

Iterations of Ichthyology:
Science, Industry, and the Asian Marine Environment, 1822-1941

By

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ABSTRACT

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This dissertation analyzes the role fish and ichthyologists played in the rise of urban society, plantation agriculture, and imperial expansion in Southeast Asia in the mid-nineteenth and early twentieth century. It focuses on how the Southeast Asian shelf—a body of water that stretches from the Bay of Bengal to the Philippine Sea—became the world’s foremost site of commercial exploitation and scientific study, profoundly reshaping the place of the region and its waters in the modern era.

Built around seven chapters, this dissertation traces how ichthyological knowledge was produced in the nineteenth century, marking a regional turn in the study of fish in South and Southeast Asia. Building on this ichthyological knowledge and its currents, the study then explores how this knowledge was institutionalized in the early twentieth century by following the development of public aquariums in the Indo-Pacific Ocean. By the interwar period, local and foreign scientists were producing new knowledge about the Southeast Asian shelf through a web of marine biological laboratories. At the same time, the economic pressures to supply fish, and certain kinds of fish specific to certain kinds of food cultures, required an expansion of fishery operations and the use of new technologies. During the interwar period, overseas fishers not only dominated the production of fish, but they also transformed Southeast Asia’s pelagic waters into a modern tuna frontier. And as these industrial fishers and Japanese ichthyologists opened the region’s tuna grounds to mass consumption, they also exploited previously untouched reef complexes. From bases

at Singapore, Batavia, and Manila, Okinawan crews provisioned the region's colonial cities and plantation settlements with cheap, abundant supplies of fresh fish, thereby creating an interwar protein boom. The dissertation concludes by revealing how fish from the *Nan'yo* (Southeast Asia and the Central Pacific) fed and fueled Japan's maritime empire from 1914 to 1941, showing the ways in which this prewar exploitation of the Asian marine environment presaged postwar conflicts over the protein riches of the South China Sea.

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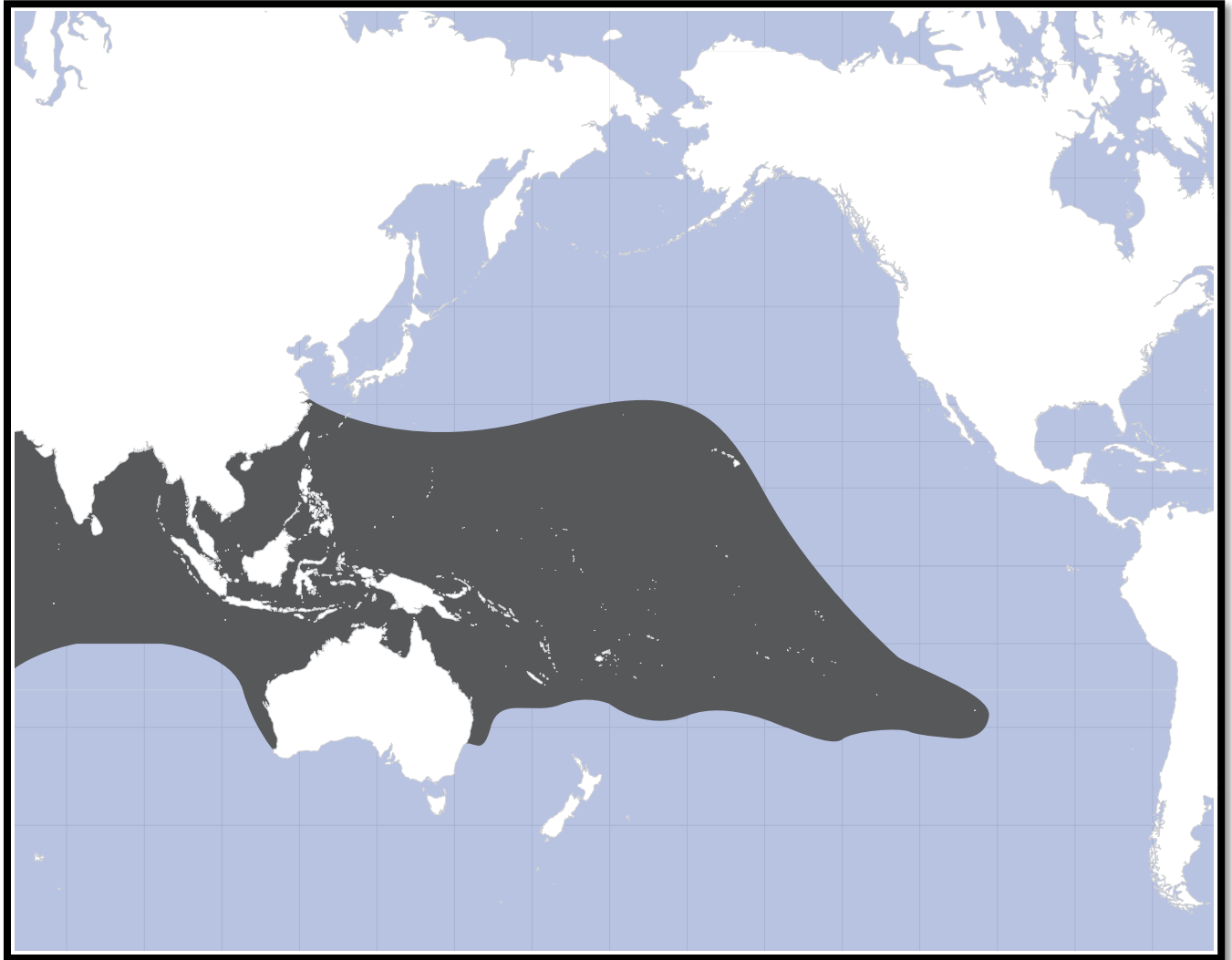
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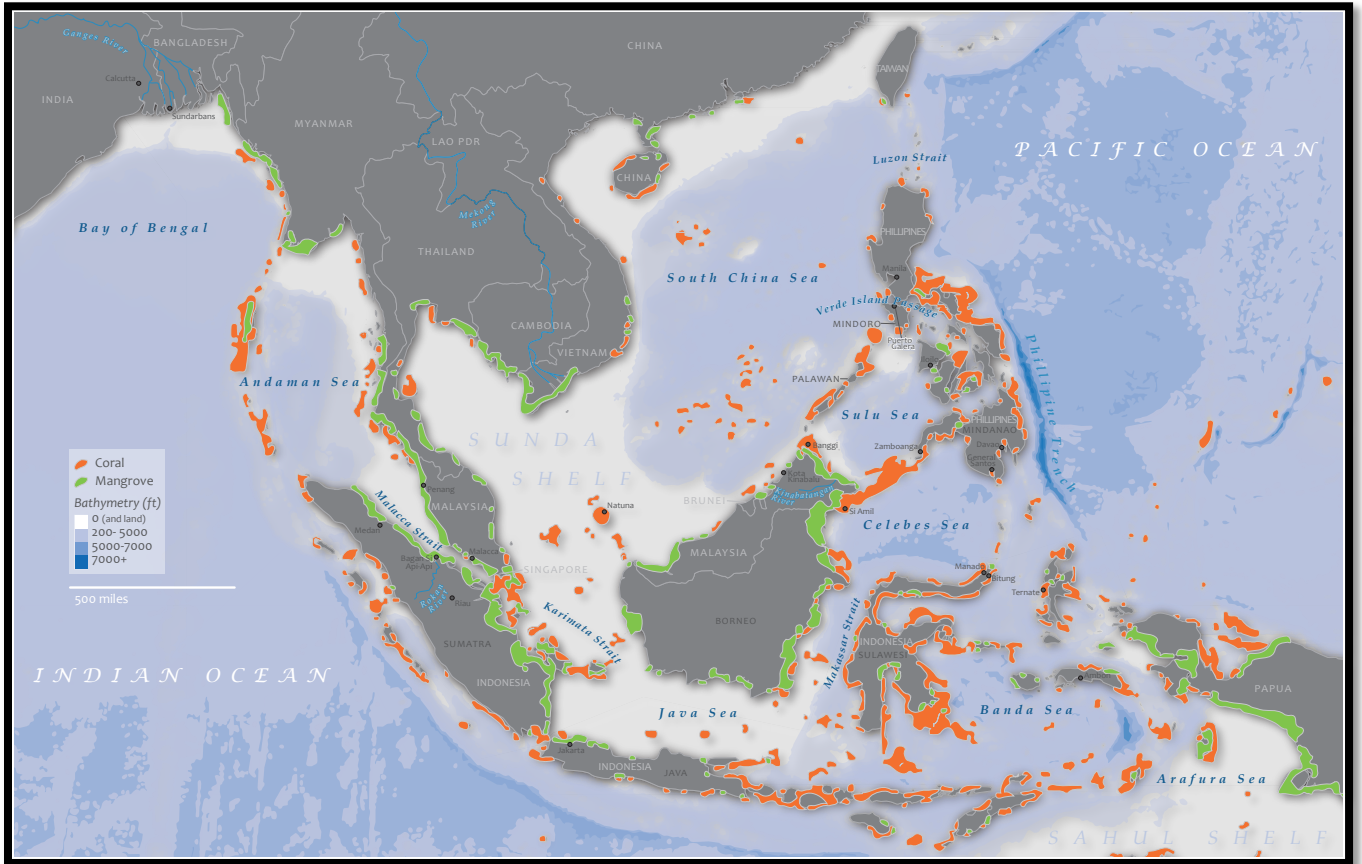
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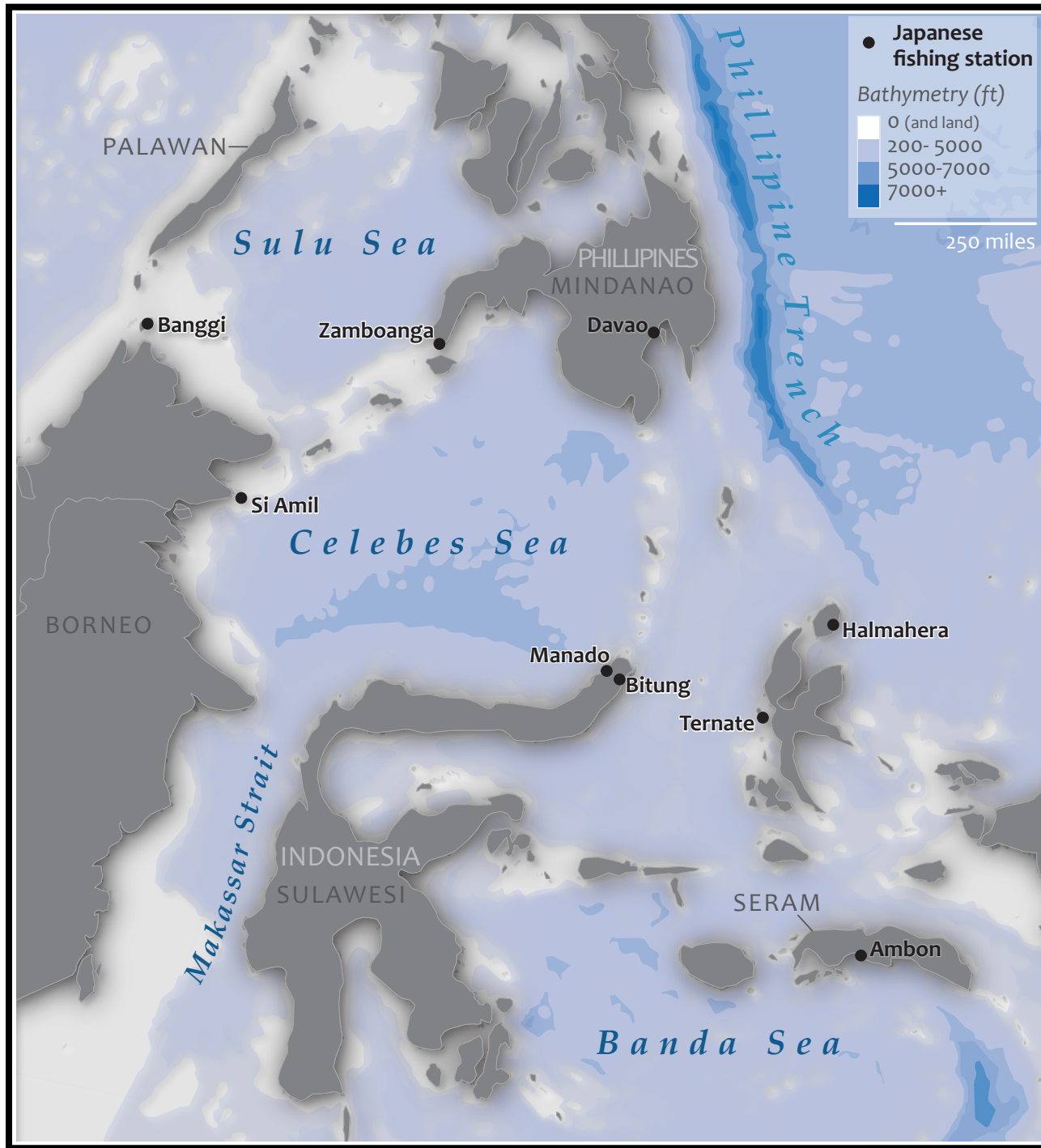
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Indo-Pacific Region



Southeast Asia Showing Coral, Mangrove, and Bathymetric Data



Japanese Tuna Fishing Stations in the Celebes Sea Zone in the 1930s

CHAPTER ONE

Introduction

Between the mid-nineteenth and the early twentieth century, Southeast Asia's ocean environment became the globe's foremost site of industrial exploitation and scientific study, profoundly reshaping the place of the region and its waters in the modern world. The Southeast Asian shelf—a body of water that stretches from the Bay of Bengal for 3,000 miles to the Philippine Sea—was harnessed to feed the rapid growth of colonial plantations, port cities, and modern states. Fish powered these human currents that opened the region's agricultural frontiers and swelled its cities. In equal measure, the mass production of cheap protein made these modern transitions possible. By 1941, Southeast Asia was consuming four times as much fish protein as it did during last quarter of the nineteenth century. At Bagan Si Api Api, a Hokkien fishing village established at the estuarine nexus of Sumatra's Rokan River and the Malacca Straits, Southeast Asia was also home to one of the world's largest centers of fish production, second in tonnage only to Bergen, Norway.¹

But why fish? Several factors explain why fish mattered most to the processes of urban, social, and agricultural change in Southeast Asia. First, the climate and topography of the region were not conducive to large-scale animal husbandry. Monsoonal rains coupled with high humidity worked against private and public efforts to raise cattle (*Bos*

¹ On the leading place of Bagan Si Api Api as a global center of fish production in the late 1920s and 1930s, see "Bagan Si Api Api, de Tweede Vischstad der Wereld," *Algemeen Handelsblad* (31 March 1928): 14; "Bagan Si Api Api," *Indische Courant* (10 March 1928): 5; "De Eerste of de Tweede? Bagan Si Api Api," *Bataviaasch Nieuwsblad* (19 March 1928): 1; and, "La consommation des produits alimentaires aux Indes Néerlandaises," in *Bulletin Economique de L'Indochine: Industrie, Commerce, Finances, Statistiques* (Hanoi: Gouvernement General de L'Indochine, 1930), 703A.

taurus) for beef consumption. There was also a lack of grazing and herding lands as most of these suitable types of terrains were committed to rice cultivation, the staple food in monsoon Asia.² And with wide swaths of the region's lands focused on the commercial production of rice, the local value of bovines was not as a food source but as a work animal.

The circulation and consequence of epizootic diseases further made fish the only viable source of mass protein in interwar Southeast Asia. In the late nineteenth and early twentieth century, the ravages of rinderpest, surra, and anthrax were deleterious to bovine populations, affecting both imported cattle (consumed largely by urban Europeans) and local carabao (*Bubalus bubalis*). The case of rinderpest clearly illustrates the scale and scope of these diseases' impact on the Indo-Pacific and its regional capacity to grow beef for popular consumption. In the Philippines, the earliest report of rinderpest (or *epizootia*) appeared in 1886 and was connected to Manila's importation of cattle for its Spanish residents.³ By 1908, and with little end in sight, epizootic outbreaks were widespread. "From one end of the Islands to the other these diseases [rinderpest, surra, and anthrax]," wrote one colonial commentator, "have destroyed thousands upon thousands of work animals. In many sections agricultural development has been almost paralyzed and the country as a whole has suffered incalculable losses."⁴ Similarly, in colonial Malaya, imported bovines such as bollocks opened the Peninsula to repeated cycles of rinderpest ravage. From 1903 to 1904, there were outbreaks in Singapore, Kedah, Malacca, Perak, and

² See Vernon D. Wickizer and Merrill K. Bennett, *The Rice Economy of Monsoon Asia* (Palo Alto: Stanford Food Institute, 1941).

³ Gines Geis Gotzens, *Una Epizootia en Filipinas* (Manila: Tipo-Litografia de Chofre y Comp., 1888), 18-19 and Daniel F. Doeppers, "Fighting Rinderpest in the Philippines, 1886-1941," in *Healing the Herds: Disease, Livestock Economies, and the Globalization of Veterinary Medicine*, eds. Karen Brown and Daniel Gilfoyle (Athens: Ohio University Press, 2010), 108.

⁴ G.E. Nesom, "Editorial," *Philippine Agricultural Review* 1,3 (March 1908): 107.

Penang.⁵ By the 1930s, the region was still waging a “war on rinderpest.”⁶ Because of the radials and ravages of these epizootic diseases, cattle and other bovines were difficult to maintain and costly to consume.⁷ During this period, Southeast Asia formed a “disease zone” that effectively barred large-scale production of livestock.⁸

But the spread of epizootic diseases was not the only reason why bovines and hogs were difficult to raise on any industrial scale. The greatest impediments challenging the mass production and popular consumption of beef and pork in Southeast Asia were religion and culture. Among the hundreds of thousands of Indian migrants who came to work the region’s rural plantations and urban ports in the late nineteenth and early twentieth century, many were either Hindu or Muslim.⁹ If Hindu, they were prohibited from consuming beef and if Muslim, eating pork was forbidden. The Indian Muslims, many having come from Tamil Nadu, simply added to Southeast Asia’s dominant faith. The majority populations of Indonesia, Singapore, and Malaysia embraced Islam, and thus constituted one of the world’s most populous Muslim regions. Moreover, most residents of island Southeast Asia reserved the slaughtering of costly goats, pigs, and *carabaos* (water buffalo) for life events, cultural rituals, and religious ceremonies.¹⁰

⁵ “Runderpest in Kedah,” *Sumatra Post* (16 February 1903): 6; “Runderpest in Perak,” *Sumatra Post* (4 June 1903): 6; “Runderpest de Singapore,” *Sumatra Post* (24 December 1903): 6; “Runderpest in de Straits,” *Sumatra Post* (11 January 1904): 6; and, “Runderpest op Malakka,” *Sumatra Post* (19 August 1904): 6.

⁶ “War on Rinderpest,” *Straits Times* (11 January 1933): 14.

⁷ “Runderpest in Penang,” *Sumatra Post* (30 May 1899): 5; “Infected Cattle,” *Straits Times* (16 October 1908): 8; and, “Cattle Epidemic in Siam,” *Malaya Tribune* (7 October 1915): 3.

⁸ On the idea of a disease zone, see David Arnold, “The Indian Ocean as a Disease Zone, 1500-1950,” *South Asia* 14,2 (1991): 1-21.

⁹ On the density and dynamics of Indian migration flows to Southeast Asia, see Sunil S. Amrith, *Crossing the Bay of Bengal: The Furies of Nature and the Fortunes of Migrants* (Cambridge: Harvard University Press, 2013) and “Tamil Diasporas across the Bay of Bengal,” *American Historical Review* 114,3 (June 2009): 547-572.

¹⁰ Along the Straits of Malacca, *pawang*s, or Muslim spirit practioners, sacrificed goats as part of a ritual to appease the gods of the sea and thus facilitate good omens for Malay fishing, See Ishak bin Ahmad, “Malay

Given the politics and peculiarities of bovines and hogs in South and Southeast Asia, fish became the most suitable sources of protein for powering social, economic, and environmental change.¹¹ But what is protein and why was it so important in the interwar age of industrial agriculture and urban development? In short, the human body requires protein and the essential nutrients it provides. As one wartime Japanese publication noted, “No life can exist without protein.”¹² It is derived from two general sources: animals and food crops (fruits, cereals, nuts, grains, seeds, and vegetables). Animal protein supplies the human body with the necessary amino acids to maintain muscle mass, whereas non-animal protein lacks one or more of these requisite nutrients.¹³ Moreover, protein performs three critical functions for the human body by strengthening the immune system so the body can ward off diseases; energizing muscles and the body for physical activity; and, rebuilding and repairing muscle tissues after they have been worn down through exertion.¹⁴

From the late nineteenth century onward, securing abundant and amenable supplies of protein was central to the rise of cities and plantations in the lands around the Southeast Asian shelf. These vital supplies provisioned the laboring masses that endlessly plowed the fields, plied the streets, and moved cargo in and out the ports. Laborers’ bodies—depleted, sapped, spent—were replenished through daily consumptions of salted, dried, boiled, and eventually fresh fish. Bovines and hogs did not keep these laboring masses nourished; nor were beef, pork, and mutton the sources of protein that rebuilt their

Fishermen’s Superstitions,” *Journal of the Malayan Branch of the Royal Asiatic Society* 19,1,138 (February 1941): 132. Fieldnotes from a Malay wedding in Kampung Bukit Durian, Malacca, August 2016.

¹¹ See for example, “The Main Protein in Malaya is the Fish,” *Straits Times* (7 April 1963): 8

¹² “Food: The Importance Of A Well-balanced Diet,” *Syonan Shimbun* (16 May 1942): 6.

¹³ “Help Yourself By Growing Your Food,” *Malaya Tribune* (6 January 1942): 5.

¹⁴ “Energy Values Of Foods & Our Requirements,” *Syonan Shimbun* (23 May 1942): 2.

muscles. Fish sustained, if not propelled, their physical bodies forward under the extreme, trying conditions of hard labor, tropical climate, and endemic disease in South and Southeast Asia.

But in a zone such as the Indo-Pacific Ocean, fishing had long existed as an economic activity integral to the diets of local societies. After 1900, traditional fishing, which relied on wind-powered boats, nets, baskets, and stakes, was challenged by other modes of marine capture in Southeast Asia. While indigenous and Chinese fishers typically worked the shore grounds, coastal waters, and river mouths of the region, Japanese and Okinawan fishers targeted previously untouched levels of the regional marine environment. These new, migrant fishers also introduced new fishing methods, skills, technologies, and knowledge.

After 1900, and especially after 1914, these Japanese and Okinawan fishing networks not only opened up new oceanic ecologies, offshore reefs and pelagic waters, but they also controlled the supply of fish from these protein-rich habitats. Reefs were exploited using an Okinawan fishing method called *muro ami*, or drive-net fishing that produced an unprecedented supply of reef fish (*Caesio*) known in Malay as *ikan delah* and *ikan kuning*. *Muro ami* fishers fueled Southeast Asia's protein boom in the 1920s and 1930s, thereby feeding the rising regional tide of rural migrants and urban laborers. From 1917 onward, these same overseas fishers worked the pelagic zone producing tuna (*Thunnini*) for Japanese communities at home and abroad.

But just as the ocean's fish were vital to the growth of urban society and industrial agriculture, they were also valuable to the expansion of ecological and scientific knowledge. Working in the wake of Carl Linnaeus's gift of taxonomy to the natural world, ichthyologists

sought to map and classify the fish fauna of the Indo-Pacific.¹⁵ In the long nineteenth century, they collected and documented specimens, scripting thousands of strange and colorful creatures into modern science with Latin-based binomial names. It was during this formative period of knowledge and spatial production that ichthyologists began to organize the region's fish life into the Linnaean system, using a hierarchy of classes, orders, families, genera, and species.¹⁶

As early as 1862, Pieter Bleeker (1819-1878), the founder of Indo-Pacific ichthyology, published the first installment of his multivolume *Atlas Ichthyologique des Indes Orientales Néerlandaises*, based largely on his networks and residence in Batavia between 1842 and 1860. Bleeker's work was the first to comprehensively catalogue the fish fauna of the Indo-Pacific. By 1926, local and foreign ichthyologists understood Southeast Asia as a "biologic province," bound by its shallow seas and marked by its aquatic diversity. From Madras to Manila, these fish experts built public aquariums for purposes of scientific study and popular education. Indeed, ecology rather than empire defined the borders of regional coherence and spatial belonging. One of the leading ichthyologists of the early twentieth century, Albert W. Herre (1868-1962), mapped this biologic province, explaining it spanned "from New Guinea and the Aru Islands on the east to the Andaman Islands in the Bay of Bengal in the west, and throughout the Philippines on the north."¹⁷

Area scientists recognized the Indo-Pacific seas were globally unique, and their public

¹⁵ Marta Paterlini, "There Shall be Order: The Legacy of Linnaeus in the Age of Molecular Biology," *EMBO Reports* 8,9 (September 2007): 814.

¹⁶ On the history of classifying fish, see Peter S. Alagona "Species Complex: Classification and Conservation in American Environmental History," *ISIS* 107,4 (2016): 738-761 and W. Jeffrey Bolster, *The Mortal Sea: Fishing the Atlantic in the Age of Sail* (Cambridge: Harvard University Press, 2012), 92-102.

¹⁷ Albert W. Herre, "Research on Fish and Fisheries in the Indo-Australian Archipelago," in *Science and Scientists in the Netherlands Indies*, eds. Pieter Honig And Frans Verdoorn (New York: Board for the Netherlands Indies, Surinam, and Curacao, 1945), 167.

aquariums exhibited this unrivalled diversity. In 1929, at the Fourth Pacific Science Congress in Batavia, the scientific consensus on Southeast Asia was that “no other region equals it in number of species.”¹⁸ Through their aquariums, writings, and conferences, these fish experts began to popularize the idea that this biologic province constituted the “greatest center of fish life in the world.”¹⁹

In the years surrounding the turn of the twentieth century, industrial fishing and scientific collecting transformed the Asia marine environment. The ocean took on a new set of meanings, values, and concerns. Civil servants, scientists, and colonial subjects no longer perceived seagrass beds, mangrove forests, coral reefs, and shallow seas as outside of society and history, but instead saw them as critical environments essential to the production of the region’s abundant aquatic life and thus its wealth of protein. Expanding knowledge about the Southeast Asian shelf created the commercial conditions for exploiting new fishing grounds and landing new food sources. From 1926 to 1928, for example, Ishak bin Ahmad (1887-1969), the father of Singapore’s first president Yusof bin Ishak, investigated the marine fauna of the Malacca Straits, Brunei Bay, and the South China Sea as the only Malay member of the *Tongkol*, colonial Malaya’s first trawling expedition in Asian waters. Ishak, and others like him, consulted fishers, fishmongers, salt traders, and *pawang*s, or Muslim spirit practitioners. These cultural encounters coproduced new forms of knowledge about edible fish, poisonous species, the seasonality of fish migrations, and the ecologies in which all of this bounty flourished. For Ishak, the motto of the *Tongkol*, “eat

¹⁸ Albert W. Herre, “The Scientific and Commercial Development of East Indian Aquatic Resources,” *Proceedings of the Fourth Pacific Science Congress* (1930): 25.

¹⁹ Rolph Malloch, “Dr. Herre Makes Largest Collection of Island Fish,” *Stanford Daily* (3 February 1933): 1. See also, Albert W. Herre, *Check-List of Philippine Fishes* (Washington, D.C.: U.S. Government Printing Office, 1953), 1; and, Frederick L. Wernstedt and Joseph Earle Spencer, *The Philippine Island World: A Physical, Cultural, and Regional Geography* (Berkeley: University of California Press, 1967), 229.

more fish,” had captured the central role science and technology could play in documenting the Asian marine environment and bringing its oceanic protein ashore. When he became Director of Fisheries in 1937 and the first non-European to head a department in colonial Malaya, Ishak championed the ocean’s edibility, insisting, “Malays should eat more fish...and awaken to [its] food values.”²⁰

In the wake of World War II, scientists, fishers, and states turned to Southeast Asian shelf to rebuild society, stem hunger, and foster community. Given the ocean’s critical place in mobilizing economic recovery and popular nationalism, fish experts gathered in the Philippines to establish the Indo-Pacific Fisheries Council in 1948. For the growing societies of postwar Southeast Asia, the ocean was a vital source of protein and livelihood. But for the region’s modernizing states, it increasingly became the base of pelagic power. In the wider protein-rich waters of the Indo-Pacific seas, modern states—*pelagic states*—came to be defined by the reach of their fishery operations and their ability to control offshore fishing grounds. In this early Cold War climate, the power to fish marked the power of the state.

Yet, scholars working at the intersection of Southeast Asian history and environmental history have narrated this crucial period of imperial transition through changes in the land, obscuring the ways in which these catalytic processes were anchored in Asia’s oceans. The absence of the marine environment as a strategic site of encounters and productions is particularly visible in today’s oceanic turn. Within this expanding literature, historians have focused their attention on mapping and making sense of how seas and basins entangle societies, markets, politics, and faiths. This scholarship has been

²⁰ “Malays Should Eat More Fish,” *Straits Times* (16 May 1937): 8.

rich and productive, pushing the bounds of knowing places and peoples beyond the territorial confines of states and regions. New conceptualizations of space and community have been borne from these interdisciplinary efforts. Despite the upsurge in sea-framed projects, there remains a significant gap—a blue hole, if you will—in the available body of work. The ocean, its fish, and the stories of those who interacted with the marine environment remain unseen and out of focus.

Sounding the Ocean: Interventions

By charting these enduring encounters between people and fish, science and society, and technology and nature in modern Southeast Asia, this study makes three important interventions. First, and fundamentally, the *marine environment* emerges from these pages as a new analytical field that will mobilize a better understanding of the rise of urban society and industrial agriculture. To facilitate this approach, the study adopts a methodology that I call a *mid-ocean perspective* as a way to help us surface a history of the marine environment, rather than a history across the seas. Such a history brings into sharper focus the ocean as a world of production and encounter.

While the ocean and its resources have long been central to the peoples and states of Southeast Asia, their presence within the available historiography has been marginal. Scholars working in the wake of Fernand Braudel's Mediterranean have largely focused on how oceans connect societies, paying little attention to the ways in which oceans shape, and are shaped by, their surrounding societies.²¹ The institutional and intellectual product

²¹ See Sunil Amrith, *Crossing the Bay of Bengal: The Furies of Nature and the Fortunes of Migrants* (Cambridge: Harvard University Press, 2013); Sugata Bose, *A Hundred Horizons: The Indian Ocean in the Age of Global Empire* (Cambridge: Harvard University Press, 2006); Thomas R. Metcalf, *Imperial Connections: India in the*

of these and related studies is that they share a common failing of viewpoint: they examine the sea solely through the optic of the strand, tracking the movement of bodies, things, and ideas across water but largely treating the ocean itself secondary. The nature of the ocean has thus remained out of sight, inviting a much-needed corrective through this mid-ocean perspective.

A mid-ocean perspective enables us to see oceans as more than a seamless span of saltwater; they emerge as complex systems of life and interaction that are bound up with human histories and social practices. Once we consider the sea as a source of scientific knowledge and material sustenance, we can move beyond the “grains bias” of conventional social and environmental history to discover the power of protein in constituting communities. We can better understand how the production of fish served as the driving force behind Southeast Asia’s historic rise to mass population and rapid urbanization.

More broadly still, this perspective helps us recognize and account for the importance of the ocean to the formation of a simultaneous but separate imperial world, a cosmopolitan space where a new social order could form surprisingly free from the racial hierarchies of landed colonial societies. Borne from the evolving relationships between people and fish in Southeast Asia, this simultaneous but separate imperial world emerged in the decades around the turn of the twentieth century. In the open market of the Indo-Pacific seas, the only criteria for entry was knowledge or expertise, and the intercultural enterprise, generally free of colonial violence and racial prejudice, was a harbinger of the postcolonial world to come. The cosmopolitan currents of this simultaneous but separate

Indian Ocean Arena, 1860-1920 (Berkeley: University of California Press, 2007); and, Eric Tagliacozzo, *Secret Trades, Porous Borders: Smuggling and States along a Southeast Asian Frontier, 1865-1915* (New Haven: Yale University Press, 2005).

imperial world forged spaces of multi-ethnic encounter and exchange, cooperation and collaboration of surprising diversity—including Japanese commercial trawlers, Filipino folk fishers, Chinese merchants, and both European and Southeast Asian scientists. Even in its human dimension, these maritime spaces constituted a history between the tides.

With a mid-ocean perspective in mind, let me draw out a few of this study's most compelling conclusions before moving on. First, and fundamentally, this mid-ocean perspective leads us to use the shape of the sea to define the unit of analysis, looking beneath the edgeless waters to find a bathymetry that forms a distinctive Southeast Asian shelf of shallow seas with rich fishing grounds, cohering this region geographically and culturally (through food). Second, this perspective shows how Southeast Asia's imperial integration into the global economy, building port cities and plantations, was fueled by a parallel scientific exploration and commercial exploitation of the seas for protein to sustain this concerted mobilization of human muscle power. Finally, by applying this mid-ocean perspective, in particular this relationship between protein provisioning and imperial expansion found in colonial Southeast Asia, leads to the discovery of an otherwise invisible, interwar Japanese maritime empire that, through formal rule over the Mandated Pacific Islands and informal influence in the Southeast Asian seas, expropriated a swelling fish harvest from a pelagic domain that encompassed nearly 20 percent of the world's temperate ocean, producing the protein that sustained Japan's urbanization, industrial growth, and imperial expansion on to the Asian mainland.

From a mid-ocean perspective, we can see how fish brought people together in ways rarely acknowledged or examined in Southeast Asia's political pasts and national narratives. The encounters of Hokkien fishmongers, Filipino and Japanese scientists,

European zoologists, and Okinawan fishers shaped, and were shaped by, the social and ecological worlds of fish. At Penang in the mid-nineteenth century, Theodore Cantor (1809-1860), a Danish-born surgeon-zoologist serving with the Bengal Medical Service, collected a variety of specimens from local markets and fishermen and thereby published the first modern study on Malayan fish.²² At Manila, Augustin Umali (1906-1983), an ichthyologist who worked for the Philippine Bureau of Fisheries, was the first to provide the local and scientific names of Manila's food fish as well as systematically document the colors, seasonality, supply, sizes, edibility, and nutrient value of these aquatic fauna. Umali's knowledge about food fish and their availability in the colonial capital were partly produced through interactions with Japanese fishers who landed their catch at different shores: the *utase*, or beam, trawlers brought their fish to Tondo Beach near the mouth of the Pasig River, and the *muro ami*, or drive-net, fishers unloaded their catch at the Royal Ice Plant on General Solano Street.²³ At Bengkalis, on the Dutch side of the Malacca Straits, Wee Leong Tan (1833-1913), the Hokkien owner and operator of the Wee Brothers Shipping Company, used his steamers to circulate *terasi* (fermented paste) and other fish products from Bagan Si Api Api to Singapore, Pontianak, and Batavia. He also controlled the provision of salt to the Hokkien fishers at the Bagan Si Api Api processing center, where

²² Theodore Edward Cantor, *Catalogue of Malayan Fishes* (Calcutta: Baptist Mission Press, 1850). Cantor's *Catalogue* first appeared in 1849 through the *Journal of the Asiatic Society of Bengal*. He was the Superintendent of the European Asylum at Bhowanipur in Calcutta. Before his work on Malayan fish and his appointment as Superintendent in Calcutta, Cantor served as the surgeon to the East India Company's Marine Survey. During which time, he published on fish from the Ganges and Bay of Bengal in 1839. Cantor was very much part of Calcutta society: his brother, Charles, worked as a banker in the city and his uncle, Nathaniel Wallich (1786-1854), was the longtime Superintendent of the Calcutta Botanic Garden (1815-1846).

²³ Augustin F. Umali, *Edible Fishes of Manila* (Manila: Bureau of Printing, 1936), 14-15. Fieldnotes: Interviews with Melchor Cichon, Iloilo, Panay Island, Philippines, July 2015.

salt was a critical commodity since it was a key ingredient in the production of *terasi*.²⁴ Focusing on the confluence of these social actors, and the systems of infrastructure that made their activities possible, historicizes the very different imperial world that fish created.

Seeing the Ocean: Interactions

In framing the ocean as a site of encounters and productions, this study tells the story of how the marine environment powered the colonial growth of cities and plantations in the early twentieth century. It upends the settled view of modern Southeast Asia by showing how proteins from the sea fueled changes on land. From the itinerant ichthyologists who identified the ocean's fish to the industrial fishers who exploited the region's waters, the imperial impulses of science and commerce created a protein boom in interwar Southeast Asia. Not unlike grains and beef in the American Midwest, guano in the eastern Pacific, or bananas in the Spanish Caribbean, the mass production of oceanic fish profoundly changed nature and society in maritime Asia, and the relationships between the two.²⁵

Focusing on a history of human-ocean interactions from the late colonial era to the end of the interwar period, we can recover the unseen yet pivotal role the ocean played in shaping Southeast Asia in the modern world. This study places the marine environment at

²⁴ For more on the political, industrial, and economic ties between salt, Wee, and Bagan Si Api Api, see John Butcher's excellent study, "The Salt Farm and the Fishing Industry of Bagan Si Api Api," *Indonesia* 62 (October 1996): 90-121.

²⁵ On the socio-ecological transformations associated with other commodities, see William Cronon, *Nature's Metropolis: Chicago and the Great West* (New York: W.W. Norton and Company, 1991); Gregory Cushman, *Guano and the Opening of the Pacific World: A Global Ecological History* (Cambridge: Cambridge University Press, 2014); and, Stuart McCook, *States of Nature: Science, Agriculture, and Environment in the Spanish Caribbean, 1760-1940* (Austin: University of Texas Press, 2002).

the center of historical analysis. It offers a new way of seeing the ocean in human history, beyond its figuration as a linkage between lands. Inspired by Braudel's conceptual framing of the sea as an "an electric or magnetic grid," scholars working on the greater Indian Ocean have tended to focus on how oceans connect societies and enable circulations.²⁶ This "oceanic turn" has gone a long way to enriching the study of Asia and its area histories by innovating new ways of thinking about space, exchange, and community. Historians, in particular, have analyzed the ocean as a spatial subject that cuts across national narratives and imperial geographies.

While this sea-centered sensibility constitutes an important shift towards histories framed around bodies of water as bodies of experience, it also perpetuates the perception that the ocean is simply a surface, linkage, or "magnetic grid"—a medium for conducting human interactions rather than an autonomous site for such interaction. Recent scholarship, for example, has privileged histories of travel and transit, with narratives anchored in the journeys of pilgrims, merchants, and coolies steaming across Asia's modern seas. This surge to the sea has given shape to new conceptualizations of colonial being and cultural belonging, but it has done little to bring the ocean itself into society and history.

Bounding the Ocean: Shallow Seas, Monsoon Winds, and Marine Diversity

To demarcate the boundless ocean and thereby bring it into the study of urban society, industrial agriculture, and state formation in modern Southeast Asia, this study

²⁶ Fernand Braudel, *The Mediterranean and the Mediterranean World in the Age of Philip II*, trans. Sian Reynolds (New York: Harper and Row, 1972), II:168.

uses the topography of the sea floor to define the spatial bounds of historical inquiry. In this way, bathymetry and the shape of the undersea geography, rather than mere surface cartography, frame the analytical field of study. Moreover, a focus on the shallow seas of the Southeast Asian shelf allows this work to examine the unique features of the region's biological waters. Although overlooked and understudied as a regionalizing force in the extant literature, the Asian marine environment is, for several complex and closely related reasons, globally significant and empirically valuable.²⁷

The broader arc of Indo-Pacific Ocean stretching from the Andamans in the west to the Solomons in the east is considered by scientists to be the global center of marine biological diversity. More species and a greater abundance of sea turtles, cetaceans, reef fish, seagrasses, mangroves, tuna, and sharks flourish within these waters than anywhere else in the world. Of equal importance, 75 percent of the planet's coral species are found within this biologic province, giving these waters the name the Coral Triangle.

At the same time, Asia is home to 80 percent of the planet's official motorized fishing fleet, with half operating in these wider Indo-Pacific seas. These fishing grounds are, therefore, some of the most productive and contentious in the world. One sea, in particular, the South China Sea, contributes almost 14 percent of the total global fish catch. The maritime countries of Southeast Asia, excluding Singapore and Cambodia, land more than 20 percent of all fish caught from the world's oceans. If we add China and India, this share

²⁷ For works that conceptualize Southeast Asia as a region along lines other than bathymetric, see Anthony Reid, *Southeast Asia in the Age of Commerce, Vol. 1 Land Below the Winds* (New Haven: Yale University Press, 1988) and Paul H. Kratoska, Remco Raben, and Henk Schulte Nordholt, eds., *Locating Southeast Asia: Geographies of Knowledge and Politics of Space* (Leiden: KITLV Press, 2005).

grows to almost half of all fish taken from the marine environment.²⁸ For ecological, nutritional, and economic reasons, the Indo-Pacific seas are critically important to human society and the natural world.

By studying the bathymetry—the actual shape of the undersea geography with its deeps, shelves, and mounts—we can see that Southeast Asia is something more than an accidental cultural zone between India and China—often defined by what it is not rather than what it might be. Between the Sunda Trench in the west and the Philippine Trench in the east, Southeast Asia’s islands and much of its mainland rest upon two sprawling subterranean shelves, what I refer to as the *Southeast Asian shelf*, that lend this otherwise diffuse, disparate region a distinct geographical coherence and a shared maritime commons of extraordinary natural wealth.

Bounding the Southeast Asian shelf are ocean deeps and a continental landmass, thereby creating a remarkable zone comprised of shallow seas and narrow straits. The Southeast Asian mainland (Vietnam, Cambodia, Thailand, Burma, and Bangladesh) marks the Southeast Asian shelf’s northern boundary. With a depth of nearly 5,000 meters, the Sunda Trench in the Bay of Bengal demarcates its western limit. The southern boundary of the Southeast Asian shelf is the Java Trench, with a depth of almost 7,500 meters. Moving eastward from the Java Trench is the Timor Trough, measuring at 3,300 meters. North from the Java Trench and Timor Trough is the Philippine Trench in the Philippine Sea, where it serves as the northeastern boundary of the Southeast Asian shelf at 10,500 meters. Within the wider Indo-Pacific Ocean, these dramatic deeps coupled with the Asian mainland mark

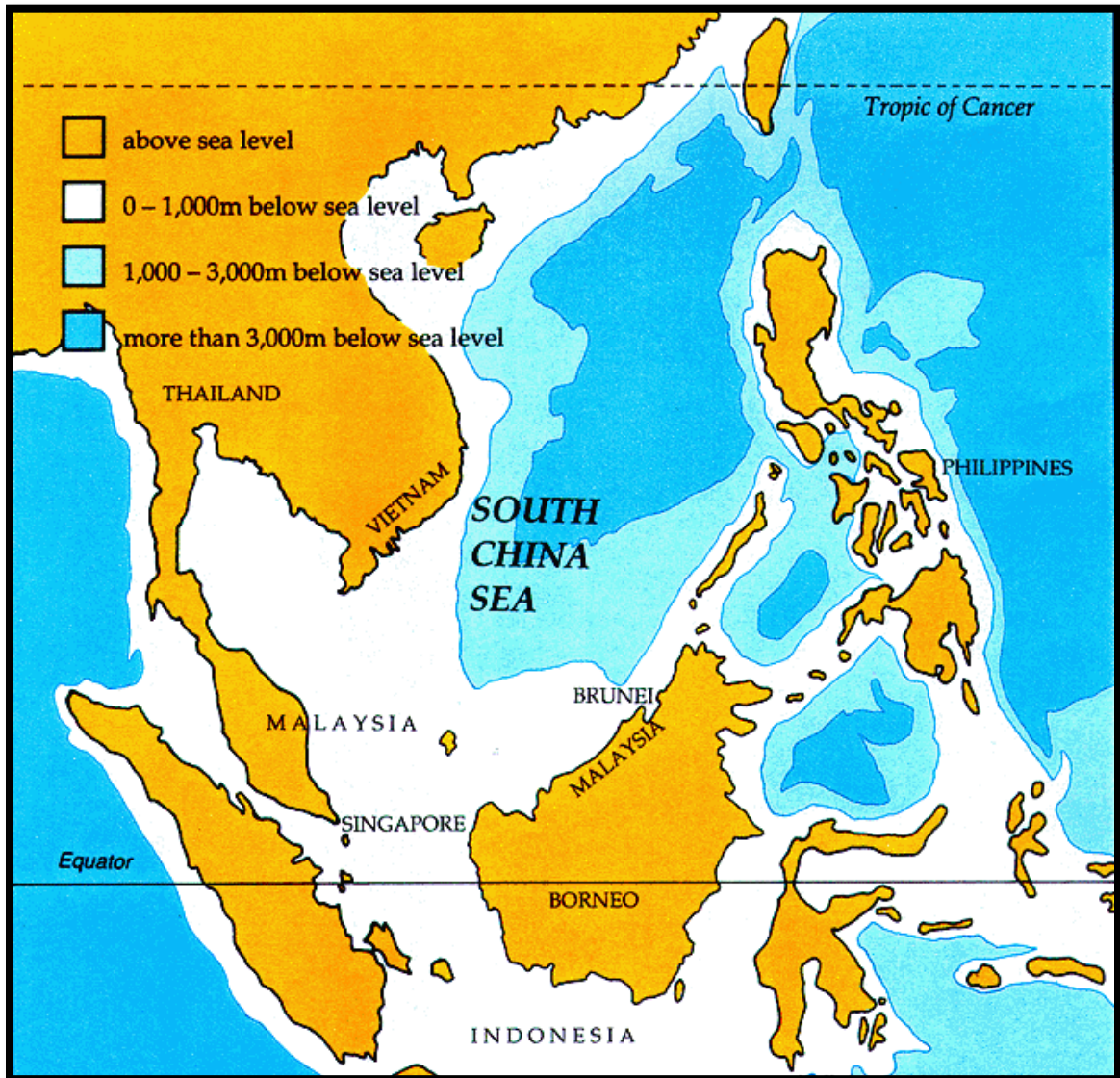
²⁸ *The State of World Fisheries and Aquaculture 2016: Contributing to Food Security and Nutrition for All* (Rome: FAO, 2016), 11, 35.

the natural borders and spatial identity of this distinct bathymetric region, the Southeast Asian shelf.

But what are the factors that explain why the Southeast Asian shelf, and not some other marine region, is so rich and diverse? First, it is remarkably shallow. Generally less than 100 fathoms, shallow seas account for only about ten percent of the world's oceans and saltwater basins. In Southeast Asia, however, shallow seas constitute more than fifty percent of the marine environment.²⁹ The high percentage of these shallow waters is caused by the presence of the Southeast Asian shelf, constituting not only 20 percent of the planet's shelf space, but also one of the lowest lying continental regions in world.³⁰

²⁹ Lee Yong Leng, *Southeast Asia and the Law of the Sea: Some Preliminary Observations on the Political Geography of Southeast Asian Seas* (Singapore: Singapore University Press, 1980), 32.

³⁰ Sabin Zahirovic et al., "Large Fluctuations of Shallow Seas in Low-lying Southeast Asia Driven by Mantle Flow," *Geochemistry, Geophysics, Geosystems* 17,9 (September 2016): 3589. See also Alan Longhurst, *Ecological Geography of the Sea* (San Diego: Academic Press, 1998), 326.



*Bathymetric Map of Southeast Asia.*³¹

The Southeast Asian shelf is thus comprised of the Sunda and Sahul shelves. Stretching from the Bay of Bengal in the west to the Sulawesi Sea in the east, the Sunda Shelf is marked by an extraordinary array of marine species and ecological habitats. Dugongs (*Dugong dugon*), for example, are endemic to select zones within the Andaman Sea, the waters around Phu Quoc in the Gulf of Thailand, the seas bounding Borneo, and the

³¹ Chou Loke Ming and Porfirio M. Alino, *An Underwater Guide to the South China Sea* (Singapore: Times Editions, 1992).

channels and straits of the Visaya Islands in the Philippines. As voracious herbivores, these threatened marine animals feed on the region's unrivaled wealth of seagrass beds. Like dugongs, whale sharks (*Rhincodon typus*) also make their home among Southeast Asia's shallow waters. The endangered whale shark is the world's largest fish, and it lives mostly in the Bohol Sea, making it a recent feature of the local tourism industry. Pearls too are abundant in these shallow waters, with historic grounds located in the Andaman and Sulu Seas.³² Along the Bali Strait, rich schools of sardine (*Sardinella lemura*) feed on phytoplankton blooms welled up by coldwater currents from the Indian Ocean, thereby forging one of the densest populations of fish protein in Southeast Asia.

Moving eastward, the Sahul Shelf covers the shallow waters between the Arafura Sea and Gulf of Papua.³³ Much like the Sulu and Andaman Seas, the Arafura Sea has long attracted merchants and divers from near and far to work its rich pearl beds.³⁴ At the port town of Dobo on the island of Aru, these modern pearling circuits gave rise to a small community of Japanese prostitutes called *karayuki-san*.³⁵ By 1913, a Japanese quarter developed around Dobo harbor, with ten inns, nine brothels, eight restaurants, three

³² On pearling in the Andaman Sea, see "Illegal Fishing Operations of Japanese Vessels," Collection 18/1, IOR/L/PS/12/2903, India Office Records and Private Papers, British Library (BL). For Sulu, see Florencio Talavera, "Pearl Fisheries of Sulu," *Philippine Journal of Science* 43,4 (December 1930): 483-499 and "Paarlvischerij bij Mindanao," *Het Nieuws Van Den Dag* (6 June 1908): 2.

³³ Mark K. Spalding et al., "Marine Ecoregions of the World: Bioregionalization of Coastal and Shelf Areas," *Bioscience* 57,7 (2007): 578.

³⁴ For an excellent account of this history in the age of technological change and border formation, see Julia Martinez and Adrian Vickers, *The Pearl Frontier: Indonesian Labor and Indigenous Encounters in Australia's Northern Trading Network* (Honolulu: University of Hawaii Press, 2015). See also, "Paarlvischerij en Molukken," *Sumatra Post* (3 July 1922): 8; "De Parel-Visscherij," *Preanger-Bode* (18 August 1908): 1; and, P.N. van Kampen, "De paarl-en Parelmoervisscherij langs de kustem der Aroe-eilanden," in *Mededeelingen van het Visscherij-Station te Batavia, No. II* (Buitenzorg: Drukkerij van het Department, 1908).

³⁵ Hiroshi Shimizu, "Rise and Fall of Karayuki-san in the Netherlands Indies from the Late Nineteenth Century to the 1930s," *Review of Indonesian and Malaysian Affairs* 26,3 (Summer 1992): 17-43.

general stores, two barbershops, and a bathhouse.³⁶ At the heart of this quarter, were more than 500 Japanese divers. Aru's extensive pearling grounds contributed to the boom of Dobo as a well-known pearl frontier in the interwar period.³⁷ Like pearls, cetaceans also thrive in the shallow seas of the Sahul Shelf. In fact, the marine zone of eastern Indonesia and Papua serves as a critical migratory corridor for more than 30 cetacean species.³⁸ Pygmy blue whales (*Balaenoptera musculus brevicauda*) make these tropical waters their breeding grounds, traveling north from Australia to the Banda Sea every June.³⁹ Sperm whales (*Physeter macrocephalus*) are also local, occurring seasonally in the Savu Sea and the waters around Solor. Catholic villagers from Lamalera on Lembata Island hunt sperm whales and other toothed whales, while Muslim villagers from Lamakera on Solor Island hunt baleen whales such as the minke whale (*Balaenoptera acutorostrata*) and Cuvier's beaked whale (*Ziphius cavirostris*).⁴⁰

Upwelling is another reason why this marine region is so rich and diverse.⁴¹ The abundance of shallow seas coupled with the great depths of the Indian and Pacific Oceans

³⁶ Hiroshi Shimizu and Hitoshi Shirakawa, *Japan and Singapore in the World Economy: Japan's Economic Advance into Singapore, 1870-1965* (New York: Routledge, 1999), 49.

³⁷ In 1915, more than 100 Japanese prostitutes moved from Singapore, Merauke, Ambon, and Makassar to Aru in response to the demand for sexual services. See Masaji Inoue, *Nanyo* (Tokyo: Fuzanbo, 1915), 87-89. Cited in Shimizu and Shirakawa, *Japan and Singapore*, 49.

³⁸ Sangeeta Mangubhai et al., "Cetaceans in the Global Centre of Marine Biodiversity," *Marine Biodiversity Records* 7 (2014): 1-9.

³⁹ Michael C. Double et al., "Migratory Movements of Pygmy Blue Whales (*Balaenoptera musculus brevicauda*) between Australia and Indonesia as Revealed by Satellite Telemetry" *PLoS One* 9,4 (2014): 1.

⁴⁰ Max Weber, "Iets Over Walvischvangst In Den Indischen Archipel," in M. Greshoff, ed., *Rumphius Gedenboek, 1702-1902* (Haarlem: Koloniaal Museum, 1902), 89-93. See also, R. H. Barnes, "Lamakera, Solor. Ethnographic Notes on a Muslim Whaling Village of Eastern Indonesia," *Anthropos* 91, 1/3 (1996): 79-81 and Tomas Tomascik et al., *Ecology of Indonesian Seas, Part Two* (Oxford: Oxford University Press, 1997), 1156.

⁴¹ Upwelling is when cold, nutrient-rich water "wells up" from below and mixes with surface water.

has made for remarkable upwelling intimately linked to the production of marine life in Southeast Asia.

The winds also play a role in upwelling and the production of marine life in these Indo-Pacific seas. Monsoons affect the “equatorial current system” and influence the all-important circulation of water in the region.⁴² While scholars have long seen the north and south monsoons as natural forces, facilitating commerce and exchange in the histories of the Indian Ocean and Southeast Asia, they have paid little attention to the significant role these powerful winds provide in shaping the movement of the seas, the salinity and turbidity of these waters, and the protein wealth borne from them.⁴³ More than eight species of tuna are found in the arc of ocean around Mindanao, including the commercially valuable skipjack (*Katsuwonus pelamis*), yellowfin (*Neothunnus macropterus*), and bonito (*Euthynnus yaito*).⁴⁴

The confluence of monsoons and the cold currents of the Indian and Pacific Oceans interact in Southeast Asian seas, and produce a critical upwelling that replenishes the nutrients of the surface water and sustains Southeast Asia’s abundance of phytoplankton, or microscopic marine plants. Phytoplankton, in turn, are crucial to the region’s marine biological wealth as they serve as the base for the ocean’s aquatic food webs.⁴⁵ In the straits

⁴² J.E. King, “Variations in Zooplankton Abundance in the Central Equatorial Pacific, 1950-1952,” in *Symposium on Marine and Fresh-Water Plankton in the Indo-Pacific* (Bangkok: Indo-Pacific Fisheries Council, 1954), 12.

⁴³ Kenneth Ruddle, “The Supply of Marine Fish Species for Fermentation in Southeast Asia,” *Bulletin of the National Museum of Ethnology* 11 (1986): 1001.

⁴⁴ Jose Domantay, “Tuna Fishing in Southern Mindanao,” *Philippine Journal of Science* 73,4 (1940): 423-436.

⁴⁵ Jochen Kampf and Piers Chapman, *Upwelling Systems of the World: A Scientific Journey to the Most Productive Marine Ecosystems* (Switzerland: Springer, 2016), 316.

around Singapore during the 1940s, Tham Ah Kow was one of the first scientists to document how local plankton levels determine the scale and density of marine fisheries.⁴⁶

This combination of shallow seas, seasonal monsoons, and powerful oceans fosters a dynamic upwelling environment in Southeast Asia, creating conditions for the world's greatest concentrations of mangroves, seagrasses, and reefs. Commonly called the Coral Triangle, Southeast Asian seas provide the necessary habitat for a wealth of aquatic species to thrive, including "the richest and most varied fish fauna in the world."⁴⁷ Additionally, the region's warm climate, high rainfall, and rich fluvial systems enable extensive coral complexes to flourish, creating what many scientists consider the "global epicenter for marine biodiversity."⁴⁸

These critical features of Southeast Asia's marine environment—shallow seas, unique upwelling conditions, and immense amounts of river discharge—define the region's ocean in ways that are spatially significant and empirically resourceful. First, the seas of Southeast Asia bind the region, not in terms of commerce or culture, but because they demarcate a sense of coherence. These interstitial waters are low-lying, and the bathymetric zone they form between the Indian and Pacific Oceans gives them a natural unity. The mix of cold oceanic currents and strong monsoonal winds also creates a dynamic upwelling environment that informs the spatial contours of Southeast Asia. Beyond this productive upwelling space, the waters are deep and less dynamic. Finally, the expansive

⁴⁶ Tham Ah Kow, "The Role of Planktonology in Fisheries Development," in *Symposium on Marine and Fresh-Water Plankton in the Indo-Pacific* (Bangkok: Indo-Pacific Fisheries Council, 1954), 18-20. See also Tham Ah Kow, *The Food and Feeding Relationships of the Fishes of Singapore Straits* (London: Colonial Office Fishery Publications, 1950). Tham served as founding director of Singapore's Regional Marine Biological Center (1968-1973), and he was the first scientist to conduct plankton surveys in the Singapore Straits.

⁴⁷ Herre, "The Scientific and Commercial Development," 25.

⁴⁸ Paul H. Barber, "The Challenge of Understanding the Coral Triangle Biodiversity Hotspot," *Journal of Biogeography* 36 (2009): 1845.

fluvial systems of Southeast Asia impart more silt and freshwater into the region's seas than any other place in the world.⁴⁹ From Sumatra's Rokan to Borneo's Kapuas, the work of these great rivers keeps the seas shallow, influences salinity levels, and influences the migrations of valuable commercial species such as anchovies, sardines, Spanish mackerel, and tuna. Sustained by these climatic forces, bathymetric features, and ecological factors, the Southeast Asian shelf is both the world's richest center of marine life and its most exploited fishery zone. By exploring Southeast Asia through these storied and significant seas, this study can chart new waters and open new ways of knowing the recent past.

People, Fish, Ocean: Old Ties, New Histories

The stories borne from these Indo-Pacific seas, and particularly the South China Sea, articulate a modern history shaped by the changing uses and understandings of the marine environment. In weaving together a series of historical moments that narrate the opening of Asia's ocean to scientific networks and mass consumption, this study aspires to contribute new insights into the rise of urban society and industrial agriculture. Built around chapters that chronicle the process of knowing, exhibiting, and exploiting the ocean environment, this analytical narrative will locate the central role fish and fish experts played in feeding development in Southeast Asia and Japan from the late nineteenth to the early twentieth century. The sum of these micro-histories—from intrepid ichthyologists to industrial fishers—provides documentary evidence that the ocean and its proteins were far more instrumental in the urban and social history of Southeast Asia than previously acknowledged.

⁴⁹ Alan Longhurst and Daniel Pauly, *Ecology of Tropical Oceans* (San Diego: Academic Press, 1987), 8.

Regional historians have long emphasized the connectivity of Southeast Asia's ocean. O.W. Wolters once remarked that, "the sea provides an obvious geographical framework for discussing possibilities of region-wide historical themes."⁵⁰ In the extant scholarship, the ocean facilitates interaction and coheres community. It configures connections in unexpected ways. This relationship between the contours of historical space and the circuits of material exchange has served as the core basis for imagining Southeast Asia as a world region.⁵¹

Braudel's early work on the Mediterranean Sea has largely informed the place of the ocean in Southeast Asian historical writing.⁵² On a conceptual level, for example, Braudel introduced a vision of the maritime as conditioned by the territorial and its cultural economy. He brought into view a basin world that extended far beyond the sea's shores. While the sea facilitated movements and fostered linkages, it remained as a site unto itself, still completely out of view. Regional historians have instead used the ocean to re-conceptualize Southeast Asia through vectors of raiding, slaving, trading, and collecting. In the late eighteenth and nineteenth centuries, these intertwined patterns of commerce, violence, and exchange constituted geographies such as the "Sulu Zone." With the sea central but silent, historians have thus created a social world of interaction routed across

⁵⁰ O.W. Wolters, *History, Culture, and Region in Southeast Asian Perspectives* (Ithaca: SEAP, 1999), 42.

⁵¹ See Barbara Watson Andaya, "Presidential Address: Oceans Unbounded: Transversing Asia across 'Area Studies'," *Journal of Asian Studies* 65,4 (November 2006): 685.

