterie à Paris de 1860 à 1914', *Historie, Économie & Société* 4 (2006), 79-103.
[59] Saleem Ali and Laurent Cartier, 'China's Pearl Industry: an Indicator of Ecological Stress,' Our World, online, 23 January 2013, https://ourworld.unu.edu/en/chinas-pearl-industry-an-indicator-of-ecological-stress
[60] 'Regional Conch Fisheries Management and Conservation Plan,' www.fao.org/3/a-i7818e.pdf
[61] Kenneth Scarrat, World Jewellery Confederation (CIBJO), 'CIBJO Special Report 2019: Pearl Commission', http://www.cibjo.org/congress2019/wp-content/uploads/2019/11/CIBJO-Special-Report-2019-Pearls.pdf, 3.
[62] Fluctuations in water temperature, ocean acidification and changing plankton profiles affect the survival rate of oysters and their overall growth , CIBJO Special Report, 5.

as other initiatives such as edible oysters as a potential food source for local populations who have habitually not eaten oysters.[63] The South Indian fisheries establishment, akin to Ceylon's, emerged out of the colonial infrastructure and institution of the pearl fishery, and Nicholson and Hornell are still uncritically cited on contemporary works of marine science and Gulf of Mannar ecologies.[64] The same is true of marine biology in Myanmar.

If eliminating the diver and the vagaries of the ocean was a decisive change in the commodification and industrialization of pearls, will eliminating oysters be next? This would seem to be the general trend based on global jewellery markets, where gold, silver, or diamonds are increasingly under criticism for the unethical labour practices and ecological degradation that are involved in their extraction. If terrain is trouble, then moving these processes to the laboratory seems to offer solutions to modes of engaging with nature which are destructive or harmful. Take the company known as *Pure Grown Diamonds* (until 2021 the company was known as *Gemesis*), which markets itself as a 'pioneer in above-ground, laboratory grown diamonds.' On its website, the company advertises that their lab-grown produce mean consumers are liberated from having to 'choose between beauty, quality and conscience.'[65] As implied in its former name, which is a play on genesis, it is the origins of the commodities that is an issue, and that holds the possibility now for new kinds of intervention.

The International Gemmological Institute still requires *Pure Grown Diamonds* to be marked as 'synthetic.' However, compared to diamonds, the oyster and many of

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[63] 'Tissue culture of marine mollusk for in-vitro pearl production,' Central Marine Fisheries Research Institute, CMFRI, https://www.cmfri.org.in/tuticorin; C.P. Suja et. al., 'First characterization report of natural pearl of *Pinctada fucata* from the Gulf of Mannar' *Biotechnology Research and Innovation* 2(1) (2018), 58-62.
[64] See use of Nicholson and Hornell for example in Bavinck, *Marine Resource Management*, 54-56.
[65] Pure Grown Diamonds, online, accessed 22 September 2021, https://puregrowndiamonds.com/about/.

its processes and mechanisms remain largely obscure. In 2009, scientists were still writing that 'the biology of pearl oysters is poorly understood.'[66] Scientists are working to make nacre in laboratories, given that it is 'tougher and stiffer than most plastics,' but this material, which oysters create with little fuss (at least as far as we can understand) is still prohibitively expensive for humans to produce in a lab.[67] Apart from their crystalline shells, on an even more focused level, the genetics revolution transformed the study of oysters just as it did other species. In 2019, a team of scientists working on Arutua atoll in the Pacific extracted cellular RNA from grafts of tissue taken from several oysters.[68] They concluded that the colour of pearls was 'determined by complex interactions between these recipient and donor genomes and the environment,' highlighting once again how the precise mode of seeing and reading the relation of the oyster to its environment (and human modes of understanding this) remains unsettled.[69]

Can we then project a day where one might produce pearls without oysters? Would these objects still have value, without the work of oysters? This is unlikely to transpire soon, since the precise mechanisms by which oyster construct crystal structures around foreign particles remains inscrutable. In fact, although there are ways to produce fake pearls such as grinding up nacre and pressing it into spherical moulds, these globules are hardly pearls from a crystallography perspective. Organic membranes in the oyster seem to be able to 'force' crystal structures which humans cannot yet reproduce. Molluscs grow crystals along axes which are kinetically not preferable, for instance. In the words of one chemist studying biomineralization in

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[66] M.H. Gervis and N.A. Sims, *The Biology and Culture of Pearl Oysters (Bivalvia: Pteriidae)* (Manila: International Centre for Living Acquatic Resource Management, 1992)
[67] Ben Cusack, 'Mother-of-pearl grown in lab could one day be used to build houses on the moon,' *The London Economic*, 24 April 2019, https://www.thelondoneconomic.com/news/science/mother-of-pearl-grown-in-lab-could-one-day-be-used-to-build-houses-on-the-moon-130166/. One research group at Cambridge is working on determining this process because of the vast (and lucrative) industrial applications that it might have if we could harness this technology.
[68] Ky et al., 'tissue morphotype with shell and pearl colouration.'
[69] Ibid.

oyster: 'Producing pearls is a lot more complicated than producing artificial diamonds which is just carbon put under high pressure in a combustion chamber.' [70] For now, we continue to dwell with molluscs.

[70] Conversation with Dennis Mayk, dated 22 September 2021. I am grateful to Dennis for many conversations about nacre and biomineralization.

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