⁵² See George Coedes, *The Indianized States of Southeast Asia*, ed. Walter Vella and trans. Susan Brown Cowing (Honolulu: East West Center Press, 1968); Anthony Reid, *Southeast Asia in the Age of Commerce, 1450-1680: Vol. I, The Lands below the Winds* (New Haven: Yale University Press, 1988) and *Southeast Asia in the Age of Commerce, 1450-1680: Vol. II, Expansion and Crisis* (New Haven: Yale University Press, 1991); Heather Sutherland, "Southeast Asian History and the Mediterranean Analogy," *Journal of Southeast Asian Studies* 34,1 (February 2003): 1-20; Angela Schottenhammer, ed., *The East Asian Mediterranean: Maritime Crossroads of Culture, Commerce and Human Migration* (Wiesbaden: Harrassowitz Verlag, 2008); and, David Henley and Henk Schulte Nordholt, eds., *Environment, Trade, and Society in Southeast Asia: A Longue Duree Perspective* (Leiden: Brill, 2015).

the surface of Southeast Asian waters rather than borne from them.⁵³ What emerges from the literature is a sense of the sea as more subtext than context. From the “age of commerce” to the era of high colonialism, the ocean has worked to configure spatial unities, political and familial networks, and cultural circuits.⁵⁴

The Indian Ocean, of which Southeast Asian waters are a distinct part, has also been framed and studied in strongly Braudelian terms. Scholars, for example, have argued that transoceanic trade in bulk and luxury goods provided a structural unity to the Indian Ocean, not unlike the Mediterranean, constituting a “world” spanning from the Swahili coast to the Malay Peninsula.⁵⁵ As a consequence, this deep structural system—maritime commerce—undergirds the cultural spaces, geographical differences, and religious contrasts that animated the long career of the Indian Ocean from the rise of Islam in the seventh century to the settling of British colonialism in the mid-eighteenth. Historians have thus imagined and inscribed the Indian Ocean as a common zone rooted in trade. Indeed, as

⁵³ See James Francis Warren, “Slave Markets and Exchange in the Malay World: The Sulu Sultanate, 1770-1878,” *Journal of Southeast Asian Studies* 8, 2 (September 1977): 162-175 and “Saltwater Slavers and Captives in the Sulu Zone, 1768-1878,” *Slavery and Abolition* 31, 3 (September 2010): 429-449.

⁵⁴ See Anthony Reid, “An ‘Age of Commerce’ in Southeast Asian History,” *Modern Asian Studies* 24, 1 (February, 1990): 1-30; “Economic and Social Change, c. 1400–1800,” in *The Cambridge History of Southeast Asia*, ed. Nicholas Tarling (Cambridge: Cambridge University Press, 1992), 460–504; Engseng Ho, *Graves of Tarim: Genealogy and Mobility across the Indian Ocean* (Berkeley: University of California Press, 2006); Leonard Andaya, *The Kingdom of Johore, 1641-1728: A Study of Economic and Political Developments in the Straits of Malacca* (Kuala Lumpur: Oxford University Press, 1975); Adrian B. Lopian, “Laut Sulawesi: The Celebes Sea, from Centers to Peripheries,” *Moussons* 7 (2003): 3-16.

⁵⁵ See K.N. Chaudhuri, *Trade and Civilization in the Indian Ocean: An Economic History from the Rise of Islam to 1750* (Cambridge: Cambridge University Press, 1985); Michael Pearson, *The Indian Ocean* (New York: Routledge, 2003); Michael Pearson, *Port Cities and their Intruders: The Swahili Coast, India, and Portugal in the Early Modern Era* (Baltimore: The Johns Hopkins University Press, 1998); Kenneth McPherson, *The Indian Ocean: A History of People and the Sea* (Delhi: Oxford University Press, 1993) and “Processes of Cultural Interaction in the Indian Ocean: An Historical Perspective,” *The Great Circle* 6, 2 (1984): 78–92; and Eric Tagliacozzo, “Trade, Production, and Incorporation: The Indian Ocean in Flux, 1600-1900,” *Itinerario* 26,1 (2002): 75-106.

Chaudhuri notes, “the ocean had its own unity...[whereby] means of travel, movements of people, economic exchange, climate, and historical forces created elements of cohesion.”⁵⁶

Environmental historians of Southeast Asia and the circum-Indian Ocean have likewise overlooked the ocean as an enduring place of human interaction and material production. The focus instead has been terracentric, centering on the historic interplay between people and forests, grasslands, valleys, and the workings of plantation agriculture.⁵⁷ Like scholars of the Asian environment, urban and social historians have obscured the sea and its resources from the stories of the city and the poor.⁵⁸ For scholars interested in food and consumption, the inattention has been consumed by rice.⁵⁹ But

⁵⁶Chaudhuri, *Trade and Civilization*, 3.

⁵⁷ See Peter Boomgaard, David Henley, and Manon Osseweijer, eds., *Muddied Waters: Historical and Contemporary Perspectives on Management of Forests and Fisheries in Island Southeast Asia* (Leiden: KITLV Press, 2005); Peter Boomgaard, *Southeast Asia: An Environmental History* (Santa Barbara: ABC-CLIO, 2007); Peter Boomgaard, “Southeast Asia in Global Environmental History,” in *A Companion to Global Environmental History*, eds. J.R. McNeill and Erin Stewart Mauldin (Chichester: John Wiley and Sons, 2012), 81-95; Peter Boomgaard, Freek Colombijn, and David Henley, eds., *Paper Landscapes: Explorations in the Environmental History of Indonesia* (Leiden: KITLV Press, 1997); Jeyamalar Kathirithamby-Wells, *Nature and Nation: Forests and Development in Peninsular Malaysia* (Honolulu: University of Hawaii Press, 2004); Greg Bankoff, “Coming to Terms with Nature: State and Environment in Maritime Southeast Asia,” *Environmental History Review* 19,3 (1995): 17-37; Corey Ross, “The Tin Frontier: Mining, Empire, and Environment in Southeast Asia, 1870s-1930s,” *Environmental History* 19,3 (2014): 454-479; and, Richard H. Grove and Vinita Damodaran, eds., *Nature and the Orient: The Environmental History of South and Southeast Asia* (Delhi: Oxford University Press, 1998).

⁵⁸ See Hayden Cherry, *Down and Out in Saigon: Stories of the Poor in a Colonial City, 1900-1940* (Yale University Press, forthcoming); Su Lin Lewis, *Cities in Motion: Urban Life and Cosmopolitanism in Southeast Asia, 1920-1940* (Cambridge: Cambridge University Press, 2016); Sunil Amrith and Tim Harper, eds., *Sites of Asian Interaction: Ideas, Networks, and Mobility* (Cambridge: Cambridge University Press, 2014); special issue on “Everyday Technology in South and Southeast Asia,” *Modern Asian Studies* 46,1 (January 2012): 1-248; and, Alfred W. McCoy and Ed C. de Jesus, eds., *Philippine Social History: Global Trade and Local Transformations* (Quezon City: Ateneo de Manila University Press, 1982). A recent exception, which accounts for the sea and its fish, is Daniel Doepfers, *Feeding Manila in Peace and War, 1850-1945* (Madison: University of Wisconsin Press, 2016).

⁵⁹ See Paul H. Kratoska, “Commercial Rice Cultivation and the Regional Economy of Southeastern Asia, 1850-1950,” in *Food and Globalization: Consumption, Markets and Politics in the Modern World*, eds. Alexander Nutzenadel and Frank Trentmann (Oxford: Berg, 2008), 75-90; Paul H. Kratoska, ed., *Food Supplies and the Japanese Occupation in South-East Asia* (London: Macmillan Press, 1998); Michael Adas, *The Burma Delta: Economic Development and Social Change on an Asian Rice Frontier* (Madison: University of Wisconsin Press, 1974); James Scott, *The Moral Economy of the Peasant: Rebellion and Subsistence in Southeast Asia* (New

cheap and abundant supplies of rice as the region's dominant carbohydrate overlooks the obvious issue of a protein source and thus can only partially explain the economic and demographic changes affecting "monsoon Asia" around the turn of the twentieth century.⁶⁰ During this historical moment, it was neither beef nor pork, but the ocean's fish that provided the protein to power the rise of urban spaces in maritime Asia. The mass production of oceanic protein fed those who swelled the cities, built the infrastructures, worked the streets, tilled the fields, and loaded and unloaded cargo ships that crowded the ports. Fish, and fresh fish at that, were crucial to the catalytic transformations that remade Asia between the mid-nineteenth and early twentieth century.

Chapter Overview

This study on the opening of the Asian marine environment to scientific research and mass consumption starts in *Chapter Two* with an examination of the nineteenth-century careers of Francis Buchanan, Theodore Cantor, and Pieter Bleeker, early ichthyologists in the Indo-Pacific Ocean. Through a range of sources, this chapter traces how ichthyological knowledge was produced in the nineteenth century, paying special attention to networks of collection and print culture. In effect, the last half of the nineteenth century marked the emergence of regional fish fauna studies, profoundly shaping the development of ichthyological knowledge on Indo-Pacific fish. Unlike earlier zoological investigations, European scientists were based in the region and not the metropole.

Haven: Yale University Press, 1976); and, Peter Boomgaard and David Henley, eds., *Smallholders and Stockbreeders: Histories of Foodcrop and Livestock Farming in Southeast Asia* (Leiden: KITLV Press, 2004).

⁶⁰ V.D. Wickizer and M.K. Bennett, *The Rice Economy of Monsoon Asia* (Palo Alto: Stanford University Press, 1940).

Building on this ichthyological knowledge and its scientific currents, *Chapter Three* explores how this knowledge was institutionalized in the early twentieth century by tracing the development of public aquariums. Using the archives of the Philippine Division of Fisheries, the Alvin Seale diaries, and colonial-era newspapers, we will see how the Manila Aquarium, and the scientists who worked at it, played a central role in bringing the ocean ashore and making its wonders known. Through the career of Alvin Seale, we can chart how Southeast Asia's first public aquarium participated in Indo-Pacific networks of knowledge by circulating fish fauna and ichthyological research across oceans and regions.

By the early decades of the twentieth century, local and foreign scientists were producing new knowledge about the Southeast Asian shelf through a web of marine biological laboratories. The rise of the first marine biological laboratory in South and Southeast Asia and the institutional linkages it had with the Marine Biological Laboratory at Woods Hole are the subject of *Chapter Four*. Through the founding and career of the Puerto Galera Marine Biological Laboratory in the Philippines, we can recover the seminal role this scientific institution played in constituting its surrounding waters as the "center of the center" of global marine biological diversity. From archival sources and oral histories, the chapter uses the biographies of Hilario Roxas (1896-1945), the first Filipino head of the Bureau of Fisheries, and Jose S. Domantay (1897-1976?), a pioneering specialist of echinoderms, to reveal the temporal shift in Southeast Asia from the labor of foreign experts to the work of local scientists, thus bringing a much-needed corrective to the history of production of marine biological knowledge. The chapter shows how local understandings of marine diversity were leveraged to serve the growing needs of state formation, national development, and colonial society.

The economic pressures to supply fish, and certain kinds of fish specific to certain kinds of food cultures, required an expansion of fishery operations and the use of new technologies. In the interwar period, overseas fishers—Hokkien, Okinawan, and Japanese—dominated the production of oceanic protein, a process explored in *Chapter Five*. It is within this context that Southeast Asia's pelagic environment—the space between the ocean's surface and the sea's floor—became prized as a modern tuna frontier. Though not consumed by the region's urban poor, tuna were vital to the growth and expansion of modern Japan and its imperial expansion into Southeast Asia and the Pacific in the interwar years. This period, a veritable age of tuna, marked a sea change in how Southeast Asia's pelagic waters, its offshore deeps, were perceived, used, and contested. No commodity or place was more pivotal to this age of tuna than abaca and Mindanao, a process revealed through the story of K.S. Ohta, a pioneer in Mindanao's abaca industry. While the demand for *katsuobushi* (dried tuna sticks) industrialized the Japanese exploitation of the Southeast Asian shelf, it also facilitated the work of Jose Domantay and Claro Martin in exploring and mapping Mindanao's pelagic resources within state systems of control.

While Japanese fishers opened Southeast Asia's pelagic deeps to industrial fishing, they also exploited previously untouched reef complexes in the decades between the wars. As discussed in *Chapter Six*, Japanese fishing *kongsis* (companies) and the predominantly Okinawan crews provisioned the region's colonial cities and plantation settlements with cheap sources of protein. These *kongsis* were able to control the supply of fresh fish and the politics they faced when delivering their catch to the public markets of interwar Southeast Asia. Drawing on colonial-era newspapers (in Dutch, English, and Malay), coroner's court files, the records of the Japanese-owned Borneo Fishing Company, and

marine police reports, we can detail Japanese modes of fishing down the food chain. In particular, it explores the use of the Okinawan fishing method known as *muro-ami* and its destructive impact on local reef environments.

The *muro-ami* method was a key development in Southeast Asia because it not only bolstered the success of Japanese kongsis, but it also played a pivotal role in powering the indigenous protein boom in the interwar period. The rise and fall story of Tora Eifuku—the largest kongsi “fish king” working out of interwar Singapore—frames this industry’s arc of boom and bust. The onset of World War II in Southeast Asia immediately collapsed these fishing operations and transregional networks, causing severe shortages of fresh fish during the Japanese occupation as well as a regional protein crisis. In 1941, Eifuku, his wife, and more than 1,000 Singapore-based Japanese fishers were sent to an internment camp in British India. Their departure marked both the end of Southeast Asia’s dramatic protein boom and the end of the interwar era.⁶¹

A concluding *Epilogue* reflects on the vantage and value of a mid-ocean perspective, drawing out the ways in which this sustained attention to the Asian marine environment has cast familiar histories of Southeast Asia, the Pacific, Japan, and Formosa in unfamiliar waters. It reveals the centrality of fish, fishing grounds, and the *Nan’yo* in feeding and fueling Japan’s maritime empire from 1914 to 1941, and connects how this prewar exploitation of the Asian marine environment presaged postwar conflicts over the protein riches of the South China Sea.

⁶¹ On the use of “fish king” and its association with Eifuku, see “Former ‘Fish King’ Returns To Revive Industry Here,” *Syonan Shimbun* (3 December 1942): 2.

CHAPTER TWO

“There Is But One Ichthyological Province”: Studying Fish in South and Southeast Asia, 1822-1878

Introduction

In 1845, John Richardson (1787-1865), a Scottish surgeon-naturalist in the service of the Royal Navy, placed the seas of Southeast Asia at the heart of “one ichthyological province.”¹ What is striking about Richardson’s production of space is how it was based on nature’s fish rather than a set of cultural, linguistic, botanical, economic, or political factors.² Richardson had a unique vantage, a wide imperial view as it were, given his role in the British Empire. After a youthful career as an Arctic explorer, working closely with John Franklin in the 1820s and recording observations that would come to serve as the origins of modern Polar research, Richardson took up a position at the Haslar Naval Hospital in Portsmouth. From 1838 to 1855, he was the Inspector of Hospitals and Fleets at Haslar, while also keeper of the Royal Navy’s zoological collections.³ As keeper, Richardson had

¹ John Richardson, “Report on the Ichthyology of the Seas of China and Japan,” *Report of the 15th Meeting of the British Association of the Advancement of Science* (1845): 190. Richardson’s nineteenth-century production of regional space accords with today’s Indo-Pacific seas. It also offers an alternative genealogy of regionalism and area studies in modern Asian history. More important, Richardson is operating within a long tradition of biogeography. For more on this history and its intellectual development, see Janet Browne, *The Secular Ark: Studies in the History of Biogeography* (New Haven: Yale University Press, 1983).

² Fish as a subject are largely absent in the intersecting fields of environmental history, Asian Studies, and the history of science. For a sense of this absence, see Vinita Damodaran et al., eds., *The East India Company and the Natural World* (New York: Palgrave Macmillan, 2015); Peter Boomgaard, ed., *Empire and Science in the Making: Dutch Colonial Scholarship in Comparative Global Perspective, 1760-1830* (New York: Palgrave Macmillan, 2013); David Henley and Henk Schulte Nordholt, eds., *Environment, Trade, and Society in Southeast Asia: A Longue Duree Perspective* (Leiden: Brill-KITLV Press, 2015); and, James Beattie et al., eds., *Eco-Cultural Networks and the British Empire: New Views on Environmental History* (London: Bloomsbury, 2015).

³ For a history of the Royal Hospital Haslar and its connections to British expeditions and explorers, see Eric Birbeck, “The Royal Hospital Haslar: From Lind to the 21st century,” *Journal of the Royal Naval Medical Service* 98 (2012): 36-38. For Richardson’s obituary, see “Obituary Notices of Fellows Deceased,” *Proceedings of the Royal Society of London* 15 (1866-1867), xxxvii-xliii.

access to fish specimens that invariably returned with each imperial expedition.⁴ It was from these jarred or dried specimens and the notes, tags, and slips of detail, which accompanied them, that Richardson outlined the contours of a new geographical space. Today, this biological zone is considered one of the richest centers of fish life in the world, both in terms of abundance and diversity.

Nature's Fish as History's Frame

Over the course of the nineteenth century, knowledge of the natural world became vital to imperial expansion and cultural governance. This was true for the East India Company (EIC) in South Asia and for colonial empires in Southeast Asia. From Malabar to Manila, Europeans living in the region labored to fill in Richardson's "ichthyological province" with information and illustrations. They assembled new knowledge about the fish fauna from their locality, the trade networks built around certain species, how fish were consumed, and the types of environments they inhabited. Fish knowledge was imperial knowledge, and in a part of the world where most people received their basic source of animal protein through the consumption of fish, this knowledge was central to ordering nature and governing society. In this era of knowledge production, describing fish was an investigative modality. It was an epistemological practice that produced documentation about Asia through its human and marine environments and the interactions between the two.⁵

⁴ "Small specimens of fish, pinned down and dried, abound in the boxes of insects sold at the Chinese ports to foreigners." See Richardson, "Report on the Ichthyology," 203. In such boxes, Richardson found samples of *Pegasus laternarius*, *Pegasus latirostris*, and *Lophius setigerus*, among other types.

⁵ On an investigative modality, Bernard Cohn explains it "includes the definition of a body of information that is needed, the procedures by which appropriate knowledge is gathered, its ordering and classification, and

As many of these nineteenth-century Europeans were surgeon-naturalists in the employ of the EIC or a colonial state, documenting fish required that they find time in between their official work.⁶ One of the earliest of these multitasking scientists was Patrick Russell (1726-1805), a Scottish surgeon-naturalist who arrived in Vizagapatam (Visakhapatnam) on the Coromandel Coast in 1781. Russell had spent sixteen years as the chief medical practitioner in Aleppo (Syria) before moving to India where he worked for the EIC as a naturalist, collecting a vast wealth of botanical and zoological specimens from Madras and its Indian littoral. Russell published *Descriptions and Figures of Two Hundred Fishes; Collected at Vizagapatam on the Coast of Coromandel* (1803).⁷ Francis Buchanan (1762-1829) also was a Scottish surgeon-naturalist who worked for the EIC in South Asia. Based on his Bengal experiences stationed near the world's largest single mangrove forest, the Sundarbans, Buchanan published *An Account of the Fishes Found in the River Ganges and Its Branches* (1822). Similarly, Theodore Cantor (1806-1860) was a Danish-born surgeon-naturalist who served with the EIC. He lived and worked in Calcutta, Malacca, Singapore, and Penang. In 1849, he published *Catalogue of Malayan Fishes*.

Across the Straits in Batavia, Pieter Bleeker (1819-1878) worked as an army surgeon for the Indies government. From 1851 to 1860, he was the founding director of two progressive, colonial-era institutions: the School for Indigenous Midwives (*School voor*

then how it is transformed into usable forms such as published reports, statistical returns, histories, gazetteers, legal codes, and encyclopedias." See Bernard Cohn, *Colonialism and Its Forms of Knowledge: The British in India* (Princeton: Princeton University Press, 1996), 5.

⁶ My thinking about this surprisingly productive "time in between work" derives from a vernacular sense of time in modern Philippine society. It stems from what Filipinos, urban and rural, have called a "sideline:" meaning work other than one's job.

⁷ Russell's research led to the publication of William Roxburgh's three-volume *Plants of the Coromandel Coast* (1795-1819). Russell wrote the preface for Volume 1. Russell also authored *An Account of Indian Serpents Collected on the Coast of Coromandel* (1796) and *A Continuation of an Account of Indian Serpents* (1801).

Inlandsche Vroedvrouwen) and the School for Indigenous Doctors (*School voor Inlandsche Geneeskundigen* or *Sekolah Dokter Jawa*).⁸ His use of time in the colony (1842-1860) and networks in the region made him by far the most productive ichthyologist in the nineteenth century. Between 1862 and 1878, Bleeker published his nine-volume magnum opus, *Atlas Ichthyologique des Indes Orientales Neerlandaises*.

On the Spanish side of the South China Sea was Casto de Elera (1852-1903), a Dominican priest who arrived in Manila in 1875. He was trained in natural history and served as the second director of the Museum of Natural History at the University of Santo Tomas from 1880 to 1897. De Elera taught zoology to Jose Rizal (1861-1896) and Antonio Luna (1866-1899).⁹ In 1895 and 1896, just as the Philippine Revolution was breaking out, he published his three-volume *Catalogo Sistemático de Toda la Fauna de Filipinas*. In a discussion of the first volume of *Catalogo* and reflecting on the broader intellectual impact of de Elera's zoological project, Domingo Sanchez y Sanchez, a prominent member of the National Museum of Natural History in Madrid, wrote in 1896: "The Dominican sage and illustrious naturalist, Fr. Casto de Elera, has collected materials for a great work; he has accumulated...valuable data; and when finished describing, classifying, ordering, and

⁸ Pieter Bleeker, "Levensbericht van Dr. Pieter Bleeker," *Natuurkundig Tijdschrift voor Nederlandsch-Indie* 40,1 (1 January 1881): 33-34.

⁹ See the series of letters between Antonio Luna and Casto de Elera, which are kept at the Archives of the University of Santo Tomas (UST). Luna, who had studied pharmacy (pharmacology) at UST and was quite close with de Elera, was in 1896 and 1897 a Philippine revolutionary (a *Katipunero*) imprisoned at Fuerza de Santiago in Manila. He was exiled to a prison in Spain in 1897, and released shortly thereafter. Luna returned to the Philippines in 1898, and led the war effort against the Americans in 1898 and 1899. He was assassinated in Cabanatuan, Nueva Ecija, in 1899. For more on Luna, see Ambeth Ocampo, *Luna's Moustache* (Pasig: Anvil, 1997).

distributing metonymically all this knowledge...it will appear, as true knowledge worthy of its author, the first body of doctrine, the first work of zoology on the Philippines.”¹⁰

But these Europeans and their foundational contributions to knowing fish have been largely forgotten, much like the field of ichthyology. Instead, they have been remembered, if at all, for their work with plants and populations, and the proximity they shared to the politics between colony and metropole. Russell, for example, is known for his medical service in Syria and the botanical and herpetological research he conducted along India’s Coromandel Coast. Buchanan is recalled for his extensive and elaborate statistical surveys, and his writings on South Asian flora. Cantor’s historiographical identity has been shaped by his career as an asylum administrator in Calcutta. As for Bleeker, scholars have narrowly focused on his politics in Batavia and Leiden, the relationship he had with the *Sekolah Dokter Jawa*, and his demographic work on Java’s population, while often footnoting that he was a productive ichthyologist.¹¹

For Bleeker and these other nineteenth-century ichthyologists, describing fish was a form of imperial knowledge, and what transformed the production and circulation of this

¹⁰ Domingo Sanchez y Sanchez, “Los Mamíferos de Filipinas,” *Anales de la Sociedad Espanola de Historia Natural* 2,19 (1900): 178. Sanchez originally presented his paper on Philippine mammalia at a session of the Spanish Society of Natural History on October 7, 1896. Sanchez (1860-1947) was a prominent zoologist and a collection builder for the National Museum of Natural Sciences in Madrid.

¹¹ For Patrick Russell, see P.K. Yasser Arafath, “Saints, Serpents, and Terrifying Goddesses: Fertility Culture on the Malabar Coast (c. 1500-1800),” in *Histories of Medicine and Healing in the Indian Ocean World: The Medieval and Early Modern Period, Vol. 1*, eds. Anna Winterbottom and Facil Tesfaye (New York: Palgrave Macmillan, 2016), 99-124 and Richard Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600-1860* (Cambridge: Cambridge University Press, 1995), 309-379. For Francis Buchanan, see C.A. Bayly, *Empire and Information: Intelligence-Gathering and Social Communication in India, 1780-1870* (Cambridge: Cambridge University Press, 1996) and Matthew H. Edney, *Mapping an Empire: The Geographical Construction of British India, 1765-1843* (Chicago: University of Chicago Press, 1997). For Theodore Cantor, see John van Wythe, *Dispelling the Darkness: Voyage in the Malay Archipelago and the Discovery of Evolution by Wallace and Darwin* (Singapore: World Scientific, 2013) and David Arnold, “Plant Capitalism and Company Science: The Indian Career of Nathaniel Wallich,” *Modern Asian Studies* 42,5 (2008): 899-928. On Bleeker, see Andrew Goss, *The Floracrats: State-Sponsored Science and the Failure of Enlightenment in Indonesia* (Madison: University of Wisconsin Press, 2011), 13-32.

knowledge was the arrival of lithography. Appearing first in Batavia in 1829, lithographic printing was a vital infrastructure that facilitated the development of scientific networks and the exchange of ichthyological research. This technological change made possible the mass production of articles, lists, catalogues, manuscripts, plates, and atlases. In Bleeker's Batavia or Cantor's Calcutta, scientific societies published journals, often several volumes a year, and their proceedings and transactions.¹² These publications were financed through subscriptions and consumed by associations, universities, and museums in Asia, Europe, and the United States.¹³

The explosion of scientific printing constituted a profound regional turn in the study of fish in Asia and for the history of ichthyological knowledge. Unlike Richardson, who was anchored in the metropole and studied specimens brought back from the seas of the Indo-Pacific, European ichthyologists in colonial cities and company towns worked up collections they acquired through professional circuits and local interactions.¹⁴ Whether at Batavia, Penang, or Calcutta, these Europeans assembled knowledge about fish by consulting coastal fishers, local fishmongers, salt traders, and *pawang pukat*, or Muslim

¹² One of the earliest and most productive publications in Batavia was the *Tijdschrift voor Nederlandsch Indie*, founded in 1838. See W. R. van Hoeffell, "Geschiedkundig Overzicht van de beoefening van Kunsten en Wetenschappen in Nederlandsch Indie," *Tijdschrift voor Nederlandsch Indie* 2,1 (1839): 112–14. On Batavia's explosion of lithographic printing since 1838 and its affect on the life of scientific activity in the Indies, see Pieter Bleeker, "Overzicht der Geschiedenis van het Bataviaasch Genootschap van Kunsten en Welenschappen van 1778-1853," *Verhandelingen van het Bataviaasch Genootschap* 25 (1853): 7–14. See also, Hans Groot, *Van Batavia naar Weltevreden: Het Bataviaasch Genootschap van Kunsten en Wetenschappen, 1778–1867* (Leiden: KITLV Press, 2009), 289–347.

¹³ On the circulation of scientific journals and their role in shaping knowledge at European museums and building individual careers within these global networks, see Agatha Gijzen, *'S Rijks Museum van Natuurlijke Historie, 1820-1915* (Rotterdam: W.L. & J. Brusse's Uitgeversmaatschappij N.V., 1938). For a recent survey of the place of print in science and science in print, see Rima D. Apple, Gregory John Downey, Stephen Vaughn, eds., *Science in Print: Essays on the History of Science and the Culture of Print* (Madison: University of Wisconsin Press, 2012), esp. Lynn K. Nyhart's "Voyaging and the Scientific Expedition Report, 1800-1940," 65-86.

¹⁴ For a sense of these personal and professional dynamics, see David Arnold, "Plant Capitalism and Company Science: The Indian Career of Nathaniel Wallich," *Modern Asian Studies* 42,5 (September 2008): 899-928.

spirit practitioners who specialized in river and sea fishing.¹⁵ More often than not, they visited public fish markets, or their contacts did, where specimens were observed, sketched, and purchased.¹⁶

Access to these local wet markets, and the fish descriptions borne from them, made the work of these imperial ichthyologists scientifically new and commercially valuable. Tools of taxonomy and practices of procurement coalesced to produce a wealth of documentation on Indo-Pacific fish, with detailed information about local and scientific names, habitats from which these fish flourished, methods and technologies of capture, and forms of consumption. By 1840, the work of collecting fish, organizing types, and describing species depended greatly on systems of infrastructure and cultures of reciprocity.¹⁷ In 1849, for example, Bleeker received a box of specimens from Cantor who was based in Calcutta. These fish formed the basis of Bleeker's ichthyological study of Bengal and the Ganges, and thus provided him the needed evidence to draw connections

¹⁵ In the Malay World, the *pawang pukat* retained a certain *ilmu*, or knowledge, which was consulted and depended upon by local fishers to ensure safe and bountiful expeditions. For examples from Sumatra in the late nineteenth century, see Christiaan Snouck Hurgronje, *De Atjèthers, Vol. 1* (Batavia: Landsdrukkerij, 1893), 302-307 and K.F.H. van Langen, "Atjeh's Westkust met Daarbij Behoorende Kaart," *Tijdschrift van het Koninklijk Nederlandsch Aardrijkskundig Genootschap* 2,5 (1888): 499-504. For the work and importance of pawangs in Malay society and in fields other than fishing, see Terenjit Singh Sevea, "Pawangs on the Malay Frontier: Miraculous Intermediaries of Rice, Ore, Beasts and Guns" (PhD diss., University of California at Los Angeles, 2013).

¹⁶ On specimen collecting at Asian markets in the nineteenth century, see Fa-ti Fan, *British Naturalists in Qing China: Science, Empire, and Cultural Encounter* (Cambridge: Harvard University Press, 2004) and his excellent article "Science in a Chinese Entrepot: British Naturalists and Their Chinese Associates in Old Canton," *Osiris* 18 (2003): 60-78. For observations made at a Calcutta market, see Francis Hamilton-Buchanan, *An Account of the Fishes found in the River Ganges and its Branches* (Edinburgh: Archibald Constable and Co., 1822), 89.

¹⁷ For more on the role of infrastructure in the practice of being in the field and the procurement of specimens, see Jane R. Camerini, "Wallace in the Field," *Osiris* 11 (1996): 44-65. For an illustration of this culture of reciprocity, see the late nineteenth-century letters between Jose Rizal and Adolf Bernhard Meyer, Edward E. Ayer Collection Newberry Library. As a political exile in Dapitan (Mindanao, Philippines) from 1893 to 1896, Rizal sent fish specimens (including a seahorse) and ichthyological descriptions to Meyer in exchange for books. From 1874 to 1905, Meyer was the director of the Royal Zoological and Anthropological-Ethnographic Museum in Dresden.

between the fish fauna of Batavia and that of “Hindostan.”¹⁸ In doing so, Bleeker forged a connected history through a connected space. Together in Asia, Cantor and Bleeker were grounding the “ichthyological province” outlined by Richardson in 1845.

Richardson’s “ichthyological province” provided a new frame for seeing and knowing South and Southeast Asia and its wider marine context. The task of realizing this spatial world was carried out by Europeans from within the region rather than from outside it. In this way, the growth of ichthyology was tied to the deepening and sprawling nature of empire. Fish knowledge and colonial expansion were intimately linked. Europeans who made their life in Asia’s cities and outposts, serving as surgeons but working as ichthyologists, were those who materialized and naturalized Richardson’s biogeographical space.

Making Knowledge Regional: The Work of Imperial Ichthyologists

One of the earliest ichthyologists who made a contribution to the development of regional fish knowledge was the Scottish surgeon Francis Buchanan (1762-1829). Through Buchanan’s Indian career (1794-1815), we can trace how the fish fauna of South Asia (and the Bengal delta in particular) were incorporated into the structures and systems of modern ichthyological knowledge. Like most of the early to mid-nineteenth century scientists, Buchanan studied botany (mosses in particular) and qualified in medicine, but he pursued interests well beyond these fields while based in Asia. According to the records of the Royal Botanic Garden at Calcutta, where Buchanan served as superintendent

¹⁸ Pieter Bleeker, *Nalezingen Ichthyologische Fauna van Bengalen en Hindostan* (Batavia: Lange & Co., 1853).

between 1814 and 1815, he made three voyages to the Indo-Pacific region before commencing a career with the East India Company in 1794.¹⁹

Buchanan's writings on fish were borne from an Indian career in motion. First as a surgeon and later as a surveyor, Buchanan traveled the width and length of South Asia and Burma.²⁰ Just after arriving in Calcutta, for example, in 1794, he was dispatched to the court of Ava as part of a mission. En route, Buchanan moved around the Bay of Bengal in the company of seventy men, including a "Hindoo pandit [Hindu scholar]...and a Moonshee [Muslim scribe]."²¹ These early travels afforded Buchanan the opportunity to encounter and explore the cultural, commercial, and faunal environments of the Bay and its vast delta. The embassy visited the Coco, Andaman, and Narcondam Islands, before entering the Irrawaddy River and proceeding to Rangoon, Ava, and Pegu. One passage from the mission's travel diary stands out as it reflects Buchanan's collecting spirit:

Dr. Buchanan, whose ardour for botanical researches often made me apprehensive for his safety, in wandering through the thickets in quest of plants, heard the report of a musket at a distance; on his approach to the spot, he found some peasants about to skin a bullock that had just been killed by a tiger: the shot had caused the animal to abandon his prey, and in its retreat it most fortunately took another way from

¹⁹ Buchanan made his voyages east as a medic with the British East India Company's Marine Service. From 1784 to 1789, he sailed twice to Bombay and China. From 1791 to 1792, he sailed to the Coromandel Coast and the Bay of Bengal. See Mark F. Watson and Henry J. Noltie, "Career, Collections, Reports and Publications of Dr Francis Buchanan (later Hamilton), 1762-1829: Natural History Studies in Nepal, Burma (Myanmar), Bangladesh and India. Part 1," *Annals of Science* 73,4 (2016): 397-398.

²⁰ Much of the extant literature has focused on Buchanan's life as a surveyor and botanist. See Arnold, "Plant Capitalism," 899-928; Edney, *Mapping an Empire*; C. A. Bayly, "Knowing the Country: Empire and Information in India," *Modern Asian Studies* 27,1 (February 1993): 3-43; and, Marika Vicziany, "Imperialism, Botany and Statistics in Early Nineteenth-Century India: The Surveys of Francis Buchanan (1762-1829)," *Modern Asian Studies* 20,4 (1986): 625-660.

²¹ Michael Symes, *An Account of an Embassy to the Kingdom of Ava, Sent by the Governor-General of India, in the Year 1795* (London: W. Bulmer & Co., 1800), 100-101. Symes was in charge of the mission.

that which the Doctor came. This was not the only time that his thirst after knowledge, and reliance upon his gun, led him into danger.²²

But while statistical surveys and botanical work have come to demarcate and define the place of Buchanan in the overlapping literatures on the history of science, environmental history, and South Asian history, his imperial life also involved a unique “thirst” for fish forged by his time in the delta.²³ His earliest reference to fish can be found in a letter he sent from his station at Luckipore to William Roxburgh on November 30, 1797. Writing to the superintendent of the Royal Botanic Garden in Calcutta, Buchanan explains: “I have given my old painter a gold mohur a month and have him employed on fishes. I am attempting to make him do the outlines with some degree of accuracy; when he succeeds in that I shall begin to colour.”²⁴ Unfortunately, we know nothing more about this “old painter,” aside from the fact that his artistic labor was critical to Buchanan’s work and reception as an imperial ichthyologist. But what we do know is that the relationship between the “old painter” and Buchanan was quite productive. In a letter sent to James Edward Smith in 1799, Buchanan reflects on the wealth and promise of Luckipore and

²² Symes, “An Account of an Embassy,” 137.

²³ See Jessica Ratcliff, “The East India Company, the Company’s Museum, and the Political Economy of Natural History in the Early Nineteenth Century,” *Isis* 107,3 (September 2016): 495-517; David Arnold, “Science and the Colonial War-State: British India, 1790-1820,” in *Science and Empire in the Making: Dutch Colonial Scholarship in Comparative Global Perspective, 1760–1830*, ed. Peter Boomgaard (New York: Palgrave Macmillan, 2013), 39-62; and, Minakshi Menon, “Making Useful Knowledge: British Naturalists in Colonial India, 1784-1820” (PhD diss., University of California at San Diego, 2013), 120-223.

²⁴ Quoted in David Prain, “A Sketch of the Life of Francis Hamilton (once Buchanan), some time Superintendent of the Honourable Company’s Botanic Garden at Calcutta,” *Annals of the Royal Botanic Garden at Calcutta* X (1905): xi. William Roxburgh was in constant communication with Buchanan, with the latter sending more than 170 letters to Roxburgh, Nathaniel Wallich, and James Smith, among others, from his postings in India, Bengal, and Nepal. Roxburgh was superintendent of the Royal Botanic Garden at Calcutta from 1793 to 1814, when Buchanan succeeded him. Wallich took over for Buchanan, and served as superintendent from 1815 to 1846. In 1905, David Prain was superintendent of the Royal Botanic Garden at Calcutta and the Buchanan letters were kept at its Library.

Barripore, his deltaic bases, explaining that by “next season...[he] should have ready nearly 200 drawings of fishes.”²⁵

Buchanan’s time in the Bengal delta played a central role in the development of his place-based contributions to knowing fish in the Indo-Pacific.²⁶ The access he had to the Sundarbans, an intertidal environment that not conjoins the Bay of Bengal to the Ganges River, but also represents the largest single mangrove forest in the world, greatly enriched the diversity of fish he collected, observed, and documented.²⁷ While at Luckipore, where the mouths of the Brahmaputra and Meghna Rivers intertwine, he “began to describe and draw fishes...collect[ing] a good many.”²⁸ His posting to Luckipore coincided with the efforts of the East India Company to stimulate the cultivation of indigo in Bengal.²⁹ From the southeast of the Bengal delta he moved to the southwest. At Barripore, a station not more than 20 miles from Calcutta and within the flood plains of the Ganges River, he

²⁵ Quoted in Sunder Lal Hora, “An Aid to the Study of Hamilton Buchanan’s Gangetic Fishes,” *Memoirs of the Indian Museum* 9,4 (1929): 172. Hora (1896-1955), an Indian ichthyologist who became Director of the Zoological Survey of India, copied Buchanan’s fish-related letters, which were, in the late 1920s, in the possession of David Prain. Smith was not only a classmate of Buchanan’s at the University of Edinburgh, but also the founder and president of the Linnean Society of London.

²⁶ M. S. Iftekhar and M. R. Islam, “Managing Mangroves in Bangladesh: A Strategy Analysis,” *Journal of Coastal Conservation* 10, 1/2 (2004): 139.

²⁷ Buchanan’s work laid the foundation for future ecological studies in and around the Sundarbans, particularly in terms of the interplay between climate, mangroves, and fish. See Anna O’Donnell and Quentin Wodon, eds., *Climate Change Adaptation and Social Resilience in the Sundarbans* (London: Routledge, 2015); R.A. Khan, *Fish Faunal Resources of Sunderban Estuarine System with Special Reference to the Biology of Some Commercially Important Species* (Kolkata: Zoological Survey of India, 2003) and A.K. Mandal and R.K. Ghosh, *Sundarban: A Socio Bio-Ecological Study* (Calcutta: Bookland, 1989).

²⁸ Hora, “An Aid,” 172.

²⁹ For a history of indigo in Bengal, see Willem van Schendel and Pierre-Paul Darrac, *Global Blue: Indigo and Espionage in Colonial Bengal* (Dhaka: University Press, 2006).

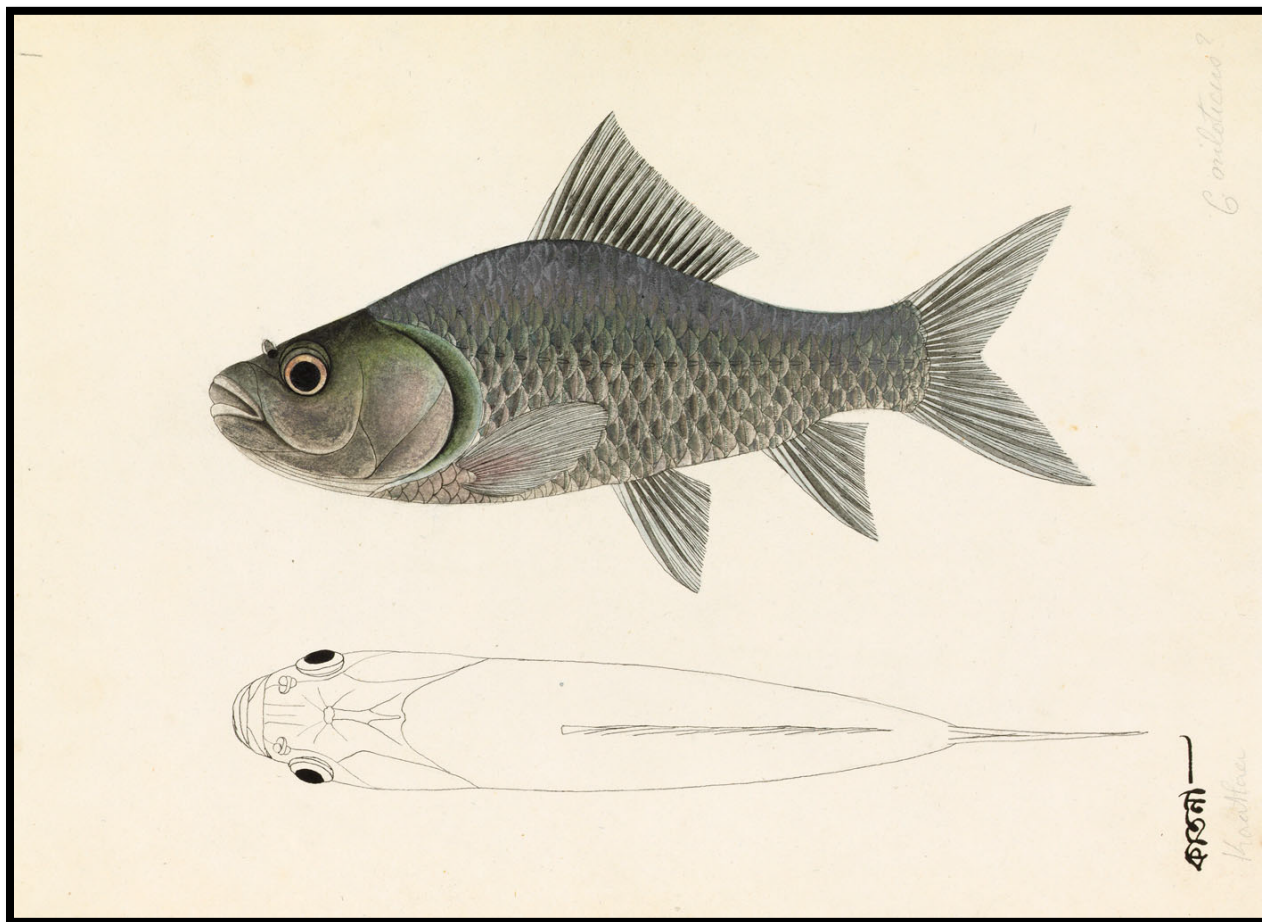
committed himself to the study of fish, observing, “For four months in the year every field swarms with fish, and at all times the only conveyance is by boats.”³⁰

From these rich years in the Bengal delta and working closely with local artists such as the “old painter” in Luckipore, Buchanan assembled a wealth of ichthyological material. He not only had specimens, drawings, and descriptions, but also notes on cultural uses, vernacular names, and the faunal ecology of the Sundarbans. From a letter Buchanan sent to Smith in 1799, we know that his intention was to make this regional fish world known—spatially, taxonomically, and imperially—through the publication of a book with nearly 200 drawings. He had hoped that Smith, founder and president of the Linnean Society of London, would see the wider value to knowledge, science, and commerce, but, unfortunately, there was little interest from those in the metropole to cover the expenses of such a project.

Undeterred, Buchanan continued his Company service and scientific work overseas, returning to England in 1815 so that he could claim a family inheritance. The new money changed Buchanan, quite literally. As a matter of law, he was required to change his last name to Hamilton, his mother’s maiden name, in order to secure the inheritance. Emboldened by a new sense of financial security, Buchanan committed the next seven years to preparing his Asian fish material for publication. In 1822, nearly twenty-three years after he first raised the prospects of an illustrated fish book to the Linnean Society, Buchanan self-published *An Account of the Fishes found in the River Ganges and its Branches*. His work was the first ichthyological study on Bengal’s fish fauna, and it included the

³⁰ Francis Hamilton, “Some Notices concerning the Plants of various Parts of India, and concerning the Sanscrita Names of those Regions,” *Transactions of the Royal Society of Edinburgh* X (1826): 176.

description of over 250 new species and approximately 170 drawings. More importantly, it played a critical part in building a base of scientific knowledge about fish in the Indo-Pacific and the place of fish within the societies, cultures, and economies of South and Southeast Asia.



Indian Carp (Cyprinus niloticus) drawn for Francis Buchanan by possibly an “old painter” from Luckipore.³¹

But while Buchanan’s fish study of the Bengal delta and its “archipelago of islands” opened the Asian environment to new orders of knowledge and forms of encounter, it also enabled a growing society of European naturalists to chart the intertextual contours of an

³¹ Francis Hamilton, *An Account of the Fishes found in the River Ganges and its Branches* (Edinburgh: Archibald Constable Co., 1822).

interconnected fish world.³² Contemporary and subsequent ichthyologists cited Buchanan's fish descriptions; and based on the species he documented, in some cases for the first time, they included the Bay of Bengal and its Gangetic estuaries as part of a wider "ichthyological province" bound by nature's fish and not by empire's design.³³ Looking closely at the nineteenth-century production of this biogeographical space—Richardson's "ichthyological province"—provides us with an opportunity to rethink and reframe the study of Asia and its area histories. Ecologically, fish and their habitats tied "Asia" together. Scientifically, this intra-Asian world was shaped and scripted by European ichthyologists on the ground.

By the mid-nineteenth century, this intra-Asian world was becoming a known ichthyological space. Already in 1845, Richardson outlined an "ichthyological province," cohering Asia biologically. But this map was grounded in dried specimens rather than personal observations. Richardson assembled his regional fish world from imperial expeditions that returned to the metropole with boxes of fauna and fragments of information.

Cantor's Social World of Malayan Fish

Theodore Cantor (1809-1860), a Danish-born surgeon who, like Buchanan, worked for the EIC, made a significant contribution towards realizing Richardson's "ichthyological province." In particular, Cantor enriched the study and understanding of fish by drawing on his experiences from the Bay of Bengal, "Sea of Penang," Malacca Straits, and Singapore. In

³² Amitav Ghosh, *The Hungry Tide* (Boston: Houghton Mifflin Harcourt, 2005), 6.

³³ On Buchanan's inclusion, intertextually, see Richardson, "On the Ichthyology," 301; Pieter Bleeker, "Diagnostische Beschrijvingen van Nieuwe of Weinig Bekende Vischsoorten van Sumatra," *Natuurkundig Tijdschrift voor Nederlandsch Indie* 3 (1852): 589; and, Francis Day, *The Fishes of Malabar* (London: Bernard Quaritch, 1865), viii, xxx, 2, 266.

1849, and with the financial support of the Calcutta-based Asiatic Society of Bengal, he published the first ichthyological work on Malayan fish. Cantor's *Catalogue of Malayan Fishes* reflected not only the currents of his imperial life, but also his extended residences in Calcutta, Penang, Malacca, and Singapore. Through these currents and circulations, Cantor gathered fish knowledge for popular and scientific consumption.³⁴

But Cantor's intra-Asian movements were guided not by the collection of fish, but rather the care of patients. As a member of the Bengal Medical Service, Cantor operated within an imperial world of asylums.³⁵ At the time of the Indian Mutiny in the late 1850s, he was the superintendent of the asylums at Bhowanipore and Dullanda. While the hospital at Dullanda was for Bengalis, the institution at Bhowanipore was originally built for Europeans and Eurasians, but as a report from 1879 noted, it began to admit "Americans, Jews, and Armenians."³⁶ This assignment to Calcutta, in charge of the psychiatric care of "soldiers, sailors and gentlemen," among other patients, however, came after he had proven himself at Fort William (Calcutta) and in Penang. From 1842 to 1845, Cantor was the superintendent of Penang's asylum and over the span of three and half years, this position,

³⁴ Cantor "gathered knowledge" through local encounters with European traders, Chinese fishers, Malay consumers, and by visiting to public markets. For more on the role of mobility and interaction in the coproduction of knowledge, see Barbara Watson Andaya, "Gathering 'Knowledge' in the Bay of Bengal: The Letters of John Adolphus Pope, 1785-1788," *Journal of Malaysian Branch of the Royal Asiatic Society* 87,2 (2014): 1-19; William Hast, "Piracy and the Production of Knowledge in the Travels of William Dampier, c.1679-1688," *Journal of Historical Geography* 37 (2011): 40-54; and, Kapil Raj, *Relocating Modern Science: Circulation and the Construction of Knowledge in South Asia and Europe, 1650-1900* (Basingstoke: Palgrave Macmillan, 2007).

³⁵ For some time, Cantor served as the "superintendent of the Asylums for European and Native Insanes at Bhowanipore and Dullanda." These hospitals were located just outside of Calcutta. See *Selections from the Records of the Government of Bengal: Reports on the Asylums for European and Native Insane Patients at Bhowanipore and Dullanda for 1856 and 1857* (Calcutta: Calcutta Gazette, 1858).

³⁶ *Report on Asylums in Bengal* (Calcutta: Bengal Secretariat Press, 1879), 18.

despite the burdens of imperial service, afforded him “ample time” to pursue “scientific inquiries.”³⁷

While based in Penang and working at the asylum, Cantor found the time to change the field of ichthyology in the Indo-Pacific. He showed how the study of fish and the describing of species were also practices of spatial production and cultural analysis. For Cantor, fish conveyed a social world of entangled places and networked people. It was a social world anchored in the Asian marine environment. More importantly, it was a social world glimpsed by those who studied fish, but largely unknown to most other Europeans.

Through his personal observations and local interactions, Cantor brought this social world of fish into global view and circulation. From Penang, he traveled to neighboring localities and environments such as Malacca, Langkawi, and Singapore. On these visits into the “field,” Cantor, like Buchanan, explored public fish markets where he gathered knowledge about the types of fish being sold, salted, and consumed as well as specimens for his drawings. The fish market in Penang, for example, was some distance from the town and its sea of peoples: Europeans, Malays, Chinese, Tamils, Bengalis, and Chulias, among others.³⁸ The market was built on stakes over the shore water, and fishing boats, or *perahu*, surrounded it on all sides. While visiting Penang’s fish market in the 1850s, A French observer noted how it was packed with a variety of small fish:

³⁷ “The Change of Residency Surgeon,” *Singapore Free Press and Mercantile Advertiser* (2 October 1845): 2.

³⁸ For a sense of these cosmopolitan currents and their contributions to Penang’s social life and transregional economy, see Khoo Salma Nasution, *The Chulia in Penang: Patronage and Place-Making around the Kapitan Kling Mosque 1786-1957* (Penang: Areca Books, 2014); Wong Yee Tuan, *Penang Chinese Commerce in the 19th Century: The Rise and Fall of the Big Five* (Singapore: ISEAS, 2015); and, Yeoh Seng Guan et al., eds., *Penang and its Region: The Story of an Asian Entrepot* (Singapore: NUS Press, 2009).

The greater number of which were not yet dead and were in general a species entirely unknown to me; some were ornamented with beautiful rays of yellow and black, and furnished with a long, sharp, gilded horn, which rose like a graceful arch; others with beaks like those of parraquets—had fins more brilliant and dazzling than the wings of the humming-bird, and a great number were covered with prickles as sharp and hard as the point of a poniard, all glowing with the most vivid colors; even the rich plumage of the native birds—the wings of the butterfly, and gilded *coleoptera*, would have appeared dull and somber by the side of these lovely inhabitants of the deep...³⁹

From the passing French traveler, we get a surface sense of Penang's fish market: the colors and spectacle of its transactions. But from Cantor, the fulltime asylum administrator and part-time ichthyologist, we learn a great deal more about the radials and rhythms, which constituted this social world of fish. First, while Malays were the majority of consumers, the overseas Chinese community controlled the fish trade in and out of Penang. The fishers who supplied the trade were "principally natives of China...[and whose] numbers in search of work annually arrived in Chinese junks."⁴⁰

To improve their economic position, these Chinese fishers often formed small groups of four or five, pooling their resources together in order for them to secure fishing stakes made out of mangrove, *ramie* nets drawn from a local grass, and *perahu*.⁴¹ As for the seaworthiness of these *perahu*, they were apparently suitable only for short distances from the coast. Cantor's observation about these *perahu* reveals two important points about human interactions with the marine environment: first, the abundance and diversity of Penang's fish market stemmed solely from its shore waters; and, second, the pelagic

³⁹ Melchior Yvan, *Six Months among the Malays; and a Year in China* (London: James Blackwood, 1855), 180-181.

⁴⁰ Cantor, "Catalogue of Malayan Fishes," i.

⁴¹ Ramie (*Boehmeria nivea*), or *rami* in Malay, is a plant-based fiber, which has been used to make fishnets from the Bengal delta, where Buchanan first introduced it in 1807, to China.

environment and the fish fauna unique to this ecology were still unknown to human activities and mass consumption.⁴²

These Chinese fishers were but one spoke in Penang's wheel of commerce. The fish trade also involved several branches of business. These lines of trade interacted and intersected at the fish market. For local Malays, Tamils, Chulias, and Chinese, fresh fish were widely consumed and intensely pursued. After fishers landed their late night and early morning catches, Chinese fishmongers organized the hauls by kinds of fish and ensured their freshness by repeatedly pouring seawater over them. As Cantor observed, while "few kinds of fishes appear on the tables of Europeans, the Malays and Chinese are less nice in their selection, and reject but few kinds."⁴³ However narrow and selective, this line of trade was the sole link through which most Europeans had contact with the social world of fish.

Other aspects of the fish trade remained outside the experience of Europeans in Southeast Asia at mid-century. While the business of dried fish was largely foreign to Europeans, it was a staple food for upriver communities, rural Malays, and Chinese tin-miners.⁴⁴ For these local populations, who lived inland among rice paddies and had no access to the ocean's fresh marine goods, dried fish was popularly consumed because it was cheap, durable, and rich in basic nutrients (protein, fatty acids, and vitamins). Short

⁴² The pelagic environment is the deep, offshore water, which is between the ocean's surface and the seafloor. This marine zone is where schools of tuna and other commercial species swim and circulate.

⁴³ Cantor, "Catalogue of Malayan Fishes," ii.

⁴⁴ For more on the radials of Penang's dried fish trade, particularly as they extended across the Malacca Straits to Sumatra's upriver communities, see Akira Oki, "The River Trade in Central and South Sumatra in the Nineteenth Century," in *Environment, Agriculture, and Society in the Malay World*, eds. Tsuyoshi Kato, Muchtar Lufti, and Narafumi Maeda (Kyoto: Center for Southeast Asian Studies, 1986), 8, 23. See also, Eric Tagliacozzo, "A Necklace of Fins: Marine Goods Trading in Maritime Southeast Asia, 1780-1860," *International Journal of Asian Studies* 1,1 (2004): 28.

mackerel (*Rastrelliger brachysoma*) was a fish especially desired in its dried form.⁴⁵

Penang's unsold fresh fish quickly became dried fish through an elaborate curing process, which included generous amounts of salt and at least forty-eight hours under the sun.⁴⁶

Fish maws, or dried fish bladders, also forged a significant business of trade.

Penang's Chinese fishmongers secured a variety of fish species from procurers rimming the Bay of Bengal and extending down the Malacca Straits. Based on his observations, Cantor emphasized that not all bladders were same, and that certain fish types were particularly pursued. From Penang's fish market, he learned from the Chinese buyers that the species prized for the dried bladder trade included the Barramundi (*Lates calcarifer*); Threadfin fish (*Polynemus dubius*); Bronze Croaker (*Otolithoides biauritus*); Tigertooth Croaker (*Otolithes rubber*); and, Mangrove Red Snapper (*Lutjanus argentimaculatus*).⁴⁷

The dried fish bladder trade thrived among Chinese buyers in Malacca and Singapore too. From these Malayan port-cities, this commodity was exported to consumers and manufacturers in China. Like *agar*, a popular seaweed extract from Southeast Asian waters, dried fish bladder functioned as a kind of collagen. It was used in the production of jellies, medicines, and other recipes central to Chinese food culture. As such, it constituted one of the "eight treasured foods from the sea."⁴⁸

⁴⁵ On the nutritive qualities of dried fish, and in particular short mackerel, or *pedah*, see A.G. van Veen, "Chemisch Onderzoek over 'Pedah', Een Gezouten Visch-Product," *Ingenieur in Nederlansch Indie* 8,12 (1941): 128-137.

⁴⁶ For more on the place and circulation of salt, see Gerrit Knaap and Luc Nagtegaal, "A Forgotten Trade: Salt in Southeast Asia 1670-1813," in *Emporia, Commodities and Entrepreneurship in Asian Maritime Trade, c.1400-1750*, eds. Roderich Ptak and Dietmar Rothermund (Stuttgart: Franz Steiner Verlag, 1991), 127-157.

⁴⁷ In the same order as above, Cantor recorded the Malay names for these fish as ikan siakap, ikan kurau, gelama selampai, gelama gigi jarang, and ikan merah.

⁴⁸ Pamela Teo Li Gek, "Man Eating Shark: Unravelling the Debate on the (Un)ethical Consumption of Shark's Fin in Singapore" (MA thesis, National University of Singapore, 2015), 11. See also Nola Cooke, "Tonle Sap Processed Fish: From Khmer Subsistence to Colonial Export Economy," in Eric Tagliacozzo and Wen-chin

*Dried Fish Bladders Imported into and Exported out of Penang, 1838-1842.*⁴⁹

Year	Import		Export	
	Quantity (Kilograms)	Value (Spanish Dollars)	Quantity (Kilograms)	Value (Spanish Dollars)
1838-39	6,228	5,118	12,335	9,140
1839-40	4,293	3,034	11,609	7,299
1840-41	18,683	10,227	8,707	5,299
1841-42	7,074	4,414	16,023	12,523
Total	79,994	50,172	117,239	73,842

Like dried fish bladders, the commerce in sharks' fins operated outside European circles as it connected Penang to waters of supply and lands of consumption. Spatially, this line of trade bounded Asia within a network of human-fish encounters. This zone of interaction stretched from the fishing grounds of the Bay of Bengal to markets in Hong Kong and China. Chinese fishmongers in Penang, Malacca, and Singapore handled the trade eastward, much in the way they managed the commerce in dried fish bladders. But before transshipping this marine commodity to Chinese destinations, these fishmongers supplied local Chinese consumers in the Straits Settlements with fins for soups and other recipes.⁵⁰

*Quantity and Value of Sharks' Fins Imported into and Exported out of Penang, 1838-1842.*⁵¹

Year	Import		Export	
	Quantity (Kilograms)	Value (Spanish Dollars)	Quantity (Kilograms)	Value (Spanish Dollars)
1838-39	11,790	3,001	25,758	5,451
1839-40	4,595	1,703	19,288	5,970
1840-41	10,400	2,582	21,767	4,689
1841-42	31,502	7,457	31,744	7,781
Total	81,626	19,216	192,094	48,036

Chang, eds., *Chinese Circulations: Capital, Commodities, and Networks in Southeast Asia* (Durham: Duke University Press, 2011), 360-379. In the case of colonial Cambodia, the fish bladder trade started in the 1870s.

⁴⁹ Cantor, *Catalogue of Malayan Fishes* (Calcutta: Baptist Mission Press, 1850).

⁵⁰ On the intra-Asian circulations of sharks' fins, see *The Chinese Repository*, Vol. XII (Canton: Printed for the Proprietors, 1843), 514-515. See also, Richard Hanitsch, *Guide to the Zoological Collections of the Raffles Museum, Singapore* (Singapore: Straits Times Press, 1908), 50-52. Hanitsch was an entomologist who served as the Raffles Museum's first director. From 1895 to 1907, he was curator and librarian of the Raffles Library and Museum.

⁵¹ Cantor, *Catalogue of Malayan Fishes* (Calcutta: Baptist Mission Press, 1850).

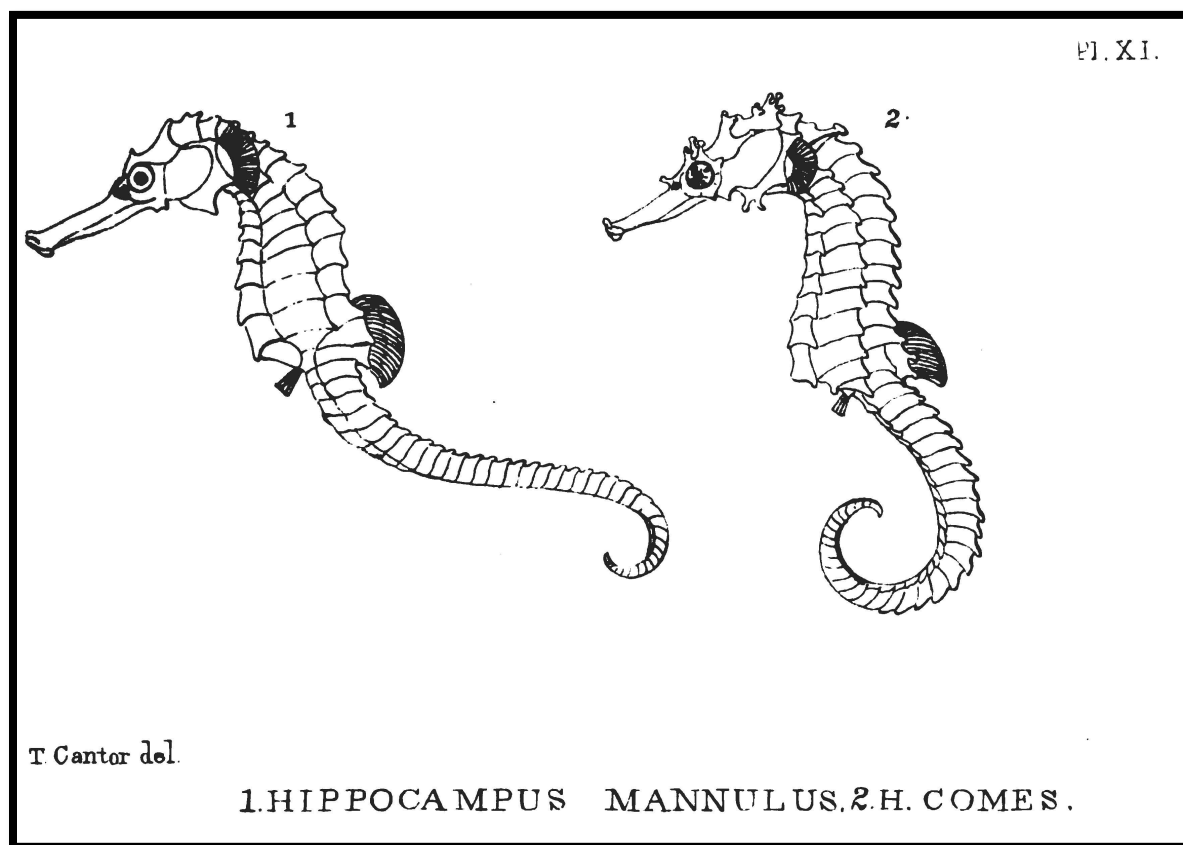
Cantor's mapping of the sharks' fins trade opened up the social world of fish, bringing its material flows into wider view, but his ichthyological work also revealed an even more significant dimension of this intra-Asian commerce. Based on his personal observations and local interactions, Cantor "discovered" that the bins of fins he inspected at the fish markets in Penang, Malacca, and Singapore were from specific species and not just sharks. What were traded as sharks' fins were in fact sourced from two families of cartilaginous fish: sharks (*Squalidae*) and rays (*Rajidae*).⁵² From the Penang fish market, in particular, he identified fins from species that today are endangered such as the Zebra shark (*Stegostoma fasciatum*) and Winghead shark (*Eusphyra blochii*). Cantor also recorded species that presently are considered vulnerable like the Hammerhead shark (*Sphyrna zygaena*), Blacktip reef shark (*Carcharhinus melanopterus*), Bowmouth guitarfish (*Rhina ancylostoma*), and Reticulate whipray (*Himantura uarnak*).⁵³

But just as Cantor's fish descriptions provided new insights into the types of species that fueled the sharks' fins trade from Coromandel to Canton, his scientific writings also complicated the ocean as a site of diversity. Through the study of fish, he documented the ecologies from which these sharks and rays were found. By explaining where certain cartilaginous fish lived and what they consumed, Cantor nuanced the nature of the Asian marine environment and how it was imagined among his reading public. Spatially, Cantor furthered the realization of Richardson's "ichthyological province" by rooting this regional fish world in a set of connected places. The case of the whipray makes this point clearly. Prized for its fins and meat, the young whipray was at home in the Malacca Straits. It

⁵² Cantor refers to these families, *Squalidae* and *Rajidae*, as suborders, *Squali* and *Rajae*.

⁵³ Cantor, "Catalogue of Malayan Fishes," v, 1378, 1381, 1386, 1387, 1391, 1405.

flourished in the shallow waters, favoring the muddy sands and seagrass bottoms. Young members of this species were especially abundant at all seasons. Often found among the Straits' brackish littorals, they nested within reach of the coast's rich mangrove forests feeding on diet of crustaceans and small fish. These same ecological features—shallow seas, brackish waters, and sandy bottoms—marked the whipray's geographical range that extended from the Cape of Good Hope to the China Sea.⁵⁴



*Cantor's Hippocampus mannulus.*⁵⁵

⁵⁴ Cantor, "Catalogue of Malayan Fishes," 1406-107.

⁵⁵ Cantor, *Catalogue of Malayan Fishes* (Calcutta: Baptist Mission Press, 1850).

For the study of fish in the mid-nineteenth century, Cantor's *Catalogue of Malayan Fishes* was a breakthrough. His work represented fish not only as specimens of nature, but also as parts of society. In Cantor's descriptions, we learn about the anatomical details of fish, but also the ways in which certain species were tied to trade networks, cultural uses, and particular environments. By 1850, this radical turn in knowing and mapping the social world of fish became the convention. More importantly, it was a conceptual and empirical turn borne from the personal observations and cultural encounters of those Europeans who lived and worked in South and Southeast Asia. Through their writings, investigations, and exchanges, these ichthyologists not only materialized Richardson's biogeographical space through the mass production of documentation about fish, but they also fostered a spatial perspective shaped from within the region rather than outside it.

Bleeker's Atlas of Indo-Pacific Fish

No nineteenth-century ichthyologist did more to realize and document the central place of Southeast Asia in a wider "ichthyological province" than Pieter Bleeker (1819-1878). Bleeker was a Dutch surgeon who lived in Batavia from 1842 to 1860. His scientific contributions are remarkable for their numerousness and the impact they have had on the field of ichthyology.⁵⁶ For today's scientists who study the world's fish fauna, Bleeker is considered the "father of Indo-Pacific ichthyology."⁵⁷ His wealth of documentation on fish

⁵⁶ The Indo-Pacific Fish Conference (IPFC) created the Pieter Bleeker Award in 2005. The award recognizes an individual's contributions to Indo-Pacific ichthyology through research in systematics or ecology. IPFC was founded in 1981 and meets every four years. It brings together hundreds of ichthyologists, and is considered the leading conference in the field.

⁵⁷ "Editorial Notes and News," *Copeia* 2012,2 (June 27, 2012): 362; "Editorial Notes and News," *Copeia* 2008,4 (Dec. 18, 2008): 948; "Editorial Notes and News," *Copeia* 2006,2 (May 26, 2006): 331; and, "Editorial Notes and News," *Copeia* 2004,3 (Aug. 20, 2004): 732.

and the biogeographical space in which they exist has provided the base knowledge for valuing and understanding Southeast Asia as the “global center of marine biodiversity.”⁵⁸ In particular, the region’s Coral Triangle has been referred to as the “Amazon of the Seas,” with more than 75% of all known coral species, 53% of the world’s coral reefs, more than 3,000 reef fish species and commercially valuable pelagic species (including a variety of tuna), more than 22 species of marine mammals (including dolphins, dugongs, sperm whales, and killer whales), and the greatest extent of mangrove forests of any region in the world.⁵⁹

But while Southeast Asia has long attracted historical attention for its wildlife and wild spaces, the ecology of its seas and straits has remained strangely marginal and understudied.⁶⁰ Bleeker’s life and career demonstrate, however, that this absence of scholarly interest is not rooted in a dearth of material. The efforts of European naturalists to catalogue the Asian marine environment are as storied and rich as the ocean life they sought to document.

The imaginative work of Samuel Fallours, for example, elicits not only the radials of empire, but also how these global ties of mobility, science, and commerce enabled the one-time soldier turned clergyman’s assistant to take up residence in Ambon between 1706 and

⁵⁸ Joseph Christensen, “Unsettled Seas: Towards a History of Marine Animal Populations in the Central Indo-Pacific,” in *Historical Perspectives of Fisheries Exploitation in the Indo-Pacific*, eds. Joseph Christensen and Malcolm Tull (Dordrecht: Springer, 2014), 14. See also L.M. Chou, “Southeast Asia as the Global Center of Marine Biodiversity,” *Tropical Coasts* 4 (1997): 4-8.

⁵⁹ World Wildlife Fund for Nature, *The Coral Triangle: At the Centre of Marine Biodiversity* (June 2007), 1-4. assets.panda.org/downloads/coral_triangle.pdf

⁶⁰ For exceptions, see 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); Masyhuri, “Pasang Surut Usaha Perikanan Laut: Tinjauan Social-Ekonomi Kenelayanan di Jawa dan Madura, 1850-1940” (Ph.D. diss., Vrije Universiteit, 1995); and, Shanty Setyawati, “Pasang Surut Industri Perikanan Bagansiapiapi, 1898-1936” (M.A. thesis, Universitas Indonesia, 2008).

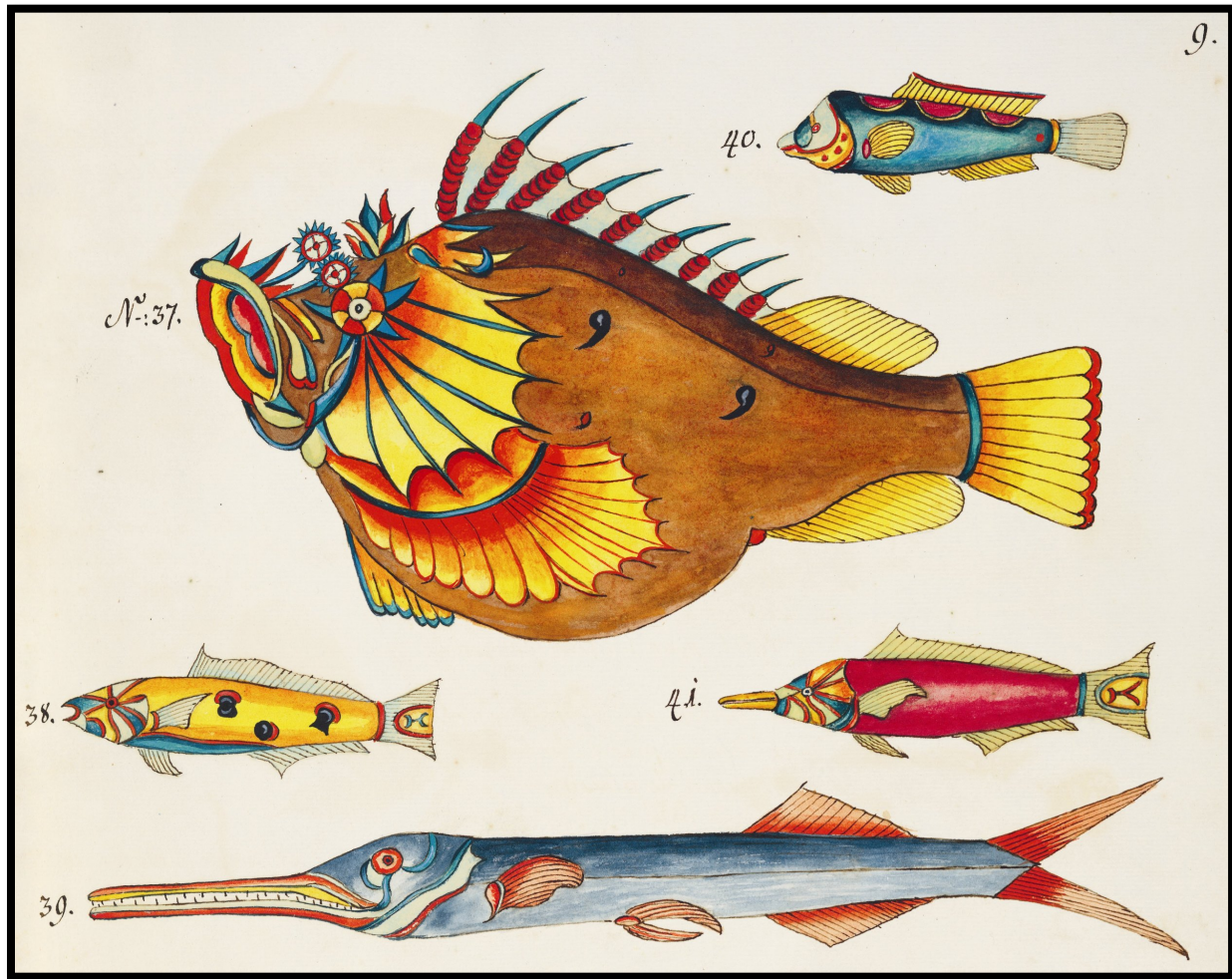
1712. Fallours would employ his years living in Ambon, a Dutch port town situated within present-day Indonesia and the Coral Triangle, to care for the sick as well as collect fish, corals, and other marine specimens from local fishers, public markets, and the surrounding shores of the Banda Sea. As a result of his time in Ambon, Fallours published *Poissons, Ecrevisses et Crabes* (Fishes, Crayfishes, and Crabs) in 1719, considered by many to be the world's first color catalogue of fish.⁶¹



Samuel Fallours's Sirenne from the East Indies, 1718.⁶²

⁶¹ M.J. Sirks, *Indisch Natuuronderzoek, Een Beknopte Geschiedenis van de Beoefening der Natuurwetenschappen in de Nederlandsche Kolonien* (Amsterdam: Koloniaal Instituut te Amsterdam, 1915), 68. On being the first color catalogue of fish, see Theodore Pietsch, *Samuel Fallours: Tropical Fishes of the East Indies* (Cologne: Taschen, 2010), 7.

⁶² Louis Renard, *Poissons, Ecrevisses et Crabes, de Diverses Couleurs et Figures Extraordinaires, que l'on Trouve Autour des Isles Moluques, et sur les Cotes des Terres Australes* (Amsterdam: Chez Reinier & Josue Ottens, 1754), no. 240.



Samuel Fallours's *Brilliant Fish from the East Indies*, 1718.⁶³

While Fallours conveyed to the world a fantastical sense of Indo-Pacific marine fauna, it was Bleeker who added scientific depth to the region's ichthyological wealth. He arrived in Batavia in 1842 and remained in the archipelago until his return to the Netherlands in 1860. Over the course of his eighteen-year career in the Indies, Bleeker amassed an unrivaled collection of fish.⁶⁴ Marinus Boeseman, who was curator of fishes at the National Museum of Natural History (*Rijksmuseum van Natuurlijke Historie*) in Leiden

⁶³ Louis Renard, *Poissons, Ecrevisses et Crabes, de Diverses Couleurs et Figures Extraordinaires, que l'on Trouve Autour des Isles Moluques, et sur les Cotes des Terres Australes* (Amsterdam: Chez Reinier & Josue Ottens, 1754), no. 9.

⁶⁴ Kent E. Carpenter, "A Short Biography of Pieter Bleeker," *Raffles Bulletin of Zoology* 14 (2007): 6.

from 1947-1981, explained that Bleeker returned with between 30,000 and 40,000 fish specimens, consisting of over 2,500 species, 2,000 of which were from the Indies, and 1,000 species that were new to science.⁶⁵ In addition to the 200 boxes of specimen that followed Bleeker to the Netherlands, he had shipped more than 12,000 fish specimens to Leiden's National Museum of Natural History. Once settled in The Hague, Bleeker utilized his extensive fish collection to ultimately publish his "life-work," a nine-volume set titled *Atlas Ichthyologique des Indes Orientales Neerlandaises* between 1862 and his death in 1878.⁶⁶ The ninth volume appeared posthumously. His addition to his *Atlas*, Bleeker authored more than 770 articles, most of which were on Indo-Pacific fish.⁶⁷

Bleeker's prolific career as an imperial ichthyologist stemmed from his energy but also his environment. His arrival in Batavia in 1842 occurred just a few short years after the emergence of the *Tijdschrift voor Nederlandsch Indie*. The founding editor of the *Tijdschrift* was Jacobus Johannes Brest van Kempen (1782-1841), director of the *landsdrukkerij* (government's printing press). From 1845 to 1848, Wolter Robert Baron van Hoeffell (1812-1879) edited the colony's earliest monthly magazine. Locally published, and shepherded under van Hoeffell's editorship, the *Tijdschrift* became central to the social

⁶⁵ Marinus Boeseman, "Collectors and Fish Collections of the Rijksmuseum van Natuurlijke Historie in Leiden, Netherlands (1820-1980)," in *Collection Building in Ichthyology and Herpetology*, eds. Theodore W. Pietsch and William D. Anderson (Lawrence: American Society of Ichthyologists and Herpetologist, 1997), 88. On Boeseman's distinguished career as an ichthyologist, see M.J.P. van Oijen and W. de Ligny, "Marinus Boeseman, 1916-2006: A Biography and a List of His Publications," *Zoologische Mededelingen Leiden* 80 (2006): 1-8.

⁶⁶ Bleeker, "Levensbericht," 38, 42.

⁶⁷ Peter Boomgaard, "The Making and Unmaking of Tropical Science: Dutch Research on Indonesia, 1600-2000," *Bijdragen tot de Taal-, Land- en Volkenkunde* 162 (2006): 201. Boeseman contends that Bleeker published about 520 papers on fish and that more than 400 of these articles focused on the fish fauna of the Indies. See Boeseman's introduction to Pieter Bleeker, *Collected Fish Papers of Pieter Bleeker, Vol. 1*, ed. W.H. Lamme (The Hague: W. Junk B.V. Publishers, 1973), 4.

and political life of the Indies. But in Bleeker's view, it did little to stimulate the growth and dynamism of scientific life in the archipelago.

Shortly after arriving in Batavia, Bleeker observed that the colony "was totally absent of a periodical for the medical and natural sciences."⁶⁸ His response to this environment was to found a new society for the core purpose of publishing material on these neglected fields. Appearing in 1844, the *Natuur- en Geneeskundig Archief van Neerland's Indie* provided readers with a range of science-oriented articles, including the first Batavia-printed list of Indies trees that was made by W.L. Blocx's botanizing work in the Moluccas.⁶⁹ Bleeker's tireless vision realized the *Archief* and this new periodical fed and was fed by the scientific community in the Indies. As a result, though, when Bleeker was transferred to Semarang in 1847, the Batavia-based *Archief* ceased to operate. But through his work and the four volumes of the *Archief* that materialized between 1844 and 1847, this short-lived journal not only opened a space for scientific writing, it also fostered a culture for producing knowledge about the natural world in the Indies.⁷⁰

The experience of the *Archief* also played a formative role in Bleeker's evolution as one of the world's most productive ichthyologists. Because he edited the *Archief*, solicited works from authors in the medical and natural sciences, and made collecting excursions to the fish markets, mangrove shores, and salty shallows of the Bay of Batavia, Bleeker came to understand how the Indies was a fertile ground for science. Motivated by the "prospect

⁶⁸ Bleeker, "Levensbericht," 22.

⁶⁹ Katharine Smith Diehl, *Printers and Printing in the East Indies to 1850, Vol. 1* (London: Caratzas, 1990), 312.

⁷⁰ Bleeker, "Levensbericht," 22. In 1847, Bleeker became major of the Indies medical corps. In Surabaya, a coastal city about 770 kilometers east of Batavia (Jakarta), he was the officer-in-charge of the army hospital and thus oversaw the care of those wounded from the first Bali expedition.

of a rich harvest,” Bleeker turned to the field of ichthyology.⁷¹ It was an area of science completely absent in the colony, where the references of Bernard Lacepede (1756-1825) were the only ichthyological works available.⁷² More importantly, Bleeker’s limited (financial) means and restricted mobility (because of his government appointment) precluded him from taxonomizing nature in any ambitious way. But the study of fish was different; it was a field of study that allowed Bleeker to collect, catalogue, and describe on a scale consistent with—or comparable to—his vision. As Bleeker explained in 1877: “The collecting of fishes was neither time-consuming nor very expensive, and the fish markets yielded an abundance of material.”⁷³

Bleeker’s reassignment to Semarang’s military hospital in 1847 bolstered his turn toward ichthyology as well. The move ended the run of the *Archief*. By 1848, the *Tijdschrift* closed its local production too. Van Hoevell had departed the Indies for the Netherlands and took the periodical with him. These changes and their influence on the life of scientific activity in Batavia, and the archipelago more broadly, prompted Bleeker to express his concern publicly. He worried for the future of science in the Indies and wanted to raise awareness among his colleagues in Singapore and beyond of its demise. He buried his critique in a quiet paper on the ichthyology of Sumbawa.⁷⁴ After a proper introduction to the fish he received from Heinrich Zollinger followed by a list of the species in the collection, Bleeker interjects his own scientific narrative with an emotional “digression”:

⁷¹ Bleeker, “Levensbericht,” 22.

⁷² Boeseman, *Collected Fish Papers*, 19.

⁷³ Bleeker, “Levensbericht,” 23.

⁷⁴ Heinrich Zollinger, a Swiss naturalist who arrived in the Indies in 1841 and made an expedition to Bima, Sumbawa in 1847, furnished Bleeker with the collection of fish described in the paper. As a sign of appreciation for the fish he received from Zollinger, Bleeker named a species of waspfish after him: *Vespacula zollingeri* (1848).

I must still lament that, from my unavoidable separation from the scientific world, I am not in a condition to lithograph the new species. I must await my return to Europe to publish my already partly completed *Fauna Archipelagi Indici Ichthyologica*. The efforts made by me with the government of Netherlands India for its publication have not only not been attended with the desired result, but, followed by a transference from Batavia to Samarang and Surabaya, have placed me even beyond the possibility of applying to the service of my cabinet of ichthyological specimens, collected by the labors of many years and at a great cost. Batavia, but a short time past the centre of science in Netherlands India, shall speedily be so no more. The scientific periodicals, the *Tijdschrift voor Nederlandsch Indie*, the *Natuur-en Geneeskundig Archief voor Neerland's Indie*, the *Indisch Magazyn*, on whose existence these possessions might pride themselves, have all fallen to the ground. The year 1848 will be noted in the history of Netherlands India as the last year of the decennium of its scientific activity. May the time come when science shall be again protected and supported here against the unfavorable influences, which, in the midst of her bloom, have by little and little undermined and menaced her with total destruction. I have allowed myself the preceding digression in order to show why my ichthyological publications are not yet more numerous, and why they are not accompanied by plates of the species discovered by me.⁷⁵

Bleeker's "digression" on the death of scientific life in the Indies came as he was banished to Semarang and Surabaya, but his return to Batavia in 1849 was accompanied by a new fervor for science and a new zeal for the study of fish. Like Buchanan, Cantor, and other ichthyologists of the nineteenth century, Bleeker devoted his "spare time" to collection building, describing fish, and rendering new species scientifically known.⁷⁶ Once in Batavia, his ichthyological writings increased exponentially.⁷⁷ The vast majority of Bleeker's fish articles appeared in *Natuurkundig Tijdschrift voor Nederlandsch Indie*, the scientific journal of the *Koninklijke Natuurkundige Vereeniging in Nederlandsch Indie* (Royal

⁷⁵ Pieter Bleeker, "A Contribution to the Knowledge of the Ichthyological Fauna of Sumbawa," *Journal of the Indian Archipelago and Eastern Asia* 2 (1848): 634-635.

⁷⁶ Boeseman, *Collected Fish Papers*, 23. See also P.J.P Whitehead et al., "The Types of Bleeker's Indo-Pacific Elopoid and Clupeoid Fishes," *Zoologische Verhandelingen* 84 (1966): 5; and, Theodore W. Pietsch and William D. Anderson, "Collection Building: An Overview," in *Collection Building in Ichthyology and Herpetology*, eds. Theodore W. Pietsch and William D. Anderson (Lawrence: American Society of Ichthyologists and Herpetologist, 1997), 6.

⁷⁷ Bleeker, "Levensbericht," 38.

Association for Natural Science in the Netherlands Indies) that was established in 1850.⁷⁸ Bleeker not only was the most important founder of the *Koninklijke Natuurkundige Vereeniging in Nederlandsch Indie*, but he also served as president of the society and editor-in-chief of its learned periodical until his departure from the Indies in 1860.⁷⁹ Under Bleeker's direction, there were twenty-two volumes of *Natuurkundig Tijdschrift* published and eight volumes of the society's *Verhandelingen* (Transactions).⁸⁰ Less than five years after his return, Bleeker had restored the vigor and vitality of scientific life back to the Batavia and the Indies.⁸¹

While *Natuurkundig Tijdschrift* provided Bleeker a global platform for his ichthyological writings, serving as president of the society enabled him to secure fish specimens from across the Indies and Indo-Pacific. Based in Batavia, he made productive use of the colonial circuits that facilitated the ebb and flow of residents, governors, administrators, colonels, shipping agents, and engineers, among others, who all wired the colonial archipelago together. From Bleeker's writings and notes we know that he was meticulous about documenting and acknowledging his informal network of collectors. These individuals dotted the Indies, from Padang to Papua, and thus provided Bleeker with a diversity of fish. For example, Don Luis Augusto d'Almeida Macedo, who was governor of Timor-Delhi and a prominent member of *Koninklijke Natuurkundige Vereeniging in*

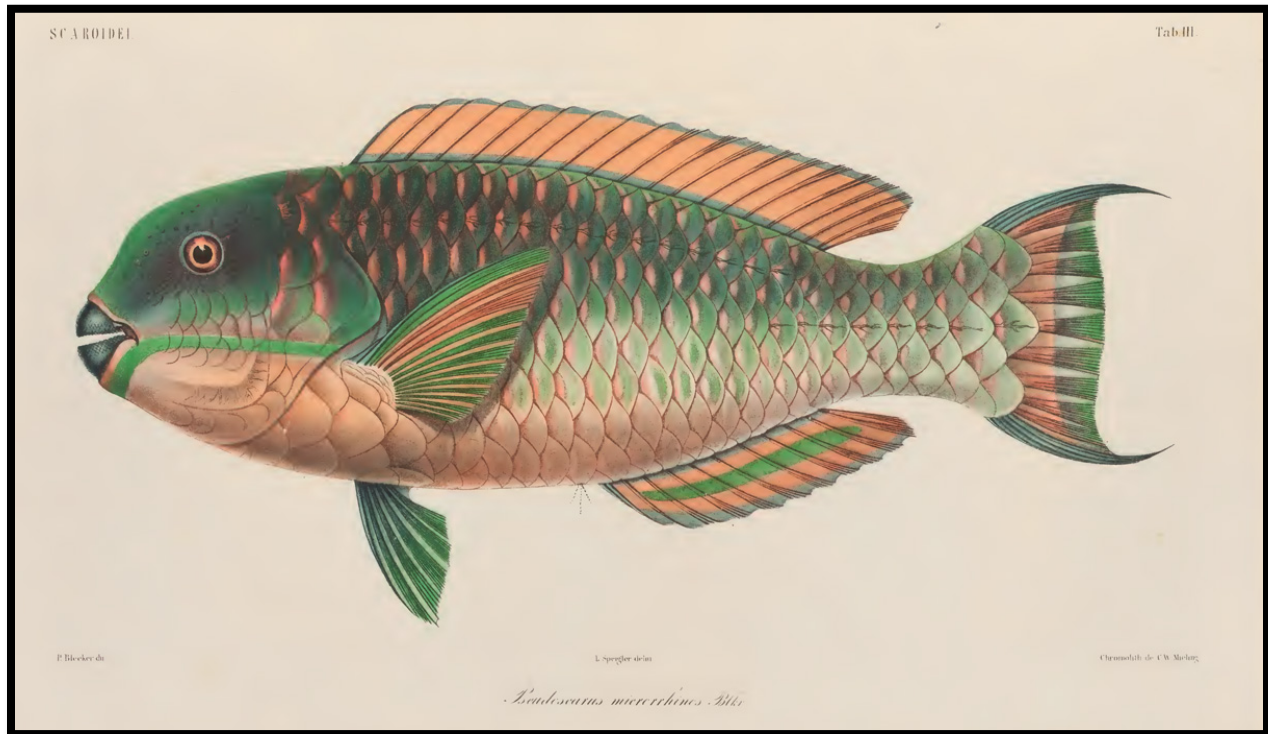
⁷⁸ "Prospectus van den Natuurkundig Tijdschrift voor Nederlandsch Indie," *Natuurkundig Tijdschrift voor Nederlandsch Indie* 1,1 (1 January 1850): 1-3.

⁷⁹ P.J. Willekes MacDonald, "De Koninklijke Natuurkundige Vereniging in Nederlandsch Indie," in *Een Eeuw Natuurwetenschap in Indonesie, 1850-1950: Gedenkboek Koninklijke Natuurkundige Vereeniging* (Bandung: Koninklijke Natuurkundige Vereeniging, 1950), 3-10. See also August Wilhelm Philip Weitzel, *Batavia in 1858 of Schetsen en Beelden uit de Hoofdstad van Neerlandsch Indie* (Gorinchem: J. Noorduijn & Zoon, 1860): 184-207.

⁸⁰ Bleeker, "Levensbericht," 31.

⁸¹ Bleeker, "Levensbericht," 33.

Nederlandsch Indie, assisted Bleeker on occasion, sending him fish from the Portuguese colony.⁸²



*Bleeker's Parrot Fish.*⁸³

As an army surgeon, Bleeker also used his professional contacts with physicians, pharmacists, and health officers to ensure that fish from Bangka, Borneo, or Bali were sent to him in Batavia. In 1849 and 1850, for instance, the Indies government sent Dr. Johan Hendrik Croockewit (1823-1888) to Bangka and Billiton, a pair of islands just off the southeast coast of Sumatra facing the Karimata Passage and the Java Sea. While Croockewit failed to locate tin, which was the main purpose of his expedition to Billiton, he did,

⁸² Pieter Bleeker, *Ichthyologiae Archipelagi Indici Prodrumus, Volumen I: Siluri* (Batavia: Lange & Co., 1858), 10.

⁸³ Pieter Bleeker, *Atlas Ichthyologique des Indes Orientales Neerlandaises: Publie sous les Auspices du Gouvernement Colonial Neerlandais* (Amsterdam: Frederic Muller, 1862), tab. III.

faithfully, manage to send Bleeker a sizeable collection of fish from this corner of the colonial archipelago.⁸⁴ Bleeker's professional ties weathered change too. In some cases, his "collectors" would ship jars of specimen from multiple sites. A collection of fish had come from Dr. Mohnike, a first class health officer, who was first stationed at Natuna, an island in the South China Sea wedged between Borneo and Singapore, and later transferred to Ambon, an old port town in the Moluccas once made famous by Samuel Fallours and Alfred Russel Wallace.⁸⁵

But while professional circuits and colonial networks were central to building up Bleeker's fish collection and thus his ichthyological knowledge so too were his interactions with local medical students in Batavia. In 1851, a pair of schools was established for the training of indigenous midwives and indigenous doctors (*School voor Inlandsche Vroedvrouwen* and *School voor Inlandsche Geneeskundigen* or *Sekolah Dokter Jawa*).⁸⁶ Proposed in 1847 by Willem Bosch, head of the Indies medical service, Bleeker upon his return to Batavia from Semarang served as the founding director of these institutions from 1851 to 1860.⁸⁷ As colonial schools, they were the first of their kinds in the Indies. Bleeker

⁸⁴ See Pieter Bleeker, "Bijdrage tot de Kennis der Ichthyologische Fauna van Blitong (Biliton), met Beschrijving van Eenige Nieuwe Soorten van Zoetwatervisschen," *Natuurkundig Tijdschrift voor Nederlandsch Indie* 3 (1852): 87 and Pieter Bleeker, "Bijdrage tot de Kennis der Ichthyologische Fauna van Banka," *Natuurkundig Tijdschrift voor Nederlandsch Indie* 3 (1852): 443. As for Croockewit, he did not find tin on Billiton, but shortly after his return a second expedition was sent specifically to Billiton. This mission discovered the much-prized mineral within 24 hours and, as a result, changed the course of the island's social, economic, and environmental history. See Jurrien van den Berg, "Tin Island: Labor Conditions of Coolies in the Billiton Mines in the Nineteenth and Early Twentieth Centuries," in *Coolie Labour in Colonial Indonesia: A Study of Labour Relations in the Outer Islands, c.1900-1940*, eds. Vincent J. Houben and J. Thomas Lindblad (Wiesbaden: Harrassowitz Verlag, 1999), 211. For more on Croockewit's expedition, see J.H. Croockewit, *Banka, Malakka en Billiton: Verslagen van Dr. J.H. Croockewit aan het Bestuur van Neerlandsch Indie, in de jaren 1849 en 1850* ('S Gravenhage: K. Fuhri, 1852).

⁸⁵ Bleeker, *Ichthyologiae Archipelagi Indici Prodrumus, Volumen I: Siluri*, 10.

⁸⁶ Bleeker, "Levensbericht," 33-34.

⁸⁷ On the founding of these institutions, see Liesbeth Hesselink, *Healers on the Colonial Market: Native Doctors and Midwives in the Dutch East Indies* (Leiden: KITLV Press, 2011), 83, 127.

was committed to the project of medical education as he saw it as an opportunity to impart the terms and values of science.⁸⁸ And given the geographical diversity of the student population, his routine encounters with local midwives and doctors surely had a beneficial impact on his ichthyological work too. For example, the male students at the *Sekolah Dokter Jawa* were from elite local families, and not all from Java. They represented the span of the archipelago: Java, Sumatra, Bangka, Sulawesi, Ambon, and other localities.⁸⁹

Bleeker's wealth of local contacts and colonial connections enabled him to pursue the study of fish on a scale worthy of his ambition. Aside from the schools and societies he directed and the journals he edited, Bleeker's lasting legacy to the world has been his countless ichthyological writings and his nine-volume *Atlas Ichthyologie*. Describing the weight of Bleeker's contribution to knowing the fish fauna of the Indo-Pacific, Francis Day (1829-1889), the eminent surgeon-ichthyologist of India, wrote, "the patient and persevering labours carried on for many years by Dr. Bleeker" had produced for "the world the...scientific *Atlas Ichthyologique*...a splendid record of personal industry in the East, unwearied research amongst the finny tribes in Malaysia and elsewhere, and a model of accuracy in the discrimination of families, genera, and species."⁹⁰ Similarly, the most important Indo-Pacific ichthyologists of the late nineteenth and early half of the twentieth century, Max Weber and L.A. de Beaufort, reflected on Bleeker's career in their second volume of *The Fishes of the Indo-Australian Archipelago*, explaining how he had "done more

⁸⁸ Bleeker, "Levensbericht," 34.

⁸⁹ Bleeker, "Levensbericht," 35. See also Hesselink, *Healers on the Colonial Market*, 84-87.

⁹⁰ Francis Day, *This Fishes of Malabar* (London: Bernard Quaritch, 1865), viii, xxx. For more on Day, see P.J.P. Whitehead and P.K. Talwar, *Francis Day (1829-1889) and His Collections of Indian Fishes* (London: British Museum, 1976).

than any man to promote our knowledge of ichthyology of the Indo-Australian Archipelago.”⁹¹

When the last of his nine volumes had been published in 1878, Bleeker’s *Atlas* represented one of the earliest and most comprehensive accounts of fish life in the Indo-Pacific.⁹² Taxonomically, it incorporated fish described by Russell, Buchanan, Cantor, Day, and other contemporary ichthyologists working and residing in South and Southeast Asia. Socially, Bleeker’s *Atlas* reflected the personal ties and scientific networks that wired the Indo-Pacific together. And, finally, spatially, his *Atlas* realized the biogeographical world that had been outlined by Richardson in 1845. Through the labors of Bleeker, his cast of collectors, and the cumulative efforts of early and mid-nineteenth century scientists, the Indo-Pacific came to be known as “one ichthyological province.” It was nature’s fish rather than society’s politics that formed and framed the bounds of this intra-Asian region.

In the Wake of Bleeker’s *Atlas*

By the late nineteenth century, there was growing interest in the Asian marine environment. Bleeker anticipated these new currents in a presidential address he delivered to the Royal Association of Natural Science in 1852. “We are in a region,” Bleeker explained, “where science...is called upon to locate natural resources and, on a large scale, use them to

⁹¹ Max Weber and L.F. de Bueaufort, *The Fishes of the Indo-Australian Archipelago, Vol. II, Malacopterygii, Myctophoidea, Ostariophysii: I Siluroidea* (Leiden: E.J. Brill, 1913), vi.

⁹² See Carpenter, “A Short Biography,” 5-6; Brian Saunders, *Discovery of Australian Fishes: A History of Australian Ichthyology* (Collingwood: CSIRO, 2012), 83; and, Max Weber and L.F. de Bueaufort, *The Fishes of the Indo-Australian Archipelago, Vol. 1, Index of the Ichthyological Papers of P. Bleeker* (Leiden: E.J. Brill, 1911), v-xi.

serve the interests of humanity.”⁹³ Indeed, in the “interests of humanity” and commerce, this regional fish knowledge that had developed since Buchanan in Bengal, Cantor in Penang, and Bleeker in Batavia, was now beginning to take on new dimensions and find novel uses. In the wake of Bleeker’s *Atlas*, technological changes and scientific networks would not only expand the world of Indo-Pacific fish beyond the circles of surgeon-ichthyologists and scientific periodicals, but these changes and networks would also transform the place of Asian marine environment in the modern world. The rise of urban aquariums and marine laboratories in the early twentieth century would bring the ocean and make its fauna public, thereby serving the interests of society, science, and industry.

⁹³ P. Bleeker, “Algemeen Verslag der Werkzaamheden van de Natuurkundige Vereeniging in Nederlandsch Indie over het jaar 1851,” *Natuurkundig Tijdschrift voor Nederlandsch Indie* 3,1 (1 January 1852): 15.

CHAPTER THREE

Bringing the Ocean Ashore:

Colonial Ichthyologists and Public Aquariums in the Indo-Pacific, 1904-1923

Introduction

By building public aquariums to exhibit the rich sea life of their tropical waters, colonial ichthyologists effectively repositioned the place of the Southeast Asian shelf in the modern world. During the early decades of the twentieth century, scientists leveraged nature not to distinguish or demarcate societies bound by the Indo-Pacific Ocean, but rather to designate this arc of ocean as a global center of endless wonder and biological wealth. From Madras to Manila, newly opened public aquariums emphasized the incomparable richness of their shared “ichthyological province.”¹ In this way, the “finny tribes” of the Indo-Pacific constituted a spatial identity that spanned seas, cultures, empires, and languages.² While this idea of regionalism had been taking shape the mid-nineteenth century, it was largely a privileged view rather than a public perception. It was a sense of regional space that manifested within the circuits and societies of “professional scientists.”³ But after 1900, this specialized understanding of the Indo-Pacific as the world’s center of fish life began to be transformed into a popular belief. Central to this transformation were the rise of public aquariums and the ichthyologists who built them.

¹ John Richardson, “Report on the Ichthyology of the Seas of China and Japan,” *Report of the 15th Meeting of the British Association of the Advancement of Science* (1845): 190.

² On the use of “finny tribes,” see Bains Prashad, “Fish and Fisheries of Bengal.” Lecture delivered before the Rotary Club, Calcutta, on 28 July 1936. At the time, Prashad was director of the Zoological Survey of India. From 1946 to 1948, he would help found the Indo-Pacific Fisheries Council and serve as chair of its inaugural meeting in Singapore in 1949.

³ Pieter Bleeker, “Levensbericht van Dr. Pieter Bleeker,” *Natuurkundig Tijdschrift voor Nederlandsch-Indie* 40,1 (1 January 1881): 38.

While nineteenth-century European scientists taxonomized the fish fauna of these waters in ways that constituted this vast zone as an “ichthyological province,” local and foreign fish experts working in their wake organized public aquariums.⁴ As ichthyologists, they also built on this earlier scientific knowledge and described new species, but their central contribution to spreading and expanding knowledge of Indo-Pacific fish was through the establishment of saltwater aquariums. By 1941, there were nine public aquariums around the Pacific Rim—in Tokyo (1882), Honolulu (1904), Madras (1909), Manila (1914), Batavia (1922), Nhatrang (1922), San Francisco (1923), Singapore (proposed 1929), Colombo (1936), and Bangkok (1940).

In the broader Indo-Pacific Ocean, the first public aquarium was founded at Tokyo’s Ueno Zoo in 1882, and with it crystallized a techno-culture marked by infrastructure and the rising social significance of the ocean in an age of empire. This emergent techno-culture was based on an inseparable relationship between humans and the marine environment. From the view of this techno-culture, the modernity of a society was shaped by its capacity to exchange and exhibit the tropicity of ocean life.⁵

From Singapore to San Francisco, fish were the most exchanged and exhibited forms of aquatic life in the early twentieth century. In the case of Indo-Pacific fish, these wonders were unrivaled in their diversity and desired for their tropicity.⁶ As we know, within natural science’s larger Linnaean project, nineteenth-century ichthyologists labored to

⁴ John Richardson, “Report on the Ichthyology of the Seas of China and Japan,” *Report of the 15th Meeting of the British Association of the Advancement of Science* (1845): 190.

⁵ On this inseparability in the context of land animals, empires, and zoos, see Ian Jared Miller, *The Nature of the Beasts: Empire and Exhibition at the Tokyo Imperial Zoo* (Berkeley: University of California Press, 2013), 2.

⁶ On the use of tropicity in relation to fish, see Judith Hamera, *Parlor Ponds: The Cultural Work of the American Home Aquarium, 1850 – 1970* (Ann Arbor: University of Michigan Press, 2012), 193-218.

classify the diversity of Indo-Pacific fish. The Indies career of Pieter Bleeker attests to the sustained seriousness of this taxonomic effort. Through his countless writings and magisterial nine-volume *Atlas Ichthyologique*, Bleeker spent his professional life systematically ordering the fish fauna of the Indo-Malay Archipelago.

But after 1900, tropical fish became more popular and whole societies, cities and nations, were attracted to their aesthetics. When W.R. Townsend of the San Francisco Bureau of Foreign Commerce steamed through the Celebes Sea in 1902, he took notice of the region's fantastical fauna: "In the fish market in Macassar, we saw a wonderful assortment of brilliantly colored, striped, and spotted fishes of various shapes, sizes, and kinds. The Bermuda fish in the New York Aquarium are nowhere in comparison."⁷ By 1930, Singapore had become the principal distributing center of a global tropical fish trade. At the heart of these circulations was Teo Way Yong, a local Singaporean who started a family business exporting aquarium fish in 1920. Through his network of collectors, Yong received fancy specimens from around Malaya that he kept alive in "Shanghai jars, small tanks, and bottles."⁸ As the leader of this new tropical fish industry, Yong supplied the world's hobby aquarists and public aquariums with colorful representatives of the Indo-Pacific such as spotted scats (*Scatophagus argus*) and Siamese fighting fish (*Betta splendens*). To fulfill just one order in 1933, Yong had to ship 20,000 tropical fish to Germany.⁹

From Townsend's "cruise" through the Celebes Sea in 1902 to Yong's tropical fish networks in the 1920s and 1930s, the popularity of the Indo-Pacific species grew through

⁷ "Cruising in the Malay Archipelago," *Straits Times* (24 January 1903): 5.

⁸ "A True Fish Story," *Straits Times* (24 December 1933): 11.

⁹ "A True Fish Story," *Straits Times* (24 December 1933): 11.

their display in the modern world of public aquariums. For Townsend, his reference to the New York Aquarium's inferiority to Makassar's "brilliantly colored" specimens was a message to the director of the New York Aquarium, C.H. Townsend.¹⁰ Clearly, the aesthetics of fish mattered. Public aquariums like the New York Aquarium built their place and secured their prominence in this age of techno-culture by bringing the ocean ashore and keeping its fauna healthy, attractive, and alive. The primary role of these institutions was to curate fish spectacles and cultivate the public's interest in the marine environment.

Globally, people responded to the rise of urban aquariums by swelling these new public institutions in record numbers. Batavia's public aquarium welcomed nearly 30,000 visitors in 1927 while the public aquarium in Madras saw about 100,000 visitors per year from 1923 to 1926.¹¹ Indo-Pacific fish at the Blackpool Aquarium in England witnessed a million visitors in the summer of 1927.¹²

Because of their tropicality, Indo-Pacific fish were central to the growing collections of public aquariums in the period around the turn of the twentieth century. For this reason, ichthyologists were not only instrumental in building these urban institutions, but they were often in charge of them as well. In India, Edgar Thurston (1855-1835) founded the Madras Aquarium in 1909, and James Hornell (1865-1949) later advised on its development.¹³ Hornell expanded the scale and scope of the aquarium between 1918 and 1923 when he served as director of the Madras Fisheries Department as well as the

¹⁰ I suspect the two Townsends were related, but I have found no evidence to support that suspicion.

¹¹ "Het Aquarium op Pasar Ikan," *Nieuws van den dag voor Nederlandsch-Indie* (3 January 1928): 5.

¹² "Malaya's Fish Supplies," *Singapore Free Press and Mercantile Advertiser* (5 May 1932): 7.

¹³ The Madras Aquarium (1909) was the second oldest public aquarium in the Indo-Pacific, after Tokyo's Ueno Zoo (1882).

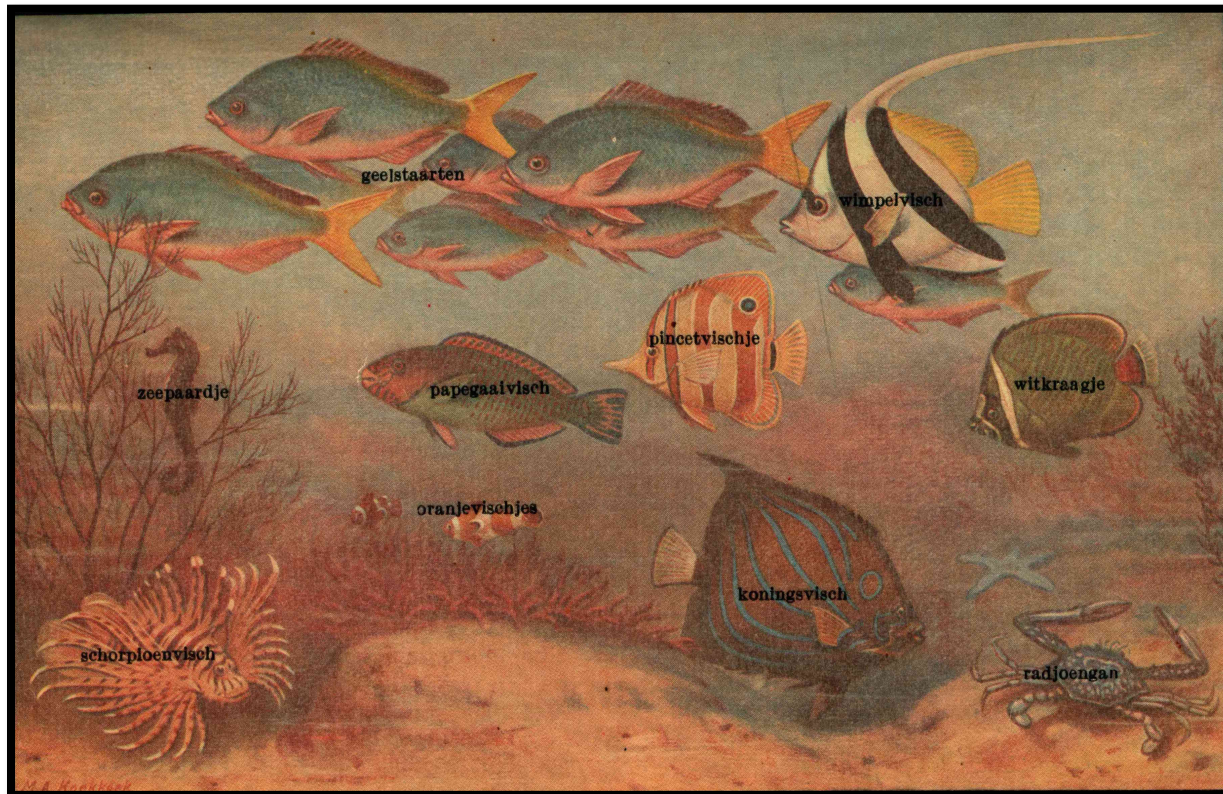
aquarium's superintendent.¹⁴ Similarly, in the Netherlands Indies, Armand Louis Jean Sunier (1886-1974) established Batavia's public aquarium in 1923, making it the third oldest in Southeast Asia. Based on his success in the Indies, Sunier went on to become the third director of Amsterdam's *Natura Artis Magistra*, the oldest zoological garden and public aquarium in the Netherlands, from 1927 to 1953.¹⁵ Succeeding Sunier as director of Batavia's public aquarium was H.C. Delsman (1886-1969), an ichthyologist who worked in the Indies from 1919 to 1926 and later became a professor of zoology at the University of Amsterdam.¹⁶ In 1924, Delsman published an illustrated color guide to Batavia's public aquarium, the first of its kind in Southeast Asia.¹⁷

¹⁴ James Hornell, "The Madras Marine Aquarium," *Madras Fisheries Department Bulletin No. 14* (Madras: Government Press, 1922), 56-95.

¹⁵ On Sunier's role at Artis and the connections he maintained with scientists in the Indies, including one connection, which enabled him to acquire a dugong (*Dugon dugong*), see "De Sirene in Artis," *Algemeen Handelsblad* (17 November 1928): 7.

¹⁶ On Delsman's career in the Indies, see S.J. de Groot, *Een Eeuw Visserijonderzoek in Nederland, 1888-1988* (Ijmuiden: RIVO, 1988), 203-204. See also, "Dr. Delsman Voorgedragen voor Professoraat," *Het Nieuws van den dag voor Nederlandsch-Indie* (19 April 1925): 4.

¹⁷ H.C. Delsman, *Indische Zeevisschen in het Aquarium van het Laboratorium voor het Onderzoek der Zee op den Pasar Ikan te Batavia* (Batavia: G. Kolff & Co., 1924).



*Coral Fish from Delsman's Aquarium Guide, 1924.*¹⁸

In the early twentieth century, no ichthyologist did more to popularize Indo-Pacific fish and the seas from which they came than the American naturalist Alvin Seale. From 1904 to 1923, he built a network of public aquariums that stretched across the Pacific from San Francisco to Manila. Within this transoceanic circuit, Seale exchanged tropical fish and introduced foreign species. In Hawaii, he imported the mosquito fish (*Gambusia affinis*) as part of an effective anti-mosquito campaign.¹⁹ In Manila, he introduced black bass

¹⁸ H.C. Delsman, *Indische Zeevisschen in het Aquarium van het Laboratorium voor het Onderzoek der Zee op den Pasar Ikan te Batavia* (Batavia: G. Kolff & Co., 1924).

¹⁹ "Little Fish Here to Kill Mosquitoes," *Pacific Commercial Advertiser* (16 September 1905): 1.

(*Micropterus*), common carp (*Cyprinus carpio*), and rainbow trout (*Oncorhynchus mykiss*) as new food sources.²⁰

But Seale's influence and legacy extended much further, reaching far beyond Honolulu, Manila, and San Francisco. His work stimulated the rise of public aquariums in South and Southeast Asia, serving as a model for these institutions in Batavia, Colombo, Bangkok, and Singapore.²¹ In particular, his sense of design and use of technology accentuated the aesthetics of Indo-Pacific fish, and thus maximized their public reception. As an ichthyologist, Seale applied his knowledge of fish diversity and aquatic environments to assemble spectacles of marine life, thereby popularizing the riches and wonders of the Indo-Pacific at a time when urban and social change were in full swing.²²

Becoming Aquatic: Alvin Seale Goes West

While Seale's story comes to a close in 1958, at the age of 87 in the comfort of his Santa Cruz home overlooking the Pacific Ocean, it opens, like many other turn-of-the-century Californians, from faraway. Seale was born in Fairmont, Indiana in 1871, and raised on a farm as a Quaker. His outdoor surroundings likely sparked his interest in zoology that he pursued at Leland Stanford Junior University. In his memoirs, Seale recounts, "peddling down the long dusty road, walking up long hills, riding through the

²⁰ 18 March 1907, Box 1, Folder 2, Alvin Seale Diaries, M0172, Department of Special Collections and University Archives, Stanford University Libraries (SUL), Stanford, CA.

²¹ See H.C. Delsman, "Het Zeewateraquarium te Batavia," *Tropisch Natuur* 13,1 (January 1924): 1-8 and "De Duizend-Eilanden," *Sumatra Post* (18 June 1932): 15.

²² In the context of Southeast Asian cities, see Su Lin Lewis, *Cities in Motion: Urban Life and Cosmopolitanism in Southeast Asia, 1920-1940* (Cambridge: Cambridge University Press, 2016); Daniel F. Doeppers, *Manila 1900-1941: Social Change in a Late Colonial Metropolis* (Manila: Ateneo de Manila University Press, 1984); Sunil Amrith and Tim Harper, eds., *Sites of Interaction: Ideas, Networks, and Mobility* (Cambridge: Cambridge University Press, 2014); and, Haydon Cherry, *Down and Out in Saigon: Stories of the Poor in a Colonial City, 1900-1940* (New Haven: Yale University Press, forthcoming).

streets of Indianapolis, St. Louis, Denver; viewing for the first time the vast prairies and high mountains of our Far West.”²³ The journey west took three months.

It was a chance encounter with David Starr Jordan, the famed American ichthyologist that not only brought Seale to the ocean, but also set in motion his life aquatic. He had attended a lecture given by Jordan when he was president of Indiana University. Jordan told the small gathering of students, “Go wherever the Masters are in whatever department you wish to study.”²⁴ For Seale, that department was zoology and so he went to study with Jordan. As his mentor, Jordan was not only a professor, but he was also president of the newly opened university.²⁵

While courses were important, Jordan’s professional network seemed to serve a more critical role in shaping Seale’s aquatic life and expertise. At the end of his first-year in 1892, he got a summer job at Stanford’s newly established Hopkins Seaside Laboratory in Pacific Grove, California, one of the earliest marine stations on the Pacific coast.²⁶ Seale spent his summer rowing a boat, collecting birds, and preserving specimens for the naturalist Leverett Mills Loomis.²⁷ Once the summer was over, Seale used his skills and experience to make his own collection of bird specimens that he sold to museums and

²³ Alvin Seale, *Quest for the Golden Cloak and other Experiences of a Field Naturalist* (Palo Alto: Stanford University Press, 1946), 100.

²⁴ Seale, *Quest for the Golden Cloak*, 100.

²⁵ Seale started at Stanford in 1891-1892 and was thus part of the inaugural class. Jordan was the founding president.

²⁶ The Marine Biological Laboratory at Woods Hole was founded in 1888, just four years before Hopkins.

²⁷ At the time, Loomis was also curator of ornithology at the California Academy of Sciences in San Francisco. In 1896, Jordan was elected president of the institution. In 1902, Loomis became director and served in this capacity until 1912.

colleges. The money he earned paid for his Stanford education and partly financed a trip to Alaska and the Arctic region.²⁸

Seale's time at Stanford coincided with a period of political change in the Pacific. On a typical schedule, Seale should have graduated in 1896. But the late nineteenth and early twentieth century was influx: empires were rising and falling, and technologies were connecting the world through cable and steam.²⁹ For Jordan and Seale, these rhythms and ruptures created new opportunities for conducting ichthyological research and popularizing the marine environment.³⁰

Through one of Jordan's connections, Seale was appointed curator of fish at the Bishop Museum in 1899, positioning him to make Hawaii the first site in his network of public aquariums. Almost immediately, Seale was sent on an expedition to the "South Seas" to forge scientific connections and build up the museum's fish library. Although the institution was founded in 1888, Seale's expedition was the first of its kind for the Bishop Museum. The itinerary included collecting stops across a string of coral islands: Tahiti and the Society Islands; the Austral Islands; the Gambier Islands; the Cook Islands; Guam; Samoa; and, the Solomons.³¹ On his visits to Guam and Samoa in 1900, Seale conducted the first zoological surveys of these new American colonial territories.

²⁸ Alvin Seale, "Notes on Alaska Water Birds," *Proceedings of the Academy of Natural Sciences of Philadelphia* (1898): 126-140.

²⁹ See Alfred W. McCoy et al., eds., *Colonial Crucible: Empire in the Making of the Modern American State* (Madison: University of Wisconsin Press, 2009) and George Johnson, ed., *The All Red Line: The Annals and Aims of the Pacific Cable Project* (Ottawa: James Hope and Sons, 1903).

³⁰ Seale received his B.S. in 1905, thirteen years after he entered the zoology program at Stanford.

³¹ "Expedition to South-Eastern Polynesia," Box 1, Folder 1, Alvin Seale Diaries, M0172, SUL.

In Guam, he also observed a “fishing fiesta.”³² The Spanish had banned this collective fishing practice that used a poison made from the juice of the futu tree (*Barringtonia asiatica*), in 1894 because they feared it was “depleting the waters,” but with the advent of American colonial rule this law was considered “obsolete.”³³ After witnessing a fishing fiesta, Seale was concerned about the “wholesale destruction of fishes” and thought the colonial government should disallow such practices.³⁴ His account documents the scale of capture and suggests at the long-term impact:

Fully seven hundred people took part in the fishing. An immense deep pool, several hundred feet across, a short distance inside the reef, was surrounded by a line of seines. At low tide about one barrel of this poisonous juice was poured into the pool. The effect was almost instantaneous; hundreds of fishes came gasping and struggling to the top of the water where they were captured and killed by the natives. No ill effect seemed to follow the eating of these poisoned fish. Thousands of small fishes were killed.³⁵

His South Seas expedition lasted until 1903, and resulted in a collection of almost 1,600 fish specimens, representing 375 different species and nearly 125 species new to science.³⁶

By 1904, Seale was recognized as the leading authority on the equatorial Pacific because he knew more about its “fishes and fisheries than anyone else in the United

³² The United States annexed Guam and Samoa in 1898. See Alvin Seale, “Report on a Mission to Guam—Part II: Fishes” *Occasional Papers of the Bernice Pauahi Bishop Museum of Polynesian Ethnology and Natural History* 1,3 (1901): 61-128 and Alvin Seale and David Starr Jordan, “Fishes of Samoa: Description of the Species Found in the Archipelago, with Provisional Check-List of the Fishes of Oceania,” *Bulletin of the Bureau of Fisheries* 25 (1905): 173-455.

³³ Seale, “Report on a Mission to Guam,” 61.

³⁴ Seale, “Report on a Mission to Guam,” 61.

³⁵ Seale, “Report on a Mission to Guam,” 61.

³⁶ “Expedition to South-Eastern Polynesia,” Box 1, Folder 1, Alvin Seale Diaries, M0172, SUL. See also “Bishop Museum Naturalist Tells of a Visit to Guam,” *Pacific Commercial Advertiser* (27 October 1900): 6; “Year’s Work in Museum, Many Specimens Have Been Added,” *Pacific Commercial Advertiser* (28 November 1902): 3; and “South Sea Pictures Shown,” *Pacific Commercial Advertiser* (25 August 1904): 10.

States.”³⁷ Building on his ichthyological knowledge, expeditionary experience, and professional authority, Seale began to lay the foundation for a public aquarium in Honolulu. He had significantly increased the size and popularity of the Bishop Museum’s fish holdings through his collecting work in the south Pacific and around the Hawaiian Archipelago.³⁸

With growing scientific, public, and commercial interests in the territory’s fish fauna, Seale worked with the Cooke and Castle families to open the Honolulu Aquarium in 1904. As curator of fish at the Museum, he knew which species would not only thrive in saltwater captivity but also present well to popularize the tropicity of Indo-Pacific fish. Based on his work keeping fish alive at the Museum, Seale advised on the design of tanks and the aquarium’s circulating water system, both of which were critical for the entire enterprise. To secure a fresh supply of seawater, Seale recommended that the aquarium be located at the water’s edge of Waikiki Beach. The Honolulu Aquarium opened with 265 fishes, representing 60 species.³⁹ As one reporter observed on its grand unveiling, “such an institution as the aquarium was for education as well as entertainment.”⁴⁰

But the Honolulu Aquarium was more than a place for education and entertainment. It was also a mark of empire and the power of this empire to exhibit the brilliance of ocean life. By 1898, the occupation of Samoa and conquest of the Spanish empire had placed large sections of the Pacific under American colonial rule. Tropical fish from these seas and their “beautiful coral gardens” were secured and put on display, as were fine examples of

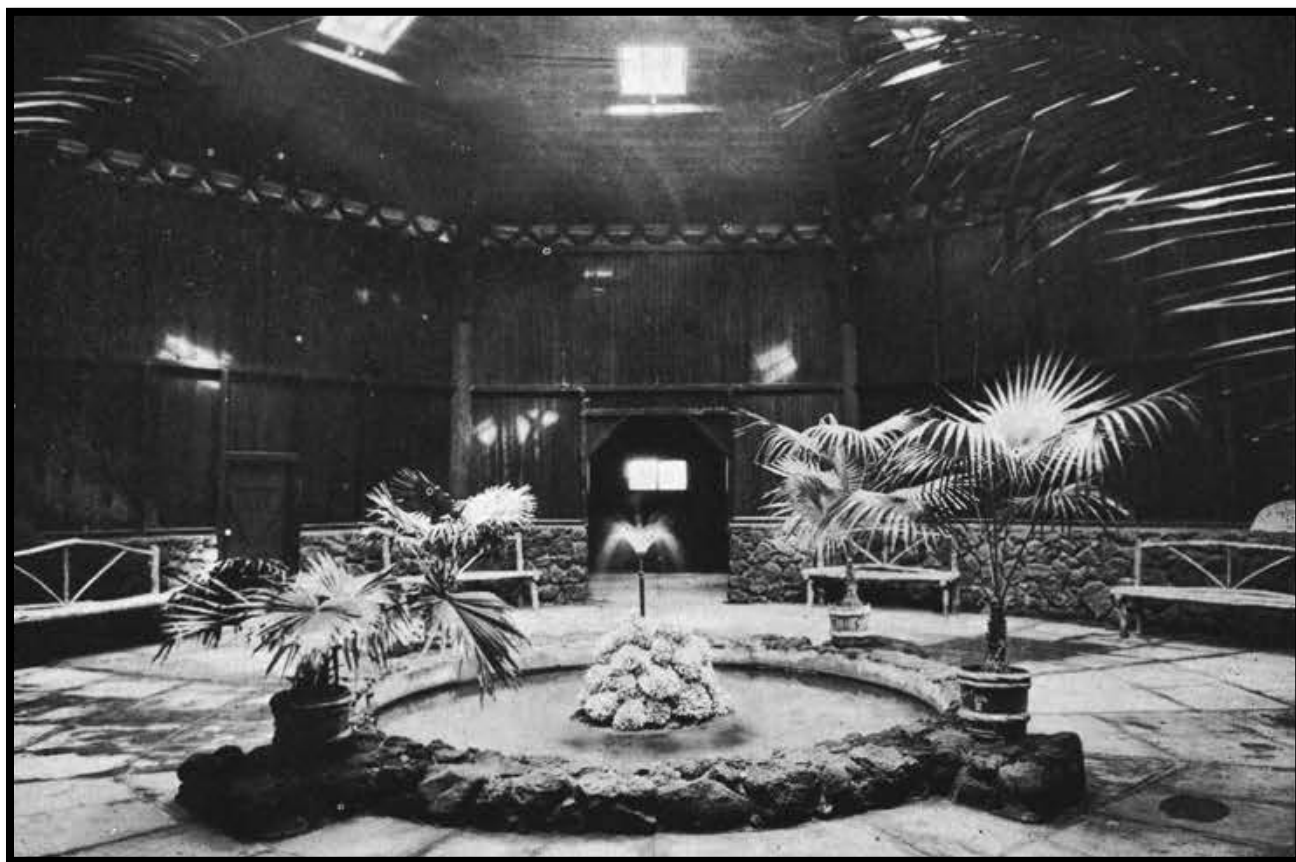
³⁷ Albert W.C.T. Herre, “Alvin Seale, Naturalist and Ichthyologist,” *Science* 129,3345 (February 6, 1959): 313.

³⁸ Alvin Seale, “New Hawaiian Fishes,” *Occasional Papers of the Bernice Pauahi Bishop Museum of Polynesian Ethnology and Natural History* 1,4 (1901): 3-15.

³⁹ “Honolulu Aquarium Open to the Public,” *Evening Bulletin* (21 March 1904): 3.

⁴⁰ “Honolulu Aquarium Open to the Public,” *Evening Bulletin* (21 March 1904): 3.

Hawaii's "piscatorial tribes."⁴¹ One fish that drew great attention was the surge wrasse (*Thalassorna purpureum*). Locally known as *olani* and found among the island's reefs, this popular attraction was especially "blue with a beak like a parrot."⁴²



*Interior View of the Honolulu Aquarium, 1923.*⁴³

⁴¹ 10 May 1901, "Expedition to South-Eastern Polynesia," Box 1, Folder 1, Alvin Seale Diaries, M0172, SUL and "Untitled," *Hawaiian Star* (24 June 1909): 4.

⁴² "Some New Beauties in Waikiki Aquarium," *Pacific Commercial Advertiser* (20 April 1904): 5.

⁴³ Sidney William Dutton, "Honolulu Aquarium," *Mid-Pacific Magazine* 25,5 (May 1923): 423.



*Exterior View of the Honolulu Aquarium, 1923.*⁴⁴

Amassing and assembling a collection of tropical fish and keeping these fish not only alive, but also healthy and attractive were signs of the ocean's evolving place in projections of American empire. On a visit to the Honolulu Aquarium in 1905, David Starr Jordan, at the time president of Stanford University and the California Academy of Sciences, declared it had "the finest collection of fishes in the world," noting that he had "seen all the famous collections."⁴⁵ Another visitor to the aquarium, Sidney M. Ballou, who was a Hawaiian Supreme Court justice, added on his tour of the saltwater tanks, "this beats the Aquarium at

⁴⁴ Sidney William Dutton, "Honolulu Aquarium," *Mid-Pacific Magazine* 25,5 (May 1923): 421.

⁴⁵ "Dr. Jordan Speaks Highly of Aquarium," *Pacific Commercial Advertiser* (13 March 1905): 2.

Naples...they have no such collection of fishes as this."⁴⁶ For Jordan and Ballou, tropical fish figured within the modernity of a society, and the position of that society within the modern world. In this way, public aquariums were places for education and entertainment, but they were also metaphors of modern empire and projects of imperial expansion.⁴⁷

The Manila Aquarium

From Honolulu, Seale followed the currents of empire to the Philippines in 1907, where he was charged with organizing a division of fisheries for the new colonial government. Like the mosquito fish he introduced to Hawaii, Seale sought to import rainbow trout and black bass into these faraway, imperial waters.⁴⁸ Crossing the Pacific for about a month en route to Manila, he managed to keep most of the bass and trout alive. In need of cold streams, he proceeded north to Baguio City, a colonial hill station planned by the Chicago-based architect Daniel Burnham. With its cooler temperature and mountain springs, Seale released the trout into one of Baguio's brooks and he planted the bass at Trinidad Lake. The bass, in particular, took well to their new environment, becoming an important food source for the peoples of Mountain Province.⁴⁹

Bearing fish as he disembarked in Manila reflected the nature of Seale's aquatic life and the kind of career he would have in the Philippines. After his detour to Baguio, Seale focused on cataloguing the available commercial fish in greater Manila. He visited popular

⁴⁶ "Dr. Jordan Speaks Highly of Aquarium," *Pacific Commercial Advertiser* (13 March 1905): 2.

⁴⁷ For more on the connection between aquariums and empire, see Sofia Lachapelle and Heena Mistry, "From the Waters of the Empire to the Tanks of Paris: The Creation and Early Years of the Aquarium Tropical, Palais de la Porte Dorée," *Journal of the History of Biology* 47 (2014): 1-27.

⁴⁸ 18 March 1907, Box 1, Folder 2, Alvin Seale Diaries, M0172, SUL.

⁴⁹ 2 May 1907, Box 1, Folder 2, Alvin Seale Diaries, M0172, SUL. See also, Hilario A. Roxas and Agustin F. Umali, "Fresh-Water Fish Farming in the Philippines," *Philippine Journal of Science* 63, 4 (August 1937): 434.

fish markets in Tondo, Marakina, and Divorsoria. He made lists of types and prices, and collected specimens for his new office.⁵⁰ Much like he did in Hawaii, Guam, and Samoa, Seale interacted with vendors, retailers, and consumers to learn about where these fish came from, how best to preserve and prepare them, and their local names.⁵¹

During his first few months in the Philippines, Seale also made excursions to nearby towns and distant waters where he sought to better understand the colony's fish fauna. He traveled to Laguna Bay, a body of water not far from Manila that was checkered with corrals and fishponds. With the use of a coast guard cutter, Seale explored the Sulu, Celebes, and Visayan Seas. In the process, he collected fish, fish knowledge, and fishing appliances.⁵²

⁵⁰ 1 August 1907, Box 1, Folder 2, Alvin Seale Diaries, M0172, SUL.

⁵¹ Alvin Seale, "Preservation of Commercial Fish and Fishery Products in the Tropics," *Philippine Journal of Science* 9,1 (February 1914): 1-18.

⁵² 25 August 1907, Box 1, Folder 2, Alvin Seale Diaries, M0172, SUL.



Alvin Seale's Collecting Trip, Palawan, Philippines.⁵³

As Seale's collection of fish grew so did the challenge of identifying them. Because of the scale of his fish collecting, space within his small office at the Bureau of Science was no longer tenable. It became imperative for Seale to push for a public aquarium in Manila that would serve the interests of science, commerce, and society through one institution.

Paul Caspar Freer (1862-1912) was equally committed to the idea of a public aquarium. As the founding Director of the Bureau of Science, he was invested in Seale, his ichthyological research, and the new work of the division of fisheries. Freer used his close, personal relationship with Dean C. Worcester, the Secretary of the Interior in the

⁵³ Alvin Seale Diaries, M0172, SUL.

Philippines, to secure a space for Seale on the *U.S.S. Albatross* in 1907, a “floating laboratory” that was conducting the first comprehensive survey of Philippine marine fauna.⁵⁴ Freer wanted to ensure that a duplicate set of collections was made for the Bureau of Science.⁵⁵ In addition, he reported to Worcester:

The division of fisheries is certainly of great importance when we consider the food value of the marine fauna to the people, and it should be continued with adequate facilities, aquariums, and personnel after the first exploratory work is over. One feature, which I have dwelt on in the past, which I still consider to be not only advisable, but almost necessary in this work, is the establishment of a public aquarium for the use of the people of the Islands.⁵⁶

For Freer and Seale the development of an aquarium was necessary to making the ocean public in the era of colonial urbanization. By bringing the sea to the city, Freer aimed to create a place for foreign scientists, grade-school students, the Japanese navy, and others to forge new types of understandings about and interactions with the Philippine marine environment.⁵⁷ To this end, Manila’s cosmopolitan nature fostered a modern world that was interested—personally and professionally—in the Indo-Pacific waters and how these waters provided the colony its basic protein and offered it a wealth of economic resources and scientific specimens. Freer envisioned that the aquarium would become a complex with a central library and marine collections, and these facilities would form the basis for

⁵⁴ Freer was recruited to Manila by Worcester to set up the Bureau of Government Laboratories, which became the Bureau of Science in 1905. Prior to the Philippines and the Spanish-American War, both were professors of science at the University of Michigan. For more on their relationship, see Dean C. Worcester, “Doctor Freer and the Bureau of Science,” *Philippine Journal of Science* 7 (July 1912): xv-xxiv.

⁵⁵ The Philippine Expedition, as the *Albatross* work called, was from 1907 to 1910. Hugh McCormick Smith, Deputy Commissioner of the U.S. Bureau of Fisheries, was its director. For more on the Philippine expedition, see David G. Smith and Jeffrey T. Williams, “The Great *Albatross* Philippine Expedition and Its Fishes,” *Marine Fisheries Review* 61, 4 (1999): 31-41. For more on Freer’s desire for a duplicate set of collections, see Paul C. Freer, *Sixth Annual Report of the Director of the Bureau of Science* (Manila: Bureau of Printing, 1907), 6.

⁵⁶ Freer, *Sixth Annual Report of the Director of the Bureau of Science*, 6.

⁵⁷ Elmer D. Merrill, *Eighth Annual Report of the Director of the Bureau of Science* (Manila: Bureau of Printing, 1920), 55.

scientists, staff, and others “to work up materials as they came in.”⁵⁸ Following suggestions made by Seale, who had pursued ichthyological work in Sandakan (British North Borneo) and Batavia (Netherlands Indies) in 1908, Freer also proposed to Worcester that the public aquarium include “laboratories for marine biological investigation” much like Batavia’s Pasar Ikan in the Netherlands Indies.⁵⁹



*The Laboratory, Library, and Collections at the Manila Aquarium, 1914.*⁶⁰

⁵⁸ Paul C. Freer, *Seventh Annual Report of the Director of the Bureau of Science* (Manila: Bureau of Printing, 1908), 26.

⁵⁹ Freer, *Seventh Annual Report of the Director of the Bureau of Science*, 26

⁶⁰ Alvin Seale Diaries, M0172, SUL.

On June 24th, 1910, Seale received a message from Cameron Forbes, Governor-General of the Philippine Islands, that the colonial government had the funds to build an aquarium and that he needed to “get busy on the project.”⁶¹ First, a central location for the aquarium needed to be decided. Seale and Freer agreed that the bastion in front of the Real Gate of the city walls, *Intramuros* (the old Spanish quarters built in 1590), would provide the space, access, and cultural heritage distinct to colonial Manila.⁶² Given the unique design of *Intramuros*, the aquarium was constructed in the “form of a tunnel, with the exhibit tanks on the inner wall...[and] light...admitted from the opposite side.”⁶³ Seale mapped out twenty-six tanks for reef, food, and poisonous fish found in Philippine waters, and three larger tanks for sharks, cetaceans, and dugongs.⁶⁴

While spacious and historical, the location of the Manila Aquarium presented one inherent problem. In contrast to Seale’s experience with the Honolulu Aquarium in 1904, which was established on the shores of Waikiki, the public aquarium built within the walled city of *Intramuros* was relatively distant from Manila Bay. And by the turn-of-the twentieth century, this body of water and the city’s *esteros* bore the costs of Manila’s urban growth and industrial development.⁶⁵ The location of the Manila Aquarium thus posed an important challenge to bringing the ocean ashore and keeping its fish fauna alive and radiant.

⁶¹ 24 June 1910, Box 1, Folder 2, Alvin Seale Diaries, M0172, SUL.

⁶² For a history of Manila’s walled city, or *Intramuros*, see Robert R. Reed, *Colonial Manila: The Context of Hispanic Urbanism and Process of Morphogenesis* (Berkeley: University of California Press, 1978).

⁶³ Paul C. Freer, *Tenth Annual Report of the Director of the Bureau of Science* (Manila: Bureau of Printing, 1912), 4.

⁶⁴ 1911, Box 1, Folder 2, Alvin Seale Diaries, M0172, SUL. See also Charles B. Elliott, *Report of the Secretary of Commerce and Police, Philippine Islands* (Washington: Government Printing Office, 1912), 187.

⁶⁵ George W. Heise and A.S. Behrman, *Philippine Water Supplies* (Manila: Bureau of Printing, 1918), 7-9. See also Xavier Huetz de Lempis, “Waters in Nineteenth Century Manila,” *Philippine Studies* 49,4 (2001): 488–517.

This was an obstacle faced not only by Manila, but also by the public aquariums in Batavia and Singapore.⁶⁶ In explaining why Singapore's aquarium was proposed "a mile from the sea" and not at the waterfront of Telok Ayer, one observer reported: "Suffice it to say that the sea around this city is exceedingly polluted by sewage, shipping, factories and so on...consequently a fish brought from the clean, clear depths off Pahang or Trengganu would be exceedingly unhappy if placed in the turbid water of our busy seaport."⁶⁷ What complicated the development of public aquariums in colonial Southeast Asia was that their shore waters were unsuitable for maintaining the ocean and its aquatic life in the city. In search of a solution, Seale proposed the idea of a closed circulating system, utilizing a combination of pumps and filtrations that would circulate fresh seawater hauled in from a distance.⁶⁸

Just a few months before the start of World War I, the Manila Aquarium opened to the public on February 7, 1914. As souvenirs, the Bureau of Science prepared "a series of colored postcards and a booklet of some of the most brilliant and curious Philippine fishes."⁶⁹ Built within the walls of the Real Gate, the aquarium's exhibition tanks were set in iron frames and kept lit with skylights that made for "a most satisfactory view of the

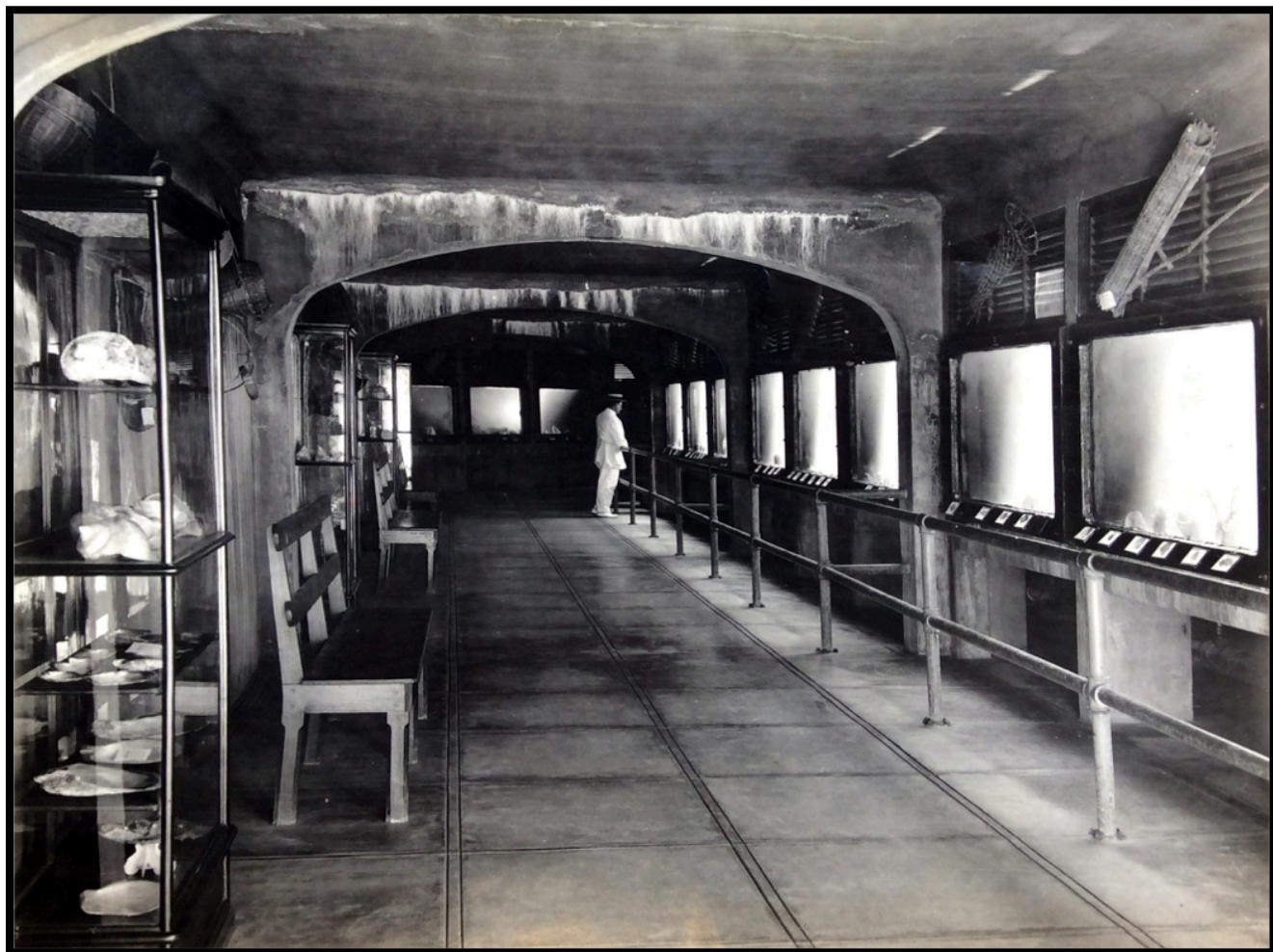
⁶⁶ On the history of the aquarium at Pasar Ikan in Batavia (present-day Jakarta) and the problems with the Bay of Batavia, see H.C. Delsman, "Het Zeewateraquarium te Batavia," *De Tropische Natuur* 8,1 (January 1924): 1-8 and "Aquarium Pasar Ikan di Tahun 1950," *Kompas* (23 March 2009).

⁶⁷ "When Singapore's Aquarium Is Opened," *Straits Times* (22 March 1936): 14.

⁶⁸ Freer, *Tenth Annual Report of the Director of the Bureau of Science*, 5.

⁶⁹ Alvin J. Cox, *Thirteenth Annual Report of the Director of the Bureau of Science* (Manila: Bureau of Printing, 1915), 48. The Madras Aquarium had a similar guide published in 1919, though the institution opened in 1909. Batavia's public aquarium at Pasar Ikan would develop a color booklet for its public aquarium as well in 1924. On the Madras Aquarium, see James Hornell, *A Guide to the Madras Marine Aquarium* (Madras: Government Press, 1919). On the aquarium at Pasar Ikan, see H.C. Delsman, *Indische Zeevisschen in het Aquarium van het Laboratorium voor het Onderzoek der Zee op den Pasar Ikan te Batavia* (Batavia: G. Kolff & Co., 1924).

fishes.”⁷⁰ Electric lights were used too, particularly for night displays. The mixture of the lights, tanks, pipes, and walls created a scientific spectacle that was unmatched in Asia and perhaps the world in 1914.



*Interior View of Tunnel, Tanks, and Lights at the Manila Aquarium, 1914.*⁷¹

Through the Manila Aquarium, Seale brought the ocean ashore and made its fauna more intimate and public. For the residents of the colonial city, seeing marine life up close was a new cultural experience not only in the Philippines but also in Southeast Asia. As the

⁷⁰ Cox, *Thirteenth Annual Report of the Director of the Bureau of Science*, 50.

⁷¹ Alvin Seale Diaries, M0172, SUL.

first aquarium in the region, Seale needed to capture and sustain the public's interest. To these ends, he stocked the aquarium with "curious and bright-colored fishes, sea anemones, crabs, sea urchins, starfishes, and other representatives of the wonderful and interesting forms of marine life found in the tropical waters of the Philippine Islands."⁷² Outside of the main tunnel, there were larger tanks that kept a variety of turtles and sharks.⁷³ In 1915, the aquarium boasted a collection of "756 specimens representing 154 species of fishes."⁷⁴ Reflecting the richness of Philippines waters and the Indo-Pacific seas, the Manila Aquarium attracted 61,673 visitors from February to December 1914. More than half of these visitors paid admission to see the ocean and its wonders in the walled city, thus making this scientific institution self-supporting in its first year of operation.⁷⁵ By 1917, the aquarium had acquired its first dugong (*Dugong dugon*) from a lighthouse keeper on Corregidor Island, just outside of Manila Bay. When delivering the dugong to the Bureau of Science officials gathered at the local pier, the keeper explained, "This fish eats more than a horse."⁷⁶

With the division of fisheries organized and the aquarium established, Seale sought new opportunities back home and returned to the United States in 1917. After three years at Harvard University's Museum of Comparative Zoology, Seale looked west to California. From San Francisco, he would commence the final chapter in the arc of his life aquatic. And again, Jordan's connections were important, but so too were Seale's ichthyological

⁷² Cox, *Thirteenth Annual Report of the Director of the Bureau of Science*, 51.

⁷³ Albert W. Herre, "Notes on Philippine Sharks I," *Philippine Journal of Science* 23,1 (July 1923): 67-73 and "Notes on Philippine Sharks II," *Philippine Journal of Science* 26,1 (1925): 113-132; and Edward H. Taylor, "Philippine Turtles," *Philippine Journal of Science* 16,2 (February 1920): 111-144.

⁷⁴ Cox, *Thirteenth Annual Report of the Director of the Bureau of Science*, 51.

⁷⁵ Cox, *Thirteenth Annual Report of the Director of the Bureau of Science*, 51.

⁷⁶ "Fish Has a Huge Appetite," *Aspermont Star* (22 November 1917): 6.

knowledge and aquarium expertise.

The Steinhart Aquarium

Seale's return to San Francisco in 1920 transformed the city by cultivating its place within the modern world of public aquariums. Fish were at the center of changing San Francisco in 1920s, and connecting it to the circuits of science, commerce, and fauna that were shaping the Indo-Pacific. Fish explain why Seale moved west and began to organize the Pacific coast's first public aquarium under the auspices of the California Academy of Sciences.⁷⁷

By 1920, Barton W. Evermann (1853-1932) was director of the California Academy of Sciences, a post he held from 1914 to 1932. But before becoming director, Evermann was a young lecturer of ichthyology at Stanford, recruited by David Starr Jordan for the 1891-1892 academic year. Evermann and Seale not only overlapped during that first year, but were both natives of Indiana. After Stanford, Evermann joined the Fish Commission, later renamed the Bureau of Fisheries, and held several administrative posts from 1892 to 1914, including curator of fishes at the United States National Museum.

While the careers of Jordan, Evermann, and Seale arced in different directions in the early twentieth century, they ultimately intersected through Indo-Pacific fish. In 1901, Jordan and Evermann surveyed the fish fauna of Hawaii, collecting a wealth of tropical species from field and the public market.⁷⁸ In 1905, Jordan and Seale worked together on a new list of fish from Negros Island in the Philippines. They named a new genus *Eleria* after

⁷⁷ "Scientific Notes and News," *Science* 54,1403 (November 18, 1921): 489.

⁷⁸ David Starr Jordan and Barton Warren Evermann, "A Check List of the Fishes of Hawaii," *Journal of the Pan-Pacific Research Institute* 1,1 (January 1926): 3-15.

Casto de Elera, the Manila-based Spanish ichthyologist and director of the University of Santo Tomas's Museum of Zoology in the 1880s and 1890s.⁷⁹ In 1906, Evermann and Seale produced a comprehensive catalogue of Philippine fish, derived from the collection of specimens used for the 1904 St. Louis Exposition.⁸⁰ Through a history these personal ties and ichthyological connections, Jordan, Evermann, and Seale shaped the production of knowledge about fish in the Indo-Pacific, but also ways of seeing this vast oceanic zone.

In 1920, Evermann recruited Seale to play a leading role in organizing a public aquarium that would bring together the many diverse species from Indo-Pacific under one institution. As director of the California Academy of Sciences, Evermann was in a unique position to realize such an institution because of the bequest of Ignatz Steinhart (1840-1917), a Bavarian-born banker who managed the Anglo-California Bank in San Francisco. Steinhart passed away in 1917 and left \$250,000 for the California Academy of Sciences to "provide the citizens of San Francisco with an Aquarium."⁸¹ With Seale as superintendent, the Steinhart Aquarium was to be "as fine and complete as anywhere in the world."⁸²

Built within the grounds of Golden Gate Park, The Steinhart Aquarium was some distance from the ocean much like its counterpart in Manila. Based on his experience, Seale was familiar with this challenge and thus suggested the use of a closed circulating system. The engineers constructing the aquarium employed a series of reservoirs, pumps, and

⁷⁹ David Starr Jordan and Alvin Seale, "List of Fishes Collected by Dr. Bashford Dean on the Island of Negros, Philippines," *Proceedings of the United States National Museum* 28 (July 3, 1905): 769-803.

⁸⁰ Barton Warren Evermann and Alvin Seale, "Fishes of the Philippine Islands," *Bulletin of the Bureau of Fisheries* 26 (1906): 49-110.

⁸¹ *Charter of the City and County of San Francisco* (San Francisco: Board of Supervisors, 1919), 15. See also "San Francisco," *Reform Advocate* (2 June 1917): 612 and "Plans Completed for Park Aquarium," *Municipal Record* 14,27 (July 7, 1921): 214.

⁸² John E. McCosker, *The History of Steinhart Aquarium* (Virginia Beach: Donning Co., 1999), 15.

filters to ensure that fresh seawater was filtered through the aquarium's tanks, keeping the sea life healthy and also healthy-looking for the public.

The Pacific coast's first public aquarium opened in San Francisco on September 29, 1923.⁸³ For Jordan, who attended the dedication, the Steinhart Aquarium was a remarkable scientific institution. It had the power to open the ocean to new publics and horizons. In his address, he offered a sense of this promise and future to the crowds that gathered for the dedication:

The people of this city, the children especially, will look with wonder and profit on the hundreds of varied forms of fishes; the men of science will make use of them for extending our knowledge of marine life. The most famous aquarium in the world is the one at Naples. Not for its variety of fishes, for in this regard the Mediterranean cannot compare with Hawaii and the South Seas. It is, however, the center to which hundreds of naturalists all over the world have been drawn for most important studies. This has been because the Aquarium made provision for such study...In the Steinhart Aquarium the same provision...and the day will come when students of sea-life will cross oceans and continents to work these hospitable halls.⁸⁴

As the aquarium's founding superintendent, Seale had the crucial task of sparking the public's interest in ocean life and sustaining it. Based on his ichthyological knowledge, aquarium expertise, and field experience, Seale arranged the exhibits and selected the fauna to best showcase the brilliant colors of the sea. Working with eighty-two tanks, he committed sixteen of the fifty-seven tanks lining the main corridor to marine life from Hawaii.⁸⁵ For these tanks, Seale warmed the seawater to replicate a habitat suitable for keeping tropical fish not only alive in the city but also attractive for public viewing. In 1924,

⁸³ Barton Warren Evermann, "Report of the Director of the Museum for the Year 1923," *Proceedings of the California Academy of Sciences* 7, 33 (1924): 1243.

⁸⁴ Evermann, "Report of the Director of the Museum for the Year 1923," 1248-1249.

⁸⁵ Alvin Seale, "San Francisco's Golden Gate Park to Adopt Rainbow Fishes From Hawaii's Isles," *Paradise of the Pacific* 36,4 (April 1923): 3.

there were 226 tropical fish representing 51 species. As a collection, these fish constituted “one of the most popular exhibits in the Aquarium.”⁸⁶

Seale added coral to these tropical tanks too. Through a partnership with Matson, Hawaii’s largest shipping company, coral species and Hawaiian fish were transported in small glass aquariums built especially for supplying the Steinhart Aquarium with Indo-Pacific life.⁸⁷ Seale arranged for the Honolulu Aquarium to host a collection of fish before they crossed the Pacific to ensure that only the strongest specimens made the journey. In keeping live coral and reef fish in warmed seawater tanks, Seale was pioneering a practice that continues to the present at the Steinhart Aquarium and enables today’s scientists to study the effects of climate change on coral environments and their rich reef fauna.⁸⁸ By reproducing this exceptional environment at the Steinhart Aquarium, Seale was bringing the marine diversity of the Indo-Pacific to publics thousands of miles away.

⁸⁶ Evermann, “Report of the Director of the Museum for the Year 1923,” 1267.

⁸⁷ Alvin Seale, “San Francisco's Golden Gate Park to Adopt Rainbow Fishes From Hawaii's Isles,” *Paradise of the Pacific* 36,4 (April 1923): 3.

⁸⁸ See <http://www.calacademy.org/exhibits/philippine-coral-reef> [accessed 23 June 2016].



Interior View of the Steinhart Aquarium, 1923.⁸⁹

Like the Manila Aquarium, the Steinhart Aquarium also maintained a well-equipped laboratory for biological and ichthyological research. Visiting scientists used the laboratory's microscopes and workstations. They also accessed the aquarium's photographic room that allowed researchers to document the specimens they examined. Illustrating trans-Pacific collaboration in this imperial age, in 1925 Seale hosted Deogracias Villadolid, a young Filipino who took the train north to San Francisco to use the aquarium's

⁸⁹ File No. N1958, Library and Archives, California Academy of Sciences.

laboratory and investigate a collection of fish.⁹⁰ After completing his doctorate at Stanford in 1927, Villadolid returned to the Philippines where he became director of the Bureau of Fisheries during the Japanese occupation and, upon independence, established the country's first fisheries school in 1946.⁹¹

Seale also used the aquarium's laboratory to develop new insights into keeping tropical fish in the city. In 1924, he made a major discovery with regards to feeding aquarium fish that started when Seale was given a collection of small, reddish shrimp (*Artemia salina*) secured from the brine ponds of San Mateo, a nearby town with salt flats across the bay from San Francisco.⁹² While the brine shrimp were excellent fish food, they were difficult to collect during the rainy season and colder winter months. But their eggs, on the other hand, were abundant and accessible. Through a series of experiments conducted in the aquarium's laboratory, Seale learned that he could harvest brine shrimp eggs after they have been collected, washed, dried, and stored in glass jars. He found that the eggs, if properly kept, were hatchable. Based on his experiments and using seawater, Seale had an eighty-five percent hatch rate; with such results, he concluded, "the young shrimp...are a splendid food for all young tropicals."⁹³ Seale's work on the brine shrimp at the Steinhart Aquarium in the 1920s and 1930s radically increased the tropical fish food

⁹⁰ Barton Warren Evermann, "Report of the Director for the Year 1925," *Proceedings of the California Academy of Sciences* 14,4 (April 28, 1926): 548.

⁹¹ I had the opportunity to interview Melchor F. Cichon, the longtime librarian of the School of Fisheries at the University of the Philippines, Visayas, in Miagao, in 2015; Sir Cichon shared many stories and insights about Villadolid and his scientific career. Fieldnotes, Iloilo City, Panay Island, Philippines, July 2015.

⁹² Alvin Seale, "The Brine Shrimp (*Artemia*) as a Satisfactory Live Food for Fishes," *Transactions of the American Fisheries Society* 63,1 (1933): 129.

⁹³ Seale, "The Brine Shrimp (*Artemia*) as a Satisfactory Live Food for Fishes," 129.

supply and thus the global growth of public aquariums and hobby aquarists.⁹⁴ With a food supply that was cheap and abundant, more tropical fish could be kept in captivity.⁹⁵ In this way, the Indo-Pacific was connected through Seale's work on brine shrimp eggs and Singapore's booming tropical fish trade during the same period. Seeing a new market open, Seale made vast quantities of these eggs available for purchase through the San Francisco Aquarium Society.⁹⁶

Finally, it was Seale's work at the Steinhart Aquarium that encompassed the entire Indo-Pacific and made its fish fauna a public attraction. In just three months after its opening in October to the end of December in 1923, the Steinhart Aquarium welcomed approximately 550,000 visitors—an unprecedented public response.⁹⁷ After this first year, the aquarium averaged about a million visitors, with most coming “primarily to see fish.”⁹⁸ In 1934, the Steinhart Aquarium exhibited 11,676 fishes representing 413 species.⁹⁹ By the end of World War II, the total number of visitors who walked through the halls of the Steinhart Aquarium reached nearly 25 million.¹⁰⁰ Seale remained in charge of keeping the aquarium a constant place of wonder, profit, and science, and served as its superintendent

⁹⁴ Alvin Seale, “Feeding Aquarium Fishes,” *Aquarium Journal* 5 (1932): 39 and “An Excellent Life Food for Tropical Fish,” *Aquarium Journal* 6 (1933): 32-33.

⁹⁵ J.L. McHugh and Boyd W. Walker, “Rearing Marine Fishes in the Laboratory,” *California Fish and Game* 34,1 (January 1948): 37-38.

⁹⁶ Seale, “The Brine Shrimp (*Artemia*) as a Satisfactory Live Food for Fishes,” 130.

⁹⁷ C.E. Grunsky, “Report of the President of the Academy for the Year 1923,” *Proceedings of the California Academy of Sciences* 7,32-33 (1924): 1229.

⁹⁸ Lea Reid, “Fresh Water Aquaria,” *Science Guide for Elementary Schools* 2,10 (May 1936): 1.

⁹⁹ Lea Reid, “Fresh Water Aquaria,” *Science Guide for Elementary Schools* 2,10 (May 1936): 1.

¹⁰⁰ Susan Wels, *California Academy of Sciences: Architecture in Harmony with Nature* (San Francisco: Chronicle Books, 2008), 13.

until his retirement in late 1941.¹⁰¹

Conclusion

From 1904 to 1923, Seale engineered a network of public aquariums spanning the Indo-Pacific Ocean. These institutions, and others like them, brought the ocean ashore and made its fauna known to society, science, and commerce. At Honolulu, Manila, and San Francisco, millions of people made their way to the city to see nature and experience it up close. In Honolulu, the public marveled at the wonders of a giant squid. In Manila, school children witnessed the strangeness of a dugong, making it an abiding object of national affection and public protection. In San Francisco, residents were captivated by the brilliance of Indo-Pacific fish. At each of these aquariums, Seale also made fish collections and described new species, writing these tropical types into science. He used the aquariums as laboratories for fisheries development too. In Manila, Seale inspected fish markets so he could compile a list of commercial species. He populated some of the aquarium's tanks with these food fish in order to breed them in captivity for scientific observations aimed at improving their catch. In San Francisco, Seale ensured that the Steinhart Aquarium was built with a hatchery for the same economic purposes.

Seale's aquariums also connected scientists who studied the Indo-Pacific, and these connections permanently shaped the place of this ecological zone in the modern world. By the early twentieth century, ichthyologists were popularizing the idea that these Indo-

¹⁰¹ "Alvin Seale Retires as Head of Aquarium in San Francisco, Calif.," *Fairmont News* (25 December 1941): 1, 8.

Pacific waters constituted one of the world's richest centers of fish life.¹⁰² Public aquariums facilitated these scientific exchanges and specimen circulations, but so did the rise of marine biological stations. While these laboratories produced new knowledge about the diversity of the Indo-Pacific, they also opened the study of the ocean and its fauna to local scientists.

One marine station that played a central role in expanding the community of scientists who investigated the Indo-Pacific was the Puerto Galera Marine Biological Laboratory in the Philippines. Founded in 1912, this laboratory, the first of its kind in South and Southeast Asia, fostered new understandings about the wealth and diversity of Philippine waters in the 1920s and 1930s, contributing to the unrivaled place these seas and their biological richness would come to occupy in the Indo-Pacific. Turning to a history of the Puerto Galera Marine Biological Laboratory reveals how this new knowledge was produced and also why the waters of the Verde Island Passage would become “the center of the center” of global marine biological diversity.¹⁰³

¹⁰² Albert W. Herre, *Check-List of Philippine Fishes* (Washington, D.C.: U.S. Government Printing Office, 1953), 1.

¹⁰³ Kent E. Carpenter and Victor G. Springer, “The Center of the Center of Marine Shore Fish Biodiversity: The Philippine Islands,” *Environmental Biology of Fishes* 72 (2005): 467-480.

CHAPTER FOUR

“Puerto Galera as a Biological Station”:

Marking the Rise of Philippine Waters through Foreign Experts and Filipino Scientists

Introduction

As the world’s richest center of marine life, the Indo-Pacific is an exceptional environment exemplified by the conditions of a strait in the Philippines called the Verde Island Passage.¹ Lying between the islands of Luzon and Mindoro, the Verde Island Passage is a marine corridor, sixteen kilometers wide and a hundred kilometers long that links the South China Sea to the Pacific Ocean by way of Tayabas Bay, Sibuyan Sea, Masbate Pass, and San Bernardino Strait. Among biologists and non-scientists alike, it is considered the “center of the center” of aquatic life with more species recorded than any other place on the planet.²

Biodiversity expeditions to survey and study the Verde Island Passage have reinforced its value to science and society, illustrated by its role in studying how climate change has been warming the oceans. Scientists are well aware, for example, that rising temperatures have caused coral bleaching, a process when corals turn white because they have expelled the algae (*zooxanthellae*) living in their tissues,

¹ See Rich Mooi, “Life at the Edge of the Verde Island Passage,” *New York Times* (31 May 2011). Accessed February 25, 2017, <https://scientistatwork.blogs.nytimes.com/2011/05/31/life-at-the-edge-of-the-verde-island-passage/?r=0>. Mooi is the Curator of Invertebrate Zoology at the California Academy of Sciences (CAS) and was part of the 2011 Hearst Philippine Biodiversity Expedition. This expedition was the largest, most comprehensive biological survey ever conducted in the Philippine Archipelago. For more on the international planning and scientific results of the 2011 expedition, see Gary C. Williams and Terrence M. Gosliner, eds., *Coral Triangle: The 2011 Hearst Philippine Biodiversity Expedition* (San Francisco: California Academy of Sciences, 2014).

² Kent E. Carpenter and Victor G. Springer, “The Center of the Center of Marine Shore Fish Biodiversity: The Philippine Islands,” *Environmental Biology of Fishes* 72 (2005): 467-480.

leading to a documented decline in reef fish fauna.³ But recent investigations into the Verde Island Passage explain why this body of water is so remarkably resilient. Through observations of coral bleaching made in October 2010, one expedition found that within three months, “corals had begun to acquire new zooxanthellae, and by May, almost all corals appeared to have virtually normal levels of pigmentation.”⁴ Scientists attribute the extraordinary resilience of the Verde Island Passage to its deep waters and strong currents. This unique ecological zone has thus proven to be biologically invaluable as well as scientifically significant.

As might be expected in the “the center of the center,” life abounds throughout the Verde Island Passage. Fish of all shapes, sizes, and colors make these waters their home. More than half of the world’s documented fish species inhabit this passage.⁵ Rare creatures such as whale sharks (*Rhincodon typus*) and red fin wrasses (*Cirrhilabrus rubripinnis*) are both found here. Otherworldly echinoderms live within this marine corridor such as the poisonous necklace starfish (*Fromia monilis*) and the edible pineapple sea cucumber (*Thelenota ananas*). Blanketing the seafloor are slimy gastropods like the species of sea slugs known as *Chromodoris lochi* and *Nembrotha chamberlaini*. Brilliantly-colored, these echinoderms and

³ See Gisele Muller-Parker and Christopher F. D’Elia, “Interactions Between Corals and Their Symbiotic Algae,” in *Life and Death of Coral Reefs*, ed. Charles Birkeland (New York: Chapman and Hall, 1997), 100-103; Samuel S. Myers et al, “Climate Change and Global Food Systems: Potential Impacts on Food Security and Undernutrition,” *Annual Review of Public Health* 38 (2017): 266-267; and, Thomas J. Goreau, Raymond L. Hayes, “Coral Bleaching and Ocean ‘Hot Spots’,” *Ambio* 23,3 (May, 1994): 176-180.

⁴ Terrence M. Gosliner and Gary C. Williams, “From Parachutes to Partnerships: An ‘Integrated’ Natural History Museum Expedition in the Philippines,” in *Coral Triangle: The 2011 Hearst Philippine Biodiversity Expedition*, eds. Gary C. Williams and Terrence M. Gosliner (San Francisco: California Academy of Sciences, 2014), 29.

⁵ Carpenter and Springer, “The Center of the Center,” 471.

gastropods occupy the nooks, crevices, cracks, rocks, and ridges of the more than 300 coral species that forest these seas.⁶ And as a sheltered corridor, marine mammals also find refuge in the Verde Island Passage. Rare species such as dwarf sperm whales (*Kogia sima*) and dugongs (*Dugong dugon*) congregate in these waters to feed on the region's rich biota.⁷

Several factors explain why the Verde Island Passage is so remarkably rich in marine diversity. Bathymetrically, it is a body of water marked by shallow seas and abrupt descents, reaching depths of at least 340 fathoms.⁸ The combination of these undersea topographies shapes the turbidity of intertidal flows that in turn supplies the life of this waterway with that most basic food source: plankton. The constant interchange between the region's shallow seas and its deep descents also stimulates the growth and recovery of coral reefs, further supporting the development of critical complexes for the ocean's flora and fauna.⁹

Mangroves are also abundant and diverse along the shores of the Verde Island Passage. These elaborate tree systems play a vital role in cycling nutrients essential to marine life. Mangroves function too as littoral habitats for birds, fish, insects, and crustaceans, thereby constituting a veritable circle of life. Extending

⁶ Rowena Boquiren et al, eds., *Climate Change Vulnerability Assessment of the Verde Island Passage, Philippines, Technical Report* (Arlington: Conservation International, 2010), 2.

⁷ A. Rex F. Montebon, Enrique Nunez, and Moonyen Alava, eds., *The Verde Framework: The Verde Island Passage Marine Corridor Management Plan Framework* (Quezon City: Philippine Department of Environment and Natural Resources, Protected Areas and Wildlife Bureau, 2009), 14-15.

⁸ Walter K. Fisher, "New Starfishes from the Philippines and Celebes," *Proceedings of the Biological Society of Washington* 30 (May 23, 1917): 89. First described by Fisher, the new starfish *Dipsacaster imperialis* was collected by the scientific steamer *Albatross* between 1907 and 1910 from dredging station no. 5115 in the Verde Island Passage. The station measured a depth of 340 fathoms, from which the starfish was collected.

⁹ Gosliner and Williams, "From Parachutes to Partnerships," 30.

from the mangroves, and covering the shallow sea bottoms, are more than 15 species of seagrass.¹⁰ These flourishing beds not only sustain the rare dugong that is the planet's only strictly herbivorous marine mammal, but they also generate oxygen, capture carbon, and cycle nutrients.¹¹ And like the region's high concentration of mangroves and reefs, they provide a natural habitat for turtles, crabs, clams, shrimps, algae, sponges, and fish. As a result of these distinct ecological factors and biophysical processes, the Verde Island Passage teems with biodiversity on a scale unlike any other place in the world.

Sounding Oceans Past: Collectors and Scientists in the Spanish Philippines

Inspired by this extraordinarily rich Asian environment, marine knowledge and scientific expertise developed over the span of two centuries have played a seminal role in making the Verde Island Passage “the center of the center.” This is a history of human-ocean interactions, obscured if not omitted from today's scientific literature.¹² In looking closely at the Verde Island Passage within the context of the Southeast Asian shelf, we can surface a history of how and by whom this global

¹⁰ Asian Development Bank, *State of the Coral Triangle: Philippines* (Mandaluyong City: Asian Development Bank, 2014), 9.

¹¹ Peter Hogarth, *The Biology of Mangroves and Seagrasses* (Oxford: Oxford University Press, 2015), 44-55 and 139-150.

¹² See Carpenter and Springer, “The Center of the Center,” 467-480; Rebecca Weeks et al., “Effectiveness of Marine Protected Areas in the Philippines for Biodiversity Conservation,” *Conservation Biology* 24,2 (April 2010): 531-540; Dan M. Arriego et al., “Population Genetic Diversity and Structure of a Dominant Tropical Seagrass, *Cymodocea Rotundata*, in the Western Pacific Region,” *Marine Ecology* 37,4 (August 2016): 786-800; Michelle R. Gaither and Luiz A. Rocha, “Origins of Species Richness in the Indo-Malay-Philippine Biodiversity Hotspot: Evidence for the Centre of Overlap Hypothesis,” *Journal of Biogeography* 40,9 (September 2013): 1638-1648; David R. Bellwood and Christopher P. Meyer, “Searching for Heat in a Marine Biodiversity Hotspot,” *Journal of Biogeography* 36,4 (April 2009): 569-576; and, D. Halas and R. Winterbottom, “A Phylogenetic Test of Multiple Proposals for the Origins of the East Indies Coral Reef Biota,” *Journal of Biogeography* 36,10 (October 2009): 1847-1860.

biodiversity hotspot came to be known and incorporated within networks of science and commerce.

We might start with 1792. In that year, the Spanish Crown sponsored the first major survey of the Philippines. Commanded by Alejandro Malaspina (1745-1810), an Italian-born naval officer, the Malaspina Expedition, as it came to be known, sought a comprehensive natural history study of the Pacific world. After working along the coasts of the Americas, venturing north to Alaska, and south to Guam and the Marianas, the expedition proceeded to the Philippines. During its five-year survey, the expedition spent nine months in the islands.¹³

The Malaspina Expedition was a grand, imperial undertaking, involving two corvettes, the *Atrevida* and the *Descubierta*, built specifically for scientific research. Stocked with books, maps, and instruments, and staffed by nearly two hundred men, these vessels also carried a scientific crew comprised of artists, astronomers, mapmakers, meteorologists, and hydrographers. Most importantly, the expedition was supplied with naturalists who were interested in all forms of life.¹⁴

¹³ Pedro de Novo y Colson, *La Vuelta al Mundo por las corbetas Descubierta y Atrevida al Mando del Capitan de Navio D. Alejandro Malaspina desde 1789 a 1794* (Madrid: Viuda e Hijos de Abienzo, 1885), vii-51.

¹⁴ See Luis Nee, "Diarios y Trabajos Botánicos de Luis Nee," ed. Felix Muñoz Garmendia, vol. 3 of *La Expedición Malaspina, 1789-1794*, 9 vols. (Madrid: Lunwerg Editores, 1987-1999), 63-96; Thaddeus Haenke, "Trabajos Científicos y Correspondencia de Tadeo Haenke," ed. Maria Victoria Ibanez Montoya, vol. 4 of *La Expedición Malaspina, 1789-1794*, 9 vols. (Madrid: Lunwerg Editores, 1987-1999), 32-56; Iris H. Wilson Engstrand, "Of Fish and Men: Spanish Marine Science during the Late Eighteenth Century," *Pacific Historical Review* 69,1 (February 2000): 3-30; and Daniela Bleichmar, *Visible Empire: Botanical Expeditions and Visual Culture in the Hispanic Enlightenment* (Chicago: University of Chicago Press, 2012), esp. 17-78.

While the *Atrevida* surveyed Macau and the coasts of China, the *Descubierta*, with Malaspina onboard, focused on the Philippines.¹⁵ At the southern Luzon port of Sorsogon in March 1792, Luis Nee, a French-born naturalist on the expedition, understood the scope and scale of his scientific role clearly. He was to increase the collection of plants and “advance as far as possible the branches of zoology and conchology.”¹⁶ On plants, Nee collected, and for the first time scientifically described, the fiber Tagalogs called abaca (*Musa textilis*).¹⁷ He also secured and made note of different types of holothurians (*balate*) and how these marine goods were central to a precarious industry. Tagalog fishers living along the strand harvested the *balate* for Luzon’s Chinese communities, who considered them a fine delicacy. But Nee recorded that the Tagalog fishers who collected these slimy slug-like creatures were in a constant state of dread, fearing that they would become enslaved through the violence of marauding Moros.¹⁸

But what most captured the attention and zeal of the expedition’s naturalists was shell collecting. Likely driven by science as well as commerce, procuring *conchas* (shells) became “something of an obsession on the *Descubierta*.”¹⁹ As

¹⁵ Glyn Williams, *Naturalists at Sea: Scientific Travellers From Dampier to Darwin* (New Haven: Yale University Press, 2013), 190.

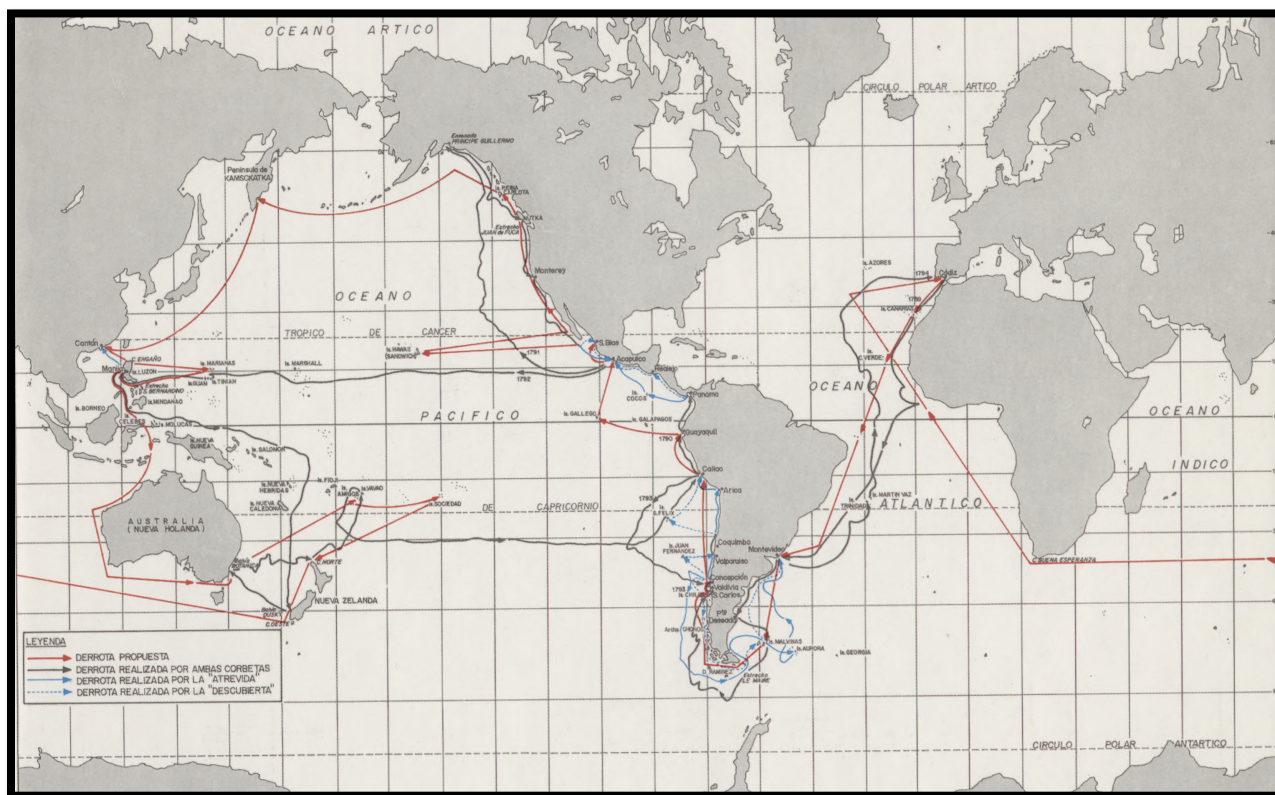
¹⁶ Luis Nee, “Diaros del Botanico Don Luis Nee desde el Puerto de Sorsogon a Manila port Tierra en 1792,” ed. Felix Munoz Garmendia, vol. 3 of *La Expedicion Malaspina, 1789-1794*, 9 vols. (Madrid: Lunwerg Editores, 1987-1999), 63. The Spanish used the term Moro, as in Moor, to describe the Muslim populations who inhabited the southern islands of Mindanao and the Sulu Archipelago. For more on these Moro raids and their spatial range, see James Francis Warren, *The Sulu Zone, 1768-1898: The Dynamics of External Trade, Slavery, and Ethnicity in the Transformation of a Southeast Asian Maritime State* (Singapore: Singapore University Press, 1981).

¹⁷ Luis Nee, “Del abaca (*Musa textilis*),” *Anales de Ciencias Naturales* 4,11 (July 1801): 123-130.

¹⁸ Nee, “Diaros del Botanico Don Luis Nee desde el Puerto de Sorsogon,” 68.

¹⁹ Williams, *Naturalists at Sea*, 190.

Malaspina and his scientific crew wove through the channels and waterways of San Bernardino, Albay, Samar, Leyte, Mindoro, Panay, Negros, and Mindanao, they inspected tide pools and endless shores with an insatiable excitement and curiosity for “the abundance of fish and exquisite shells.”²⁰ After Nee and the other naturalists exhausted what shells locals on the island of Samar had to offer, these heavy-dressed Europeans “scoured the beaches themselves, so that ‘not a stone remained unturned on the nearby shores, nor was there a single species of the shells of these waters that we did not find’.”²¹



*The Routes of the Malaspina Expedition, 1789-1794.*²²

²⁰ Novo y Colson, *La Vuelta al Mundo por las corbetas Descubierta y Atrevida*, 215.

²¹ Williams, *Naturalists at Sea*, 190. Williams quotes from Andrew David et al., eds., *The Malaspina Expedition 1789–1794: Journal of the Voyage by Alejandro Malaspina*, Vol. 2 (London: Hakluyt Society, 2001-4), 399, 402.

²² *La Expedicion Malaspina, 1789–1794*, 9 vols. (Madrid: Lunwerg Editores, 1987–1999).

After nearly five years surveying the Pacific World, including those nine months in the Philippines, the Malaspina Expedition returned to Spain in 1794. With a wealth of shells, plants, animals, minerals, surveys, charts, sketches and drawings, astronomical readings, and political and ethnographic data, the expedition was a massive success for the Spanish empire. Sadly, and almost immediately upon his return, Malaspina was entangled in a case of political intrigue. In a quick succession of events, a minister at the court of Carlos VI charged Malaspina with treason; he was arrested and imprisoned for several years, and then exiled to Italy where he died in obscurity in 1810.²³ Two outcomes followed this tragedy. First, the expedition's rich materials and collections were seized, suppressed, and kept from public or scientific view until the late nineteenth century.²⁴ Consequently, explained Joaquin Gonzalez Hidalgo (1839-1923), one of Spain's leading scientists, in 1887:

After the voyages of Pineda [one of the naturalists on the Malaspina Expedition], a long series of years passed, during which the attempts to study our Philippine Islands ceased altogether; Spain went through one of its saddest times in memory, in the evolution of its intellectual development.²⁵

While the fallout from the Malaspina Expedition was a period of Spanish scientific decline, it was not so for other countries and empires. In 1836, an English

²³ Raquel A.G. Reyes, "Collecting and the Pursuit of Scientific Accuracy: The Malaspina Expedition in the Philippines, 1792," in *Empire and Science in the Making: Dutch Colonial Scholarship in Comparative Global Perspective, 1760-1830*, ed. Peter Boomgaard (New York: Palgrave Macmillan, 2013), 64.

²⁴ Reyes, "Collecting and the Pursuit of Scientific Accuracy," 64.

²⁵ Joaquin Gonzalez Hidalgo, "Datos para la Fauna Filipina: Vertebrados," *Anales de la Sociedad Espanola de Historia Natural* 17 (1888): 248. Hidalgo was a Spanish scientist, Manila resident, and professor of malacology at the National Museum of Natural History in Madrid.

naturalist named Hugh Cuming (1791-1865) made an expedition to the Philippines for the purposes of collecting specimens and marketing them to European subscribers. Cuming was a professional who operated in the commerce of natural objects.²⁶ Seashells were his passion, many of which he collected from the Mindoro shores of the Verde Island Passage. In doing so, Cuming was one of the first conchologists to work the rich grounds at Puerto Galera, a sheltered bay on the north coast of Mindoro, which opens to the Verde Island Passage.²⁷

²⁶ See Hugh Cuming's letter to William Jackson Hooker, Director of the Royal Botanic Gardens at Kew, dated November 18, 1838. In the letter, which was sent from Manila, Cuming conveys his trust in Hooker and his ability to secure subscribers in England for his Philippine specimens. Directors' Correspondence 54/93, Library and Archives at Royal Botanic Gardens, Kew.

²⁷ Elmer D. Merrill, "Hugh Cuming's Letters to Sir William J. Hooker," *Philippine Journal of Science* 30,2 (June 1926): 153-185.



Spanish Map of Verde Island Passage, Mindoro Island, and Puerto Galera (bottom left corner), 1899.²⁸

From the waters and reefs of Puerto Galera, Cuming amassed an unrivalled collection of seashells, describing many for the first time scientifically. Just after

²⁸ Jose Algue, *Atlas de Filipinas, Coleccion de 30 Mapas* (Baltimore: A Hoen & Co., 1899), no. 15. Father Jose Maria Algue (1856-1930) was the second director of the Manila Observatory and he had prepared these maps, employing the skill of local draftsmen, prior to American colonial rule in the Philippines.

thirteen months, he had collected 1,809 species of shells.²⁹ But in supplying wealthy collectors and European museums with a diversity of conchological specimens, he also made Puerto Galera, its biological wealth, and the Verde Island Passage known to the world. In a letter to Richard Owen, a close friend and eventual director of the British Museum (Natural History), dated November 5, 1839, Cuming reflected on the end of his three-year expedition: "Here I am on the point of embarking for Singapore and Malacca, having concluded my rambles over the Philippine Islands...I trust those of my worthy esteem'd scientific Friends who know me well, will give me some small degree of credit for my industry and perseverance through sickness, Rainy Seasons, and all the inconvenience of Travelling through unexplored Countries by Land and Sea, my object having been accomplished of adding a mite to the scientific stores of my Native Country."³⁰

Cuming's work incorporated Puerto Galera and its surrounding environment into the scientific world. Other nineteenth-century naturalists would not only cite his shells, noting their procurement from Puerto Galera, but they too would describe specimens from this sheltered bay and collect among its coral complexes and shallow grounds.³¹ One of these scientists was Joaquin Gonzalez Hidalgo, a Spanish

²⁹ See Hugh Cuming's letter to Richard Owen (1804-1892), eventual head of the British Museum (Natural History), dated November 1, 1837. The letter was sent from Manila. Cuming reports to Owen, an admirer of shells too, that although he has not seen either a Nautilus or Argonaut alive, he wants to assure him that he has not been "idle" during his thirteen months in the Philippines. Cited in S. Peter Dance, "Hugh Cuming (1791-1865) Prince of Collectors," *Journal of the Society for the Bibliography of Natural History* 9,4 (1980): 486.

³⁰ See Hugh Cuming's letter to Richard Owen, dated November 5, 1839. The letter was sent from Manila. Cited in S. Peter Dance, "Hugh Cuming (1791-1865) Prince of Collectors," *Journal of the Society for the Bibliography of Natural History* 9,4 (1980): 488.

³¹ On the work of late nineteenth-century Spanish scientists and the prominence of Puerto Galera as a fruitful biological site, see Jose Florencio Quadras, *Catalogo de la Coleccion de Moluscos de Filipinas* (Manila: Colegio de Santo Tomas, 1893) and Joaquin Gonzalez Hidalgo, *Catalogo del los Moluscos*

resident in Manila and professor of malacology at the National Museum of Natural History in Madrid, who learned of Puerto Galera's bounty through Cuming's work. In his own *Catalogo de los Moluscos* (1904), Hidalgo references the contributions and collections made by Cuming, but he also builds up the Philippines as an invaluable site for science, study, and society. Towards the end of his *Catalogo*, Hidalgo reflected upon this relationship:

As the reader can see in the data collected in this Catalog, from which examination it turns out, the Philippine fauna is one of the richest and most varied of the globe. But with both the number of species there collected, it can be said in advance that there are still many who will find themselves in those seas, when they are carefully examined by a greater number of naturalists and with the powerful means that science today has for that kind of research.³²

While the collecting and taxonomic work of Cuming, Hidalgo, and other nineteenth-century naturalists opened the Philippine marine environment to new global currents, the broader structures of science in the Spanish colony engaged the ocean through its surface, tides, and circulating typhoons.³³ The heart of scientific production in the late nineteenth-century Philippines was the Manila Observatory, founded in 1865, and this institution studied the ocean but only from a meteorological point of view and for clues germane to understanding the nature of

Testaceos de las Islas Filipinas, Jolo y Marianas (Madrid: Imprenta de la Gaceta de Madrid, 1904). See also Casto de Elera, *Catalogo Sistemático de Toda la Fauna de Filipinas, Vol. III, Moluscos y Radiados* (Manila: Colegio de Santo Tomas, 1896).

³² Hidalgo, *Catalogo del los Moluscos*, 388-389.

³³ See the works by Jose Algue, *Baguios o Ciclones Filipinos: Estudio Teorico-Practico* (Manila: Imprenta Privada del Observatorio, 1897); *El Baguio de Leyte y Samar 12-13 de Octubre de 1897* (Manila: Poto-Tipografia de J. Marty, 1898); and, *Baguios o Tifones de 1894: Estudio de los Mismos Seguido de Algunas Consideraciones Generales Acerca de los Caracteres de Estos Meteoros en el Extremo Oriente* (Manila: Imprenta Litografia Partier, 1895).

climate change.³⁴ For the Spanish scientific establishment, the marine environment was a surface rather than a place.

But by the start of the American colonial period (1898-1946) in the Philippines, a changing culture of colonial science had pushed below the ocean's surface and began studying its biological universe. Puerto Galera embodied these changes and their transpacific connections. This quiet corner on the north coast of Mindoro had become a popular faunistic paradise. On a visit to Puerto Galera in 1913, one American traveler explained, "The marine garden [reef environment] is a wonder, coral of every color and variety, and all the fish they try to catch for the aquarium—red, green, yellow, pink, lavender—every shade and combination you have ever dreamed of. I saw one fellow striped like a tiger and another, which looked like a peacock."³⁵

Nature's Laboratory: Puerto Galera in the Early Twentieth Century

The shift from Spanish to American empire in the Philippines signaled a qualitative leap in marine science and the role scientists would play in the workings of modern imperial expansion. Through a system of American colonial rule, science and technology transformed Puerto Galera and the ocean around it. Producing the Verde Island Passage cartographically and amassing data about its location and environment were priorities for the new government in Manila.

³⁴ See Miguel Saderra Maso, *Historia del Observatorio de Manila, 1865-1915* (Manila: E.C. McCullough and Co., 1915).

³⁵ William Dickson Boyce, *The Philippine Islands* (Chicago: Rand McNally & Co., 1914), 61.

Under the guidance of G.R. Putnam, assistant director of the newly created Philippine Bureau of Coast and Geodetic Survey (1901), mapping the entire archipelago commenced in 1902. The first survey of Puerto Galera and Varadera Bay was undertaken in 1903, with R. B. Derickson in charge of a small field party and the steamer *Research*. Derickson and his technical crew conducted base measurements, magnetic and astronomical observations, and triangulation work. To ensure an accurate triangulation, points were connected to the church spire at Batangas, on the southern Luzon side of the Verde Island Passage, and the flagstaff at Calapan, on the Mindoro side.³⁶ Using a whaleboat and a small launch, N.G. Grayson and Malcolm Elliot handled the hydrographic work of Puerto Galera, Point Escarceo, and Varadera Bay. From November 20, 1902 to February 5, 1903, they recorded when and how the tides changed, studied the ways in which the currents shifted, and made countless soundings. Their hydrographic readings were imperative for knowing—spatially and environmentally—the nature of Puerto Galera and the Verde Island Passage.³⁷ The work of Derickson and his technical staff produced new knowledge about these waters and their shores. Over the span of three months from

³⁶ *Report of the Superintendent of the Coast and Geodetic Survey Showing the Progress of the Work from July 1, 1902 to June 30, 1903* (Washington: Government Printing Office, 1903), 124-125. See Appendix no. 1: Details of Field Operations.

³⁷ *Report of the Superintendent of the Coast...1903*, 125. For a sense of how tidal observations can reveal periods of marine environmental change, see the 1896 report by Assistant Surveyor Jaya Suriya from Perak and his correspondence with Dutch officials on the Sumatra side of the Malacca Straits. Over a ten-year span, Suriya observed how the sea had encroached upon the coastlines of Perak, Penang, and Selangor. The initial report and subsequent exchanges are enclosed in Colonial Office (CO) 273/214/254. On the politics of mapping in colonial Southeast Asia, see Eric Tagliacozzo, "Hydrography, Technology, Coercion: Mapping the Sea in Southeast Asian Imperialism, 1850-1900," *Archipel* 65,1 (2003): 89-107; Kunio Katayama, *The Japanese Maritime Surveys of Southeast Asian Waters Before the First World War* (Kobe: Kobe University of Commerce, Institute of Economic Research Working Paper 85, 1985); and, Christiaan Biezen, "'De Waardigheid van een Koloniale Mogendheid': De Hydrografische Dienst en de Kartering van de Indische Archipel tussen 1874 en 1894," *Tijdschrift voor Zeegechiedenis* 18,2 (1999): 23-38.

Pacific, mapping facilitated the expansion of infrastructure, and infrastructure mobilized the reach of science and society.

We can trace these new currents and circulations to developments in Manila, Chicago, and Woods Hole. First, in Manila, as discussed in the previous chapter, Alvin Seale was organizing the Bureau of Science's Division of Fisheries and laying the groundwork for Southeast Asia's first public aquarium. But in the colonial capital as well, the University of the Philippines (UP) was expanding its areas of training through the newly established zoology department, which was founded in 1910. Lawrence E. Griffin became the department's first head, and he was tasked with developing a collection of specimens for the university but also stimulating the study of the archipelago's marine fauna.⁴⁰

Far from Manila, but not unconnected, was Chicago. The University of Chicago played an important role in cultivating a generation of foreign and Filipino scientists who would further shape and define the global significance of Puerto Galera, the Verde Island Passage, and the Philippine marine environment in the 1920s and 1930s. Among these Chicago-trained scientists was Pranis Baltras (P.B.) Sivickis, a Lithuanian émigré who completed a doctorate degree in zoology at the University of Chicago in 1922.⁴¹ A student of Charles Manning Child, Sivickis studied *Planaria*, or regenerating flatworms, at a time when Chicago was "a stronghold of

⁴⁰ Lawrence E. Griffin, "The Philippine Marine Biological Station at Port Galera, Mindoro, P. I.," *Internationale Revue der Gesamten Hydrobiologie und Hydrographie* 6, 2/3 (1913): 325.

⁴¹ For Sivickis's dissertation, see P.B. Sivickis, "Studies on the Physiology of Reconstitution in *Planaria lata*, with a Description of the Species," *Biological Bulletin* XLIV,3 (March 1923): 113-152.

Planaria studies.”⁴² Constancio Pacifico Rustia y Sison also studied *Planaria* and worked under Child at Chicago’s Hull Zoological Laboratory. Originally from Baliuag, Bulacan, a provincial town just north of Manila, Rustia completed his Ph.D. in zoology at Chicago in 1924.⁴³ Most important was Hilario Atanacio Roxas (1896-1945), a Filipino from Manila, who studied zoology at Chicago with the department’s chair Frank R. Lillie, and received his doctorate in 1926.⁴⁴



*Marine Biological Laboratory at Woods Hole, Massachusetts, 1930.*⁴⁵

⁴² For more Child and the rise and fall of *Planaria* in the study of genetics and regeneration, see Gregg Mitman and Anne Fausto-Sterling, “Whatever Happened to *Planaria*? C.M. Child and the Physiology of Inheritance,” in *The Right Tools for the Job: At Work in Twentieth-Century Life Sciences*, eds. Adele E. Clarke and Joan H. Fujimura (Princeton: Princeton University Press, 1992), 172-197. The quote is from page 173.

⁴³ For Rustia’s dissertation, see Constancio Pacifico Rustia, “The Control of Biaxial Development in the Reconstitution of Pieces of *Planaria*,” *Journal of Experimental Zoology* 42,1 (May 1925): 111-142.

⁴⁴ For Roxas’s dissertation, see Hilario A. Roxas, “Gonad Cross-transplantation in Sebright and Leghorn Fowls,” *Journal of Experimental Zoology* 46,1 (August 1926): 63-119.

⁴⁵ “Marine Biological Laboratory, Woods Hole, Mass.,” No. 77252, Massachusetts Postcards, Tichnor Brothers Collection, Boston Public Library.

Like Chicago, the Marine Biological Laboratory at Woods Hole was instrumental in fostering a model and method to investigate Puerto Galera and the Verde Island Passage. For the foreign and Filipino scientists who would soon document and describe the richness of the Philippine marine environment, Woods Hole and their experiences at this laboratory were invaluable.⁴⁶

Chicago's unique place within these Woods Hole experiences was also significant. The founding director of the Marine Biological Laboratory was Charles Otis Whitman, who served from 1888 to 1907 and later became chair of Chicago's zoology department. Frank R. Lillie became the second director of Woods Hole and remained in charge from 1908 to 1925. During these directors' tenures, a coterie of scientists would participate in the laboratory's summer program and go on to play key roles in building up the Philippines as marine biodiversity hotspot. Among the most important of these scientists was Reinhart Parker Cowles, who taught zoology at UP and later became an advisor to Rachel Carson at Woods Hole and Johns Hopkins University. He spent time at the Marine Biological Laboratory in 1901 and 1906.⁴⁷ The founding chair of UP's department of zoology, Lawrence E. Griffin, also had a connection to Woods Hole. He served as a zoology instructor at the laboratory in 1908.⁴⁸ Before joining UP's department of zoology in 1923, P.B. Sivickis was a

⁴⁶ For more on the experience of place in doing research and shaping knowledge, see Robert E. Kohler, "Practice and Place in Twentieth-Century Field Biology: A Comment," *Journal of the History of Biology* 45,4 2 (Winter 2012): 579-586.

⁴⁷ U.S. Commission of Fish and Fisheries, *Report of the Commissioner For the Year Ending June 30, 1901, Part XXVII* (Washington: Government Printing Office, 1902), 127 and *The Marine Biological Laboratory, Tenth Report for the Years 1903-1906, including Financial Report from 1900-1906* (Woods Hole, 1907), 21.

⁴⁸ Frank R. Lillie, "The Twenty-First Session of the Marine Biological Laboratory, June 1 to October 1, 1908, Preliminary Announcement," *Science* 26,676 (Dec. 13, 1907): 841.

summer fellow at Woods Hole in 1921 and 1922.⁴⁹ Finally, Roxas was an embryology student at the marine biological laboratory in the summer of 1924.⁵⁰ After his program at Woods Hole, Roxas returned to the UP zoology department, becoming its first Filipino head in 1929.

GRIFFIN'S REPORT AND EXPEDITION IN 1912

Under American rule, it became common knowledge that the marine environment was central to the social and economic life of the country.⁵¹ From the vantage of the colonial state and its public university, it was the role of scientists to map and materialize this biological wealth. Scientists were to record the abundance and diversity of aquatic fauna, but also identify viable food sources and commercial industries.⁵²

The currents of science and empire coalesced to open and transform Puerto Galera and the Verde Island Passage in 1912, when the first scientific expedition was sent to study the marine life of this corner of the Philippines. Organized jointly between the Bureau of Science and UP's zoology department, the biological survey

⁴⁹ "The Marine Biological Laboratory, Twenty-Fourth Report, for the Year 1921, Thirty-Fourth Year," *Biological Bulletin* 42,6 (June 1922): 296 and "The Marine Biological Laboratory, Twenty-Fifth Report, for the Year 1922, Thirty-Fifth Year," *Biological Bulletin* 45,1 (July 1923): 23.

⁵⁰ "The Marine Biological Laboratory, Twenty-Seventh Report, for the Year 1924, Thirty-Seventh Year," *Biological Bulletin* 49,1 (July 1925): 34.

⁵¹ The recruitment of Alvin Seale to organize a Division of Fisheries in the Bureau of Science in 1907 underscores the importance of the ocean and its socio-economic role in the country. See Alvin Seale, "The Fishery Resources of the Philippine Islands, Part IV, Miscellaneous Marine Products," *Philippine Journal of Science* 6,6 (December 1911): 283-320.

⁵² See Alvin Seale, "Sea Products of Mindanao and Sulu, I: Food Fishes and Sharks," *Philippine Journal of Science* 11, 3 (May 1916): 235-244; H.C. Delsman and J.D.F. Hardenberg, *De Indische Zeevisschen en Zeevisscherij* (Batavia: Visser & Co., 1934); and, Agustin F. Umali, *Edible Fishes of Manila* (Manila: Bureau of Printing, 1936).

included the colony's most distinguished field naturalists who all had experience working at marine stations in the United States, including Alvin Seale (Bureau of Science), Andres Celestino (Bureau of Science), Clara M. Graham (Philippine Normal School), Sol Felty (S.F.) Light (UP), Reinhart Parker Cowles (UP), Artemas Lawrence Day (UP), Lawrence Diller Wharton (UP), and Lawrence E. Griffin (UP). As head of the field party, Griffin explained the purpose of the expedition expansively: "The products of the sea form so important a part of the economy of the Filipino people that an exhaustive marine biological survey of Philippine waters is a most necessary undertaking."⁵³ Griffin read the work of earlier naturalists such as Cuming, Hidalgo, and de Elera as proof that the archipelago was home to a wealth of ocean fauna. And in light of this natural bounty and the potential for industry, it was necessary for scientists to study the marine environment in a "thorough and systematic way."⁵⁴

For Griffin, scale was central to both knowing the sea and exploiting its resources. As head of the expedition, he argued that in building a foundation for future work along "economic lines, the marine fauna of the Philippines must be extensively collected and classified."⁵⁵ It was essential to have some comprehensive knowledge of the islands' biological waters before scientists could confidently address the nature of the colony's "marine products of economic importance."⁵⁶ From identifying new types of edible fish to locating new supplies of button shell,

⁵³ Lawrence E. Griffin, "The Philippine Marine Biological Station at Port Galera, Mindoro, P. I.," *Internationale Revue der Gesamten Hydrobiologie und Hydrographie* 6, 2/3 (1913): 325.

⁵⁴ Griffin, "The Philippine Marine Biological Station," 325.

⁵⁵ Griffin, "The Philippine Marine Biological Station," 334.

⁵⁶ Griffin, "The Philippine Marine Biological Station," 334.

the demand for economic products was intimately linked to the scale of scientific investigation.

Scope mattered too. The field party was configured in such a way that different areas of expertise were represented. Seale was an ichthyologist who collected brilliant reef fish for the public aquarium he was building. With Celestino, a Filipino taxidermist and expert collector, Seale also mapped new food sources and identified poisonous species. Together, they documented the “spawning season and habitats” of Puerto Galera’s fish fauna, and secured “specimens of the very young of a number of our most important food fishes.”⁵⁷ With the anticipated opening of the Manila Aquarium in 1914, and the projected need for colorful marine life, Seale noted that Puerto Galera would make “a good base of supply” once steamer connections had been established and the proper infrastructure put in place.⁵⁸ And while Seale and Celestino worked on fish, Graham focused on mollusks, Light and Griffin studied corals, Day collected crinoids or sea lilies and feather stars, Wharton handled worms, and Cowles examined crustaceans. The expedition’s wide scope of research ensured a comprehensive approach to building scientific knowledge and specimen collections.

The success of the field party’s work, however, depended heavily on Celestino, the sole Filipino on the expedition, whose official title at the Bureau of Science was “collector of natural history specimens.”⁵⁹ For one, his language skills

⁵⁷ Alvin J. Cox, *Eleventh Annual Report of the Bureau of Science, For the Year Ending August 1, 1912* (Manila: Bureau of Printing, 1913), 20.

⁵⁸ Cox, *Eleventh Annual Report*, 21.

⁵⁹ *Official Roster, Officers and Employees in the Civil Service of the Philippines Islands, Compiled to January 1, 1912* (Manila: Bureau of Printing, 1912), 19. See also, Richard C. McGregor, “Notes on Four

were invaluable. Celestino was a native Tagalog speaker, a language widely spoken in the Puerto Galera area. Additionally, his collecting expertise was a critical asset. Since the 1890s, he had secured bird specimens for British, American, and Australian collectors including John Whitehead, Cameron Forbes, and Richard C. McGregor, respectively. In recognition of his service and contributions to Philippine ornithology, McGregor, one of the world's leading bird experts during the early twentieth century and longtime editor of the *Philippine Journal of Science*, named the small Buttonquail, *Turnix sylvaticus celestinoi*, after Celestino in 1907.⁶⁰ Most importantly, Celestino provided the expedition with a wealth of place-based knowledge specific to Puerto Galera and its surrounding natural and social environments. With McGregor, Celestino had first collected birds from Puerto Galera, Verde Island, and Mindoro proper in December 1902, with subsequent collecting trips in the years after.⁶¹

The field expedition arrived in Puerto Galera in the summer of 1912, and stayed from March through June. During this time, and under the direction of Griffin, a marine biological station was established. This was the first laboratory of its kind in South and Southeast Asia, and the second oldest in Asia. The University of Tokyo founded the Misaki Marine Biological Station in Kanagawa Prefecture (Japan) in

Birds from Luzon and on a Species of Doubtful Occurrence in the Philippines—Notes on Birds from Apo Island—Notes on a Collection of Birds from Banton—Notes on a Collection of Birds from the Island of Tablas," *Philippine Journal of Science* 1,7 (September 1906): 768.

⁶⁰ Richard C. McGregor, "Descriptions of Four New Philippine Birds," *Philippine Journal of Science* 2 (1907): 292.

⁶¹ Richard C. McGregor, "Birds from Benguet Province, Luzon, and from the Islands of Lubang, Mindoro, Cuyo, and Cagayanillo," *Bulletin of the Philippine Museum* 3 (January 1904): 3-16.

1887, a year before the opening of the Marine Biological Laboratory at Woods Hole.⁶²

With Griffin drawing on his experience at Woods Hole, Puerto Galera offered a unique set of advantages for him to build a marine biological laboratory in Asia. In the first instance, Puerto Galera was a short train (110 kilometers) and boat ride away from Manila. This manageable distance made the north coast of Mindoro and its surrounding marine environment an ideal site for Manila's students, faculty, and the university to study the fauna and flora of Philippine waters. Puerto Galera's natural design also made it an exceptional place for collection, observation, and research. As a small bay connected to, but sheltered from Verde Island Passage, Puerto Galera had access to the region's ecology without the perils posed by riotous waves and forceful gales. "In fact," reported Griffin, "the bay of Port Galera is one of the best typhoon anchorages in the Philippines. The fact that no matter from what direction the wind blows, there is calm water in some part of the bay, is a great advantage of the locality for biological work."⁶³ In this way, Puerto Galera was similar to Woods Hole in that both localities presented natural advantages for biological work.

For Puerto Galera, one of these natural advantages was the symbiotic relationship between tidal currents and coral reefs. The strength of the tides

⁶² The founding date differs, with some sources using 1887 and others citing 1886. See Hiroshi Terayama, "The Misaki Marine Biological Station (Faculty of Science, University of Tokyo)," *International Society of Developmental Biologists Newsletter* (May 1979): 3-4; Kazuo Inaba, "Japanese Marine Biological Stations: Preface to the Special Issue," *Regional Studies in Marine Science* 2 (November 2015): 1-4; and, M.F. Guyer, "Biological Stations of Japan," *Scientific Monthly* 29,5 (November 1929): 385-393. Using either date, the Misaki Marine Biological Station was the oldest ocean laboratory in Asia.

⁶³ Griffin, "The Philippine Marine Biological Station," 326.

affected both the bay as well as the passage, producing strong currents with tiderips. While these tiderips were a perennial hazard for local *bancas* (light craft), they were a consistent source of food for the life of the sea. With each rising tide the bay swelled with nutrient-rich water, thereby forming and feeding, over time, both an abundance of coral reefs and a diversity of fauna. In describing the bay at Puerto Galera, Griffin explained, “Coral reefs border the shores of all parts of the bay...while considerable reefs extend into the bay from the points of land. The outer shores of the headlands and islands, which bound the bay, are also bordered with reefs, which are of considerable extent in several places. Particularly fine coral reefs are found at the entrance of Little Balateras Cove.”⁶⁴

It was Puerto Galera’s aquatic life that made it an exceptional base for biological investigations. As a zoology instructor at Woods Hole in 1908, Griffin knew the power of place and residence when it came to the studying the marine environment.⁶⁵ The production of knowledge occurred through field research and laboratory work. For this reason, Griffin built the Puerto Galera laboratory at the water’s edge.⁶⁶ With the marine station no more than ten feet from the high-tide mark, the field party had unobstructed access to the wonders of the bay’s coral complexes, which “were alive with brightly colored fishes many of which...as

⁶⁴ Griffin, “The Philippine Marine Biological Station,” 326.

⁶⁵ For more on the place of “residence” in the history of science, see Robert E. Kohler, “Paul Errington, Aldo Leopold, and Wildlife Ecology: Residential Science,” *Historical Studies in the Natural Sciences* 41,2 (Spring 2011): 216-254.

⁶⁶ For a history of marine biological stations in the continental United States, see Samantha K. Muka, “Working at Water’s Edge: Life Sciences at American Marine Stations, 1880-1930” (PhD diss., University of Pennsylvania, 2014).

remarkable in their shape as in the intensity of their colors.”⁶⁷ The diversity of the Puerto Galera’s coastline also made collecting specimens and studying life in place a convenient practice and a rewarding experience. Within a two-mile radius of the marine station, there was a mix of shores of various types: rocky, sandy, muddy, and grassy. Each of these ecological stretches provided the expedition with a wealth of species unknown to science. For example, in his report, Griffin noted, “ I found on the Port Galera reefs more than 180 species of corals; and one morning collected in a very limited territory and in two hours time 37 species of corals. A number of these are new species and many are forms, which hitherto have been considered to be extremely rare.”⁶⁸ The position of the laboratory at the water’s edge and along a highly diverse coastline “made it possible for the parties to do much more effective work in observation and collecting than would have been possible if the coast had been of the more ordinary character, in which the same formation extends for a long distance.”⁶⁹

In the end, the expedition to Puerto Galera and the Verde Island Passage resulted in new knowledge about the biological diversity of Philippine waters and the significant place of these waters in understanding the global marine environment. With their specimens and field notes, the party returned to Manila at the end of June 1912 and began to prepare a series of publications.⁷⁰ Members of the

⁶⁷ Griffin, “The Philippine Marine Biological Station,” 333.

⁶⁸ Griffin, “The Philippine Marine Biological Station,” 330.

⁶⁹ Griffin, “The Philippine Marine Biological Station,” 327.

⁷⁰ See S.F. Light, “Notes on Philippine *Alcyonaria*,” *Philippine Journal of Science* 9,3 (1914): 233-245 and “Some Philippine Sctphomedusae, Including Two New Genera, Five Species, and One New Variety,” *Philippine Journal of Science* 9,3 (June 1914): 195-231; and, R.P. Cowles, “Palaemons of the

expedition also forged new networks of scientific exchange by circulating their collected fauna to laboratories and institutions outside the Philippines. Cowles sent a set of crustaceans to Stanley Kemp, assistant superintendent at the Indian Museum in Calcutta.⁷¹ Griffin shipped a collection of hydroids, or jellyfish-like creatures, to Charles W. Hargitt at Syracuse University. These hydroids, representing almost fifty species, were preserved in jars with tags of detail about the localities from which they were acquired, including “interisland cables from depths of 8 to 177 fathoms.”⁷²

While the expedition had a lasting impact on the scientific place and global import of Philippine waters, the establishment of the Puerto Galera Marine biological Station was temporary. By October 1912, Seale had departed for Santa Cruz, California, where he and his wife Ethel purchased the San Augustine Ranch.⁷³ Griffin became Dean of Liberal Arts at UP, and then he too left the islands for Harvard University before moving on to the University of Pittsburgh.⁷⁴ S.F. Light continued at UP until 1922, at which time he became chair of the zoology

Philippine Islands,” *Philippine Journal of Science* 9,4 (August 1914): 319-403 and “The Habits of some Tropical Crustacea: II,” *Philippine Journal of Science* 10,1 (January 1915): 11-18.

⁷¹ Stanley Kemp, “On a Collection of Stomatopod Crustacea from the Philippine Islands,” *Philippine Journal of Science* 10,3 (May 1915): 169-186.

⁷² Charles W. Hargitt, “Hydroids of the Philippine Islands,” *Philippine Journal of Science* 24,4 (1924): 467. Based on Griffin’s collection, which had “a large proportion of strange forms,” Hargitt described a new genus and species of hydroid, *Zancloidea philippina* (468).

⁷³ *Diary of Alvin Seale, Philippine Years (1905-1914)*. Special Collections, Green Library, Stanford University. Seale and Ethel would arrive back in Manila on the January 3, 1913.

⁷⁴ Pearl A. Heal, ed., “Department of Personals and News,” *Alumni Quarterly of Hamline University* 10,3 (January 1914): 12; and, “University and Educational News,” *Science* 40,1028 (September 11, 1914): 379.

department at the newly founded University of Amoy in southern China.⁷⁵ Not long after the expedition, Cowles returned to Johns Hopkins University and commenced summer teaching duties at Woods Hole as well as project work for the U.S. Bureau of Fisheries. From these three institutions, Cowles advised and shaped the young career of Rachel Carson.⁷⁶ As for A.L. Day, he would stay on at UP, becoming chair of the zoology department in 1921 and retiring from the university in 1922.⁷⁷

Day's retirement from UP in 1922, and the series of personnel changes that preceded it, opened a pedagogical space for a new generation of scientists and students to study the Philippine marine environment. Two Chicago-trained zoologists and Woods Hole alumni, P.B. Sivickis and Hilario A. Roxas, would build on the legacy of the 1912 expedition and add new life to UP's zoology department. They would also quickly rehabilitate and permanently institutionalize the marine biological station at Puerto Galera, changing its name to the Puerto Galera Marine Biological Laboratory. More like Woods Hole than ever before, the Puerto Galera laboratory would house Filipino students, conduct summer courses, facilitate research, and foster global networks of scientific exchange. And like Chicago's

⁷⁵ S.F. Light, "The University of Amoy, Amoy, China," *Bulletin of the Pan-Pacific Union* 59 (September 1924): 11-12. Tan Kah Kee, a Hokkien merchant in Singapore, founded the University of Amoy in 1921.

⁷⁶ See Robert K. Musil, *Rachel Carson and Her Sisters: Extraordinary Women Who Have Shaped America's Environment* (New Brunswick: Rutgers University Press, 2014), 96; William Dritschilo, "Rachel Carson and Mid-Twentieth Century Ecology," *Bulletin of the Ecological Society of America* 87,4 (October 2006): 358; Linda Lear, *Rachel Carson: Witness for Nature* (Boston: Mariner Books, 2009), 61; and, Gabriel Popkin, "Right Fish, Wrong Pond," *Johns Hopkins Magazine* 65,2 (Summer 2013): 51-55.

⁷⁷ *The University of the Philippines General Catalogue, 1922-1923, Bulletin No. 10* (Manila: Bureau of Printing, 1923), 9.

relationship to the running of Woods Hole, the Puerto Galera laboratory was under the administration of UP faculty.

P.B. Sivickis and the Puerto Galera Marine Biological Laboratory, 1922-1928

With Day's departure from the Philippines in 1922, P.B. Sivickis arrived from the University of Chicago not only to rehabilitate the Puerto Galera Marine Biological Station but also to make it a training ground for Filipino scientists.⁷⁸ Encouraged by Sivickis's Filipino classmate at Chicago and colleague at Woods Hole, Constancio P. Rustia, to visit the Philippines and work at UP, Sivickis joined UP's zoology department in the wake of Day's retirement as its acting head in September 1922.⁷⁹ By 1924, he was head of the department until his return to Lithuania in 1928.

In joining UP's zoology department, Sivickis also brought the experiences and expectations he had cultivated from his time at Woods Hole. During these summer months in 1921 and 1922, Sivickis participated in field research and laboratory work, investigating marine life and also carrying out experiments on the regeneration of planarians (flatworms).⁸⁰ Almost immediately, Sivickis's work

⁷⁸ The Philippines were a matter of destiny for Sivickis. His convocation speaker at Chicago was David Prescott Barrows, an early American administrator in the colonial Philippines.

⁷⁹ Rustia and Sivickis shared the same dissertation advisor, C.M. Child, and they both worked on *Planaria*. After finishing at Chicago in 1924, Rustia joined UP's zoology faculty. He taught and served as an administrator at the Junior College in Cebu. For reference on Rustia's encouragement to Sivickis, see Ramona Sivickyte Simokaitiene and Meile Vitkauskaitė, *Gyvoji Mintis: Pagal Prof. P.B. Sivickio Atsiminimus* (Vilnius: Vilniaus Universiteto Ekologijos Institutas, 2005), 243.

Cited in Laima Petrauskiene, "Scientific Activity of Prof. Pranciskus Baltrus Sivickis at University of Philippines in 1922–1928. Is he still Remembered in Philippines?," *Ekologija* 59,1 (2013): 23.

⁸⁰ See P.B. Sivickis, "Studies on the Physiology of Reconstitution in *Planaria lata*, with a Description of the Species," *Biological Bulletin* 44,3 (March 1923): 113-152.

served to restart the marine biological station at Puerto Galera. As he had done at Woods Hole, Sivickis wanted to create a learning environment for students to explore the field but also work in the laboratory. With approximately 322 zoology students, more than any other department in the 1922-1923 academic year, Sivickis understood the importance of finding a suitable site for their applied research.⁸¹ By March 1923, his efforts combined with those of the department and the university administration resulted in the opening of the Puerto Galera Marine Biological Laboratory for students and investigators to study the life and ecology of Philippine waters.

One of these UP students who made the most of Sivickis's presence and the laboratory at Puerto Galera was Hilario A. Roxas, who had completed a BS in zoology in 1922 under the direction of Day and Light, scientists from the 1912 expedition, and worked for several years in the department as an assistant in zoology.⁸² For the academic year 1922-1923, Roxas was promoted to instructor of biology at the Junior College of the University of the Philippines in Cebu.⁸³ During this time, Roxas was the only instructor of biology or zoology of record.⁸⁴ With Sivickis serving as acting head of the department for that year (1922-1923), it is

⁸¹ See Sivickis letter to the chair of zoology at the University of Kaunas, dated 1923, no. F. 144-1274, Manuscript Unit, Wroblewski Library of the Lithuanian Academy of Sciences (LMAVB), Vilnius, Lithuania. Cited in Petrauskiene, "Scientific Activity of Prof. Pranciskus Baltrus Sivickis," 23.

⁸² *The University of the Philippines General Catalogue, 1920-1921, Bulletin No. 9* (Manila: Bureau of Printing, 1921), 22 and 109.

⁸³ Created in 1918, the Junior College was located in the central region of the Philippines to serve the needs of provincial students.

⁸⁴ *The University of the Philippines General Catalogue, 1922-1923, Bulletin No. 10* (Manila: Bureau of Printing, 1923), 19.

likely that he and Roxas were not only in correspondence, but that Sivickis offered the young instructor advice on where he should pursue his PhD.

Whether it was the guidance of Sivickis or Rustia, who had just joined UP's zoology department, Roxas took a leave of absence from the Junior College and began his PhD at Chicago in 1923. But unlike Sivickis and Rustia, who both worked under C.M. Child and focused on planarians, Roxas studied with Frank R. Lillie and specialized in embryology. Lillie would serve an instrumental role in the development of Roxas's scientific career. Not only was he chair of the zoology department at Chicago, but Lillie was also director of the Marine Biological Laboratory at Woods Hole.



Hilario Roxas (seated front row, third from the left) at the Opening of the Whitman Laboratory at the University of Chicago, 1926.⁸⁵

After only his first year at Chicago, Roxas was selected to participate in the Marine Biological Laboratory's summer program in 1924. He attended lectures by visiting experts, took courses in embryology, made collections of local marine fauna, and spent hours doing laboratory work.⁸⁶ The culture and community at Woods Hole would broaden Roxas's view of, and hopes for, Puerto Galera and the Verde

⁸⁵ University of Chicago Photographic Archive, apf1-05622, Special Collections Research Center, University of Chicago Library.

⁸⁶ "The Marine Biological Laboratory, Twenty-seventh Report, For the Year 1924," *Biological Bulletin* 49,1 (July 1925): 34.

Island Passage. For Roxas, these localities constituted an ideal place for training Filipino scientists and producing new knowledge about the Philippine marine environment. And given the area's rich biological wealth, it was also an exceptional site for building global exchange networks and developing new fishery resources.

Meanwhile, back in Manila, Sivickis was initiating a study program at the Puerto Galera Marine Biological Laboratory. Under his direction, the summer school welcomed its first cohort of UP students, assistants, and instructors in 1924. Drawn from the zoology and botany departments, there were 21 participants who accompanied Sivickis on the sea voyage to Puerto Galera.⁸⁷ The program ran from April through May, and the lecturers for the inaugural session were Sivickis on zoology and Raymond Kienholz, who covered topics related to the region's "beach jungle."⁸⁸

⁸⁷ "Scientific Notes and News," *Science* 60, 1551 (September 19, 1924): 265.

⁸⁸ Raymond Kienholz, "An Ecological-Anatomical Study of Beach Vegetation in the Philippines," *Proceedings of the American Philosophical Society* 65,5 (1926): 58.



Puerto Galera Marine Biological Laboratory, 1926.



Filipino students at the Puerto Galera Marine Biological Laboratory, 1926.

Not only did he direct the summer school at Puerto Galera until his departure from the Philippines in 1928, but Sivickis also cultivated popular interest in the ocean and political support for the laboratory. From his photographs, we know that two guests in particular made the trip to see and experience the world of science at work: Rafael Palma, president of UP, and Maximo M. Kalaw, dean of the College of Liberal Arts. During Sivickis's tenure as head of the zoology department and director of the laboratory, President Palma and Dean Kalaw represented the two most important individuals within the university. By securing their support for scientific work and expanding their interest to the life of the sea, Sivickis was institutionalizing the Puerto Galera Marine Biological Laboratory as a training ground and collecting site for current and future Filipino scientists.



Rafael Palma (left) and Maximo Kalaw (right) at the Puerto Galera Marine Biological Laboratory, 1926.

P.B. Sivickis, Puerto Galera, and the Making of a Holothurian Expert

One of these Filipino scientists who worked closely with Sivickis was Jose Sison Domantay (1897-1976?), from Malasiqui, Pangasinan, a provincial town north of Manila and within view of Lingayen Gulf and its rich marine environment. Like Roxas, he studied zoology at UP, completing his BS and MS degrees in 1925 and 1928. And also like Roxas, he worked as an assistant and later as an instructor in the department.

Domantay's time in the department coincided with Sivickis's tenure and the rise of the Puerto Galera Marine Biological Laboratory. The institutional surge in support and interest in the study of the sea presented a set of unique opportunities

for Domantay. First, he was able to participate in the summer sessions at Puerto Galera, fostering what would become his lifelong passion: the study of echinoderms (specifically, holothurians or *balate*). With Sivickis as his graduate advisor, Domantay would not only write a thesis on holothurians, but he would also become the first Filipino to publish a scientific study about them based on field research and laboratory work undertaken at Puerto Galera.⁸⁹ Through his personal relationship with Sivickis, moreover, Domantay was in charge of preparing the summer school for each cohort of students and investigators. In this capacity, he was able to spend extended periods of time at Puerto Galera, exploring its marine gardens, collecting *balate*, and studying their ecological distribution.⁹⁰ Over time, he amassed a considerable collection of holothurians while also becoming deeply familiar with their life histories and littoral habitats.⁹¹ Finally, Domantay leveraged the experience and expertise he acquired through Puerto Galera to map marine species of scientific and economic importance. Drawing on his intimate knowledge of holothurians, he identified a variety of types that he thought were suitable for commercial exploitation and human consumption.⁹²

⁸⁹ Jose S. Domantay and P.B. Sivickis, "The Morphology of a Holothurian, *Stichopus chloronotus* Brandt," *Philippine Journal of Science* 37 (November 1928): 299-332.

⁹⁰ Jose S. Domantay, "The Ecological Distribution of the Echinoderm Fauna of the Puerto Galera Marine Biological Station," *Natural and Applied Science Bulletin of the University of the Philippines* 4,5 (1936): 385-418.

⁹¹ See Jose S. Domantay, "Autonomy in Holothurians," *Natural and Applied Science Bulletin of the University of the Philippines* 1,4 (1931): 389-404 and "Littoral Holothurioidea of Port Galera Bay and Adjacent Waters," *Natural and Applied Science Bulletin of the University of the Philippines* 3,1 (1933): 41-101.

⁹² Jose S. Domantay, "Philippine Commercial Holothurians," *Philippine Journal of Commerce* 10,9 (1934): 5-7 and "The Edible Holothurians," *Searchlight Manila* 1,1 (1936): 11-18.



Jose S. Domantay and a lobster at the Puerto Galera Marine Biological Laboratory, 1926.

But for Domantay, Puerto Galera would figure more than just a place to study the biological diversity and industrial promise of Philippine waters.⁹³ By the time Sivickis returned to Lithuania in 1928, the laboratory and its surrounding marine environment had become the center of a burgeoning Filipino scientific community. As a permanent institution with direct ties to the *Philippine Journal of Science* and the *Natural and Applied Science Bulletin of the University of the Philippines*, Puerto Galera hosted Filipino scientists who not only documented the local names of

⁹³ Jose S. Domantay, "Four Additional Species of Littoral Holothurioidea of Port Galera Bay and Adjacent Waters," *Natural and Applied Science Bulletin of the University of the Philippines* 4,1 (1934): 109-118.

various fauna, but also described the presence of new species. Domantay, for instance, identified four new holothurians from Puerto Galera's waters, naming one of them after Hilario A. Roxas, *Pseudocucumis roxasi*.⁹⁴ What emerged through Puerto Galera in the wake of Sivickis was a vernacular society of Filipino investigators and UP students, which spanned and brought together the worlds of science, commerce, and education.

Hilario Roxas and the Puerto Galera Marine Biological Laboratory

In 1928, Hilario A. Roxas became the first Filipino director of the Puerto Galera Marine Biological Laboratory. After spending a summer at Woods Hole in 1924, completing his PhD in 1926, and resuming his teaching duties at the Junior College of UP at Cebu City in 1927, Roxas moved to Manila where he joined his old faculty, replacing Sivickis in the department and at the laboratory.⁹⁵ By 1929, though still an assistant professor, Roxas became the first Filipino to serve as acting head of the zoology department.

With his local relations and global connections, Roxas was at the heart of the scientific community that formed around the zoology department and the marine laboratory in the 1930s—these diverse linkages, which were strengthened by the

⁹⁴ Jose S. Domantay, "Four Additional Species of Littoral Holothurioidea of Port Galera Bay and Adjacent Waters," *Natural and Applied Science Bulletin of the University Philippines* 4,1 (1934): 109-118.

⁹⁵ Likely not a parting gift, but a gift nonetheless, Roxas sent a collection of spiders (*Latrodectus hasseltii*) to Sivickis from Cebu in 1927. Reference to the gift was made in an article co-authored by Sivickis and Roberta S. Filoteo of UP's zoology department. See P. B. Sivickis and Roberta S. Filoteo, "Observations on Development of the Spider, *Latrodectus hasseltii* Thorell," *Transactions of the American Microscopical Society* 47,1 (January 1928): 12. Filoteo was not only a member of the Puerto Galera Marine Biological Laboratory, but she was also the first woman to join UP's zoology department as a member of its teaching faculty. She and Domantay were assistants (and later instructors) in zoology when Sivickis was chair of the department.

scope and rigor of his research. At Chicago, he had written a dissertation on birds. In Cebu, he collected spiders. From Puerto Galera, Roxas studied starfish, holothurians, and other echinoderms. At the Berlin and Breslau Museums, he analyzed their collections of Philippine soft corals (*Alcyonaria*).⁹⁶ And in Manila, he published on the history and cultivation of food fish such as goramy, catfish, carp, and black bass, which had been introduced into the Philippines before 1937.⁹⁷ He also sent a variety of coral types (*Octocorallia*) to G. Stiasny at the Rijksmuseum van Natuurlijke Historie in Leiden.⁹⁸ In all these projects, Roxas worked closely with Filipino and foreign scientists—collaborating, co-authoring, and co-producing knowledge about the biological diversity of Philippine waters and lands.

The scientific labor at Puerto Galera—with its knowledge production, taxonomy work, and collection building—was important to Roxas. But so too was the practice of communication. Not since Griffin’s account of the Puerto Galera station in 1912 had there been a report on the work accomplished at the field laboratory or its surrounding marine wealth. Under Sivickis, the administrative goal was to build the social, political, and physical infrastructure needed to pursue the investigation of the sea. To this end, he brought President Palma and Dean Kalaw to Puerto Galera so they could experience, first-hand, the culture, pedagogy, and value of science in practice. But for Roxas and the evolving colonial bureaucracy, it was

⁹⁶ Hilario A. Roxas, “Philippine Alcyonaria: The Families Cornulariidae and Xeniidae,” *Philippine Journal of Science* 50,1 (January 1933): 49-110.

⁹⁷ Hilario A. Roxas and Agustin F. Umali, “Fresh-water Fish Farming in the Philippines,” *Philippine Journal of Science* 63,4 (August 1937): 433-468.

⁹⁸ G. Stiasny, “Octocorallia from Philippine Waters,” *Philippine Journal of Science* 76,1 (September 1941): 67-74.

necessary to communicate the nature of the marine laboratory and its contributions to society, science, and commerce.

In 1930, Roxas prepared the first comprehensive report on the Puerto Galera Marine Biological Laboratory.⁹⁹ He documented the location of Puerto Galera Bay, noting the ease with which visitors from Manila were able to cross the Verde Island Passage from Batangas to Mindoro with the aid of chartered motorboats and wind-powered *bancas* (light craft). He also covered a brief history of the marine laboratory, tracing its origins to Griffin's expedition to Puerto Galera in 1912 and the field party's temporary construction of a biological station.

Most importantly, Roxas communicated the investigative work undertaken at the laboratory and in the field, underscoring Puerto Galera's scientific, pedagogical, and economic value. "The station," he explained:

Is established primarily to provide...training in marine zoology...[and] to study problems of direct economic importance...It is the ultimate purpose of the station to gather more data on the habitats, life-histories, natural enemies, food, etc., of the known edible animals, all of which will be of immense value for the fishery industry of the Islands.¹⁰⁰

His report clearly conveyed what the wider scientific community already knew: that Puerto Galera and its adjacent waters constituted an exceptional environment with unrivalled diversity. "Its location is most ideal," Roxas reported. "Its situation at the northern point of Mindoro just at the Verde Island Passage is a distinct advantage, zoologically speaking...[and] together with the absence of city life and the

⁹⁹ Hilario A. Roxas, *The Puerto Galera Marine Biological Laboratory of the University of the Philippines* (Manila: University of the Philippines, 1930).

¹⁰⁰ Roxas, *The Puerto Galera Marine Biological Laboratory*, 3.

abundance of marine animals make Puerto Galera an ideal place for the study of zoology.”¹⁰¹

For Roxas, like Domantay, the study of zoology had a critical role to play in knowing the biological wealth of Philippine waters, but also in developing the country’s marine resources and expanding its food supply. In translating the state of scientific knowledge about Puerto Galera’s material richness, he accompanied his report with a checklist of the region’s aquatic fauna along with a survey of its most productive collecting grounds. Guided by the demands of science as much as by the calls for development, Roxas presented his list “not so much to show how many forms there are, but more to show how much additional work has to be done to make our list up to date and complete.”¹⁰²

Combining the interests of science with the needs of society would come to define the rise of Roxas’s career and his promotion of the value of Philippine waters in the interwar period. A Guggenheim fellowship enabled Roxas to study the soft coral (*Alcyonaria*) collections at the Berlin and Breslau Museums in 1931 and 1932—an experience made possible by the global circulations of Philippine marine fauna. In the early twentieth century, coral specimens collected by S.F. Light in 1912 from Puerto Galera had been sent to Willy Georg Kukenthal (1861-1922) in Germany. At the time, Kukenthal was one of the world’s leading experts on alcyonarian material, spending most of his career at the University of Breslau and

¹⁰¹ Roxas, *The Puerto Galera Marine Biological Laboratory*, 4-5.

¹⁰² Roxas, *The Puerto Galera Marine Biological Laboratory*, 11.

later at the University of Berlin, where he taught courses in zoology and directed each institution's zoological museum.

Roxas's work as a Guggenheim fellow focused on "examining all these specimens, the types of previously described Philippine species, and types from other parts of the world."¹⁰³ Given his knowledge, expertise, and experience at Puerto Galera, Roxas was in a "position to deal with them [the museums' Philippine corals] more or less intimately."¹⁰⁴ As a result of his investigations, Roxas not only corrected the classification of *Alcyonaria*, clarifying the proper place of the families *Cornulariidae* and *Xeniidae*, but also described a number of new coral species. Following zoology's tradition, Roxas named several of these new species after people who had been meaningful and important to him, including Frank R. Lillie (*Xena lillieae*), his advisor at Chicago; S.F. Light (*Heteroxenia lighti*), one of his professors at UP and an earlier collector of soft corals from Puerto Galera; Rafael Palma (*Heteroxenia palmae*), president of UP; Amado Feliciano (*Xenia felicianoi*), a colleague in the UP; and, Willy Georg Kukenthal (*Xenia kukenthalii*), the German zoologist who had built up the coral collections at the Berlin and Breslau Museums.

While coral research in Europe had little effect on development in the Philippines, it did cast Roxas in a new light. After returning from Europe and resuming his responsibilities at UP, he was appointed the director of fisheries for the Philippine government in 1934, making him the first Filipino to hold this position. Shortly thereafter, Roxas recruited Domantay from his zoology department

¹⁰³ Roxas, "Philippine Alcyonaria," 49.

¹⁰⁴ Roxas, "Philippine Alcyonaria," 49.

and the Puerto Galera Marine Biological Laboratory to work for him at the Fish and Game Administration under the Bureau of Science.

The scientific community that Roxas had fostered through UP and Puerto Galera was now mobilized to harness the protein riches of Philippine waters. A history of ecological knowledge borne from observations of Puerto Galera's coral reefs, muddy flats, and coastal mangroves was put to use and made commercially valuable.¹⁰⁵ While the diverse fauna of the Verde Island Passage was scientifically significant, it was also a living index of the different types of food fish, which inhabited local seas and possibly regional waters. Registering the vital importance of fish to Filipino society and marking the progress of scientific knowledge about them, Roxas and Claro Martin assembled the first Filipino-authored checklist of Philippine fish in 1937.¹⁰⁶ Timely in its production and comprehensive in its scope, this was an ichthyological study that firmly documented the Philippines as one of the world's richest centers of fish life.¹⁰⁷ Drawing, in large part, on specimens and studies from Puerto Galera and the Verde Island Passage, Roxas and Martin described 1,918 species.

¹⁰⁵ On the insights about coral reefs and mangrove forests as rich fish habitats, see Hilario A. Roxas and Antolin G. Agco, "A Review of Philippine Carangidae," *Philippine Journal of Science* 74,1 (January 1941): 1-82.

¹⁰⁶ Hilario A. Roxas and Claro Martin, *Checklist of Philippine Fishes* (Manila: Bureau of Printing, 1937). 314.

¹⁰⁷ See Albert W. Herre, *Check List of Philippine Fishes* (Washington: Fish and Wildlife Service, 1953), 1.

Conclusion

From the late eighteenth to the late nineteenth-century, the Philippines emerged as a fertile ground for imperial collecting and knowledge production. The efforts of the Malaspina Expedition, the collector Cuming, and the scientific pioneer Hidalgo historically situated the rich fauna of the country's waters and the unique place of Puerto Galera as a site for sourcing specimens and writing new species into science. Similarly, the scientific careers of Griffin, Sivickis, Domantay, and Roxas are central to knowing how these same Philippine waters became a global biodiversity hotspot in the long twentieth century. Understanding the ways in which Chicago, Manila, and Woods Hole are tied together thus explains the rise of the Puerto Galera Marine Biological Laboratory and the central role this institution ultimately played in documenting the life of these seas in the interwar period.

This history of knowledge production and species identification, however, also opened the Philippine marine environment to an age of mass consumption and commercial exploitation that materialized most acutely in the early decades of the twentieth century through the Filipino scientists associated with Puerto Galera. Along with others, Roxas and Domantay were at the forefront of using scientific knowledge about marine species, local habitats, and seasonal changes to identify new food sources and develop new fishing industries. Reefs, mangroves, and shore waters were rich with a diversity of proteins such as shrimps, clams, sea cucumbers, fish, and crabs. Because of the Puerto Galera Marine Biological Laboratory and its surrounding waters, Filipino scientists such as Roxas knew these ecologies and their fauna well and thus were able to bring both under intense human activity.

But one space of the Philippine marine environment still remained beyond the reach of local fishers and Filipino scientists: the offshore, deep-water pelagic zone. Ecologically, it was home to large, fast-moving, migratory fish such as yellowfin, skipjack, and other tuna species. Catching pelagic fish required a set of skills, expertise, and knowledge, which was largely unknown in the interwar Philippines. Most Filipino fishing industries were built around traps, stakes, corrals, slow-moving trawls, and drive-nets that, in the period before World War II, depended on known fishing grounds such as river mouths, coral reefs, and coastal waters. As conventional outfits, they were generally traditional and reliant on human power and shifting currents. A lack of capital and credit prevented them from using such technologies as cold storage and diesel engines. For all these reasons, the pelagic environment lay beyond the Filipino range of marine capture.

It was a zone of the ocean, however, deeply familiar to Japanese society and its overseas communities. A kind of tuna known as skipjack was the source of *katsuobushi*, one of Japan's staple foods. In the early twentieth century, Japanese migrants moved to the Philippines, specifically to Mindanao where they developed the island's abaca industry after 1905 and thus the need for *katsuobushi* became critical. Exploiting the pelagic zone for tuna resources thus became central to feeding the growth of Mindanao's Japanese community and the island's strategic position in the global abaca industry, bringing this seemingly remote Philippine shore within an expanding Japanese maritime empire.

CHAPTER FIVE

Becoming Pelagic:

Southeast Asia in the Age of Tuna, 1914-1941

Introduction

In the early twentieth century, local and foreign scientists documented the wealth and diversity of the Southeast Asian shelf. Working through global scholarly exchange and local commercial interaction, they produced checklists of edible fish and catalogues of poisonous species.¹ They built public aquariums and biological laboratories.² They studied and mapped the ocean's ecology, and classified its fauna. As a tribute to this scientific collaboration, in 1933 Hilario A. Roxas named a new species of soft coral, *Dendronephthya guggenheimeri*, after the John Simon Guggenheim Memorial Foundation, which had awarded him a travel fellowship to examine the coral collections at the Berlin and Breslau Museums.³ A decade later,

¹ See Albert W.C. Herre, "A Review of the Eels of the Philippine Archipelago," *Philippine Journal of Science* 23,2 (August 1923) 123-236 and "Poisonous and Worthless Fishes: An Account of the Philippine Plectognaths," *Philippine Journal of Science* 25,4 (October 1924): 415-512; Agustin F. Umali, *Edible Fishes of Manila* (Manila: Bureau of Printing, 1936); Hilario A. Roxas and Antolin G. Agco, "A Review of Philippine Carangidae," *Philippine Journal of Science* 74,1 (January 1941): 1-82; M. Paul Chabanaud, *Inventaire de la Faune Ichtyologique de l'Indochine: Premiere Liste* (Saigon: Gouvernement General de l'Indochine, 1928); Pierre Chevey, *Inventaire de la Faune Ichtyologique de l'Indochine: Deuxieme Liste* (Saigon: Gouvernement General de l'Indochine, 1932); C.N. Maxwell, *Malayan Fishes* (Singapore: Methodist Publishing House, 1921); and, H.C. Delsman and J.D.F. Hardenberg, *Indische Zeevisschen en Zeevisscherij* (Batavia: Visser & Co., 1934).

² For a survey of these institutions in colonial Asia, see "Marine Biologisch Institut," no. 232, *Indisch Comite Wetenschappelijke Onderzoekingen, 1888-1941* (2.20.34), The Hague, Netherlands, Nationaal Archief (NA); James Hornell, "The Madras Marine Aquarium," *Madras Fisheries Department Bulletin No. 14* (Madras: Government Press, 1922), 56-95; H.C. Delsman, *Indische Zeevisschen in het Aquarium van het Laboratorium voor het Onderzoek der Zee op den Pasar Ikan te Batavia* (Batavia: G. Kolff, 1924); "Aquarium Society for Ceylon," *Straits Times* (10 October 1936): 16; and, "Koraaleilanden in de Baai van Batavia," *Bataviaasch Nieuwsblad* (26 July 1937): 2.

³ Hilario A. Roxas, "Philippine Alcyonaria II: The Families Alcyoniidae and Nephthyidae," *Philippine Journal of Science* 50,4 (April 1933): 430.

the American ichthyologist Henry Weed Fowler (1878-1965) named a new genus of fish, *Roxasella*, for Roxas, “in appreciation of his work in Philippine ichthyology.”⁴

But the work of these fish experts also had commercial applications that opened Southeast Asia’s oceans to mass consumption and industrial exploitation. Their nuanced understanding of the sea and its reefs, mangroves, and shore waters was essential to locating new food sources and fostering new fishing industries. The late-colonial expansion of marine fisheries was pivotal to increasing the regional food supply, and provisioning the migrant laborers who worked Southeast Asia’s tin mines, rubber plantations, and agricultural frontiers, linking these changes in the land closely to changes out at sea. In this interwar period, the ocean environment sustained industrial agriculture marked by swelling population growth and expanding resource extraction.

From Sumatra’s rubber estates to Mindanao’s abaca farms, provisioning mattered in this era of industrial change in Southeast Asia.⁵ While cost, supply, and religion were decisive factors in what made fish the main source of provision for these plantation societies, these reasons alone cannot explain why tuna (*Thunnini*) were so important to Mindanao and its interwar cultivation of abaca (Manila hemp).

⁴ Henry W. Fowler, *Contributions to the Biology of the Philippine Archipelago and Adjacent Regions; Descriptions and Figures of New Fishes Obtained in Philippine Seas and Adjacent Waters by the United States Bureau of Fisheries Steamer “Albatross”* (Washington: Government Printing Office, United States National Museum, Bulletin 100, Volume 14, Part 2, 1943), 87. Fowler studied zoology under David Starr Jordan at Stanford University, co-founded the American Society of Ichthyologists and Herpetologists in 1927, and served as curator of fish at the Academy of Natural Sciences in Philadelphia. He worked at the Academy from 1903 to his death in 1965.

⁵ For more on provisioning as a critical yet overlooked subject in the study of modern Southeast Asia, see Daniel F. Doeppers, *Feeding Manila in Peace and War, 1850-1945* (Madison: University of Wisconsin Press, 2016), 3-14.

In the case of colonial Mindanao, tuna and abaca were linked together through food culture, and this link shaped provisionment. Plantation communities needed to be fed, but they also needed to be fed protein that was cheap, abundant, and amenable to both cultural tastes and religious beliefs. From 1903 to 1941, the abaca industry formed the center of an overseas Japanese community at Davao, a fertile gulf region on the southeastern coast of Mindanao. Davao's Japanese population grew from about 30 laborers in 1903 to nearly 20,000 in 1938, making it the largest overseas Japanese community in Southeast Asia on the eve of war.⁶

Whether at home or abroad, tuna constituted the essence of Japanese food culture. In particular, a species of tuna known as skipjack (*Katsuwonus pelamis*) was transformed into a household broth called *dashi* that was a core ingredient in most Japanese dishes, including *miso* soup. But skipjack was valuable for another reason: it was used to make *katsuobushi*, or dried, fermented, and smoked tuna sticks. *Katsuobushi* was a known source of *umami*, one of the five known tastes.⁷ And because of its flavor profile, *katsuobushi* was central to the Japanese diet; it was added to soups, vegetables, and rice. As a dried, fermented, and smoked product, *katsuobushi* also kept well under trying equatorial conditions. Its unique preservation ensured the availability of *umami* flavoring, and guaranteed the ready

⁶ Serafin Quiason, "The Japanese Colony in Davao, 1904-1941," *Philippine Social Sciences and Humanities Review* 23, 2-4 (June-December 1958): 229. Employed by Juan Awad, a Lebanese migrant who arrived in Davao in the 1880s, at his abaca plantation in the municipality of Santa Cruz, Davao, these early laborers, under the recruitment of Suda Ryosaku, came from Kagoshima Prefecture in 1903. On this first group of Japanese migrants and the role of Ryosaku, see Josefa M. Saniel, "The Japanese Minority in the Philippines before Pearl Harbor: Social Organization in Davao," *Asian Studies Review* 4,1 (April 1966): 119.

⁷ On *umami*, see Ole G. Mouritsen and Klavs Styrbaek, *Umami: Unlocking the Secrets of the Fifth Taste* (New York: Columbia University Press, 2014). . In 1913, Shintaro Kodama, a chemist at Tokyo Imperial University, identified the link between *katsuobushi* and *umami*.

provision of basic protein. For the Japanese migrants who worked Mindanao's abaca frontier, supplies of tuna were therefore necessary if they were to build an overseas community and produce abaca as a global commodity. By 1941, Davao became globally strategic, contributing nearly fifty percent of the world's production of abaca.⁸

While abaca changed Davao and the economic position of colonial Mindanao, tuna transformed Southeast Asian waters and the place of these waters in the modern world, making this historical moment—the period from 1914 to 1941—nothing less than the age of tuna. The Japanese origins of Mindanao's tuna industry marked a new phase in how people understood and interacted with Southeast Asia's ocean environment.

The pursuit of tuna signaled the rise of transregional fishing networks. To feed the cities of modern Japan and provision its colonial empire and overseas communities, *zaibatsu* (conglomerates) such as Mitsui and Mitsubishi financed fishing companies, which operated across the Indo-Pacific. Transregional in scope, these Japanese fishing networks tied together Japan, Taiwan, Southeast Asia, South Asia, and the Central Pacific in the age of tuna.⁹

⁸ By the start of the war, the Philippines produced about ninety-five percent of the global abaca supply. See Karl J. Pelzer, "Philippine Abaca Industry," *Far Eastern Survey* 17,6 (March 24, 1948): 71. See also Frederick L. Wernstedt and Joseph Earle Spencer, *The Philippine Island World: A Physical, Cultural, and Regional Geography* (Berkeley: University of California Press, 1967), 533; Shinzo Hayase, "Tribes, Settlers and Administrators on a Frontier: Economic Development and Social Change in Davao, Southeastern Mindanao, the Philippines, 1899-1941" (PhD diss., Murdoch University, 1984), 71, 133; and, Salvador L. Pacis, *Davao: Its Progress and Future* (Davao City: Southern Islands Publishing Co. 1950), 93.

⁹ On the nature and reach of these Japanese fishing networks, see John L. Kask, *Japan's Big Fishing Companies* (Washington: Fish and Wildlife Service, 1947). Kask was assigned to the Fisheries Division, Natural Resources Section of the Supreme Commander for the Allied Powers (SCAP) and he

Significantly, this period was marked by the combined use of science and technology to target previously unexploited fish species. With capital from *zaibatsu*, local Japanese fishing subsidiaries were the first in the region to power their fleets with diesel engines. In addition, they used their lines of credit to dominate the production of ice and establish canning and cold storage facilities.¹⁰ From their bases at Takao and Taihoku, on the island of Formosa, Japanese fisheries scientists conducted surveys of the South China seas, searching for viable tuna grounds, mapping ocean currents, inspecting fish bellies, and collecting data on the temperature and salinity of the region's waters.¹¹

Finally, tuna fishing in Southeast Asian waters resulted in the opening of a new environment to mass consumption: the pelagic zone. Until the arrival of the Japanese, this offshore space of the ocean had remained largely outside of the range of scientists and fishers operating in the Indo-Pacific. The pelagic environment was not only deep and distant, but it was also the principal habitat for migratory fish such as yellowfin, skipjack, and other tuna species. Pursuing tuna demanded a set of skills, expertise, and knowledge that Japanese fishers had cultivated by exploiting

prepared this preliminary report while stationed in Tokyo on March 13, 1947. It was republished as "Fishery Leaflet 268" for the Fish and Wildlife Service.

¹⁰ In 1937, the Japanese-owned Borneo Fishing Company, the only tuna fishing firm working out of British North Borneo, applied to extend its ice-making and tuna canning operations to Banggi, a small island just north of Kudat on the northeast coast of Borneo. See enclosures within bundle no. 03043-A, "Borneo Fishing Company Extension to Banggi Island," Arkib Negeri Sabah (ANS), Kota Kinabalu, Malaysia.

¹¹ See correspondence between the Advisor for Japanese Affairs to the Governor General, dated 4 September 1929, "Bydrage voor het Tokiorapport No. 66/29," Agenda No. 1168, Dossier Geheim 40, Inventarisnummer 196, Japan/Tokio Gezantschap (1880) 1923-1941 (1942), Archief Ministerie van Buitenlandse Zaken, Nationaal Archief (NA), The Hague, The Netherlands; "Japansche Inspectietoicht," *Keesings Historisch Archief* 116 (5 September 1933): 930; and, *Rapports Grand Conseil des Interets Economiques et Financiers et au Conseil de Gouvernement, Session Ordinaire de 1933, Fonctionnement des divers Services Indochinois* (Hanoi: Imprimerie D'Extreme-Orient, 1933), 167.

their home waters. But with migrants moving to Davao in the early decades of the twentieth century, the need to secure tuna became imperative both for an expanding Japan and a changing Mindanao. Working the pelagic zone was therefore central to feeding the growth of Mindanao's Japanese community and the island's strategic position in the global abaca industry. Transregionally, these pelagic waters were also critical to fueling the urban, agricultural, and industrial changes, which were reshaping modern Japan and its colonial empire in the early half of the twentieth century.

By the late nineteenth century, Japan's tuna grounds had been overfished. The exhaustion of their home waters compelled Japanese fishers to extend their operations into the *Nan'yo*, or the South Seas—a geographical area that encompassed Southeast Asia and the Central Pacific. From Takao and Taihoku in Formosa or Misaki in Kanagawa Prefecture, the Japanese conducted expeditions to determine where in the *Nan'yo* the rich fishing grounds were, the types of tuna available, the seasonality of their migrations, and the locality of baitfish.¹² With the combined use of motorized vessels, ice storage, and scientific knowledge, the Japanese were the first to exploit Southeast Asia's pelagic frontier and incorporate these distant waters into their fishing networks. Driven by the interwar demand for *katsuobushi* in Tokyo, Osaka, and other Japanese cities coupled with the demand among its overseas settlements in Davao and Tawau, Japanese fishing operations worked the seas of Southeast Asia, following schools of skipjack along coldwater

¹² Yoshinori Ban, "On the Search for Southern Tuna Fishing Grounds" *Nanyo Suisan* 7,9 (1941): 1-2. This report was originally published in Japanese. It was translated by W.G. van Campen and republished as "Special Scientific Report: Fisheries No. 48" under the title *Japanese Tuna Surveys in Tropical Waters* (Washington: Fish and Wildlife Service, 1951).

currents and strategically setting up base stations in places such as Banjarmasin, Bitung, Ambon, and Halmahera.¹³

These vast Japanese fishing networks spanning the *Nan'yo* mobilized colonial-era scientists to investigate the offshore environment, identifying the pelagic zone's resources and fishing grounds. It was not until the late 1930s that Filipino fish experts such as Claro Martin would begin to study Mindanao's tuna fisheries. But the presence and practice of Japanese tuna operators working out of Zamboanga and Davao after 1934 facilitated the production of local scientific knowledge about these pelagic fish and their habitat. For Claro Martin, among other Filipino scientists, this prewar pelagic knowledge, derived from close interactions with Japanese fishers who exploited Mindanao's waters, was critical to recovering the tuna fisheries in the wake of World War II. Ultimately, this scientific knowledge and local expertise were central to building up Mindanao as one of the leading producers of tuna in the postwar world.

Opening the Abaca Frontier

Japanese settlers who came to work on the emerging abaca frontier made Davao the first tuna capital in the Philippines. As a commercial fiber, abaca was used to make a variety of manufactured goods—everything from cordage, marine rope,

¹³ Yutaka Imamura, "The Skipjack Fishery," *Suisan Koza* 6 (March 5, 1949): 13. This report was originally published in Japanese for the Japanese Fisheries Association, Tokyo. It was translated by W.G. van Campen and republished as "Special Scientific Report: Fisheries No. 49" under the new title *The Japanese Skipjack Fishery* (Washington: Fish and Wildlife Service, 1951).

and fishing nets to envelopes and bulk cargo sacks.¹⁴ Large quantities of abaca were shipped to interwar Japan, where it was used in the production of “a thousand different articles for daily use.”¹⁵

The cultivation of abaca, or Manila hemp, in Davao started shortly after 1898 when discharged American soldiers introduced this industry to the Davao Gulf region.¹⁶ By the 1920s, the demand for this “world commodity” had transformed southeastern Mindanao into “the land of the long hemp fiber.”¹⁷ Touring Davao’s abaca zone in 1922, Kilmer Moe, the superintendent of the Central Luzon Agricultural School in Nueva Ecija, observed:

The hemp plantations spread over the side of the mountain like giant forests. We walked through miles of hemp fields six meters tall and even taller. The clumps had twenty and more stalks to the hill. And their fronded crests met overhead, completely shutting out the light of the sun. We were glad to have a guide, for in the deep recesses of this forest of hemp one is about as helpless as in the most impenetrable jungle. Captain Burchfield, an old timer in the Davao hemp region, led us through and explained to us the mysteries of hemp culture.¹⁸

While Moe’s tour provided a sense of the scale of abaca production, it failed to convey a feel for the people involved in this industry. For example, his report made only one reference to the overseas Japanese, noting, “We were taken to the heart of the plantation where the Japanese laborers were operating hemp strippers

¹⁴ Francis K. Danquah, “Reports on Philippine Industrial Crops in World War II from Japan’s English Language Press,” *Agricultural History* 79,1 (Winter 2005): 91.

¹⁵ Kilmer O. Moe, “In the Land of the Long Hemp Fiber,” *American Chamber of Commerce Journal* 2,10 (October 1922): 12.

¹⁶ Shinzo Hayase, *Japanese in Modern Philippine History* (Tokyo: Waseda University, Institute of Asia-Pacific Studies, 2014), 148.

¹⁷ Moe, “In the Land of the Long Hemp Fiber,” 12.

¹⁸ Moe, “In the Land of the Long Hemp Fiber,” 12.

by water power.”¹⁹ But he did mention James Burchfield and his connection to the rise of Davao’s Japanese community and its control over the abaca industry.²⁰ In 1915, Burchfield had owned the largest abaca plantation in the Davao Gulf region. But a downturn in the global market forced Burchfield to sell his estate and his abaca interests to the Itoh *zaibatsu* in October 1915, which had direct links to Yoshizo Furukawa, one of the leading abaca planters in prewar Davao.²¹ Two years later, Burchfield sold his remaining Mindanao assets to the Davao Mercantile Company, a newly incorporated firm, which was *zaibatsu*-backed. In 1917, the Davao Mercantile Company took control of the Davao Ice and Cold Storage Company, which was founded by Burchfield in 1914.²²

¹⁹ Moe, “In the Land of the Long Hemp Fiber,” 12.

²⁰ For more on James and Evelyn D. Burchfield, see the Evelyn D. Burchfield Papers held in the Manuscripts and Folklife Archives at Western Kentucky University. Mrs. Burchfield prepared a memoir of their time in Davao, including her detention at a Davao prison camp during the Japanese Occupation.

²¹ Furukawa established the Furukawa Development Company in 1914, shortly after finishing a degree in agriculture and forestry at Tokyo Imperial University.

²² “The News of the Week,” *Philippine Free Press* (3 November 1917): 9. On the Davao Ice and Cold Storage Company, see “Japanese Buying Up Properties in the Philippines,” *Honolulu Star Bulletin* (15 December 1917): 13.

*Japanese Population of Davao, 1903-1941*²³

Year	Figure	Year	Figure	Year	Figure	Year	Figure	Year	Figure
1903	30	1911	600	1919	7,000	1927	7,002	1935	13,535
1904	150	1912	650	1920	5,533	1928	8,972	1936	14,029
1905	250	1913	700	1921	4,268	1929	10,025	1937	15,000
1906	300	1914	1,250	1922	3,209	1930	12,469	1938	16,100
1907	350	1915	1,550	1923	2,696	1931	12,750	1939	17,300
1908	450	1916	2,450	1924	3,761	1932	12,992	1940	18,600
1909	500	1917	5,300	1925	4,571	1933	12,742	1941	20,000
1910	550	1918	7,350	1926	5,462	1934	13,065		

Davao's Japanese community started with about thirty Okinawan laborers who arrived in 1903 to work on Juan Awad's abaca plantation.²⁴ Awad was a migrant himself, having come from Syria to Davao in 1885. As a pioneering planter, Awad established his abaca estate in Lapanday, calling it "Hacienda Belen" because the surrounding environment reminded him of Bethlehem.²⁵ While these

²³ For 1903 to 1919, Koji Kamohara, *Dabao Hojin Kaitakushi* (Davao: Nippi Shimbunsha, 1938), appendix. For 1920 to 1941, Yoshizo Furukawa, *Dabao Kaitaku-ki* (Tokyo: Furukawa Takushoku, 1956). These sources and figures are cited in Reiko Furiya, "The Japanese Community Abroad: The Case of Prewar Davao in the Philippines," in *The Japanese in Colonial Southeast Asia*, trans. Saya Shiraishi and Takashi Shiraishi (Ithaca: Cornell Southeast Asia Program, 1993), 155.

²⁴ Nagib Abdou, *Dr. Abdou's Travels in America* (Washington: Nagib Abdou, 1910), 435.

²⁵ Information on Awad in Davao is based on personal communication with Daniel Doeppers in Madison, Wisconsin (4 November 2016) and a review of Doeppers' fieldnotes conducted in Davao in 1969. See also, Christopher J. Collier, "The Politics of Insurrection in Davao, Philippines" (PhD diss., University of Hawaii at Manoa, 1997), 61; Timothy Marr, "Diasporic Intelligences in the American Philippine Empire: The Transnational Career of Dr. Najeeb Mitry Saleeby," *Mashriq & Mahjar* 2,1 (2014): 93; and, William Gervase Clarence-Smith, "Middle Eastern Migrants in the Philippines: Entrepreneurs and Cultural Brokers," *Asian Journal of Social Science* 32,3 (2004): 433.

Okinawans returned to Japan shortly after their contract, the connection between Davao, Japan, and Japanese workers in the Philippines had been established.²⁶

In 1904, Ota Kyosaburo (1876-1917), a native of Kobe who had been in the Philippines since the late Spanish period, saw a future in Davao and its fertile lands.²⁷ At the time, Ota was concluding a contract he had with the U.S. colonial government to provide the labor needed to build the Benguet Road, a critical transport route connecting the hill station at Baguio with the lowlands and eventually Manila. Ota recruited about 500 Okinawan workers to complete the project, and he also managed their wellbeing by provisioning them with Japanese foodstuffs.²⁸ Ota had access to Japanese consumer goods because he and his brother operated the Japanese General Import Company of Manila.²⁹

After realizing the development of the Benguet Road in 1905, Ota turned his attention to Davao. He recruited Okinawan laborers from the Benguet project and began servicing the needs of Mindanao's plantation owners. Building on his enterprising background, he also opened a general store, which supplied the nascent Japanese community with basic goods, foods, and materials.³⁰

In 1906, Ota ventured beyond his general store and purchased some indigenous (Bagobo) land so that he could develop his own abaca plantation. The

²⁶ Hayase, *Japanese in Modern Philippine History*, 148.

²⁷ Personal communication with Prof. Shinzo Hayase, Dumaguete City (7 July 2016). See also Ota Kyosaburo, *Ota Kyosaburo-Shi tuisoroku* [Memoirs of Ota Kyosaburo] (Davao: Ota Kogyo Kabushiki Kaisha, 1937).

²⁸ "The Japanese Influence and the Commonwealth," *Commerce and Industrial Manual* 12 (1936): 60.

²⁹ Saniel, "The Japanese Minority," 119.

³⁰ See Grant K. Goodman, *Davao: A Case Study in Japanese-Philippine Relations* (Lawrence: Center for East Asian Studies, University of Kansas, 1967), 1. Goodman's publication was the first in a series edited by Edgar Wickberg.

American governor of Davao informed Ota that he was in violation of the Philippines Act of 1902 that classified indigenous lands as public lands. And as public lands, foreign individuals were prohibited from acquiring them for commercial use.³¹ Undeterred, Ota found the answer to his abaca aspirations in the Public Land Act of 1903, which permitted any legally organized corporation to purchase or lease agricultural land in the public domain up to a maximum of 1,024 hectares (one hectare = 2.471 acres).³² By law, leases were for 25 years and renewable for an additional 25 years. As a result, in August 1907, Ota established the Ota Development Company, thereby drawing more Japanese migrants from within the Philippines and beyond to the Davao Gulf region.³³ The Philippine government awarded the Ota Development Company a little over a thousand hectares of public land to plant and harvest abaca.³⁴

By 1914, these labor flows expanded the dietary demands of Davao's Japanese community and thus the critical need for cheap, familiar sources of food. In 1918, for example, there were 164 plantations in Davao: 71 owned by Japanese, 44

³¹ Lydia N. Yu-Jose, *Japan Views the Philippines, 1900-1944* (Quezon City: Ateneo de Manila University Press, 1992), 80.

³² Goodman, *Davao*, 2.

³³ Peter Borseth, "Report of District Director, Second District," in *Report of the Philippine Commission to the Secretary of War, 1908, Part 2* (Washington: Government Printing Office, 1909), 415. In 1908, Ohta also expanded his operations into pearling in the Sulu Sea. By the time Alvin Seale surveyed Sulu's pearling industry in 1914, the Ohta Development Company owned and operated forty-six pearling boats. And by the time Florencio Talavera conducted a follow-up study of Sulu's pearling industry in 1930, the Ohta Development Company was one of the largest operations. On Ohta's entry into the Sulu pearl industry, see "Paarlvijscherij bij Mindanao," *Het Nieuws Van Den Dag Voor Nederlandsch-Indie* (6 June 1908): 2. On the evolution of his company's dominance, see Alvin Seale, "Sea Products of Mindanao and Sulu, II: Pearls, Pearl Shells, and Button Shells," *Philippine Journal of Science* 11,4 (July 1916): 256-257 and Florencio Talavera, "Pearl Fisheries of Sulu," *Philippine Journal of Science* 43,4 (December 1930): 495.

³⁴ See "The Japanese Influence and the Commonwealth," 60.

by Filipinos, 34 by Americans, and 15 by other nationalities.³⁵ By the end of the interwar period, just two Japanese firms, the Ohta Development Company and the Furukawa Development Company, produced ninety percent of Davao's abaca, and Davao contributed fifty percent of the world's supply.³⁶

The period between 1914 and 1920 also marked an important turning point in the *Nan'yo*. At the outbreak of World I, Japan moved into the Central Pacific and occupied a string of German-controlled territories. But this wartime move not only brought the Marshall, Caroline, and Mariana Islands under Japanese military rule, it also changed the Pacific's political map, creating new opportunities for overseas Japanese development.³⁷ By 1920, and on order of the League of Nations, this Japanese zone was called the South Sea Mandate.³⁸ Through this mandate, Japan incorporated an area of ocean into its colonial empire equal to the size of the United States, and it would hold onto this swath of tuna-rich sea until the end of World War II.³⁹ Davao was only 600 miles from Japan's closest colonial base at Koror, Palau.

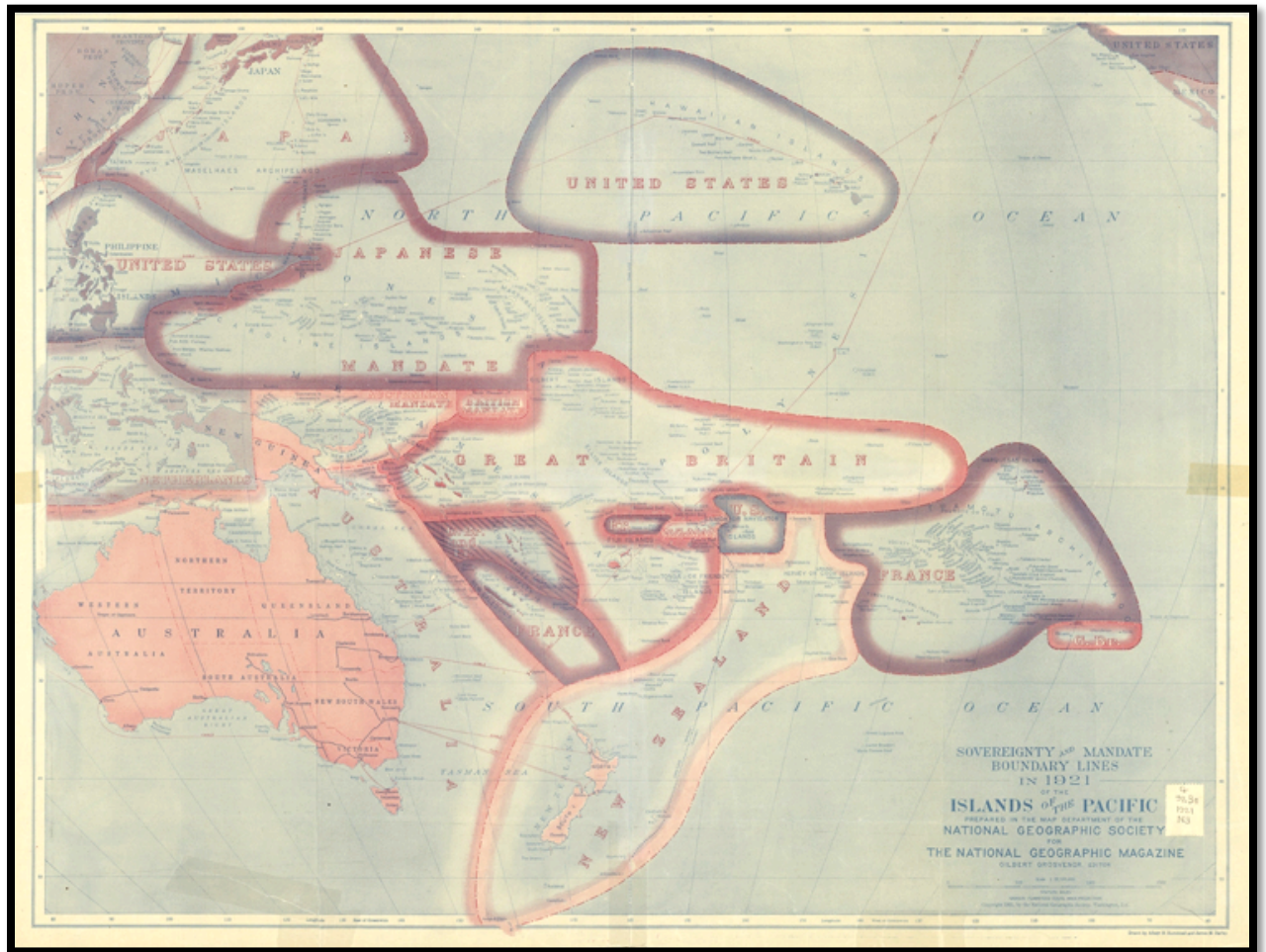
³⁵ Goodman, *Davao*, 4. Goodman cites these figures from "Report of Teopisto Guingona, Acting Gov. of Dept. of Mindanao and Sulu. BIA 6144/74."

³⁶ *Seventh and Final Report of the United States High Commissioner to the Philippine Islands Covering the Period from September 14, 1945 to July 4, 1946* (Washington: Government Printing Office, 1947), 62 and Pelzer, "Philippine Abaca Industry," 71.

³⁷ Ban, "On the Search for Southern Tuna Grounds," 1-2.

³⁸ Mark R. Peattie, "The Nan'yo: Japan in the South Pacific," in *The Japanese Colonial Empire, 1895-1945*, eds. Ramon H. Myers and Mark R. Peattie (Princeton: Princeton University Press, 1984), 172.

³⁹ Robert O. Smith, *Survey of the Fisheries of the Former Japanese Mandated Islands* (Washington: Fish and Wildlife Service, 1947), 1-2.



The Japanese Mandate and Other Colonial Powers in the Pacific, 1921.

Feeding Society: Space and Tuna in the Interwar Period

While abaca opened this plantation frontier, tuna fed it. Dried skipjack tuna sticks (*katsuobushi*) were a main staple of Davao's Japanese residents and one of their primary sources of protein. It was used to make soups and sauces and cook vegetables.⁴⁰ *Katsuobushi* was also an effective way to preserve fish and store crucial protein for extended periods of time and under extreme climatic

⁴⁰ John Butcher, *The Closing of the Frontier: A History of the Marine Fisheries of Southeast Asia, c.1850-2000* (Singapore: ISEAS, 2004), 156.

conditions.⁴¹ The durability of *katsuobushi* was the result of its unique preservation. As explained by a Dutch scientist who observed a Japanese fishing base in the Moluccas, *katsuobushi* was prepared using a three-step process. Fillets of skipjack were steamed, smoked, and then dried until they became as hard as wood (giving *katsuobushi* the local name *ikan kayu* or “wooden fish” in Malay).⁴² *Katsuobushi* was cut into thin slices and boiled as an ingredient, or shaved over rice.⁴³

While no special Southeast Asian fishery existed for catching tuna prior to the Japanese production of *katsuobushi*, there is evidence that Filipinos and Indonesians had a history of interactions with these pelagic fish.⁴⁴ Filipino fishers from Mindanao, Sulu, Batangas, Mindoro, and other parts of southwestern Luzon used a variety of methods to secure different kinds of shore fish for local consumption and occasionally tuna would get caught in these traps.⁴⁵ The most common was the *baklad*, or fish trap.⁴⁶ The beach seine was also known to have caught tuna, principally in the waters around Sulu, Mindanao, Palawan, and

⁴¹ *Civil Affairs Guide: Far Easter Nutritional Relief (Japanese Culture)* (Washington: Office of the Chief of Naval Operations, 1944), 10. See also, “Tunny Fisheries in Kyushu,” *Journal of the Royal Society of Arts* 66,3421 (June 14, 1918): 484.

⁴² B. Markus, *De Japansche Visscherij in het Oosten van de Archipel* (Batavia: Instituut voor de Zeevisscherij, 1930), 3-4. See also M.R. Qureshi, “A Study of Improved Methods for the Production and Storage of Dried Fish, with Particular Reference to Methods Suitable for Wet, Humid Seasons of the Year,” *Indo-Pacific Fisheries Council Proceedings 6th Session, Section 1* (1955): 126 and Butcher, *The Closing of the Frontier*, 156.

⁴³ Arthur C. Avery, *Fish Processing Handbook for the Philippines* (Washington: Fish and Wildlife Service, 1950), 45. Avery worked closely with Dominador Calvez, noting in the preface “the value this handbook may have for the processors of fish will be a reflection of his [Calvez’s] efforts” (II).

⁴⁴ Herbert E. Warfel, *Outlook for Development of a Tuna Industry in the Philippines* (Washington: Fish and Wildlife Service, 1950), 18.

⁴⁵ Warfel, *Outlook*, 22. For a deeper description of these fishing methods, see Agustin F. Umali, *Guide to the Classification of Fishing Gear in the Philippines* (Washington: U. S. Fish and Wildlife Service, 1950), 1-165. Illustrations were done by Silas Duran.

⁴⁶ For the efficacy of the *baklad*, see Doeppers, *Feeding Manila*, 164-169.

Mindoro. Fishers from Zamboanga reported catches of tuna with their *talakop*, which was a type of purse seine.⁴⁷ But none of these methods were exclusively used to target skipjack, bonito, yellowfin, or other tuna species. These large and fast-moving fish inhabited the region's pelagic zone—its offshore, deep waters—and thus were beyond the technological reach of local fishers in interwar Southeast Asia.

Japanese fishers, on the other hand, were intimately tied to the pelagic zone. Since the turn of the twentieth century, they had leveraged technology, science, and state investment to work this arc of the marine environment for domestic, colonial, and overseas consumption. In Meiji Japan, most tuna operations were small scale and confined to coastal waters. But by the 1890s, several internal changes were beginning to open the scope and scale of the Japanese fishing industry. In 1895, the Manchu government ceded Formosa to Japan following the Treaty of Shimonoseki.⁴⁸ Formosa figured strategically not only in the workings of the Japanese colonial empire, but also in its search for new fishery resources. By the late 1910s, experimental fisheries stations were established in Formosa at Takao (in the south) and Taihoku (in the north) for the purposes of investigating and exploiting the waters of the *Nan'yo*.⁴⁹

⁴⁷ M.A. Sabado, "Report submitted on the work performed at Zamboanga City Market," 11 October 1948, Box 1, Record Group 22, Entry 197, Folder 0-9a 725, Records of the U.S. Fish and Wildlife Service, Philippine Fishery Reports and Other Records, 1947-50 [hereafter cited as PFP], National Archives and Records Administration, College Park, Maryland.

⁴⁸ See Mark R. Peattie, "Introduction," in *The Japanese Colonial Empire, 1895-1945*, eds. Ramon Hawley Myers and Mark R. Peattie (Princeton: Princeton University Press, 1984), 3-25; Seiji Hishida, "Formosa: Japan's First Colony," *Political Science Quarterly* 22,2 (June 1907): 267; and, Yosaburo Takekoshi, *Japanese Rule in Formosa*, trans. George Braithwaite (Calcutta: Longmans, Green, and Co., 1907).

⁴⁹ Ta-Yuan Chen, "Taiwanese Offshore (Distant-Water) Fisheries in Southeast Asia, 1936-1977" (PhD diss., Murdoch University, 2007), 34-43.

In 1897, the Meiji government passed the Distant-Water Fisheries Promotion Act. With local tuna fisheries collapsing, this law ensured that lines of capital, scientific support, and other means of government assistance would be available to Japanese fishing companies. This new law incentivized fishing in the *Nan'yo*. It also encouraged the building of a transregional infrastructure made up of modern ports, cold storage facilities, food provisions, material supplies, and trusted (overseas) communities.

As the final step in this process, with government support and financial assistance, Japanese fishing companies began to modernize their fleets with diesel-powered engines that enlarged the tonnage of their crafts. They also mechanized the practice of line hauling, refrigerated their vessels, and upgraded their lines, nets, and live-bait tanks.⁵⁰ These multiple measures opened the pelagic seas of the *Nan'yo* to Japanese fishing in the early half of the twentieth century.⁵¹ By the 1920s, motorized fleets from Takao had an “operating radius of over 1,000 miles,” allowing them to work the rich tuna grounds of the Philippines, Indonesia, and the Mandated Islands.⁵²

⁵⁰ Yoshiaki Matsuda and Kazuomi Ouchi, “Legal, Political, and Economic Constraints on Japanese Strategies for Distant-Water Tuna and Skipjack Fisheries in Southeast Asian Seas and the Western Central Pacific,” *Memoirs of the Kagoshima University Research Center for the South Pacific* 5,2 (1984): 153.

⁵¹ Tokuzo Uehara, “A Survey of Tuna Grounds in Equatorial Waters,” *Nanyo Suisan Joho* 5,3 (1941): 13-17. This survey was originally published in Japanese. It was translated by W.G. van Campen and included in *Exploratory Tuna Fishing in Indonesian Waters* (Washington: Fish and Wildlife Service, 1951).

⁵² Hiroshi Nakamura, “Report of Investigation of the Spearfishes of Formosan Waters,” *Reports of the Taiwan Government-General Fishery Experiment Station* 10 (January 1938): 41. This report was originally published in Japanese. It was translated by W.G. van Campen and republished under the same title as “Special Scientific Report: Fisheries No. 153” by the U.S. Fish and Wildlife Service in July 1955.

Driving the rise of pelagic fishing in the *Nan'yo* were demographic changes in Japan and its overseas communities. From 1900 to 1940, Japan's population grew at a rapid pace, and its society became more industrial, urban, and diasporic.⁵³ Simultaneously, provisionment became a national security priority for sustaining development at home and commodity production abroad. With local waters suffering from extensive exploitation, Japanese fishers looked to the *Nan'yo* after 1914. They pursued skipjack and other tuna species in order to feed "Japan Proper" and its transregional arc of resource frontiers such as Davao's abaca industry.⁵⁴ In 1922, for example, a pioneering group of Okinawan fishers extended skipjack fishing to the seas around Saipan, Yap, Truk, and Ponape.⁵⁵ Most of the skipjack caught became *katsuobushi*, and supplies of this staple food were exported to Osaka, Tokyo, and Southeast Asia's Japanese communities.

Searching the Sea for Tuna: The Scientific Work of the Shonan Maru

With Japan's food needs growing at home and abroad, it was science and technology that produced vital information about the marine resources of the Indo-

⁵³Peter J. Rimmer and Howard W. Dick, *The City in Southeast Asia: Patterns, Processes and Policy* (Singapore: NUS Press, 2009), 9. During this period, Tokyo's population grew from 1,497 million to 6,779 million; Osaka's population expanded from 931 thousand to 3,252 million; Nagoya's population grew from 250 thousand to 1,328 million; and, Kyoto's population went from 371 thousand to a little over a million.

⁵⁴ Katsuzo Kuronuma and Sidney Shapiro, *The Japanese Tuna Fisheries* (Washington D.C.: Fish and Wildlife Service, 1948), 50. The Natural Resources Section of the Supreme Commander for the Allied Powers in Tokyo originally published this report as No. 104. Katsuzo Kuronuma of the Tokyo Central Fisheries Experimental Station compiled the data and procured the information.

⁵⁵ Kenzo Ikebe and Takeshi Matsumoto, "Progress Report on Experimental Skipjack Fishing near Yap," *Nanyo Suisan Joho* 4 (November 1937): 3. This report was originally published in Japanese. It was translated by W.G. van Campen and included in *Exploratory Tuna Fishing in the Caroline Islands* (Washington: Fish and Wildlife Service, 1951).

Pacific Ocean. Biological surveys and fishery expeditions were some of the most effective ways in which Japanese scientists collected data on the waters, currents, and fish populations in the *Nan'yo*. In the age of tuna—1914 to 1941—Japanese fish experts participated in a number of scientific expeditions, including surveys done by the research vessels *Hakuyo Maru*, *Haruna Maru*, *Kiyo Maru*, *Koho Maru*, *Shunkai Maru*, and *Zuiho Maru*.⁵⁶ Among these, the scientific ship *Shonan Maru* carried out one of the most valuable and comprehensive tuna surveys—work that reveals how these Japanese circuits of expedition and exploitation were wired together in the 1930s.

Departing from Takao on July 13, 1933, the *Shonan Maru* commenced what would become the first systematic investigation of tuna in Southeast Asian waters. In charge of the survey was Imaizumi Taikoku and joining him were other fisheries scientists from Takao, including Yosine Hada, a planktonologist, and Toshiro Kumada, an ichthyologist and illustrator.⁵⁷ The expedition's route circled Southeast Asia, with research conducted in the South China, Sulu, Celebes, and Java Seas as well as the Malacca, Karimata, Sunda, and Makassar Straits.⁵⁸ After several months

⁵⁶ For more on these prewar expeditions and the fish and ecological data they collected, see Hiroshi Nakamura, *The Tuna Longline Fishery and Its Fishing Grounds* (Tokyo: Association of Japanese Tuna Fishing Cooperatives, 1951). This study was originally published in Japanese. It was translated by W.G. van Campen and republished as "Special Scientific Report: No. 112" under the new title *Tuna Longline Fishery and Fishing Grounds* (Washington: Fish and Wildlife Service, 1954).

⁵⁷ "Japansche Visscherij-Studieboot," *Het Nieuws Van Den Dag Voor Nederlandsch-Indie* (22 August 1933): 3 and "Japansche Visscherij-Studieboot te Tandjong Priok," *Sumatra Post* (25 August 1933): 3.

⁵⁸ On the stops and route of the *Shonan Maru* in Malayan and Indonesian waters, see correspondence between Tanun Kotani of the Japanese Consulate in Batavia and J.M. Kiveron, first secretary to the governor-general of the Indies, dated July 1933, "Bezoek Japaansch schip voor visschery onderzoek 'Shonan Maru' aan Ned. Indie," Tokiorapport 115/1933, Japan/Tokio Gezantschap (1880) 1923-1941 (1942), Inventarisnummer 196, Archief Ministerie van Buitenlandse Zaken, NA. See also "Japansche inspectie-tocht, de route van de 'Shonan Maru'," *Het Volk* (31 August 1933): 5.

cruising the colonial waters of Indochina, Malaya and Singapore, the Netherlands East Indies, and the Philippines, recording catches, collecting data, and interacting with overseas Japanese communities, the expedition finally returned to Takao to analyze the information it had amassed on the region's tuna grounds.⁵⁹

Three particular insights surfaced from this scientific survey. First, the catch rate (number of fish per 100 hooks) data suggested that one tuna season occurred across multiple seas in Southeast Asia rather than different seasons for specific seas. The *Shonan Maru* observed that Japanese fishers moved their operations from the Celebes Sea after September to the Sulu Sea, and from the Sulu Sea after October to the South China Sea for the "season of the northeasterly winds."⁶⁰ The conventional wisdom was that this arc of water from the Celebes Sea to the South China Sea followed a south-north migration of tuna. But the *Shonan Maru* fished these connected waters during the same season and found that there were "no conspicuous differences" in the size of the tuna caught.⁶¹ Moreover, based on the catch rates of this Japanese research vessel, the Sulu Sea had the richest tuna grounds, followed by the South China Sea and then the Celebes Sea.⁶²

The *Shonan Maru* also revealed that, within the pelagic environment, there was a variance of depths, which were home to different commercial species. In determining the kinds of pelagic fish available, the scale of their density, and the nature of their vertical distribution, the *Shonan Maru* used a specific type of fishing

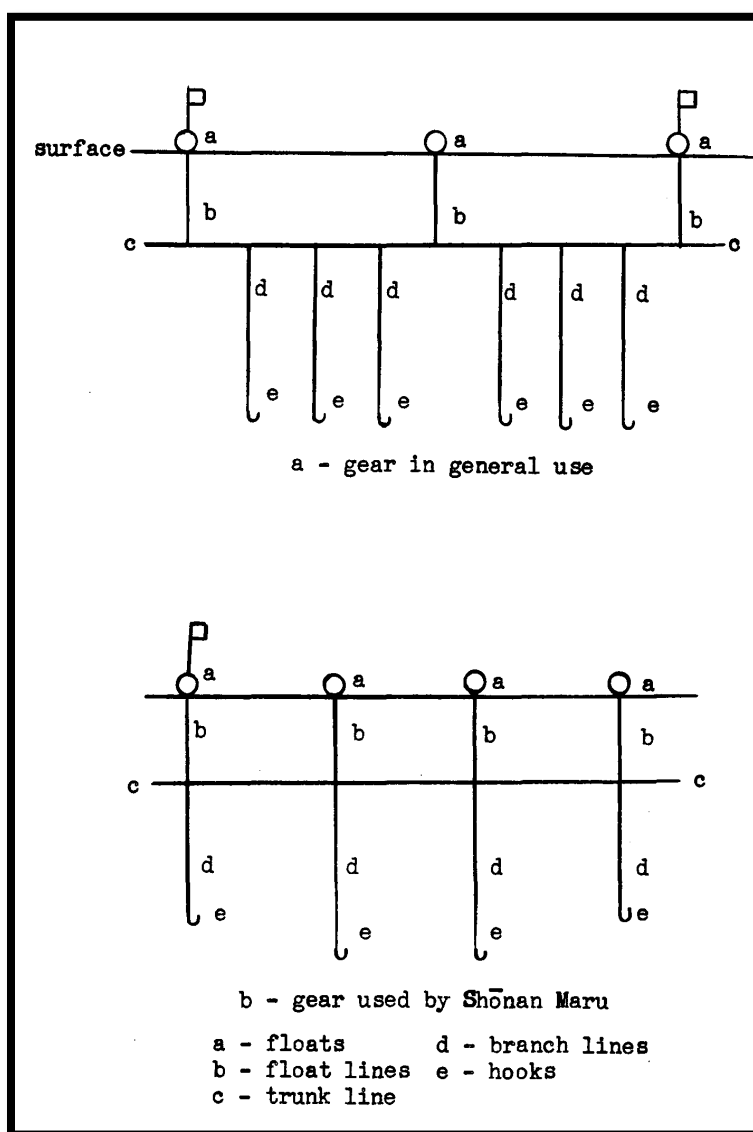
⁵⁹ Yosine Hada, "Studies on the Tintinnoinea from the Western Tropical Pacific," *Journal of the Faculty of Science Hokkaido Imperial University* 6,2 (1938): 88.

⁶⁰ Nakamura, *The Tuna Longline Fishery and Its Fishing Grounds*, 58.

⁶¹ Nakamura, *The Tuna Longline Fishery and Its Fishing Grounds*, 59.

⁶² Nakamura, *The Tuna Longline Fishery and Its Fishing Grounds*, 59.

gear.⁶³ Whereas conventional practices were grossly imprecise when it came to locating the depths at which fishhooks dangled, the *Shonan Maru* applied floats to its branch lines so that “the position of the hook could not be deeper than the length of the branch line plus the length of the float line.”⁶⁴



*Shonan Maru's Float Line Gear.*⁶⁵

⁶³ Hiroshi Nakamura, “Tunas and Spearfishes,” *Kaiyo no Kagaku* 3,10 (October 1943): 32-33. This study was originally published in Japanese. It was translated by W.G. van Campen and republished as “Special Scientific Report: Fisheries No. 48” under the title *Japanese Tuna Surveys in Tropical Waters* (Washington: Fish and Wildlife Service, 1951).

⁶⁴ Nakamura, *The Tuna Longline Fishery and Its Fishing Grounds*, 57.

⁶⁵ Nakamura, “Tunas and Spearfishes,” 34.

This simple but innovative technology proved to be more accurate in mapping the swimming depths of tuna and other pelagic species, and more efficient in producing catches.⁶⁶ Evidence from the *Shonan Maru* indicated the presence of a differentiated tuna world with schools swimming at 160 meters, others around 100 meters, and still others at 50 meters. But in terms of fishery production, the greatest catch rate occurred in the range of 100 meters.⁶⁷

Fishing Conditions at Different Depths (Celebes Sea, July-August 1933, Shonan Maru)

Depths (meters)	Number of Tuna	Catch Rate
45	65	6.25
76	182	8.76
106	205	9.86

Notes: (1) Depths are length of branch line plus length of float line and (2) Catch rate is the number of fish caught per 100 hooks.⁶⁸

The scientific work of the *Shonan Maru* also provided new understandings about the choice of bait.⁶⁹ While it was important to know the spatial, temporal, and vertical conditions of tuna and their circulations around the Southeast Asian shelf, this valuable information mattered little if fishers were unable to hook them.

Exploiting the region's rich tuna grounds also required knowing what types of foods

⁶⁶ Hiroshi Nakamura, *The Tunas and Their Fisheries* (Tokyo: Takeuchi Shobo, 1949), 82-83. This study was originally published in Japanese. It was translated by W.G. van Campen and republished as "Special Scientific Report: Fisheries No. 82" under the same title *The Tunas and Their Fisheries* (Washington: Fish and Wildlife Service, 1952).

⁶⁷ Nakamura, *The Tuna Longline Fishery and Its Fishing Grounds*, 57.

⁶⁸ Nakamura, *The Tuna Longline Fishery and Its Fishing Grounds*, 57.

⁶⁹ Hiroshi Nakamura, "The Food Habits of Yellowfin Tuna *Neothunnus Macropterus* (Schlegel) from the Celebes Sea," *Taiwan Hakubutsu Gakkai Kaiho* 26,148 (January 1936): 6. This study was originally published in Japanese for the Natural History Society of Formosa. It was translated by W.G. van Campen and republished as "Special Scientific Report: Fisheries No. 23" under the same title *The Food Habits of Yellowfin Tuna Neothunnus Macropterus (Schlegel) from the Celebes Sea* (Washington: Fish and Wildlife Service, 1950).

these pelagic fish consumed and when. On two expeditions to the Celebes Sea in the 1930s, the *Shonan Maru* preserved the stomach contents of the yellowfin tuna caught in order to analyze the food habits of these commercial fish. These studies found “squids [were] the most single important item of food.”⁷⁰ After squids, anchovies or herrings represented the bulk mass of the stomach contents. However, consuming these bait species depended largely on the season. From July to September 1933, the tuna bellies were full of anchovies, but there was no trace of herrings. But in February 1934, the opposite occurred: herrings were present, but anchovies absent.⁷¹

While mapping the seasonality of baitfish made for more productive and efficient tuna fishing, so did amassing knowledge about the life cycles of these prized pelagics. Merging this information from the *Shonan Maru* with the career of Kamakichi Kishinouye (1867-1929), Japan’s pioneering tuna biologist and one of its foremost ichthyologists, allows us fuller sense of the state of scientific knowledge on these commercial fish. Kishinouye had studied the family *Scombridae* since 1911, determining, “tunnies...feed, spawn, and grow in the open sea.”⁷² But because these fish spent much of their lifetime in the deep ocean, far from shore, Kishinouye drew on a *Nan’yo* network of experimental stations, fishing companies, and scientific vessels to acquire key details on the biology of tuna.⁷³ In 1919, Emile Gobee of the fisheries station in Batavia, Netherlands Indies sent Kishinouye a set of juvenile tuna

⁷⁰ Nakamura, “The Food Habits of Yellowfin,” 2.

⁷¹ Nakamura, “The Food Habits of Yellowfin,” 4.

⁷² Kamakichi Kishinouye, “Contributions to the Comparative Study of the So-Called Scombroid Fishes,” *Journal of the College of Agriculture Imperial University of Tokyo* 8,3 (March 30, 1923): 381.

⁷³ “A Symposium on the Investigation of Tuna,” 3-4.

collected from the South China Sea and Formosa.⁷⁴ He also received immature specimens secured by Seijiro Tominaga from the waters around Okinawa in 1921.⁷⁵

Although Kishinouye suddenly passed away in 1929 while on a fish expedition up the Yangtze River in China, the *Shonan Maru* continued to build on his research in the 1930s, contributing a richer biological view of the offshore lives of tuna.⁷⁶ First, tuna spawned in the tropical waters of the *Nan'yo*, with yellowfin and skipjack specifically spawning from March to May in the South China, Celebes, Banda, and Flores Seas.⁷⁷ Each fish released between 100,000 and 1 million eggs.⁷⁸ While this spawning period was reported as being “extraordinarily long” and spatially expansive, a closer examination of the extant data revealed that tuna schools comprised fish at various stages of gonad ripeness.⁷⁹ Kishinouye contended that these spawning habits were unique to tuna, and knowledge of them was key to understanding the “character of the stock and the fishery.”⁸⁰

Supported by collections made from research vessels such as the *Shonan Maru*, Japanese scientists were also able to substantiate Kishinouye’s earlier claims that tuna matured in the tropical seas of the *Nan'yo*. The depth of this observational knowledge about the skipjack’s growth in the open ocean allowed Japanese

⁷⁴ Kishinouye, “Contributions to the Comparative Study,” 388.

⁷⁵ Kishinouye, “Contributions to the Comparative Study,” 388.

⁷⁶ T.W.V., “Kamakichi Kishinouye,” *Science* 71,1833 (February 14, 1930): 179.

⁷⁷ “Symposium on the Investigation of Tuna,” 2; and, Nakamura, *The Tunas and Their Fisheries*, 15, 32.

⁷⁸ Walter M. Matsumoto et al., *Synopsis of Biological Data on Skipjack Tuna, Katsuwonus pelamis* (Seattle: National Oceanic and Atmospheric Administration, National Marine Fisheries Services, 1984), 23.

⁷⁹ Kishinouye, “Contributions to the Comparative Study,” 380-381, 441.

⁸⁰ Nakamura, *The Tunas and Their Fisheries*, 14.

scientists to chart the lifecycles of this exceptional animal, from birth in the spawning grounds of the Celebes and Sulu Seas, through a youth spent in schools swimming long-distances, to an old age feeding on the faunal-rich reefs of Southeast Asia. As a juvenile, for example, the skipjack was not only thin and slender, weighing between 300 and 400 *momme* (or 39.7 to 53 ounces), but was also active as it liked “to leap about on the surface of the water.”⁸¹ Its age at this stage of development was between one and two years old.

At three and four years old, the skipjack was considered medium-size, weighing between 600 and 800 *momme* (4.96 to 6.62 pounds) and forming the extraordinary density of the schools of up to 50,000 fish following the food-rich currents of Southeast Asia, Japan, and the Mandated Islands. As a strong, swift swimmer, the skipjack preferred feeding on slimy squids rather than plankton. Its movements were disciplined, orderly, and focused as it cut through the surface of the ocean, pursuing an overlapping mix of warm water flows and resource-abundant currents.⁸² At this age, skipjack schools developed three core characteristics: an insatiable appetite for baitfish, the cunning ability to herd their food sources (“bait-herding” was known in Japanese as *sodokozukuri*), and the social instinct to accompany sharks and whales.⁸³

But by the age of six, Japanese scientists observed a significant change had occurred in the skipjack’s life. It no longer swam in a large school, but rather in a small group. This late stage shift reinforced the overall decline of the tuna’s bait-

⁸¹ Imamura, “The Skipjack Fishery,” 18.

⁸² Imamura, “The Skipjack Fishery,” 18.

⁸³ Imamura, “The Skipjack Fishery,” 18.

herding skills, its “schooling instinct,” and basic drive to migrate.⁸⁴ Once in these small groups, skipjack were known to move to the warm waters around offshore reefs, places the Japanese scientists called “fish nests,” and feed on this ecology’s wealth of biomass such as squids, crustaceans, and fish.⁸⁵ Surrounded by limitless food sources, the skipjack would naturally grow to a weight of more than 2,000 *momme* (16.56 pounds); and, after it did, the now old skipjack (six to eight years of age) would retire from making long migrations and instead inhabit these so called “fish nests” year round. At this final stage in their biological life, they became what the Japanese called *dekiuwo*, or fish that were drawn to chum-bait, trolling lures, and surface commotion.⁸⁶ The discovery of these mature skipjack and their fish nests allowed exploitation of the tropical grounds for productive skipjack fisheries.

Finally, the work of research vessels such as the *Shonan Maru* explained not only why tuna circulated between the *Nan’yo* and Japan, but also, and more importantly, when and where these migrations occurred. A closer look at the case of skipjack reveals the fishery significance of knowing these movements. First, skipjack circulations were shaped by age and informed by the temperature of the ocean.⁸⁷ Fish populations under five years of age inhabited the Northern Equatorial Countercurrent and followed the route of this warm swell on a long, circuitous journey. They traveled from the waters of the Mandated Islands west to the Celebes and Sulu Seas, north through the Philippines and Formosa, and then northeast into

⁸⁴ Imamura, “The Skipjack Fishery,” 19.

⁸⁵ Imamura, “The Skipjack Fishery,” 19.

⁸⁶ Imamura, “The Skipjack Fishery,” 19.

⁸⁷ Kishinouye, “Contributions to the Comparative Study,” 389.

the ocean around Okinawa and Japan.⁸⁸ From this northern Japanese terminus the countercurrent intersected with the Kuroshio Current and the skipjack and other migrating tuna flowed southward along the eastern edge of the Philippine Sea, where they rejoined the Northern Equatorial Current.⁸⁹ These tuna movements circled between Southeast Asia, Japan, and the Mandated Islands—covering a sweeping distance of some 8,000 miles—leading Kishinouye to declare that these fish were “really cosmopolitan.”⁹⁰

As cosmopolitan fish, skipjack circulations were not just spatial, but also seasonal. In waters around Palau, the Marianas, and the Caroline Islands, skipjack schools appeared in mass during the months of November, December, and January.⁹¹ In an arc of ocean extending from Papua to Borneo and north through the South China Sea, skipjack schools were known to congregate from the months of March to May. Around August and September, skipjack were present in Japanese waters.

But the accumulated data from the *Shonan Maru* and other research vessels, which surveyed these tuna-rich waters in the 1930s, also cautioned against drawing too rigid of a tuna migration picture. They recorded multiple skipjack populations, representing a range of ages, which inhabited the Northern Equatorial

⁸⁸ Ban, “On the Search for Southern Tuna Grounds,” 4.

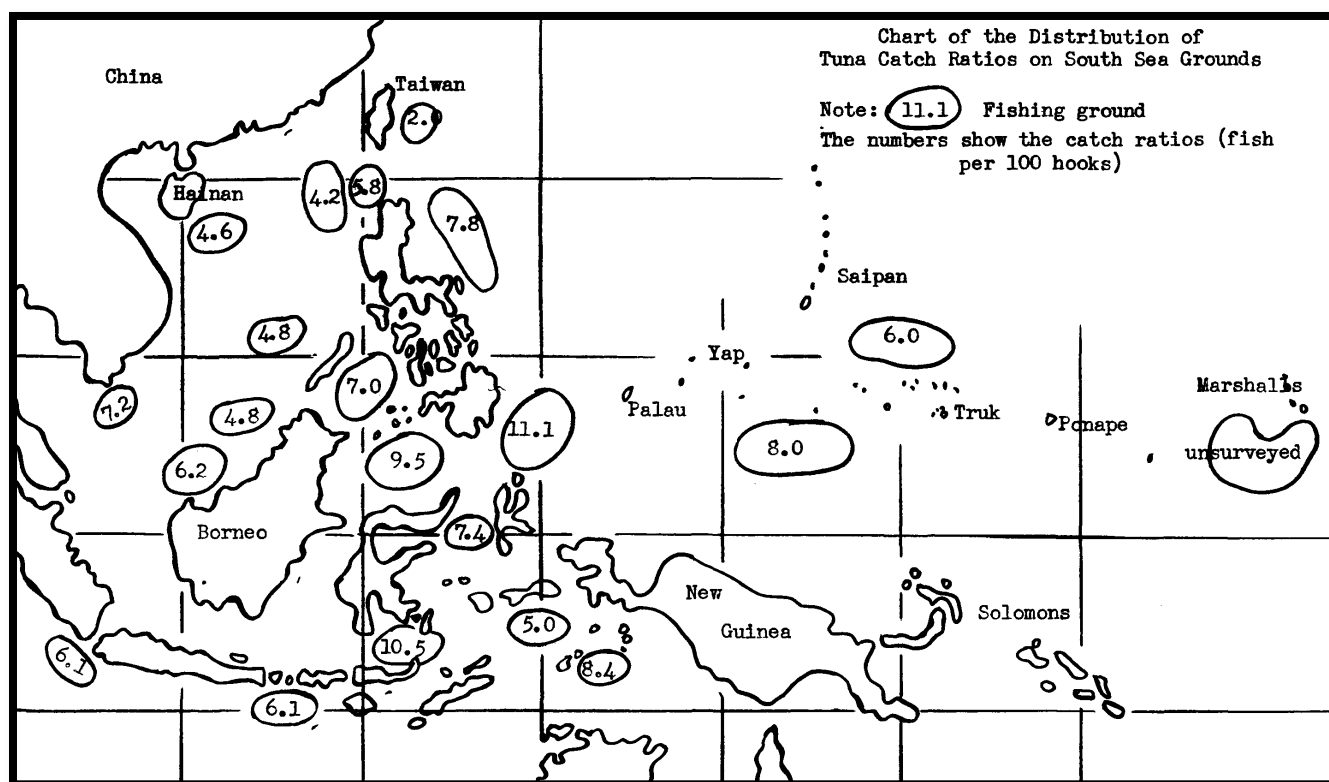
⁸⁹ Nakamura, “Tunas and Spearfishes,” 20.

⁹⁰ Kishinouye, “Contributions to the Comparative Study,” 390.

⁹¹ “Report of Survey of Fishing Grounds and Channels in Palau Waters, 1925-1926,” in *Fisheries Research Station Progress Report No. 1, 1923-1935* (Palau: South Seas Government-General, 1937), 20. This study was originally published in Japanese for the South Seas Government. It was translated by W.G. van Campen and republished as part of “Special Scientific Report: Fisheries No. 42” under the new title *Tuna Fishing in Palau Waters* (Washington: Fish and Wildlife Service, 1951).

Countercurrent and the Kuroshio Current.⁹² What was clear from the information collected by the *Shonan Maru* was that the tropical waters of the *Nan'yo* were largely untapped tuna grounds. The Sulu and Celebes Seas were considered especially rich.

In the wake of the *Shonan Maru*, Southeast Asia's pelagic environment changed in spatial, material, and epistemological ways. No longer were these offshore waters simply seen or understood as spaces of connection, linking together human shores in a world of modern transit. Following the scientific currents of Japan's fisheries surveys, embodied in the labors of the *Shonan Maru*, the seas of Indonesia, Borneo, and Mindanao became sites of tuna production.



Japanese Tuna Surveys and Their Catch Rates in the 1930s.⁹³

⁹² Imamura, "The Skipjack Fishery," 19-20.

⁹³ Ban, "On the Search for Southern Tuna Grounds," 12.

Science revealed the wealth of these seas and technology materialized it. For the making of *katsuobushi* and the feeding of Japan's home population and its overseas diaspora, "the skipjack fishery...entered upon a golden age."⁹⁴ Indeed, rather than wait for schools of skipjack to pass through their local waters, Japanese fishers, armed with this scientific data, could pursue these prized proteins in the *Nan'yo*. Scientific knowledge and technological change made "year round fishing...possible" for the Japanese tuna industry, allowing the fisheries sector to transcend "its natural limitations."⁹⁵ The *zaibatsu*, or conglomerates, which constituted this industry, used scientific data to refine their tuna operations and develop fishing bases, processing plants, ice factories, and refrigeration facilities around the rich, Southeast Asian seas they exploited.⁹⁶

Across the *Nan'yo*, and especially in the Philippines, the expansion of Japanese fishing networks marked a new phase in the age of tuna. For Mindanao, the industrialization of tuna fishing transformed the Davao Gulf region and Zamboanga City in the 1930s. While Davao's Japanese community had fished for skipjack since the late 1910s, the scaling up of this fishery in 1936 and the development of a canning base at Zamboanga in 1934 repositioned Mindanao within the world of

⁹⁴ Imamura, "The Skipjack Fishery," 6.

⁹⁵ Imamura, "The Skipjack Fishery," 6.

⁹⁶ "A Symposium on the Investigation of Tuna and Skipjack Spawning Grounds," *Kagaku Nanyo* 4,1 (July 1941): 64-75. This report was originally published in Japanese. It was translated by W.G. van Campen and republished as "Special Scientific Report: Fisheries No. 18" under the new title *Spawning Grounds of Tuna and Skipjack* (Washington: Fish and Wildlife Service, 1950). See also Kask, *Japan's Big Fishing Companies*.

Japanese fisheries.⁹⁷ In the closing years of the interwar period, these cities became centers of tuna production for Davao's growing Japanese population as well as new overseas markets, particularly for canned tuna. By 1935, Davao was a "Japanese colony"—home to an international port, a Japanese consulate, the Davao and Mintal Japanese Elementary Schools, the Davao Japanese Association, Japanese banks, a retail sector dominated by Japanese vendors, the Japanese Oriental Hospital, and Japanese agricultural syndicates, producing half the world's abaca supply.⁹⁸ Davao also had a Japanese population that was climbing towards 20,000.

At the same time, the rise and spread of Japanese industrial fishing also opened Mindanao's pelagic waters to Filipino scientists and the colonial state. Local fish experts working for the Bureau of Fisheries began to investigate the ecology of tuna and the state of their exploitation. But because offshore waters were largely outside the range of Filipino fishers, these local scientists partnered with Japanese fishing companies. Working with Japanese fishers, Filipino fish experts gained access to a new marine environment and an insider's perspective on the booming

⁹⁷ Zambaonga City's cannery, the first of its kind in the Philippines, was under the management of the Sea Foods Corporation, a subsidiary of the Kyodo Gyogyo. Kyodo Gyogyo was founded in 1913 and changed its name to Nippon Suisan K.K. in March 1937. According to SCAP authorities, Kyodo Gyogyo was Japan's largest fishery and marine products firm and possibly the largest such firm in the world prior to World War II. During the interwar years, Kyodo Gyogyo expanded its overseas fishing operations to include the waters around Mindanao, Borneo, Singapore, Taiwan, Korea, Manchuria, Antarctica, and Argentina. Like in Zamboanga City, Kyodo Gyogyo established local subsidiaries to conduct its overseas operations. These local firms included Minami Manshu Kaiyo Gyogyo K.K. (Manchuria), Minami Nippon Gyogyo Tosei K.K. (Taiwan/Formosa), Borneo Suisan K.K. (Balikpapan), and the Argentine Commercial and Industrial Fisheries Company. For more on Kyodo Gyogyo, see Kask, *Japan's Big Fishing Companies*, 1-12.

⁹⁸ Quiason, "The Japanese Colony," 215-230. See also Joseph Ralston Hayden, *The Philippines: A Study In National Development* (New York: Macmillan Co., 1947), 70. From 1933 to 1935, Hayden was the Vice-Governor of the Philippine Islands. For more on origins and presence of these Japanese cultural and social institutions in prewar Davao, see Furiya, "The Japanese Community Abroad," 155-173; Koji Kamohara, *Dabao Hojin Kaitakushi* (Davao: Nippi Shimbunsha, 1938); and, Cecil E. Cody, "The Consolidation of the Japanese in Davao," *Comment* 7,3 (1958): 23-36 and "The Japanese Way of Life in Prewar Davao," *Philippine Studies* 7,2 (April 1959): 172-186.

Japanese tuna industry, facilitating the earliest Filipino-authored publications on these pelagic fish and their commerce in 1938.⁹⁹ Up to the mid-1930s, Mindanao's deep seas, and the commodity circuits these waters sustained, were matters that existed at the edge of state concern and scientific interest, not just for the Philippines but for the rest of the *Nan'yo* too. By the end of the interwar period, however, Southeast Asia's pelagic zone became a place of social interaction and knowledge production. Through Japanese radials of industrial fishing and biological surveying, the region's rich tuna grounds were made legible to local scientists and area states.

Okinawan Fishers and Filipino Scientists in the Age of Tuna

In 1934, the *Shonan Maru* stopped at Davao on its way to survey the tuna resources of the Celebes Sea.¹⁰⁰ Japanese scientific expeditions had already studied the fish fauna of this body of water, determining that tuna stations would be well placed if they were built around the Celebes Sea.¹⁰¹ Geographically, this sea is

⁹⁹ See Jose S. Domantay, "Tuna Canning in Zamboanga," *Agricultural-Industrial Monthly* 5,7 (1938): 11-15 and Claro Martin, "Tuna Fishery and Long-line Fishing in Davao Gulf, Philippines," *Philippine Journal of Science* 67,2 (September 1938): 189-199.

¹⁰⁰ On the *Shonan Maru* in 1934, see Nakamura, "The Food Habits of Yellowfin," 1 and "The Tuna Longline Fishery and Fishing Grounds," 57; and, Martin, "Tuna Fishery and Long-Line Fishing," 189.

¹⁰¹ For example, in 1930, Ko Hara, a representative in the Diet for Kagoshima Prefecture, established skipjack stations in the areas of Manado and Ambon, and fished the tuna grounds of the Celebes Sea. Manado is just south of Davao on the island of Sulawesi in the Netherlands Indies. Hara was also one of the first skipjack operators to work in the Pacific zone of the *Nan'yo*. He conducted a tuna survey of Palau's waters in 1927. See "Tonijnenvisscherij in de Molukken (Dr. Ko Hara)," Tokiorapport No. 147/35, Japan/Tokio Gezantschap 1900-1941, Inventarisnummer 197, Archief Ministerie van Buitenlandse Zaken, NA. See also, Eddy Mantjoro, "Sejarah Kendala dan Hambatan Investasi Sektor RIL Terhadap Perkembangan Ekonomi Masyarakat Pesisir (Studi Kasus Pabrik Pengolahan Ikan)," *Akulturas: Jurnal Ilmiah Agrobisnis Perikanan* 1,2 (October 2013): 69-82; "De Haruna Maru, Japansche Belangstelling voor Tonijn-Visscherij," *Sumatra Post* (20 January 1934): 11; 21; Nakamura, "Tuna Longline Fishery," 53; Takashi Mita, "Japan's Development Assistance in the Republic of Palau: Community Impacts and Effect" (MA thesis, University of Hawaii at Manoa, 2001), 37-38. Mita's

bounded by Mindanao on the north, Sulawesi on the south, and Borneo on the west. To the east lie the Sangir and Talaud Islands and beyond them, the Pacific Ocean. Research vessels such as the *Shonan Maru* revealed that this body of water was a corridor for a diversity of tuna, many of which, circulated within the cold, shallow, and nutrient-rich waters of the Southeast Asian shelf. Amidst this amazing tuna traffic was Davao, located on the southeast coast of Mindanao where it faced the Celebes Sea.

For Davao, the visit of the *Shonan Maru* was an encounter that would reshape the pelagic future of Mindanao. The ship's scientific crew led by Hitoshi Hiratsuka met with local Japanese fishermen, and impressed upon them the tuna riches, not just in the Davao Gulf but also the surrounding Sulu, Celebes, and Philippine Seas.¹⁰² By sharing information about the location and nature of Mindanao's tuna grounds, "the technical men" from the *Shonan Maru* encouraged the local fishing community to scale-up their operations and exploit the island's pelagic wealth.¹⁰³ Two years later, in 1936, the Davao Fishery Company was founded, and with it the extension of Japan's industrial fishing network to southern Mindanao.

While the founding of the Davao Fishery Company opened Mindanao's pelagic waters to mass consumption and industrial development, it also made this offshore environment accessible to Filipino scientists. In 1938, Claro Martin (1908-1990), a fish expert attached to the Fish and Game Administration, gained access to

reference to the skipjack work of Ko Hara in Palau in 1927 is drawn from Nansuikai, *Nanko Suisan no Ashiato* (Tokyo: Nansuikai, 1994), 22.

¹⁰² Nakamura, "The Food Habits of Yellowfin," 1.

¹⁰³ Martin, "Tuna Fishery and Long-Line Fishing," 189.

one of Davao Fishery's motorboats, the *Nena*. He worked closely with the Okinawan fishers of the *Nena*, astutely documenting the culture and nature of tuna fishing from the inside out.¹⁰⁴ Martin was the first Filipino scientist to write about Davao's tuna grounds, drawing attention to the species of greatest abundance and commercial value. Based on his observations in 1938, Martin's work would serve as a baseline for Filipino scientists looking to rebuild Mindanao's tuna industry in the immediate postwar era.

Martin's experience on the *Nena* provides us with a rare window into the operations of Japanese tuna fishing in the *Nan'yo*. For most consumers in Davao, the Philippines, and Southeast Asia in the interwar period, their interactions with fish occurred at public markets or on the streets, where hawkers often supplied the urban poor with selections, which were cheap but less-than-fresh. In general, people accepted fish as "something that just happens...it turns up" in the city "with unfailing regularity."¹⁰⁵ Not unlike Davao's consumers or consumers elsewhere in interwar Southeast Asia, historians have treated fish as "something that just happens."¹⁰⁶ It is

¹⁰⁴ Claro Martin was born in Malolos, Bulacan. He received his BS degree from the Zoology Department at the University of the Philippines in 1927. From 1947 to 1957, he was chief of the Division of Fisheries Technology, a unit within the Bureau of Fisheries. In 1949, Martin was one of several Filipino delegates to the inaugural meeting of the Indo-Pacific Fisheries Council in Singapore. I had the opportunity to interview Melchor F. Cichon, the longtime librarian of the School of Fisheries at the University of the Philippines, Visayas, in Miagao, in 2015; Sir Cichon shared many stories and insights about Martin and his scientific career. Fieldnotes, Iloilo City, Panay Island, Philippines, July 2015.

¹⁰⁵ "Malaya's Important Fish Supplies," *Singapore Free Press and Mercantile Advertiser* (29 July 1931): 12.

¹⁰⁶ Notable exceptions from Southeast Asia include: Ismail Ali, *Pembangunan Industri Hiliran Berasakan Perikanan di Sabah* (Kota Kinabalu: Penerbit Universiti Malaysia Sabah, 2007); Masyhuri, *Menyisir Pantai Utara: Usaha dan Perekonomian Nelayan di Jawa dan Madura, 1850-1940* (Yogyakarta: Yayasan Pustaka Nusatama, 1995); John Butcher, *The Closing of the Frontier: A History of the Marine Fisheries of Southeast Asia c. 1850-2000* (Singapore: Institute of Southeast Asian Studies,

precisely for these reasons that Martin's observations are so invaluable and important. They bring texture and clarity to an otherwise invisible system of production and provision.

Onboard the *Nena* in 1938, Martin, a trained ichthyologist, made note of the species of tuna taken from Davao Gulf, identifying two types of tuna that were commercially exploited, the skipjack (*Katsuwonus pelamis*) and the yellowfin (*Thunnus albacares*). According to Martin, these fish were locally called *tulingan* and *bareles*. Two years later, Jose Domantay, a fisheries scientist based in Zamboanga City, would list eight tuna species, which were fished out of the Sulu and Celebes Seas.¹⁰⁷ By 1950, Herbert Warfel, a biologist who worked with Martin and Domantay through the U.S.-sponsored Philippine Fishery Program, would catalogue more than twenty species of *Thunnini* found in Philippine waters.¹⁰⁸

From the vantage of the *Nena*, Martin gathered information about how the passage of time affected tuna fishing within and beyond Davao Gulf. While seasonal monsoons generally influenced fish migrations, resulting in the presence or absence of certain species, they apparently had little impact on local tuna grounds. Martin learned that this body of water was "below the typhoon zone," and thus could be worked throughout the year.¹⁰⁹

2004); and, Mohammad Raduan bin Mohd. Ariff, *Dari Pemungutan Tripang ke Penundaan Udang: Sejarah Perkembangan Perusahaan Perikanan di Borneo Utara, 1750-1990* (Kuala Lumpur: Penerbit Universiti Malaya, 1995).

¹⁰⁷ Jose S. Domantay, "Tuna Fishing in Southern Mindanao," *Philippine Journal of Science* 73,4 (December 1940): 423.

¹⁰⁸ Herbert E. Warfel, *Outlook for Development of a Tuna Industry in the Philippines* (Washington: Fish and Wildlife Service, 1950), 2.

¹⁰⁹ Martin, "Tuna Fishery and Long-Line Fishing," 190.

But in examining the records of the *Nena* for the twelve months between 1936 and 1937, Martin reported that while fishing appeared consistent, catch levels were not. The variance in tuna production was tied to seasonal shifts in the availability of key baitfish. Working with Okinawan fishers on the *Nena* and drawing from his own knowledge of marine fisheries in the Philippines, Martin concluded that the monsoons mattered significantly because they affected the abundance of herrings (*Dussumieria hasseltii*), anchovies (*Stolephorus indicus*), or sardines (*Sardinella perforata*).¹¹⁰ Moreover, Martin's observations about the seasonality of baitfish confirmed the stomach studies conducted by the *Shonan Maru* in the 1930s: that herrings were in short supply between July and October.¹¹¹

Whereas fishing for bait demanded a sense of seasonality, fishing for tuna required a feel for geography. Place mattered, and locating these places, or grounds, where tuna were was a strategic task for both fishers and scientists. Through their interactions and exchanges, they coproduced critical knowledge and invaluable maps. On the *Nena*, Martin circulated through Davao Gulf, rewriting the scientific understanding of this body of water from the density of its tuna. The mapping that emerged was indeed a new space borne from an old sea. It was a new way of seeing, and understanding, Davao Gulf and the many reference points embedded within its wider cultural seascape. He reported, for example, that the principal tuna ground for skipjack was located along the western edge of the gulf, between Samal and Talicod

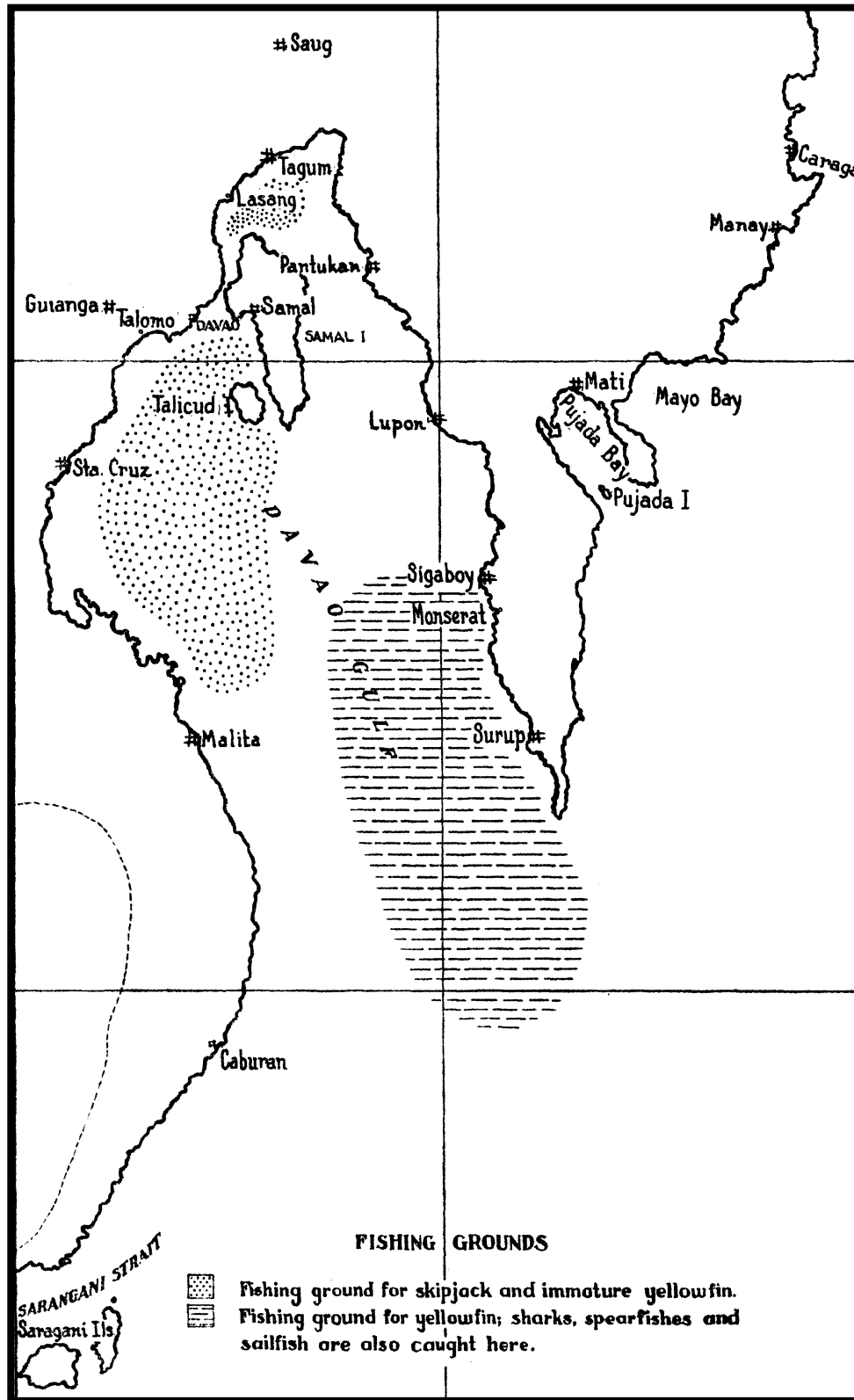
¹¹⁰ Jose A. Domantay, "The Catching of Live Bait for Tuna Fishing in Mindanao," *Philippine Journal of Science* 73,3 (1940): 337.

¹¹¹ Nakamura, "The Food Habits of Yellowfin," 4.

Islands and extending north to Malita.¹¹² Similarly, and drawing from his travels and interactions with Japanese fishers working for Zamboanga City's Sea Foods Corporation, a local subsidiary of Kyodo Gyogyo, Domantay remapped the Sulu and Celebes Seas to indicate where the tuna grounds were in 1940.¹¹³

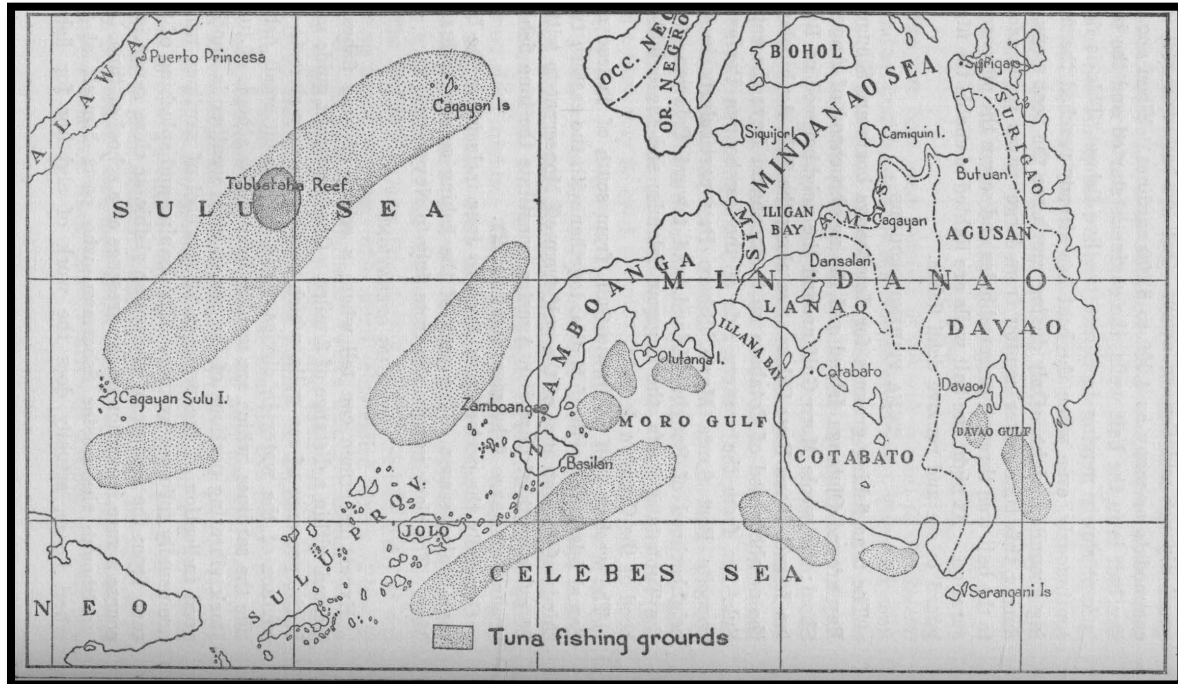
¹¹² Martin, "Tuna Fishery and Long-Line Fishing," 191.

¹¹³ Domantay, "Tuna Fishing in Southern Mindanao," 430.



Claro Martin's Tuna Map, Davao Gulf, 1938.¹¹⁴

¹¹⁴ Martin, "Tuna Fishery and Long-Line Fishing," 192.



*Jose Domantay's Tuna Map, Sulu and Celebes Seas, 1940.*¹¹⁵

But while knowing the geography of Mindanao's surrounding tuna grounds was vital, so too was being able to get to these waters and effectively exploit them. Throughout this age of tuna, the main advantage that Japanese companies had over Southeast Asian fishers was the widespread use of diesel engines. Motorization made fishing the pelagic waters of Davao Gulf and the Celebes Sea possible.

From the inner world of the *Nena*, Martin also documented the design of the motorboats that fished the waters of Davao Gulf. He quickly observed that the species of fish determined the type of fishing, which shaped the nature of the motorboat and the size of its crew. The *Nena* fished for skipjack so it was outfitted for pole-and-line fishing with about twenty Okinawan fishers, including a *patron*

¹¹⁵ Domantay, "Tuna Fishing in Southern Mindanao," 430.

(captain) and an engineer.¹¹⁶ As a pole-and-line operation, it had a set of live wells (tanks) with holes on the bottom that doubled as keeps for baitfish and stores for caught tuna. A long pipe ran the length of the boat, pumping seawater into the wells to ensure freshness. On closer inspection, Martin detected too that the pipe had spraying fixtures, which would come to play a pivotal role in the act of actual tuna fishing.

Starting with the Davao Fishery Co. in 1936, industrial fishing in Davao Gulf was still a new enterprise when Martin made his observations in 1938. Few people outside Mindanao's tuna industry knew how these prized, pelagic fish were actually caught, including the methods used and technologies employed. In the case of the *Nena*, the crew fished with pole-and-line, the proven method for skipjack fishing throughout the *Nan'yo*.¹¹⁷ The eighteen fishers (excluding the *patron* and the engineer) were each given a pole, measuring about 3.5 meters. The top of the pole had two lines, both slightly shorter than the length of the rod, with barbless hooks. One of the hooks had a simple yet effective lure: "solid tin molded in the shape of a small fish, dressed with white feathers in the hind portion."¹¹⁸

¹¹⁶ Martin, "Tuna Fishery and Long-Line Fishing," 193.

¹¹⁷ See letter from Ko Hara to R.J. Koppenol, governor of Dutch Moluccas, about Hara's pole-and-line operations out of Ambon, dated May 10, 1933. "Japansche Visscherij by Ambon," Tokiorapport No. 109/1933, Japan/Tokio Gezantschap (1880) 1923-1941 (1942), Inventarisnummer 196, Archief Ministerie van Buitenlandse Zaken, NA; Imamura, "The Skipjack Fishery," 12-13; and, Wakako Higuchi, "Pre-war Japanese Fisheries in Micronesia: Focusing on Bonito and Tuna Fishing in the Northern Mariana Islands," *Immigration Studies* 3 (2007): 49-68.

¹¹⁸ Martin, "Tuna Fishery and Long-Line Fishing," 194. See also, Imamura, "The Skipjack Fishery," 30-31.

The art and function of this lure were crucial to catching the attention of the “watchful and wild” skipjack.¹¹⁹ On the other hooks, the Okinawan fishers applied live bait (herrings were used when Martin was on the *Nena*). By sunrise, the motorboat headed to the fishing ground, with one fisher assigned the important role of scanning the sea for schools of skipjack. After spotting fish, another fisher began to chum the water with a few herrings at a time. Caught within the moment, Martin documented how the Okinawan crew built a veritable fish frenzy, and the techniques they used to fully exploit it. With the *Nena* no longer moving, but its engine still on, Martin discovers why the pipe running the length of the motorboat had spraying fixtures. The seawater flowing through the pipe, which was feeding the live wells, was sprayed on the chum zone to “simulate the commotion of a school of small fish, and also...to hide the activity of the fishermen from the fish.”¹²⁰ Amidst the spraying water and chum-induced frenzy, the fishers could yield “a ton of fish...in a half an hour.”¹²¹ Given this level of production, what Martin observed on the *Nena* in 1938 was pole-and-line fishing on an industrial scale.

For the first time in Southeast Asia, a local scientist not only witnessed the mass exploitation of skipjack from the company of a Japanese motorboat and its Okinawan crew, but this fish expert also brought the unseen world of industrial fishing into public view. Through this rare vantage, he provided an ethnographic glimpse of a growing transregional industry, which reconfigured East and Southeast Asia through fish, and showed how it landed tons of protein for Davao’s thriving

¹¹⁹ Martin, “Tuna Fishery and Long-Line Fishing,” 191.

¹²⁰ Martin, “Tuna Fishery and Long-Line Fishing,” 195.

¹²¹ Martin, “Tuna Fishery and Long-Line Fishing,” 195.

Japanese community. In the late 1930s, the scaling up of the gulf's skipjack fishery was linked to Davao's expanding share of the global abaca market, which secured almost half of the world's supply by 1941.¹²²

So while abaca opened Davao's frontier, fish indeed fed it. As Martin noted once the *Nena* returned to port with the day's catch, the skipjack were kept not on ice, but rather stored in the ship's live wells with fresh, circulating seawater. The homeport for all Japanese motorboats also served as the main center for fish distribution. As soon as the *Nena* docked, retailers jostled to secure their daily supplies for the city's public market and its peddlers who hawked protein from the streets. Fish not sold off the dock were then held in iceboxes for a maximum of five days, after which time they turned soft, mushy, and unmarketable.¹²³

Working closely with Okinawan fishers on the *Nena*, Martin was able to document a system of critical provisionment. For tuna, and fish in general, this was a system of production and provision, which, in the popular view, just happened "with unflinching regularity."¹²⁴ From Singapore to Manila, Southeast Asian publics were familiar with fish markets and they were often well-versed in selecting quality fish, but few people knew how, where, and by whom these fish were procured.¹²⁵ In the

¹²² Pelzer, "Philippine Abaca Industry," 71; Wernstedt and Spencer, *The Philippine Island World*, 533; Hayase, "Tribes, Settlers and Administrators on a Frontier," 71, 133; and, Pacis, *Davao: Its Progress and Future*, 93.

¹²³ Martin, "Tuna Fishery and Long-Line Fishing," 198.

¹²⁴ "Malaya's Important Fish Supplies," *Singapore Free Press and Mercantile Advertiser* (29 July 1931): 12.

¹²⁵ W. Birtwistle, "Choosing Fish," in *The International Cookery Book of Malaya*, eds. Ursula Holttum and Gertrude Hinch (Singapore: The Young Women's Christian Association of Malaya, 1935), 23-40; D.W. Le Mare, *Malayan Fish and How to Cook Them* (Singapore: 1941); Maria Y. Orosa, *Recipes for Sea Food* (Manila: Bureau of Printing, 1931); Arthur C. Avery and Dominador Calvez, *Cosmopolitan Fish Cookery for the Philippines* (Washington: Fish and Wildlife Service, 1950), 2-9; "Fish On The Menu

case of tuna, Martin charted this system of supply, from loading the *Nena*, securing the herrings, and scanning for skipjack to chumming the water, hooking the fish, and feeding the market.

But the rise of Japanese fishing networks and the opening of Southeast Asia's pelagic waters were not responses to the food needs of local populations in this age of tuna. Rather, tuna fed Japan's demographic boom, which had been sparked by industrial development and agricultural change. Skipjack, in particular, powered the growth of Japan's overseas communities and the commodity frontiers they worked. In Mindanao, abaca was a Japanese industry; Davao was a Japanese colony; and, the Davao Fishery Co. was a Japanese company. Skipjack were principally used to make *katsuobushi*, a Japanese staple food, and so as Davao's population grew so grew the demand for tuna. Reflecting this reality in 1938, Martin's final observation was that "80 percent of the skipjacks, yellowfins, and spearfish landed in Davao are consumed by Japanese residents."¹²⁶

A Pelagic Turn in the Age of Tuna

From 1914 to 1941, Southeast Asia's offshore environment became an invaluable source of tuna for modern Japan and its expanding imperial periphery. This historical moment that we can call the age of tuna, redefined the spatial, ecological, and economic understandings of Southeast Asia through a completely

Need Not Be Ikan Merah," *Singapore Free Press and Mercantile Advertiser* (22 August 1941): 5; "Vitamins, Mullagtany And Malay Dishes," *Straits Times* (22 July 1948): 9; and, "Fish for a Change!," *Morning Tribune* (25 March 1938): 14.

¹²⁶ Martin, "Tuna Fishery and Long-Line Fishing," 198.

new space: the pelagic zone. These deep waters were rich with tuna species and other protein resources. But before the extension of Japanese fishing to Southeast Asia after 1910, these pelagic fish were largely unexploited by local fishers, and the arc of ocean from which they came was unknown to local scientists. The rise of Japanese tuna networks, however, opened the region's offshore environment to industry, science, and consumption, thereby marking a profound pelagic turn in the production of fish and knowledge in the early half of the twentieth century.

Japanese scientists and Okinawan fishers changed Southeast Asia in the age of tuna. They mapped and exploited its pelagic resources for distant markets and non-local consumers. In the process, they built an industry and an infrastructure that tied together East and Southeast Asia through the social world of fish. While the region's tuna grounds fed Japanese growth at home and abroad in the interwar period, they also created spaces and opportunities for the local production of new scientific knowledge. Filipino scientists such as Claro Martin and Jose Domantay would leverage their prewar expertise in tuna fisheries and pelagic waters to build up Mindanao as a postwar tuna capital.

In the first half of the twentieth century, moreover, Japanese scientists and Okinawan fishers were also central to opening up Southeast Asia's reef environments to mass consumption and commercial exploitation. While tuna fed overseas markets and non-local consumers, reef fish, known in Malay as *ikan delah*, provisioned the region's swelling cities and sprawling plantations with low-cost protein. Like Southeast Asia's pelagic waters, its coral reefs were spaces of the marine environment that had been largely unexploited by local fishers. From

Rangoon and Singapore to Batavia and Manila, the region's reef environments became new, abundant sources of edible fish. Targeting these previously untouched coral complexes, Okinawan fishers used a fishing method called *muro-ami*, or drive-net fishing, and produced a seemingly endless supply of affordable food. From these human activities, the expansion of *muro ami* fishing created a protein boom in interwar Southeast Asia that fed workers across its burgeoning arc of cities and plantations. While overlooked and understudied, this protein boom—and the Okinawan fishers who powered it—provisioned the floating masses of urban and agricultural poor who remade the region's cities and produced its global commodities. The scale of reef fish caught by Okinawan fishers using the *muro ami* method made possible the demographic, urban, and land use changes, which have marked and defined Southeast Asia in the modern period.

CHAPTER SIX

Muro Ami Fishing and the Protein Boom in Interwar Southeast Asia

Introduction: The City and the Sea

Southeast Asia became urban in the age of industrial commodities. This was an era of human currents, conditioned by changing landscapes, sprawling frontiers, and bustling cities. In the decades between 1890 and 1940, the region's population more than doubled from 83 million to 184 million.¹ This was also a time of "plantationization," with rural and migrant populations enmeshed in the world of industrial agriculture.² While area scholars have focused on the ways in which plantation commodities forged a range of social, economic, and environmental changes in the region and the world, less attention has been paid to a more fundamental question: how was the mass of humanity, which powered these urban and agricultural processes, provisioned?

Demographically, a swell of people shifted the scale of cities, more than doubling their size in this age of plantation commodities. In 1900, for example, Manila had a population of 257,000, but by 1940, this figure had expanded to 661,000. Similarly, Batavia (Jakarta) commenced the century with a population of

¹ Anthony Reid, *A History of Southeast Asia: Critical Crossroads* (Oxford: Wiley Blackwell, 2015), 263.


² Eric Tagliacozzo, "Finding captivity among the peasantry: the Malay/Indonesian world 1850–1925," *South East Asia Research* 11,2 (July 2003): 214. For a sense of this literature, see Corey Ross, "The Tin Frontier: Mining, Empire, and Environment in Southeast Asia, 1870s–1930s," *Environmental History* 19 (2014): 454–479; Peter Boomgaard et al., eds., *Paper Landscapes: Explorations in the Environmental History of Indonesia* (Leiden: KITLV, 1997); Jeyamalar Kathirithamby-Wells, *Nature and Nation: Forests and Development in Peninsular Malaysia* (Honolulu: University of Hawaii Press, 2005); and, Peter J. Rimmer and Lisa M. Allen, eds., *The Underside of Malaysian History: Pullers, Prostitutes, Plantation Workers* (Singapore: Singapore University Press, 1990).

115,000, but it ended the interwar years with a total of 545,000. In 1900, Singapore had a population of 228,000 and by 1940 this number had increased to 680,000.

Outside of Bangkok, which had a population of 800,000 in 1940, Singapore was the most populated city in interwar Southeast Asia. For purposes of comparison, one of the world's great tea ports, Colombo (Ceylon/Sri Lanka), started 1900 with a population of 691,000 and ended 1940 with this figure far over a million at 1,420,000.³

Growth of Asian Cities from 1900 to 1940.⁴

City	1900	1940
Rangoon	245,000	501,000
Jakarta	115,000	545,000
Manila	257,000	661,000
Singapore	228,000	680,000
Bangkok	600,000	800,000
Colombo	691,000	1,420,000
Tokyo	1,497,000	6,779,000



³ For these population figures, see Peter J. Rimmer and Howard W. Dick, *The City in Southeast Asia: Patterns, Processes and Policy* (Singapore: NUS Press, 2009), 9.

⁴ Photo by author. Phu Quoc Island, Vietnam, 2014.

As cities grew and commodities boomed, people fueled Southeast Asia's economic expansion by burning calories through hard, physical labor. They built the region's infrastructures and powered its systems. Not only did workers dig the roads, lay the tracks, and construct the buildings of commercial and population centers, but this sea of humanity—comprised of peddlers, pullers, prostitutes, and porters—also plied the city's streets and handled the port's docks. From sunrise to sunset, and often longer, countless bodies were engaged in break-in-bulk cargo work. In this most vital service, workers carried the weight of Southeast Asia's "uncontrolled boom" in rubber and other plantation commodities.⁵ By 1940, 90 percent of the world's rubber was cultivated in Southeast Asia and exported through ports such as Singapore.⁶ Physically arduous, and seemingly endless, loading and unloading cargo was a way of life for many urban poor.

While people built cities and opened frontiers, they also needed to eat in order to survive the urban and rural demands of their labor. Rice was expected. It was a staple carbohydrate for families in interwar Southeast Asia. But for a combination of cultural, economic, ecological, and religious factors, most societies got their protein by consuming fish—rather than beef or pork. In 1937, a dietary study of workers from Paco, an urban district in Manila, found that 80 percent of their protein intake came from fish.⁷ For the poor and the pious, fish were cheap to procure and amenable to local faiths. The Southeast Asian shelf was rich with

⁵ E.O.H., "Malaya's 'Uncontrolled Boom'," *Far Eastern Survey* 6,24 (December 1, 1937): 281.

⁶ Amarjit Kaur, *Wage Labour in Southeast Asia since 1840: Globalisation, the International Division of Labour, and Labour Transformations* (Basingstoke: Palgrave Macmillan, 2004), 108.

⁷ Marciano Gutierrez and Francisco O. Santos, "The Food Consumption of One Hundred Four Families in Paco District, Manila," *Philippine Journal of Science* 66,4 (August 1938): 400.

aquatic life. In 1929, Albert W. Herre, one of the world's leading ichthyologists at the time, explained as much to members of the Pacific Science Congress, stating that the region had "the richest and most varied fish fauna in the world."⁸



Traditional fish pen in the Sulu Sea, 2013.⁹

In interwar Southeast Asia, the demand for fish supplies outpaced the capacity of local fishers who used their *kelongs*, or catch-nets tied to stakes, or *corrales* (fish pens). The city and its people needed the ocean and its protein. The

⁸ Albert W. Herre, "The Scientific and Commercial Development of East Indian Aquatic Resources," *Proceedings of the 4th Pacific Science Congress* 3 (1930): 25.

⁹ Photography by author. Bum Bum Island, Sulu Sea, 2013.

agricultural and urban growth that remade Southeast Asia and the world in the early half of the twentieth century depended on an endless supply of this essential nutrient, a basic requirement of the human body.

By looking at the rise of Japanese fishing networks, we can see how Southeast Asia's growing protein needs were met, and how Okinawan fishers, in particular, opened the ocean's reefs to mass consumption and ecological change. From 1922 until 1941, Japanese *kongsis*, or companies, dominated the supply of fresh fish to an ever-expanding network of cities and frontiers. In retrospect, there were three factors that enabled these firms to gain control over the mass production of oceanic fish in the decades before World War II. First, they introduced a new fishing method that targeted previously untouched, offshore reef environments.

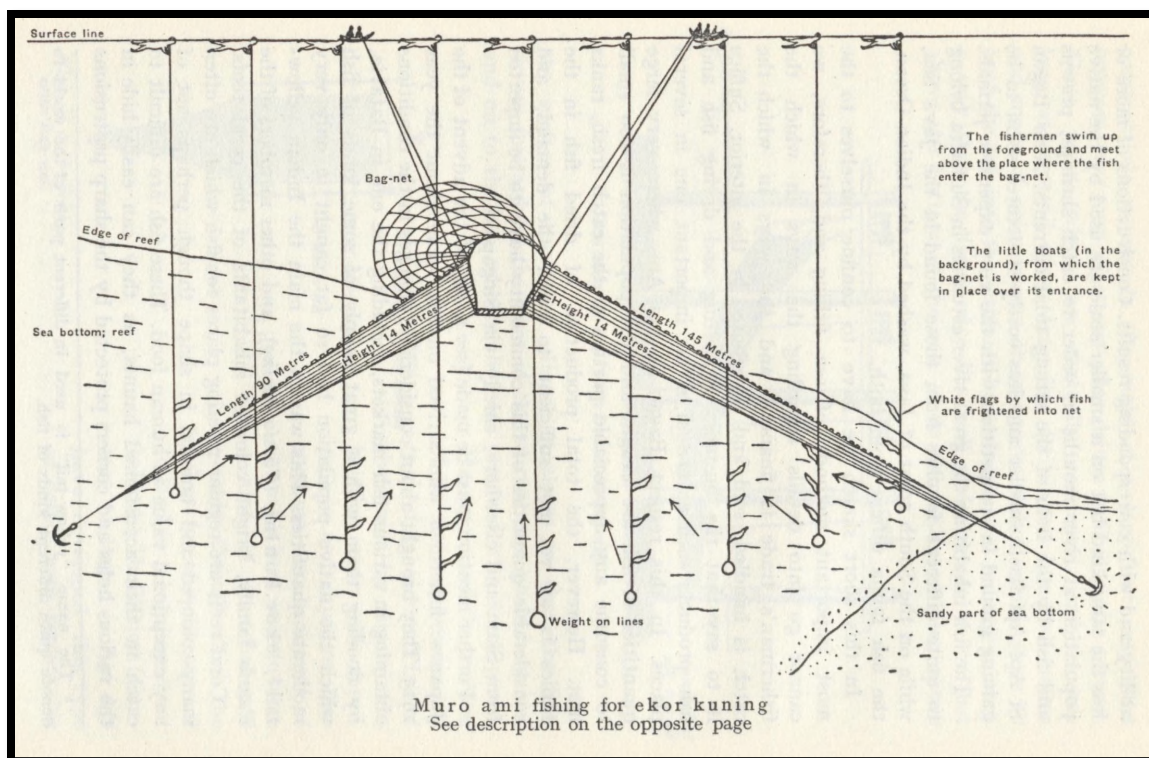
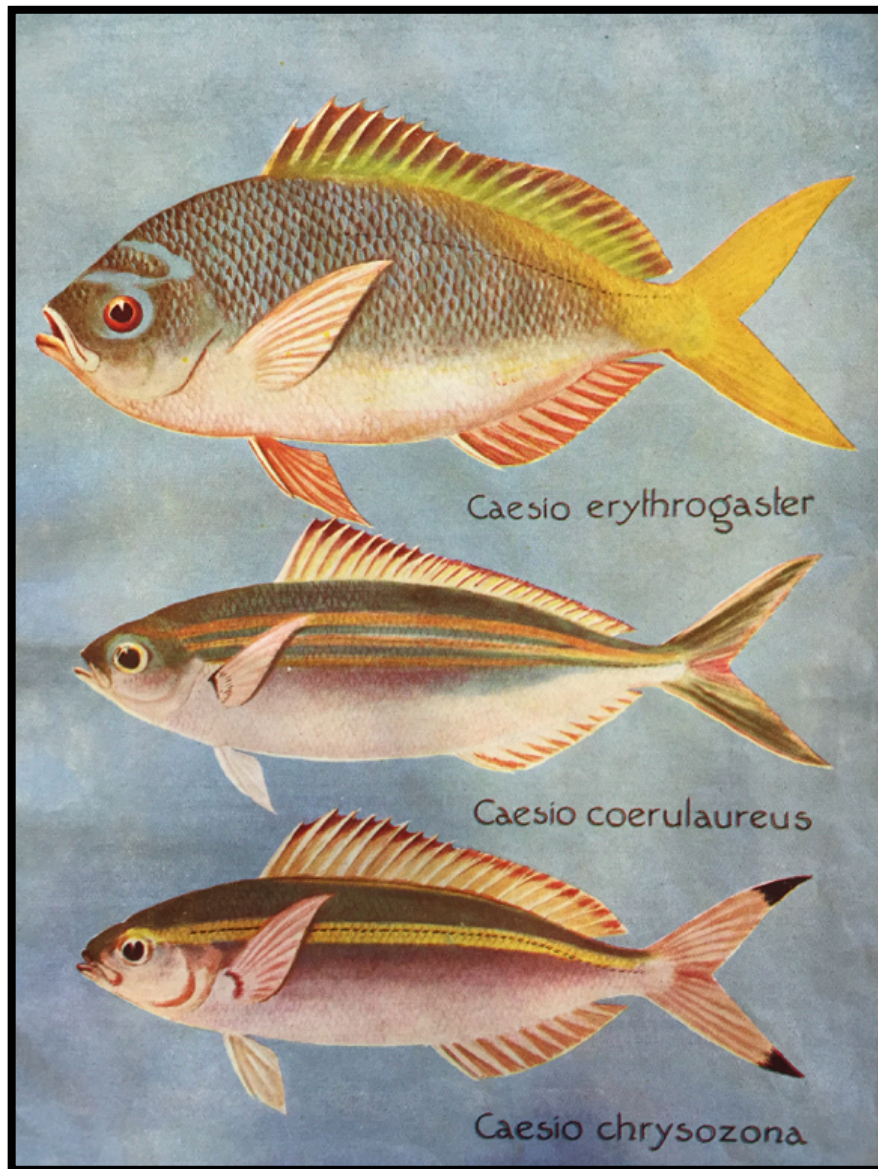


Illustration of muro ami fishing in the Netherlands Indies, 1939.¹⁰

¹⁰ H.C. Delsman, "Fishing and Fish Culture in the Netherlands Indies," *Bulletin of the Colonial Institute of Amsterdam* 2,2 (February 1939): 102.

While this Okinawan fishing practice, called *muro ami*, or drive-net fishing, was effective in securing large quantities of reef fish (*Caesio*), it was also ruinous to coral complexes.



Types of reef fish (*Caesio*) caught by muro fishers. Locally known as ikan delah and ikan kuning.¹¹

¹¹ H.C. Delsman, *Indische Zeevisschen in het Aquarium van het Laboratorium voor het Onderzoek der Zee op den Pasar Ikan te Batavia* (Batavia: G. Kolff & Co., 1924).

Of equal import, Japanese fishers used diesel-powered engines to scale up their operations and exploit the region's offshore resources. Backed with capital from the colonial government in Taiwan and *zaibatsu* such as *Nippon Suisan*, these fishing *kongsis* were well positioned to adopt new technologies, and leverage these technological changes like motorization, ice production, and refrigeration to their advantage. Finally, Japanese fishing networks pursued fish in ways that marked the beginnings of illegal fishing, or what the Dutch in the Netherlands Indies called "clandestiene visscherij."¹² These three factors—introducing the *muro ami* method, harnessing new technologies, and "fishing in forbidden waters"—produced the oceanic protein boom that powered the rise of urban Southeast Asia.¹³ This protein boom lasted until colonial policies, global politics, and local boycotts collapsed the Japanese fishing networks that had created it.

Japanese Fishers and the Muro Ami Method

In 1926, severe weather made for a poor fish year in the Straits Settlements.¹⁴ Heavy monsoon rains restricted the number of days local fishers could go out to their *kelongs*, the conventional fishing method practiced by most residents. Climatic forces created a crisis in the supply of fish, impacting communities from Singapore to Kelantan. Most of the 22,253 fishermen—of whom

¹² Agenda No. 598, Bijdrage voor het Tokiorapport No. 111/36, "Japansche visschers te Sorong," dated March 30, 1936, Geheim 40, "Japanasche Visscherij in de Nanyo," Nederlandse Gezantschap in Japan (Tokio), 1923-1941, Inv. Nr. 197, The Hague, Netherlands, National Archive (NA).

¹³ In 1932, the Dutch had captured and destroyed a Japanese motorboat off the north coast of Edam in the Netherlands East Indies for "fishing in forbidden waters." See Batavia dispatch No. 88 of October 28, 1932, Enclosure No. 92504, in CO 531/24.

¹⁴ On one weekend in July, there were reports of six typhoons passing through the South China Seas. "Shipping Notes," *Singapore Free Press and Mercantile Advertiser* (20 July 1926): 11.

98 percent were Malay, Chinese, and Tamil—had suffered economically, physically, and materially through loss or damaged fishing stakes (poles made from mangrove or some other wood).¹⁵ They were unable to provide the colony's fish markets with that most basic yet crucial nutrient: protein. The implications of this "dearth of fish" would have been far worse had it not been for one group: Japanese fishers. The Japanese community was largely comprised of young men from the town of Itoman on the island of Okinawa.¹⁶ In 1926, there were 292 Okinawan fishers registered in Singapore.¹⁷ The total number of Japanese fishers was 411, representing a little over one percent of the entire fishing population in the Straits Settlements, and it was this group that "made up the deficit" caused by the year's violent climate.¹⁸

Unlike the rest of the Straits fishers in 1926, the Japanese community used cold storage, motorboats, and the Okinawan fishing method known as *muro ami*.¹⁹ While the combination of refrigeration and diesel engines certainly allowed this small but critical community to fish further from shore and keep larger catches fresh

¹⁵ Governor Hugh Clifford to Members of the Legislative Council, October 10, 1927, enclosed in (Colonial Office) CO 273/537/24.

¹⁶ For references to Okinawan fishers in Southeast Asia, see *De Indische Courant* (25 November 1925): 2; *Het Vaderland* (25 December 1929): 8; *De Sumatra Post* (1 December 1925): 5; and, B. Markus, *De Japansche visscherij in het Oosten van de Archipel* (Batavia: Instituut voor de Zeevisscherij, 1930/1941), 2. In the 1920s, Okinawans, mostly from Itoman, also went to work the waters around Saipan, Palau, and the Marianas. See Wakako Higuchi, "Pre-war Japanese Fisheries in Micronesia—Focusing on Bonito and Tuna Fishing in the Northern Mariana Islands," *Immigration Studies* 3 (2007): 51. For a close analysis of the relationship between Itoman and Singapore, see Shimizu Hiroshi, "Theories of Migration and the Okinawan Fishermen in Colonial Singapore," *Research on Contemporary Society* 3 (June 2008): 27-42.

¹⁷ Shimizu Hiroshi, "The Japanese Fisheries Based in Singapore, 1892-1945," *Journal of Southeast Asian Studies* 28,2 (September 1997): 329. Hiroshi uses the Japanese Foreign Ministry Archives, J1.2.0, 1927, to reconstruct the number of Okinawans in Singapore.

¹⁸ Governor Hugh Clifford to Members of the Legislative Council, October 10, 1927, enclosed in CO 273/537/24.

¹⁹ "'Muro Ami'—Japanese Fishing Methods as Used in Malaya," *Straits Times* (4 September 1926): 11.

for local markets, it was the introduction of *muro ami* to Straits waters that transformed the fish industry in interwar Southeast Asia. *Muro ami* fishing was one of the main factors that led to the region's protein boom in the 1920s and 1930s, and thus secured the place of these fishers as the dominant suppliers of fresh fish to urban markets in Singapore, Penang, Batavia, and Manila.²⁰

Muro ami fishing revolutionized the capture of fish in interwar Southeast Asia. Ecologically, it targeted offshore reefs, zones of the ocean, which had previously been untouched by local fishers. Economically, it exploited reef fish called *ikan delah* or *ikan kuning* (*Caesio*), a class of fish rare in local fish markets and quite expensive.²¹ But after the advent of *muro ami* fishing, these reef fish became a cheap and abundant source of protein, accounting for about 30 percent of the total weight of fish sold in Singapore's markets in 1928.²² To understand how *muro ami* fishing came to occupy such an important aspect of the provisionment of protein in interwar Southeast Asia, it is useful to consider the history of Japanese reef and demersal (bottom) fishing in the region and its evolution under the leadership of Tora Eifuku.

²⁰ On Singapore and Penang, see "Annual Report on the Colony of the Straits Settlements for the Year 1927," in CO 273/552/17; on Batavia, see H.C. Delsman, "Fishing and Fish-culture in the Netherlands Indies," *Bulletin of the Colonial Institute of Amsterdam* 2,2 (February 1939): 92-105; and, on Manila, see Albert W. Herre, "Miscellaneous Notes," Box Folder: 2, Series: Notes III, Dates: 1929-1948, Albert W. Herre Papers, Western Washington University, Western Libraries Heritage Resources (WLHR).

²¹ "Report on the Tongkol," *Straits Times* (7 July 1928): 3 and "Notes of the Day," *Straits Times* (21 May 1929): 9.

²² "Singapore's Fish Supply," *Straits Times* (14 May 1928): 3.

Historical Encounters: Japanese Fishing and the Southeast Asian shelf

One of the earliest glimpses of Japanese fishers interested in Southeast Asia comes from the Spanish Consulate in Yokohama in 1890.²³ In a series of exchanges between Yokohama and Manila, we learn of the efforts of a crew of Japanese men seeking permission to explore the fishing grounds near the islands of Babuyanes and Batanes in the Straits of Luzon, between northern Luzon and Taiwan.²⁴

In the course of communication, the crew's request was forwarded to Manila's Junta de Pesca to ascertain whether or not these northern waters were in fact within Spanish jurisdiction. What transpires is a wonderful genealogy of colonial space stretching back to 1802, with the Junta providing the Consulate a chronology of incorporation based on encounters with these northern islands, royal decrees, hydrographic work, traveling foreigners, and lighthouses.²⁵ To aid in this effort, one also finds in the consular records a map of Taiwan that is unfortunately undated.²⁶

²³ Spanish Consulate in Yokohama, Philippine National Archives (PNA), Estado de Japon (1870-1898), Bundle SDS 12427. Within Bundle SDS 12427, see document numbers: s341-s354, s502-s521, s609-s625, and, s735-s736.

²⁴ For more on the fisheries of these northern waters, see Guillermo Blanco, "Fisheries of Northeastern Luzon including the Babuyan and Batanes Islands," *Philippine Journal of Science* 66 (1938): 501-521. Blanco was born in Laoag City in Ilocos Norte, a province facing the Straits of Luzon. He completed his undergraduate and graduate degrees at the University of Washington, Seattle, studying under the ichthyologist Albert Herre who himself had served as director of fisheries in the Philippines from 1919 to 1928.

²⁵ "Sobre pretension de varias Japoneses de dedicarse a la pesca en algunas provincias de estas Yslas," 26 July 1890, PNA, Estado de Japon (1870-1898), SDS 12427, s505-s508.

²⁶ For more on the intersection of fisheries, Japan, and colonial Taiwan, see Ta-Yuan Chen, "Taiwanese Offshore (Distant Water) Fisheries in Southeast Asia, 1936-1977" (Phd diss., Murdoch University, 2007), 8-13.

The correspondence between Yokohama and Manila also reveals the types of ocean produce these Japanese fishers hoped to find and exploit.²⁷ They were looking for skipjack or katsue (*Katsuwonus pelamis*), ayu (*Plecoglossus altivelis*), tai (*Pagrus major*), and hamaguri (*Meretrix lusoria*), among other species. But significantly not reef fish (*Caesio*). The nature of these Japanese names suggests that the fishers were working for the markets of Japan rather than Southeast Asia. Interestingly, the Spanish authorities in Yokohama discuss a few of the Japanese ways in which certain fish are enjoyed, such as preparing ayu in beer.²⁸ Moreover, the Junta de Pesca in Manila acknowledges the aid and assistance of Fr. Casto de Elera (1852-1903), who, in 1890, was serving as director of the University of Santo Tomas's Museum of Natural History in the Spanish colonial capital.²⁹

By 1900, Japanese fishers had moved from the waters around northern Luzon to Manila Bay.³⁰ Shinzo Hayase has documented the growing presence of these fishers, from 45 men and 17 fishing boats in 1903 to 110 men and 50 fishing boats in 1906.³¹ Early on these fishers organized themselves into a cooperative

²⁷ "Sobre pretension de varias Japoneses de dedicarse a la pesca en algunas provincias de estas Yslas," 26 July 1890, PNA, Estado de Japon (1870-1898), SDS 12427, s515-s516.

²⁸ "Sobre pretension de varias Japoneses de dedicarse a la pesca en algunas provincias de estas Yslas," 26 July 1890, PNA, Estado de Japon (1870-1898), SDS 12427, s516.

²⁹ "Sobre pretension de varias Japoneses de dedicarse a la pesca en algunas provincias de estas Yslas," 26 July 1890, PNA, Estado de Japon (1870-1898), SDS 12427, s520. In 1895, Fr. Casto de Elera published his three-volume work *Catalogo Sistemático de toda la Fauna de Filipinas conocida hasta el presente y a la vez el de la coleccion zoological del museum de PP. Dominicos del Colegio, Universidad de Sto. Tomas de Manila* (Manila: Imprenta del Colegio de Santo Tomas, 1895). Elera's *Catalogo* was prepared for the Philippine Regional Exposition, which was held in Manila on January 23, 1895. The next year, in August 1896, the Philippine Revolution broke out.

³⁰ Agustin F. Umali, "The Japanese Beam Trawl Used in Philippine Waters," *Philippine Journal of Science* 48,3 (July 1932): 389.

³¹ Shinzo Hayase, *Japanese in Modern Philippine History* (Tokyo: Waseda University, Institute of Asia-Pacific Studies, 2014), 15.

under the leadership of Kasai Kyozo who was from Fukuoka, Kyushu.³² While not Okinawans, and therefore not implementing the *muro ami* fishing method, these southern Japanese fishers nevertheless played an important role supplying fresh fish to Manila's markets.³³ In 1918, the Japanese fishing community that resided in a shoreline area of Manila called Tondo, expanded the cooperative into the Tondo Fishermen's Supply Store and Association.³⁴

Members of the Tondo Fishermen's Association, sometimes referred to as the Japanese Fishermen's Association, were largely beam (*utase*) trawlers who worked Manila Bay in the early decades of the twentieth century. Beam trawling used sailing sampans, or seaworthy craft, weighing between 6 and 17 gross tons. Each sailing sampan operated five to seven beam trawls with a crew of four or five men. The beam itself was made from bamboo with a design that kept the mouth of the trawl open. As the boats fished Manila Bay, they maintained these trawls in horizontal positions not far from the ground. In 1930, Claro Martin and Heraclio Montalban, government fisheries scientists, described the *utase* method in operation: "The upper edge of the mouth is buoyed up by the wooden floats of the float line, and the lower edge is kept next the bottom by the weight of the ground line and by that of

³² Japanese Ministry of Foreign Affairs Archives, 3.3.7.25, Nokoshogyogyo ni Jujisuru Zaigai Honpojin no Eigyo Jotai Torishirabe Ikken [Survey of business affairs of Japanese residents abroad who are engaged in agriculture, industry, commerce, and fisheries], September 1902-November 1904. Cited in Yoko Yoshikawa, "Jose M. Tagawa and the Japanese Commercial Sector in Manila, 1898-1920," *Philippine Studies* 43,2 (Second Quarter 1995): 181.

³³ See Doeppers, *Feeding Manila*, 161-188.

³⁴ Umali, "The Japanese Beam," 389; and, Lydia N. Yu-Jose, *Japan Views the Philippines, 1900-1944* (Quezon City: Ateneo de Manila University Press, 1992), 245. In the 1930s, S. Miyasaki headed the Tondo Fishermen's Association.

the net itself, there being eleven stone weights on the lead line of the anterior portion of each wing.”³⁵

These *utase* fishers targeted a unique ecological niche that bolstered their dominant position supplying fresh fish to Manila’s central fish market at Divisoria in Tondo. From Divisoria, varieties of fish were purchased by local retailers and distributed to smaller markets throughout the urban metropolis and its provincial environs. Given the design of the *utase*, these Tondo fishers focused on landing marine species that inhabited the muddy, sandy seafloor of Manila Bay. In particular, they specialized in supplying Divisoria Market with slip-mouths (*Leiognathidae*), or in Tagalog *sapsap*, which was a popular fish used in the production of *patis* and *bagoong*, common forms of fish sauce and fish paste.³⁶ For many Filipino families and workers, *bagoong* was a staple food, constituting a vital source of cheap and accessible protein.³⁷ In addition to *sapsap*, the *utase* fishers supplied local retailers with a diversity of other food sources, including shrimps, lizardfish (*Synodontidae*, kalaso), and pampano (*Carangidae*, talakitok).³⁸

³⁵ Heraclio R. Montalban and Claro Martin, “Two Japanese Fishing Methods used by Japanese Fishermen in Philippine Waters,” *Philippine Journal of Science* 42,4 (August 1930): 472.

³⁶ H.D. Gibbs and F. Agcaoili, “Some Filipino Foods,” *Philippine Journal of Science* 7A,6 (December 1912): 386 and Arthur C. Avery, *Fish Processing Handbook for the Philippines* (Washington D.C.: Fish and Wildlife Service, 1950), 25.

³⁷ Claro Martin and Augusto D. Manalo, “Methods of Preservation and Processing Fish,” in *Philippine Fisheries: A Handbook Prepared by the Technical Staff of the Bureau of Fisheries* (Manila: M. Colcol & Co., 1952), 128.

³⁸ Montalban and Martin, “Two Japanese Fishing Methods,” 476-477.

The Rise of Japanese Fishing in Interwar Singapore: The Case of Tora Eifuku

By 1911, the Japanese government had recognized the economic and ecological value of the *Nan'yo*.³⁹ In line with this vision, Tokyo sent a fishery scientist, Takayama Itaro, to study the commercial conditions and local fish markets in colonial Malaya.⁴⁰ At the end of his investigation, Takayama produced a detailed report, suggesting Malayan seas were not only rich grounds for Japanese expansion, but also that fishing licenses were simple to secure. For Takayama, the *Nan'yo* represented an opportunity for migrants from Japan's rural villages to contribute to the country's development through remittances.⁴¹

³⁹ Ta-Yuan Chen, "Taiwanese Offshore (Distant Water) Fisheries in Southeast Asia, 1936-1977" (Phd diss., Murdoch University, 2007), 11.

⁴⁰ See correspondence between Colonial Office and Foreign Office, dated 18 September 1924, in FO 371/10299; Goto Kenichi, *Kindai Nihon to Tonan Ajia* (Tokyo: Iwanami Shoten, 2001), 48; Eric Robertson, *The Japanese File: Pre-war Japanese Penetration in Southeast Asia* (Singapore: Heinemann Asia, 1979), 49.

⁴¹ Itaro Takayama, *Nanyo no Suisan* (Tokyo: Dainihon Suisankai, 1914), 306. Cited in Shimizu Hiroshi, "The Japanese Fisheries Based in Singapore, 1892-1945," *Journal of Southeast Asian Studies* 28,2 (September 1997): 326.



Malay Peninsula with Singapore in the bottom right corner, 1898.⁴²

⁴² GE C-2635, Departement Cartes et Plans, Bibliotheque Nationale de France (BNF).

Following up on Takayama's findings, the government of Kagawa Prefecture organized a fishery expedition to the ocean around Singapore, Natuna, Riau, Malacca, and Penang in 1914.⁴³ In charge of this two-year survey were Tora Eifuku and Ishii Teiji, recent graduates of the Fisheries Training College in Tokyo.⁴⁴ Working with Eifuku and Ishii were two fishermen, Yoshino Nobuyoshi and Someya Hamashichi. Not unlike Takayama's investigations a few years earlier, their objectives were to assess the fishery possibilities of this corner of the *Nan'yo* and index the nature of local fish markets.⁴⁵ The exploratory survey had five fishing boats and twenty men to work Malaya's shallow waters, using a variety of nets to determine which were best given the conditions and currents.⁴⁶ The expedition revealed that driftnets and lines were suitable methods for Japanese fishermen looking to exploit these seas and that there was a considerable demand for fresh fish.

While Ishii returned to Japan at the end of the two-year experiment, Eifuku remained in Singapore. This decision would have lasting implications for the growth of Japanese reef fishing in interwar Southeast Asia and the region's unprecedented protein boom. With loans from relatives and a local Indian Chettiar, Eifuku established the *Taisei Kongsu* in 1917.⁴⁷ Employing fishers from Kagawa Prefecture, the *Taisei Kongsu* used driftnets in the waters around Singapore and Riau as well as

⁴³ Eric Robertson, *The Japanese File: Pre-war Japanese Penetration in Southeast Asia* (Singapore: Heinemann Asia, 1979), 49.

⁴⁴ Shimizu Hiroshi and Hirakawa Hitoshi, *Japan and Singapore in the World Economy: Japan's Economic Advance into Singapore, 1870-1945* (New York: Routledge, 1999), 97.

⁴⁵ Hiroshi and Hitoshi, *Japan and Singapore*, 97.

⁴⁶ Hiroshi, "the Japanese Fisheries," 327.

⁴⁷ Hiroshi and Hitoshi, *Japan and Singapore*, 97.

up the Malacca Straits. Eifuku and his Japanese crew fished for Spanish mackerel (*Scombridae*, tenggiri), shad (*Clupeidae*, terubok), pomfret (*Bramidae*, bawal puteh), and dorab (*Chirocentridae*, parang).⁴⁸

Competing with Eifuku were two Japanese fishers who came from Nagasaki and arrived in Singapore in 1917. Nakamura Itaro and Ishizu Tojiro both set up driftnet operations, fishing for the same types of bottom fish as Eifuku. They employed fifteen Japanese fishers who worked the Malacca Straits and the rich fishing grounds around Natuna and Riau in the Netherlands Indies.

However, in 1918, Nakamura made a revolutionary change to his operations that would reshape the scale of protein production in interwar Southeast Asia. He recruited ten Okinawan fishers who introduced the *muro ami* method in the *Nan'yo*.⁴⁹ Initially, Nakamura's crew fished reefs around eastern Sumatra, near Medan, but soon after their operations expanded to coral complexes near Singapore. In 1920, with capital from his *muro ami* business, Nakamura organized the *Nanmei Kongsi*. And Ishizu having ventured out on his own that same year established the *Ishizu Kongsi* in January 1921. Both began to practice *muro ami* fishing, thereby bringing new food fish such as *ikan delah* and *ikan kuning* to Singapore's markets.⁵⁰

⁴⁸ Hiroshi, "The Japanese Fisheries," 325.

⁴⁹ Aichi-ken Suisan Shikenjo, *Nanyo Gyogyo Chosa Hokoku* (Gamagori: Aichi-ken Suisan Shikenjo, 1932), 32. Cited in Hiroshi, "The Japanese Fisheries," 327.

⁵⁰ Tokiorapport No. 272/36, "Onderzoek naar de gedragingen van buitenlandse visschers," dated 26 September 1936, Geh.40, "Japanasche Visscherij in de Nanyo," Nederlandse Gezantschap in Japan (Tokio), 1923-1941, Inv. Nr. 196, NA. This correspondence is from the Resident der Westerafdeeling van Borneo.

Despite the competition posed by Nakamura and Ishizu, Eifuku was recognized as the head of Singapore's Japanese fishing community in 1920.⁵¹ That same year, Eifuku's Taisei Kongsu received financial backing from the Japanese Ministry of Agriculture and Commerce and he was able to scale up his operations.⁵² In fact, from 1919 to 1923, the Japanese government had provided the Taisei Kongsu with an annual subsidy of ¥10,000 to cover expenses related to fisheries research.⁵³ In effect, the Ministry was using science as a way to ensure the success of Japanese fishing in colonial Singapore. Despite Tokyo's lifeline, Eifuku struggled to compete against other fishing kongsus and had to resign from the Taisei Kongsu in 1922. The underlying problem for Eifuku was that he depended solely on driftnets and long lines in supplying Singapore's markets with species such as tenggiri, terubok, and parang. He was working the demersal zone, or that area of the sea near the ocean's muddy or sandy bottom, which was a costly endeavor, while other Japanese *kongsus* were using Okinawan fishers and their *muro ami* method to fish the unexploited reefs in and around Singapore. In doing so, these *muro ami* fishers were bringing to shore an abundance of new food fish that sold for cheap and quickly became preferred by local consumers.⁵⁴

Just as the year 1922 marked the end of Eifuku's relationship with his failing *kongsu*, it also signaled a turn toward new possibilities as he bought Nakamura's Nanmei Kongsu and changed its name to Taichong Kongsu. Then, Eifuku evolved his

⁵¹ "Profiteering—Present and Future Fish Supply," *Straits Times* (30 November 1920): 10.

⁵² Kee Yeh Siew, "The Japanese in Malaya before 1942," *Journal of the South Seas Society* 20 (1965): 58.

⁵³ Hiroshi, "The Japanese Fisheries," 397.

⁵⁴ "Diving Fishermen," *Straits Times* (22 June 1927): 11.

fishing operations beyond driftnets and demersal fish to include the commercially productive, but environmentally destructive practice of *muro ami* fishing. Eifuku also began to recruit, employ, and manage a fleet of young men from the southern town of Itoman, home of the *muro ami* method.⁵⁵ By 1926, Eifuku not only owned the largest fishing *kongsi* in the Straits Settlements, with fishing operations spanning the Southeast Asian shelf, but he also had offices in Penang, Batavia, and Singapore.⁵⁶

From Japanese Fishing to Okinawan Fishers

The rise of Eifuku's Taichong Kongsi was the result of these Okinawan migrants and their *muro ami* method. Johaan Reuter, a fishery scientist working out of Batavia in the 1930s, gathered some telling information about these Itoman fishers from Noboru Ogura and Ike Seiko, both Okinawans who worked in the Netherlands Indies. Ogura was the local operator of Eifuku's Taichong Kongsi and Seiko was connected to the Oshiro Kongsi.⁵⁷ According to Noboru and Seiko, these *muro ami* fishers expanded across the Indo-Pacific because they had exhausted their

⁵⁵ Takada Fujio calculates that nearly 80 percent of the fishers employed by Eifuku and Ishizu and their respective kongsis were from Itoman. See Takada Fujio, "Shingaporu no Itomanjin: Tokuei Maru jiken wo chushin ni," *Okinawa Bunka* (1989): 601-602. Cited in Hiroshi, "Theories of Migration," 34.

⁵⁶ For Eifuku's work in the Netherlands Indies, see "De Japansche Visscherij," *Bataviaasch Nieuwsblad* (25 November 1925): 1; "Het Visscherijbedrijf te Soerabaia," *De Sumatra Post* (9 September 1926): 5; "De 'Fuku Maru,'" *Het Nieuws Van Den Dag Voor Nederlandsch-Indie* (7 January 1938): 2; and, "The Malayan Bulletin of Political Intelligence," dated June 1925, enclosed in CO 537/933/4. For his operations in the Gulf of Martaban, Burma, see "Mystery Move By Japanese Fishing Craft Suddenly Leave Singapore," *Straits Times* (11 December 1938): 1. In 1936, Eifuku applied for a license to fish in the Mergui Archipelago, but, according to John Butcher, he had already been operating there for several years. Butcher cites: "Fishery by Japanese in the Mergui Archipelago", series 1/7, accession no. 1266, 1936-37, file no. IV-8, National Archives of Myanmar. On his offices in Penang, Batavia, and Singapore, see "De Japansche Visscherij," *De Sumatra Post* (1 December 1925): 5.

⁵⁷ On Ogura and the Taichong Kongsi, see *Bataviaasch Nieuwsblad* (11 November 1937): 2, and on Seiko (Ike) and the Oshiro Kongsi, see *Bataviaasch Nieuwsblad* (23 February 1938).

local fishing grounds and damaged their coral reefs. In pursuit of fish, these *muro ami* fishers moved outside of Okinawa into the coral-rich waters of Indochina, Siam, the Philippines, the Straits Settlements, Netherlands Indies, British Borneo, Sarawak, Portuguese Timor, Somaliland, Mexico and Hawaii.⁵⁸ Reuter referred to this movement outward as an “exodus” (*uittocht*).

This exodus of Okinawan fishers played a significant role powering the protein boom in interwar Southeast Asia. For the Straits Settlements, a dispatch from the British consulate in Nagasaki to the British Embassy in Tokyo reported an increase in the number of Japanese who had received visas to reside in the colony during the year 1924-1925. M. Paske Smith, the consular official in Nagasaki, noted in his communiqué that these fishers were mostly coming from Okinawa and that they were going to work in the fishing industry. Based on the issuance of visas from the Consulate in Nagasaki, the number was 200 for 1924 and 269 for January through July in 1925.⁵⁹ The Okinawan population in Singapore increased to 1,015 between 1926 and 1930.⁶⁰ The growth was attributed to the success of *muro ami* fishing.⁶¹ By 1938, these Okinawan fishers represented the vast majority of the

⁵⁸ J. Reuter, “Een Nieuwe Inheemsche Visscherij,” *Koloniale Studien* (1940): 200.

⁵⁹ Nagasaki Despatch No. 34, “Number of visas granted to Japanese emigrants to the Straits Settlements and Malay States,” 7 August 1925, NAM, Sel. Sec. 4073/1925.

⁶⁰ Asato Nobu, *Okinawa Kaiyo Hattenshi: Nippon Nanyo Hattenshi Josetsu* (Naha: Okinawa Kaigi Kyokai, 1941), appendix 1. Cited in Hiroshi, “Theories of Migration,” 31.

⁶¹ “Annual Report on the Colony of the Straits Settlements for the Year 1927,” enclosed in CO 273/552/17.

approximately 1,500 Japanese fishers in Singapore. Collectively, they accounted for more than half of the Japanese community in the colonial port city.⁶²

“Death by Misadventure”: The Dangers of Muro Ami Fishing

Unlike *utase* fishing in Manila Bay or the use of driftnets in the waters around Singapore, which both depended on little labor, the *muro ami* method was built on human power and physical endurance. This fishing method required large crews of swimming fishers (*zwemmende visschers*).⁶³ It was an operation that involved at least 40 or 50 “goggled swimmers.”⁶⁴ These workers would surround an offshore reef, swimming up and down in deep water, at times measuring fifteen fathoms, with each fisher dropping a heavy weight (such as a sack of rocks or coral) tied to a white streamer, on the reef.⁶⁵ The aim was to frighten the fish by violently stampeding across the reef, driving the *Caesio* and other species into an expansive net waiting at the opposite end. This net enclosed the reef, resembling a kind of floating receptacle that trapped the fish driven in by the goggled swimmers.⁶⁶ In total, there might be eight or nine boats as part of one *muro ami* operation, mostly for transporting crew and fish. The boats would be equipped with cold storage for keeping the catch fresh and conveying them to the markets of Singapore, Batavia,

⁶² “Japanese Fishermen May Not Get Renewals of Licenses,” *The Singapore Free Press and Mercantile Advertiser* (9 September 1938): 3.

⁶³ *Bataviaasch Nieuwsblad* (6 July 1929) and “De Wonderbare Vischvangst,” *Het Nieuws Van Den Dag Voor Nederlandsch-Indie* (28 October 1925): 9.

⁶⁴ “Diving Fishermen,” *Straits Times* (22 June 1927): 11.

⁶⁵ Singapore Subordinate Courts, “Coroner’s Certificate B, Coroner’s Inquests and Inquiries,” AD-049, July-September 1937, National Archives of Singapore (NAS). The case of Chukusei Urasaki, July 3, 1937.

⁶⁶ “Diving Fishermen,” *Straits Times* (22 June 1927): 11.

and Manila.⁶⁷ Martin and Montalban, Filipino scientists who worked in Manila in the 1920s and 1930s, described how the *muro ami* fishing operated out of Iloilo, Culion, Cebu, Mindoro, and Batangas also used “water telescopes” for locating fish and surveying reef conditions.⁶⁸

Because these goggled swimmers labored in deep waters, for long hours, and in the nude, according to some accounts, their lives were constantly exposed to danger. A review of the coroner’s court records at the National Archives of Singapore reveals a number of fishing-related fatalities from shark attacks to sea snake bites and drowning.⁶⁹ The coroner officially classified these occupational hazards as “death by misadventure.”⁷⁰ In determining the nature of each case, the coroner would take testimonies from available witnesses as well as interview the marine police involved. While these witness testimonials account for the loss of life, they also provide a window into the inner worlds of the *muro ami* fishing community in Singapore.

⁶⁷ On the role of cold storage in Japanese *muro ami* operations, see Agenda no. 1168, Bydrage voor het Tokiorapport No. 66/29, 4 September 1929, “Drang van onze Visscherij naar De Nanyo,” dated 4 September 1929, Geh.40, “Japanasche Visscherij in de Nanyo,” Nederlandse Gezantschap in Japan (Tokio), 1923-1941, Inv. Nr. 196, NA.

⁶⁸ Montalban and Martin, “Two Japanese Fishing Methods,” 465. See also Agustin F. Umali and Herbert E. Warfel, *Reef Fishing in the Philippines* (Manila: Fish and Wildlife Service, 1949), 27.

⁶⁹ Singapore Subordinate Courts, “Coroner’s Inquests and Inquiries,” AD-006-AD-060, 1904-1939, NAS.

⁷⁰ The coroner F.G. Bourne declared the case of Komesuke Konashiro, a 26 year-old *muro ami* fisher who was working the reefs off the coast of Trengganu before he disappeared underwater, “death by misadventure.” Singapore Subordinate Courts, “Coroner’s Inquests and Inquiries,” AD-013, July-September 1927 and April-June 1928, NAS. The case of Komesuke Konashiro, April 10, 1928.

On September 6, 1935, Anzen Ikehara, a young fisherman employed on the *Taifuku Maru*, had died while *muro ami* fishing in Dutch waters.⁷¹ A shark had bitten him. The coroner, William George Porter, made a point of noting in his report that A. Ikehara was “very well nourished.” Hisamatsu Arakake, an older fisherman also employed on the *Taifuku Maru*, described the incident to the coroner. At around 5:00pm on September 6, 1935, they were fishing off the island of Tokong Kembang in Dutch waters. A. Ikehara was in charge of the net, Arakake was tasked with the sampan, and the others were “swimming about driving the fish into the net.” Arakake explains to the coroner, “I suddenly heard Ikehara scream out; I went near in the sampan and saw that a shark was biting his legs.” After scaring off the shark and throwing a rope to A. Ikehara, Arakake pulled him into the sampan and saw that he was alive, but unable to speak. His body was taken back to Singapore. The court’s Japanese language interpreter, K. Kiri, recorded Arakake’s testimony for the coroner.

The witness account of Yesuzo Ikehara, captain of the *Taifuku Maru*, provides additional details about A. Ikehara and the nature of fishing operation. First, Eifuku and his Taichong Kongsu employed the crew of the *Taifuku Maru*. Moreover, they were five miles from the island of Tokong Kembang, but still in Dutch territory. And there were almost fifty *muro ami* fishers in the water at the time of the shark attack. Y. Ikehara recalled, “from the fishing boat I saw a commotion among the swimmers; I realized that one had been attacked.” A. Ikehara was pulled into a sampan and once

⁷¹ Singapore Subordinate Courts, “Coroner’s Inquests and Inquiries,” AD-041, July-September 1935, NAS. The case of Anzen Ikehara, September 8, 1935.

the sampan got the *Taifuku Maru*, the body was put on ice. Y. Ikehara followed the body to the Marine Police Station and then the hospital. Y. Ikehara turned over a passport of the deceased that indicated that the latter was only 19 years old. His permanent residence was given as Okinawa-ken, and he was the first son of Yasutaro.⁷²

In Singapore, where most of the fishing *kongsis* were based, the growing demand for *ikan delah*, *ikan kuning*, and other types of *Caesio* pushed these “goggled swimmers” to work for hours in the water and under dangerous conditions. In the coroner’s reports, one finds frequent attention given to the individual’s skilled capacity as a swimmer and his good health. In the case of Seishin Tamashiro, aged 24, who died while *muro ami* fishing in the Riau Straits, “he was a fisherman since he was 15; he was very healthy.” Tamashiro’s cousin, Sojiro Tamashiro, aged 25, was part of the crew fishing in Dutch waters; he explained to the coroner, “He dived in pursuit of fish and did not come to the surface...there was no question that he had become entangled in the net.”⁷³ Similarly, in recounting the death of Chukusei Urasaki, who drowned while *muro ami* fishing near Pulau Tioman in Dutch waters, the captain of the crew Tanjo Toguchi noted “he was a good swimmer” and that he had been “in the water about six hours.”⁷⁴ Toguchi explained, “when fishing the men who chase the fish into the net must do a lot of diving under the water; they have no

⁷² Singapore Subordinate Courts, “Coroner’s Inquests and Inquiries,” AD-041, July-September 1935, NAS. The case of Anzen Ikehara, September 8, 1935.

⁷³ Singapore Subordinate Courts, “Coroner’s Certificate B, Coroner’s Inquests and Inquiries,” AD-049, July-September 1937, NAS. The case of Seishin Tamashiro, September 19, 1937.

⁷⁴ Singapore Subordinate Courts, “Coroner’s Certificate B, Coroner’s Inquests and Inquiries,” AD-049, July-September 1937, NAS. The case of Chukusei Urasaki, July 3, 1937.

equipment except diving glasses; the boat belongs to the Oshiro Kongsu.”⁷⁵ A fellow *muro ami* fisher, Mathu Kanashiro, added, “The sea was about fifteen fathoms deep...we had to chase the fish by diving and coming to the surface...I have known Urasaki since February 1937 and have worked with him on different ships...he was very healthy; a good swimmer; I think he remained in the water too long and was exhausted.”⁷⁶ Despite the risks of *muro ami* fishing, the drive for protein and profit kept these Okinawan fishers out at sea and kept alive the notion that they were uniquely skilled for this type of work.⁷⁷ As one contemporary account put it, “The Japanese fisherman, his hair bleached a deep red by constant exposure to sun and water, is a hardy type and in Eastern waters he has often ventured where others have halted.”⁷⁸

Muro Ami Fishing and the Protein Boom

While *muro ami* fishing was dangerous, it was nonetheless highly effective at catching reef fish and fueling the protein boom in interwar Southeast Asia. In 1928, Japanese fishing *kongsu* were supplying about 30 tons of *ikan delah* a month to Singapore’s markets.⁷⁹ These fish came from offshore reefs, located in the Gulf of Siam, along the Trengganu and Pahang coasts, near the chokepoints of the Anambas and Natuna Islands, in the waters around Riau, and up the Malacca Straits into the

⁷⁵ Singapore Subordinate Courts, “Coroner’s Certificate B, Coroner’s Inquests and Inquiries,” AD-049, July-September 1937, NAS. The case of Chukusei Urasaki, July 3, 1937.

⁷⁶ Singapore Subordinate Courts, “Coroner’s Certificate B, Coroner’s Inquests and Inquiries,” AD-049, July-September 1937, NAS. The case of Chukusei Urasaki, July 3, 1937.

⁷⁷ “Local Japanese Fishermen,” *Straits Times* (16 May 1929): 2.

⁷⁸ “Harbour Log,” *Straits Times* (26 July 1935): 18.

⁷⁹ “Singapore’s Fish Supply,” *Straits Times* (14 May 1928): 3.

Mergui Archipelago.⁸⁰ A few years later, these same *kongsis* were landing nearly half of Singapore's annual fresh fish supply or about 4,500 tons.⁸¹ By 1936, Eifuku's *muro ami* fleets, and others like his, were making "1,000-mile journeys searching for fish" from the Bay of Bengal to the China Sea.⁸² Between August 1936 and July 1937, Eifuku's Taichong Kongsis alone supplied 2,858 tons of fresh *ikan delah* to Singapore's markets.⁸³

In the 1930s, *muro ami* fishers also dominated the supply of fresh fish in the Philippines. Writing on this *muro ami* revolution and its boom in protein, Albert Herre, who had served as Philippine Director of Fisheries from 1919 to 1928, observed:

[These] new comers used motor launches, able to go out in all kinds of weather except an actual typhoon, and fished by what they called the "muro ami" method. They worked the reefs, bringing in large quantities of excellent food fish not obtained by the ordinary Malay methods. Several kinds of *Caesios*, and of surgeon fishes and *siganids* were those most commonly taken, a single haul often giving one or two tons of *Caesios*. The fish were packed at once in crushed ice and as soon as the storage chamber was filled the boat left for market. In this way cargoes were delivered in excellent condition at distances from 30 miles to over 500 miles in the Philippines...And at the same time that this method was expanding in the Philippines it was rapidly being introduced at Singapore, Batavia, and all important centers of population throughout the Dutch East Indies. In a few years more there were crews of Japanese *muro ami* fishermen at every maritime provincial capital and many other large towns throughout the Philippines and Dutch East Indies. Because they supplied large quantities of

⁸⁰ Secret No. 30, "The Malayan Bulletin of Political Intelligence," dated June 1925, enclosed in CO 537/933/5. See also Correspondence between the Residency of Riau to the Governor-General of the Netherlands Indies. Agenda No. 24, Bydrage voor het Tokiorapport No. 75/1931, "Japansche visschers," dated November 19, 1931, Geheim 40, "Japanasche Visscherij in de Nanyo," Nederlandse Gezantschap in Japan (Tokio), 1923-1941, Inv. Nr. 196, NA.

⁸¹ "Malaya Cannot Supply Her Own Requirements Of Fish," *Singapore Free Press and Mercantile Advertiser* (30 August 1934): 4.

⁸² "Elaborate Freezing Plant," *Straits Times* (8 August 1937): 28.

⁸³ "Elaborate Freezing Plant," *Straits Times* (8 August 1937): 28.

desirable fish, they soon occupied a dominant position in the Singapore and Batavia markets, and a very important position in the Philippines.⁸⁴

As this protein boom ensured greater food security for people in the city and the frontier, it also changed local food culture. For example, the peddlers, pullers, and prostitutes who worked Singapore's streets often secured their daily protein in the form of fish balls or "hoo wan."⁸⁵ The urban poor would purchase this basic necessity from any one of Singapore's many hawkers. But with the advent of *muro ami* fishing and the flood of reef fish into local markets, *ikan delah* quickly displaced parang (dorab, *Chirocentridae*) and tenggiri (Spanish mackerel, *Scombridae*) as the preferred choice for making fish balls. For the "itinerant food-hawker of Singapore," *ikan delah* were cheaper, tastier, and more abundant.⁸⁶

Beyond fish balls, reef fish revolutionized Singapore's food culture because they were fresh. One critical axiom in interwar Southeast Asia was that "all the icing in the world will not restore a stale fish to its freshness."⁸⁷ Given that such protein was often caught many miles from shore, the Japanese *kongsis* adapted new technologies to their *muro ami* operations, thereby securing their local dominance. Specifically, the use of cold storage and diesel engines was central to ensuring that large landings were made and that these catches were fresh upon delivery to

⁸⁴ Albert W. Herre, "Miscellaneous Notes," Box Folder: 2, Series: Notes III, Dates: 1929-1948, Albert W. Herre Papers, Western Washington University, Western Libraries Heritage Resources.

⁸⁵ "Malayan Fisheries," *Singapore Free Press and Mercantile Advertiser* (6 July 1927): 11.

⁸⁶ "Malayan Fisheries," *Singapore Free Press and Mercantile Advertiser* (6 July 1927): 11. See also "Tropical Recipes," *Malayan Saturday Post* (21 January 1933): 27 and "Leaves From A Malayan Note Book," *Straits Times* (30 May 1935): 18.

⁸⁷ "Malaya's Important Fish Supplies," *Singapore Free Press and Mercantile Advertiser* (29 July 1931): 12.

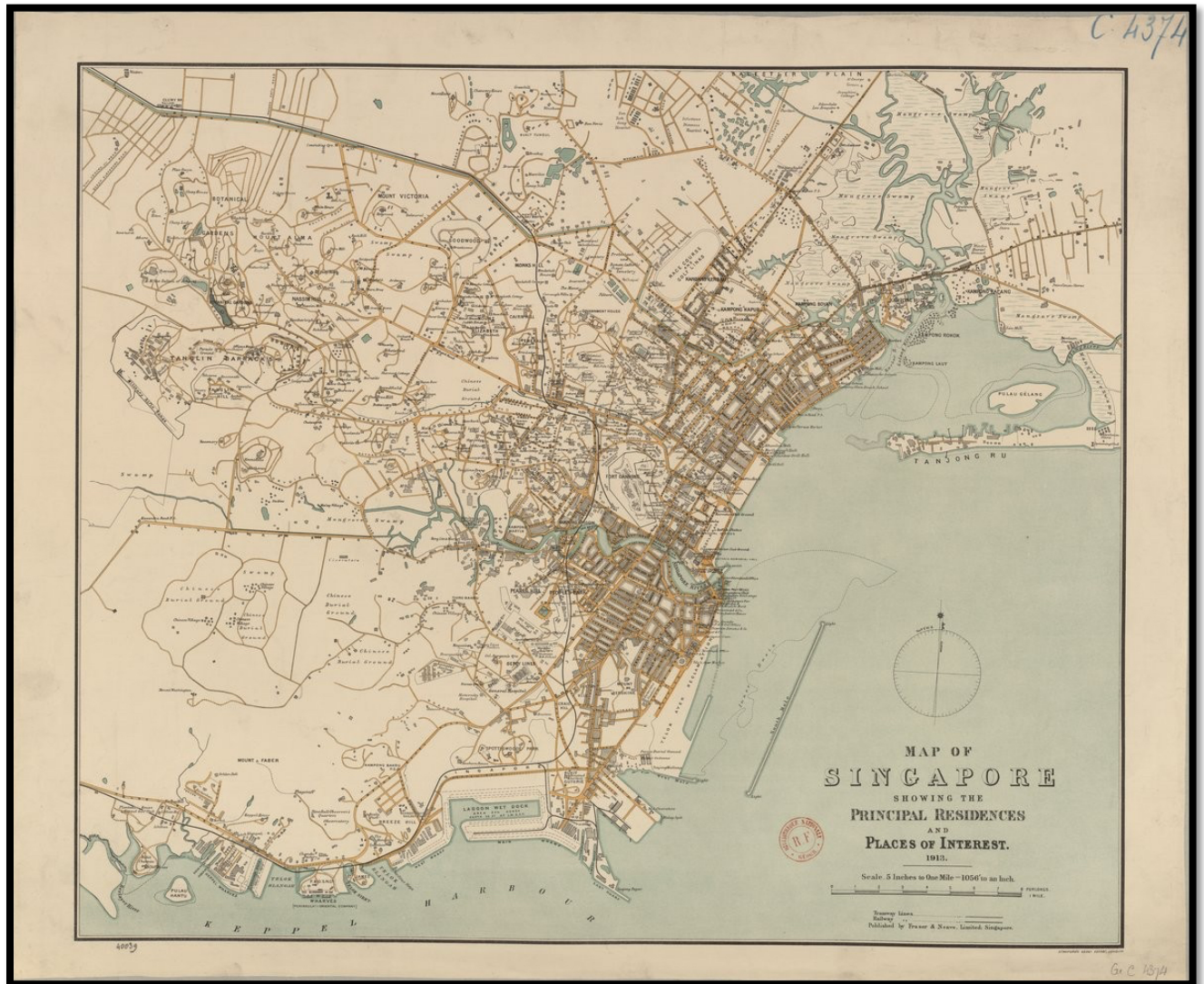
Singapore's fish markets. By 1931, the abundance of fresh fish was so natural and common that William Birtwistle (1890-1953), Director of Fisheries in colonial Malaya, reported, "Fish furnishes the bulk of the 'meat' in the daily ration of the Asiatics."⁸⁸ Provisionment mattered, as Daniel Doepfers has recently shown with regards to feeding Manila, and freshness and consistency were signs of a modern provisionment system.⁸⁹ In this way, the sustained arrival of fresh fish marked a critical moment in the region's modernity. It signaled a time of transition in interwar Southeast Asia when "stale fish...[and] salt fish, too, belong[ed] to the past" and fresh fish belonged to the future.⁹⁰

In the years just before the war, the king of fresh was Eifuku. Not only did he run the largest fishing *kongsi* with offices in Batavia, Singapore, and Penang, and have his *muro ami* crews operate in waters from the Gulf of Siam to the Bay of Bengal. Eifuku also had established an ice-making factory at Tanjong Ru in the central part of the colonial city.

⁸⁸ "Malaya's Important Fish Supplies," *Singapore Free Press and Mercantile Advertiser* (29 July 1931): 12.

⁸⁹ On markers of the modern, see Nicholas B. Dirks, "History as a Sign of the Modern," *Public Culture* 2,2 (Spring 1990): 25-32. See also Susanne Freidberg, *Fresh: A Perishable History* (Cambridge: Belknap Press, 2010), 235-276.

⁹⁰ "Malaya's Important Fish Supplies," *Singapore Free Press and Mercantile Advertiser* (29 July 1931): 12.



Map of Singapore with Tanjung Ru in the top right, jetting into the sea, 1913.⁹¹

He named his ice business Taihock Kongsu.⁹² The development of this modern plant along the waterfront of Singapore allowed him to pack his motorboats with crushed ice.⁹³ Hendricus C. Delsman (1886-1969), a fishery scientist at the Laboratory for the Investigation of the Sea in Batavia, observed in the 1930s that

⁹¹ GE C-4374, BNF.

⁹² Robertson, *The Japanese File*, 56.

⁹³ "Elaborate Freezing Plant," *Straits Times* (8 August 1937): 28.

Japanese fishers often brought their fish to local markets on ice. He explained the use of ice was “necessary not only because of the quantities caught by their methods but also because these fishers often stay away from the shore for more than a week and go considerable distances to find rich grounds.”⁹⁴ Similarly, Albert Herre, the Director of Fisheries in Manila, shared with an audience at the Pacific Science Congress in Batavia in 1929:

At the present time the cities of Batavia, Singapore, and Manila would each have a serious shortage of fresh fish were it not for the...Japanese fishermen using the Muro Ami method...From Singapore they go as far as the Gulf of Saigon and the west coast of British Borneo. From Java they go to the coasts of Sumatra and Dutch Borneo and the islands of the South China Sea. From Manila they go to Palawan, the Central Visayas, and the Sulu Sea. From the above it is readily seen that some of these fishermen travel not less than 600 kilometres from their base of operations or market to their fishing grounds. Of course it is necessary to use ice to bring fresh fish such great distances.⁹⁵

For Eifuku, controlling the production of ice was a key aspect to the workings of his protein empire. As head of the Japanese fishing community in interwar Singapore, he used his position to meet the growing ice needs of other Japanese fishing *kongsis*. As both Delsman and Herre noted, the further afield these *muro ami* crews searched for reef fish, the more ice they needed to keep their catches fresh for the long haul back to port. In fact, one of Eifuku’s motorboats had a cold storage capacity of 30 tons of ice.⁹⁶ The combination of engines and ice were integral to the expansion of *muro ami* fishing in the interwar years, and Eifuku’s place and the

⁹⁴ H.C. Delsman, “Fishing and Fish-culture in the Netherlands Indies,” *Bulletin of the Colonial Institute of Amsterdam* 2,2 (February 1939): 103.

⁹⁵ Herre, “The Scientific and Commercial Development,” 28-29. This congress was held in Batavia and Bandoeng in 1929.

⁹⁶ “Elaborate Freezing Plant,” *Straits Times* (8 August 1937): 28.

place of other *kongsis* in dominating the supply of fresh fish to the local markets of Singapore, Batavia, and Manila.⁹⁷ By 1937, the routine was efficient and the provisionment system was set: “The Japanese come up from Singapore in power boats carrying ice tanks and the fish is taken back to Singapore in cold storage and sold in the fresh fish market.”⁹⁸ Commenting on the effectiveness of Eifuku’s Taichong Kongsu, one local newspaper ran the headline: “A Malayan Industry Worth Millions.”⁹⁹

The End of an Era, the End of a Run

Throughout the 1920s and 1930s, it was common knowledge that *muro ami* crews operated in waters stretching from the quiet corners of the South China Sea to the distant shoals of the Bay of Bengal. These vast fishing operations, led by Eifuku’s Taichong Kongsu, played a crucial role in the interwar provisionment of Singapore, Batavia, and Manila and the region’s commodity frontiers. While Japanese fishers supplied the markets with fresh fish, they were not the ones who sold it to the public. Fishmongers were often local-born Chinese. They controlled the stalls, the prices, and the distribution of this basic yet essential source of protein. It was a system that evolved in the pre-war years and one that firmly connected sea to land with minimal disruption.

In late 1937, however, this system, which was built on provisioning protein, was adversely affected by events outside Southeast Asia. In response to the Second

⁹⁷ “The Fisheries of Kedah,” *Singapore Free Press and Mercantile Advertiser* (26 February 1927): 8.

⁹⁸ “Fishing Industry of Trengganu,” *Straits Times* (11 September 1936): 5.

⁹⁹ “A Malayan Industry Worth Millions,” *Straits Times* (8 August 1937): 28.

Sino-Japanese War and the violence at Nanking, Chinese fishmongers began to boycott Japanese-caught fish. The implications of this boycott in Singapore coupled with colonial fears concerning Japanese espionage in the region marked the rapid decline of Japanese fishing in interwar Southeast Asia and the protein boom it fueled.

Global developments and local conditions had conspired to shape a new, reigning attitude towards Eifuku, his *kongsi*, and the whole Japanese fishing community. In particular, the growing anxiety over Japanese espionage and the rising problem of out of work or underemployed Southeast Asian fishers led to stricter fisheries laws. In May 1938, the British Consul-General communicated an amendment to the Netherlands Indies' ordinance on the "Territorial Sea and Naval Area." The added regulation imposed stricter controls regarding the registration of foreign fishing vessels.¹⁰⁰ Built on Dutch ordinances between 1927 and 1935 that limited those allowed to fish in the Indies, this policy effectively reduced the work of Japanese fishers in the colony's territorial waters.¹⁰¹

Not unlike today, violators of this fisheries ordinance were fired upon by Dutch patrol boats.¹⁰² For example, on September 30, 1937, a Dutch surveillance airplane had alerted the colonial navy to a suspicious fishing boat in the waters

¹⁰⁰ Enclosure in Batavia despatch no. 147, dated 24 May 1938, in CO 273/645/4.

¹⁰¹ Butcher, *The Closing of the Frontier*, 166.

¹⁰² "De 'Flores' te Priok," *Indische Courant* (26 October 1937): 1; "Incident in Riouw-Archipel," *Indische Courant* (2 October 1937): 1; "De 'Flores' beshiet Japans vissersvaartuig," *Volksdagblad* (2 October 1937): 1; "Japansche Visschers in Het Riouwsche," *Sumatra Post* (6 October 1937): 1. For contemporary accounts of Indonesian authorities blowing illegal fishing boats, see "Praperadilan Kapal Pencuri Ikan Ditolak, Susi Serius Perangi 'Illegal Fishing'," *Kompas* (7 October 2015); "Akhir Tahun, Susi Akan Tenggelamkan 40 Kapal Pelaku 'Illegal Fishing'," *Kompas* (15 December 2015); and "Cerita Dari Laut," *Tempo* 38,44 (22 November 2015).

around Riau, just south of Singapore. The navy dispatched the *Flores*, a refitted patrol steamer to inspect the fishing boat. Upon arriving at the scene, the *Flores* observed not just one fishing vessel; it was a mothership with a fleet of about 30 sampans (small boats). This was a *muro ami* operation. The main fishing boat was the *Tokei Maru*. As the *Flores* got closer to inspect for permits, the *Tokei Maru* tried to escape and shots were fired. After attempts to stop the *Tokei Maru* were made, but to no avail, additional shots were fired. A third round of shots finally stopped the Japanese motorboat, allowing Dutch authorities to go on board. Two *muro ami* fishers were dead and two others were wounded. The whole operation was seized, and towed to Tanjong Pinang on Riau Island in the Netherlands Indies. The injured were apparently treated and cared for by the crew of the *Flores*.¹⁰³

Similar to the Dutch, Singapore's fisheries department also began to restrict Japanese fishing in the late 1930s. This was largely accomplished by radically curtailing the number of fishing licenses the department issued to Japanese *kongsis* such as Eifuku's.¹⁰⁴ *Kongsis* were unable to secure permits so many collapsed, with a number of *muro ami* fishers taking to work on Japanese-owned plantations and mines such as the Nippon Mining Company in Trengganu.¹⁰⁵ The public rationale for

¹⁰³ On the work of the *Flores*, see Agenda No. 1157, Bijdrage voor het Tokiorapport No. 45/31, "Japansche Visschers," dated August 15, 1931, Geheim 40, "Japanasche Visscherij in de Nanyo," Nederlandse Gezantschap in Japan (Tokio), 1923-1941, Inv. Nr. 196, Department der Marine, NA; Agenda No. 977, Bijdrage voor het Tokiorapport No. 187/36, "Optreden van de bemanning van de Japansche visschersboot 'Kaiun Maru' tegenover Philippijnsche politiebeambten," dated July 20, 1936, Geheim 40, "Japanasche Visscherij in de Nanyo," Nederlandse Gezantschap in Japan (Tokio), 1923-1941, Inv. Nr. 197, Dienst der Oost-Aziatische Zaken, NA; and, "Gewonde Japansche visschers hersteld," *Telegraaf* (23 February 1938): 10.

¹⁰⁴ "Fishing Licenses for Japanese," in CO 273/656/8 and "Japanese Fishermen Lose Their Licences In Malayan Waters," *Straits Times* (20 August 1939): 3.

¹⁰⁵ "Singapore Fish Market," *Straits Times* (2 April 1939): 7. See also Siew, "The Japanese in Malaya," 56-61.

this new fisheries policy was the conservation of local fishing grounds for Malay and local-born Chinese fishers, but private correspondence spoke of an imminent Japanese threat.¹⁰⁶ These tighter fisheries laws were aimed at thwarting what had been forming since 1922: an operational arc of Japanese fishing fleets constituting “a continuous line of communication from Nagasaki, via the Lu Chiu Islands, Formosa, Aberdeen (Hong Kong), the Paracels, Anamha Islands, Singapore, to Sabang and the Indian Ocean.”¹⁰⁷

The Indies government suspected the development of a similar arc of communication. The Dutch believed that the *Nippon Enyo Katsuo Maguro* was not only provisioning critical sources of protein to Japan and its growing cities, but also serving the hydrographic and oceanographic needs of the Japanese Navy. *Nippon Enyo* had opened fishing stations across the Netherlands Indies at Sabang, Ambon, Batavia, Surabaya, Menado, and Manokwari; and at these stations, this *kongsi* operated a tuna fishing fleet and hosted visiting Japanese fish experts and scientists.¹⁰⁸

By 1941, the interplay between colonial policies, global politics, and local boycotts had a disastrous effect on Japanese fishing in the *Nan'yo*. From the 30 Japanese *kongsis* that were registered in Singapore in 1938, there were only three left on the eve of the war. Eifuku's *kongsi* was still around as were two others: the

¹⁰⁶ See the correspondence from H. Fitzmaurice, British Consul General in Batavia, dated December 21, 1936, No. 153 Confidential, “Memorandum on the Political Situation in the Netherlands East Indies in 1936,” enclosed in CO 275/625. “Japanese Espionage in the Netherlands Indies,” *The Singapore Free Press and Mercantile Advertiser* (22 October 1941): 4.

¹⁰⁷ Malayan Bulletin of Political Intelligence, Secret No. 21, dated June 30th, 1924, enclosed in CO 537/924.

¹⁰⁸ “Visscherij’ incident in den Riouw-Archipel,” *Sumatra Post* (2 February 1942): 7.

Oshiro Kongsis and the Kinjo Kongsis.¹⁰⁹ With three *kongsis* operating *muro ami* crews, the supply of fresh fish fell significantly.¹¹⁰ Fishers became farmers due to the limited market, tight restrictions, and changing political climate.

Finally, the onset of the war completely collapsed what infrastructure was remaining of the Japanese fishing industry. Immediately, the British imposed bans on local fishing for security reasons and interned nearly 1,000 Japanese residents, transporting them to the Purana Qila Camp in India. Almost half of those interned were fishers, including Eifuku and his wife.¹¹¹ Eifuku's departure from Singapore marked not only the close of the interwar period, but also, and more importantly, the end of Southeast Asia's unprecedented protein boom.

¹⁰⁹ Watanabe Haruo, *Nanpo Suisangyo* (Tokyo: Chukokan, 1942), 211. Cited in Hiroshi and Hitoshi, *Japan and Singapore*, 110.

¹¹⁰ D.W. Le Mare, "Malaya's Fishing Industry: Guiding the Fisherman to Modernisation," *Malaya* (July 1954): 391.

¹¹¹ Chikashi Kataoka, *Nanyo no Nihonjin Gyogyo* (Tokyo: Dobunkan, 1991), 85. Cited in Hiroshi, "The Japanese Fisheries," 341. See also, Raghu Karnad, "The Ghost in the Kimono," *Granta* 130 (2015): 7-8. Also interned at Purana Qila were the editors of the dailies *Singapore Herald* and *Singapore Nippo*, the presidents of the Japan Societies in Burma and Johor Bahru, and the manager of the Fujiya Hotel.

CHAPTER SEVEN

Conclusion:

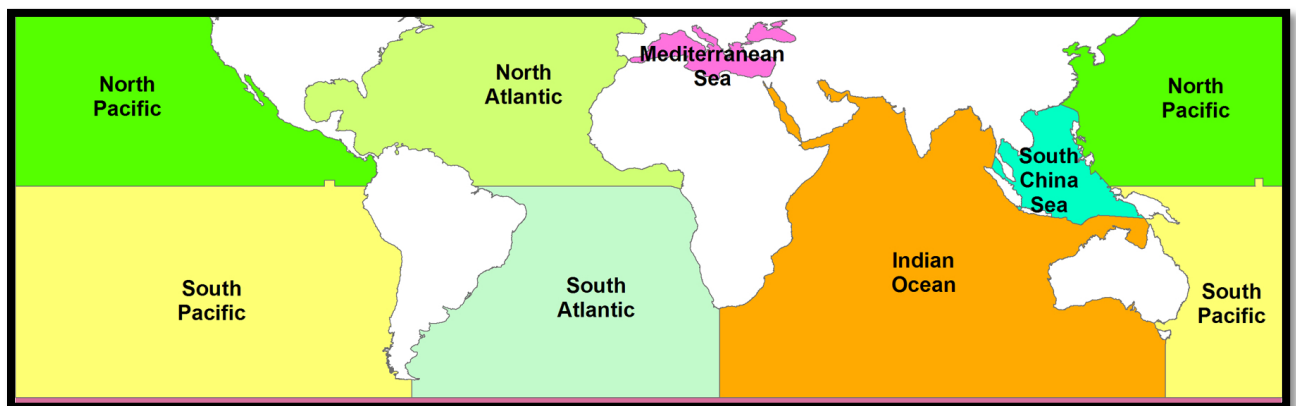
Following Fish, Making Connections

Introduction

In its opening chapter, this study posited, quite boldly, that a mid-ocean perspective would reconfigure our knowledge about the formation of territorial states and modern societies, revealing new ways of seeing urban change and agricultural development while casting the Asian marine environment as a place of encounter and production. From this mid-ocean perspective, we would see how land and sea were intimately connected, with offshore developments powering the rise of colonial cities and industrial plantations in maritime Asia. As its first contribution, this new perspective brought into view the Southeast Asian shelf, a bathymetric zone comprised of shallow seas, lending the region a distinct, unquestionable coherence. This regional coherence was not only spatial and ecological, but it was also cultural, with fishery products serving as the main sources of animal protein for the vast majority of Southeast Asia's population.

This mid-ocean perspective would also lead, through these chapters, to new understandings about modern Japan's maritime empire and the place of the *Nan'yo* in its rise and expansion. I have explored how the wealth and abundance of the Southeast Asian shelf was intimately incorporated into Japan's prewar world of colonial rule and imperial influence. After 1914, the Southeast Asian shelf and the Mandated Islands came to constitute the *Nan'yo*, a vast Japanese sphere of fishery

production. By the 1930s, Japan's interwar empire reached its fullest extent and comprised three somewhat distinct zones—the Mandated Islands (Central Pacific), Southeast Asia, and the Eastern Pacific (from Alaska to Peru)—covering nearly 38 million square miles or 40 percent of the world's tropical and temperate ocean surface, and thereby feeding the country's urbanization and territorial ambitions in the early twentieth century.¹



The Range of the World's Tropical and Temperate Waters.²

While scholars of Japan's total empire and modern Southeast Asia have provided clear assessments of imperial expansion and industrial development, the sum of this scholarship has rendered a partial picture of how these regions were deeply intertwined through infrastructures of commercial fishing and scientific

¹ The total surface of the world's oceans is 140 million square miles. Alan R. Longhurst and Daniel Pauly calculate that tropical and temperate waters account for 75 percent of this total surface, or 105 million square miles. Based on the aquatic areas of its interwar maritime empire—Southeast Asia, Northeast Asia, and the Central and Eastern Pacific—I have estimated that Japan's protein production zone covered 38 million square miles or about 40 percent of the world's tropical and temperate ocean surface.

² B.W. Eakins and G.F. Sharman, *Volumes of the World's Oceans from ETOPO1* (Boulder: NOAA National Geophysical Data Center, 2010). Accessed at https://www.ngdc.noaa.gov/mgg/global/etopo1_ocean_volumes.html

research. Recognition of this transpacific imperial world will allow us to knit together three historiographies that have heretofore displaced its existence—writings on Japan’s continental expansion, its insular possessions, and the Japanese diasporic experience along the Pacific Coast. Foundational works by Shinzo Hayase, Mark Peattie, Louise Young, Jerry Garcia, and Paul Kratoska have detailed and examined Japan’s projects of empire in Mindanao, Micronesia, Manchuria, Mexico, and Malaya in productive ways.³ But the depth and richness of these interventions have also obscured the wider environmental history of how these spatial parts constituted the whole of Japan’s interwar maritime empire in the 1930s. For historians of modern Southeast Asia and the Mandated Islands, in particular, Japan and its overseas diaspora have been analyzed through prewar cultures of economic penetration and political intrigue, but largely overlooked in the making of a transregional zone of fishery exploitation and scientific investigation. Similarly, scholars have documented the fishing operations and social experiences of Japanese migrants along the Pacific Coast while eliding the ways in which their industrial practices were integral to Japan’s transpacific world.⁴ By focusing on the rooting and

³ See Shinzo Hayase, *Japanese in Modern Philippine History* (Tokyo: Waseda University, 2014); Mark R. Peattie, *Nanyo: The Rise and Fall of the Japanese in Micronesia, 1885-1945* (Honolulu: University of Hawaii Press, 1988); Louise Young, *Japan’s Total Empire: Manchuria and the Culture of Wartime Imperialism* (Berkeley: University of California Press, 1999); Jerry Garcia, *Looking Like the Enemy Japanese Mexicans, the Mexican State, and US Hegemony, 1897-1945* (Tucson: The University of Arizona Press, 2014); Paul H. Kratoska, ed., *Asian Labor in the Wartime Japanese Empire: Unknown Histories* (Armonk: M.E. Sharpe, 2005); and, Paul H. Kratoska, ed., *Food Supplies and the Japanese Occupation in Southeast Asia* (London: Palgrave, 1998). See also Alfred W. McCoy, ed., *Southeast Asian under Japanese Occupation* (New Haven: Yale University Southeast Asian Studies, 1980).

⁴ See Arthur F. McEvoy, *The Fishermen’s Problem: Ecology and Law in the California Fisheries, 1850-1980* (Cambridge: Cambridge University Press, 1986); Eileen H. Tamura, *In Defense of Justice: Joseph Kurihara and the Japanese American Struggle for Equality* (Urbana: University of Illinois Press, 2013); Daniel M. Masterson and Sayaka Funada-Classen, *Japanese in Latin America* (Urbana: University of Illinois Press, 2004); Connie Y. Chiang, *Shaping the Shoreline: Fisheries and Tourism on the Monterey Coast* (Seattle: University of Washington Press, 2011); John Steinbeck, *The Log from the Sea of Cortez*

uprooting of Japanese communities along the Pacific Coast in the early half of the twentieth century, there has been a historiographical blindness to the self-conscious role these diasporic workers (as fishers, canners, and divers) played in Japan's Pacific project. In the absence of a full consideration of the *Nan'yo*, the Pacific Coast, and the necessity of these resource zones in the formation of modern Japan and its interwar hegemony, we are left with an incomplete understanding of the dynamics between oceans and empires in the decades leading up to World War II.

This study of the relation between oceanic protein and imperial expansion in the port cities and industrial plantations of Southeast Asia thus provides a model for parallel analysis of modern Japan. The interplay of European and American ichthyologists, Asian scientists, and Japanese expertise and industry, as discussed in the chapters above, built the social and physical infrastructure for the rapid rise of an invisible, interwar Japanese maritime empire that spread outward from its formal core in the home islands, Formosa, and Mandated Islands to cover much of the Southeast Asian shelf and the Central and Eastern Pacific. Within this modern empire, knowledge of fish and their marine environment was paramount.

In the long nineteenth century, the work of European ichthyologists who lived in Asia's colonial cities and company towns produced a regional turn in the study of fish, laying the scientific foundation for Japan's later maritime expansion. While naturalists in the Europe built their careers on specimens brought back from Indo-Pacific waters, those European scientists based in Asia worked up collections

(New York: Penguin Books, 1995); and, *Kathleen Whalen Fry*, "Farming the Water: Japanese Oyster Laborers in Washington State and the Creation of a Trans-Pacific Industry" (PhD. diss., Washington State University, 2011).

they acquired through professional circuits and local interactions. These colonial ichthyologists cultivated knowledge about fish by consulting fishers, fishmongers, and traders. They surveyed fish markets and inspected docked fishing boats, or had trusted associates who did. From a range of fish encounters, these scientists procured specimens, made detailed anatomical observations, had illustrations drafted, documented the uses and circulations of particular species, and registered Asia's diversity of fish based on the Linnaean system of classification.

By the late nineteenth century, these European scientists had documented thousands of new species of fish into science, thereby establishing a wealth of knowledge on Indo-Pacific fauna. But the production of this knowledge and materiality relied on physical and social forms of imperial infrastructure. Because mail steamers connected ports in Asia and rail lines networked these ports to an expanding world of cities, towns, and stations, ichthyologists were able to receive specimens from people located in faraway outposts or from persons in places not yet mapped, as in the case of Francis Buchanan, India's imperial surveyor. They were also able to send specimens and writings to fellow ichthyologists who lived in other parts of colonial Asia, deepening personal and professional connections in the process.

The outcome of these scientific currents was the discovery of a regional maritime zone based on its diversity of fish and shared ecology. Extending from the Bay of Bengal to the Philippine Sea, fish delineated the contours of regional space and inclusion. But more regional than the curious and commercial fish that tied this world together, as scientists in the early twentieth century would learn, was the

remarkable bathymetry of the Southeast Asian shelf. We can see the outlines of this shelf by moving from the Andaman Trench in the west along the Java Trench in the south towards the Philippine Trench in the east and then north to the Southeast Asian mainland. Comprising the Sunda and Sahul shelves and accounting for more than a fifth of the planet's shelf surface, this unique bathymetric zone, the Southeast Asian shelf, explains the region's spatial coherency along with its rich abundance and diversity of fish life.

By the early twentieth century, the rise of public aquariums around the Southeast Asian shelf had produced new knowledge about the region's biological waters and popularized its brilliant tropical fish. During this time, science, technology, and empire brought the ocean ashore and made its fauna public. From Madras to Manila, colonial aquariums attracted large crowds to see the wonders of the Asian marine environment, up close and in person. The experience was stunningly new and modern, and made possible by the advances in science and technology. Visiting publics were able to observe strange-shaped, rainbow-colored creatures, collected from habitats familiar to most: shallow seas, coral reefs, mangrove forests, and sheltered bays. On night tours, they saw spotted sea slugs and devilish horned fish illuminated through a spectacle of electric lights. But local publics were also able to learn about these aquatic species in ways that rendered their surrounding marine environment in new terms. Fish were named using local and scientific references. They were described with information about what they ate and what ate them, and their habitats were explained. In Madras, Manila, and Batavia, the aquarium directors, who also served as head ichthyologists, produced

multilingual guides for visitors with illustrations, descriptions, and summaries of the different exhibit tanks and their diverse oceanic fauna.

Marine laboratories emerged alongside public aquariums across the Indo-Pacific region. By the 1920s, local and foreign scientists were documenting, classifying, and studying the biological diversity of the Southeast Asian shelf. They coproduced knowledge, named species after each other, published scientific journals, and expanded the world's understanding of the Asian marine environment. At the center of these scientific networks and intellectual developments were local ichthyologists from the Philippines—Hilario Roxas, Jose Domantay, and Deogracias Villadolid—who contributed new insights to the wealth and ecology of the Southeast Asian shelf through their work at the Puerto Galera Marine Biological Laboratory, the second institution of its kind in Asia (after Japan's Misaki Marine Station). They circulated their scientific writings and material collections to museums and universities across the world. From Berlin and Breslau to San Francisco and San Diego, Filipino scientists also traveled to distant shores, examining Philippine fauna and making corrections and revisions to the taxonomic record.

Despite all the meticulous attention to describing a largely unseen universe of pink and red corals, spiky purple urchins, and tiny orange gobies, science was not yet in the full service of industry—at least not among the home societies of interwar Southeast Asia. This however was not the case for the Japanese in and around the Southeast Asian shelf during the same period. Since its formation of Asia's first public aquarium and marine biological laboratory in the 1880s, Japan had seen

science as way to understand the ocean environment, exploit its resources, and increase the nation's food supply. In this way, science served industry, and industry fed and fueled Japan's maritime empire. Fishery products from the *Nan'yo*—Southeast Asia and the Central Pacific—were central to the rise of modern Japan and its cities, industries, and overseas territories.

By the turn of the twentieth century, these decades of ocean science had fostered two key developments that supported Japan's expansion into Southeast Asia and the Central Pacific, creating, in rapid succession, the principle components for a vast maritime empire that, through formal and informal controls, covered nearly 40 percent of the world's tropical and temperate waters. First, Japan relieved its rural population pressures by facilitating the out-migration of laborers to the fertile frontiers of the *Nan'yo*. In its wake, waves of Japanese scientists followed to conduct surveys mapping out the economic geography of the *Nan'yo*. Itaro Takayama, for example, was one of the first and most productive Japanese scientists to document the fishery wealth of the Malayan marine environment. As for migrants, Okinawan settlers, in particular, built thriving pre-war colonies in Davao, Iloilo, Manila, Saipan, Baguio, Aparri, Singapore, Batavia, Tawau, and Sandakan. While these communities worked at mines and on plantations producing phosphate, abaca, rubber, sugar, and copra, they also ran *muro-ami* fishing operations. Since the *muro-ami* method came from Okinawa, most of the fishing crews comprised strong, skilled Okinawan swimmers. During the interwar period, these *muro-ami* networks provisioned Southeast Asia's colonial cities and agricultural frontiers with the bulk of their fresh fish and protein supplies. From urban nodes and provincial ports to

remote outposts and interior bases, Japan's overseas population spanned the breadth of Southeast Asia in the 1920s and 1930s.

At the same time, Japan's fishing industry modernized its deep-water fleets. Commencing shortly after 1900, this national development meant that many of the country's fishing vessels were equipped with diesel engines, freezer compartments, live-bait wells, and advanced gear. In particular, the rise of refrigerated cargo ships for protein provisioning revolutionized the relationship between resource frontiers and consumer markets. It deepened the urban reliance on commodity-producing regions, greatly impacting the natural ecology and political import of these landscapes and seascapes. The histories of Australian, Argentine, and New Zealand beef produced for British markets or the transformation of the cod fisheries in the northeast Atlantic for Anglo-American societies speak to these spatial linkages and their effects on natural systems.⁵ In the case of Japan, these technological changes opened the *Nan'yo* to its fishing industry and thus expanded the scale of the country's fishery production.

The leading *zaibatsu* involved in widening the scope of Japan's fishing industry was *Nippon Suisan*—the world's largest fishing company in the prewar period.⁶ Founded in 1913 under the name *Kyodo Gyogyo* and largely controlled by

⁵ See Rebecca J.H. Woods, "From Colonial Animal to Imperial Edible: Building an Empire of Sheep in New Zealand, ca. 1880-1900," *Comparative Studies of South Asia, Africa and the Middle East* 35,1 (2015): 117-136; Mark Kurlansky, *Cod: The Biography of the Fish that Changed the World* (New York: Walker and Company, 1997); William Beinart and Lotte Hughes, *Environment and Empire* (Oxford: Oxford University Press, 2007), 93-110; and, Freda Harcourt, "P&O and Orient: A Cool Partnership, 1886-1914," *Great Circle* 17,2 (1995): 73-94.

⁶ John L. Kask, *Japan's Big Fishing Companies* (Washington: Fish and Wildlife Service, 1947), 3. This report was original prepared as preliminary study no. 5 for the Fisheries Division, National Resources Section of the Supreme Commander for the Allied Powers in Tokyo on March 13, 1947.

Mikitaro Miho, president of the Manchuria Investment and Securities Corporation, this marine products company operated a vast protein empire, with local subsidiaries in Manchuria, Shanghai, Korea, Singapore, the Netherlands Indies, the Philippines, Formosa, California, and Mexico.⁷ Through a global fleet of 262 modern vessels, ranging in tonnage from 5 tons to 20,000 tons, *Nippon Suisan* produced annually between 200,000 metric tons and 300,000 metric tons of marine products in the late prewar years.⁸ It also had factory-ships, like the kind made famous by the prewar novelist Kobayashi Takiji.⁹ *Nippon Suisan* employed thousands of Japanese and Okinawan fishers and hundreds of locals, many of whom worked at the company's intricate web of cold storages, ice factories, canning facilities, fishing ports, and processing plants.

⁷ Kask, *Japan's Big Fishing Companies*, 9.

⁸ Kask, *Japan's Big Fishing Companies*, 10.

⁹ Kobayashi Takiji, *The Crab Cannery Ship and Other Novels of Struggle*, trans. Zeljko Cipris (Honolulu: University of Hawaii Press, 2013).



Canning tuna for the Sea Foods Company, a Philippine subsidiary of Nippon Suisan, 1940.¹⁰



Loading ice for the Sea Foods Company, a Philippine subsidiary of Nippon Suisan, 1940.¹¹

By the 1930s, *Nippon Suisan's* distant-water trawlers had effectively turned Singapore into a "fish transshipment center," where extraordinary catches made in the Indian Ocean were offloaded to Nippon Yusen Kaisha mail liners calling at the

¹⁰ Jose S. Domantay, "The Fishing Industry and the Fishery Resources of Zamboanga," *Philippine Journal of Science* 71,1 (January 1940): plate 6.

¹¹ Jose S. Domantay, "Tuna Fishing in Southern Mindanao," *Philippine Journal of Science* 73,4 (December 1940): plate 4.

British colonial port city before they continued on their line to Japan.¹² In 1935, for example, Captain Sanada Imamura had made three trips to Singapore with the *Shinkyō Maru*, a 480-ton motor trawler, the largest trawler that had visited the port city, transferring hundreds of tons of fish to *Nippon Suisan*-owned cold storages and then to 10,000-ton mail liners that transported the frozen protein to Japanese markets.¹³ Serving as the Singapore agent for *Nippon Suisan*'s transshipment operations was Tora Eifuku's company, *Taichong Kongsie*. By 1937, *Nippon Suisan* was landing almost 78,000 metric tons of fish annually from its vast trawling operations.¹⁴

Like Southeast Asia, the Central Pacific became a vital resource zone of the *Nan'yo* and thus Japanese fishing operations. With the outbreak of World War I in 1914, Japan moved into the Pacific and occupied the German-controlled Mariana, Caroline, and Marshall Islands, assuming administrative power over a zone of ocean equivalent to the size of the United States. From 1914 to 1921, administration of these islands was conducted through the Japanese Navy and its headquarters in Koror, Palau.¹⁵ Almost immediately, a South Sea Island Defense Force was organized

¹² "Singapore As Fish Transshipment Centre," *Singapore Free Press and Mercantile Advertiser* (21 December 1935): 3.

¹³ "Japanese Trawlers," *Straits Times* (30 August 1935): 18 and "Singapore As Fish Transshipment Centre," *Singapore Free Press and Mercantile Advertiser* (21 December 1935): 3.

¹⁴ Kask, *Japan's Big Fishing Companies*, 10.

¹⁵ Mark R. Peattie, "The Nan'yo: Japan in the South Pacific, 1885-1945," in *The Japanese Colonial Empire, 1895-1945*, eds. Ramon Hawley Myers and Mark R. Peattie (Princeton: Princeton University Press, 1984), 180-181.

and an arc of garrisons erected, linking together Truk, Yap, Palau, Ponape, Saipan, and Jalaut in a shared network of communication and control.¹⁶

During this military period, the *Nan'yo* also quickly became a fertile ground for Japanese industrial operations such as phosphate and ore mining on Angaur and Peleliu Islands; copra, coffee, and sugar production on Yap, Rota, and Saipan; and, most important, commercial fishing and shell collecting.¹⁷ Because ocean resources were critically important to the rise of modern Japan and its maritime empire, their exploitation was governed as a protected industry, reinforced by a military decree in 1916 that prohibited all fishing and gathering of shells without administrative approval.¹⁸

With the end of World War I, military administration turned into colonial rule as the Caroline, Marshall, and Mariana Islands became Japanese mandates in 1921. These resource-rich spaces constituted a core component of Japan's maritime empire. One of the Mandated Islands' greatest values and contributions to Japan's imperial expansion were ocean resources. A closer examination of tuna production bears this extraordinary fact out. In 1922, these islands exported 18 tons of tuna to Japan, most of which were skipjack for making *katsuobushi*, a staple food in the Japanese diet. By 1937, tuna exports to Japan had reached a prewar peak of 38,215 tons.¹⁹ The *Nan'yo* was not only feeding Japan, it was also fueling its expansion.

¹⁶ Peattie, "The Nan'yo," 184.

¹⁷ David C. Purcell, "The Economics of Exploitation: The Japanese in the Mariana, Caroline and Marshall Islands, 1915-1940," *Journal of Pacific History* 11,3 (1976): 190-205.

¹⁸ Purcell, "The Economics of Exploitation," 205.

¹⁹ Purcell, "The Economics of Exploitation," 206.

But fish, science, and industry also connected the Mandated Islands to Southeast Asia, completing the spatial configuration of the *Nan'yo*. In particular, Japanese scientists had amassed a wealth of fishery data from their surveys, interactions, and expeditions around the *Nan'yo* in the age of tuna (1914-1941). On these scientific cruises through Southeast Asia and the Mandated Islands, Japanese experts would meet with members of the local Japanese diaspora, gathering vital information about weather patterns, ocean currents, fishing conditions, and hydrographic features (such as deep trenches, exposed shoals, and known reefs). From these scientific surveys and diasporic encounters, Japanese scientists developed a rich body of biological, oceanographic, and ichthyological knowledge about the Southeast Asian shelf and its surrounding Indo-Pacific Ocean.

By 1930, this invisible maritime empire took full form, harvesting massive tuna catches that provisioned modern Japan and its *Nan'yo* world with protein through a layered apparatus of formal and informal dominions whose sum was nothing less than a vast imperial zone covering nearly 40 percent of the world's tropical and temperate oceanic surface. To the British Empire's appropriation of the world's oceans in the mid-nineteenth century and the U.S.'s rule over the stratosphere in the mid-twentieth, we must add Japan's maritime zone in the interwar period to the list of empires that made command over the commons central to their rise.²⁰

²⁰ See Barry R. Posen, "Command of the Commons: The Military Foundation of U.S. Hegemony," *International Security* 28,1 (Summer 2003): 5-46.

Spatially, this command over the commons was exercised through *Nippon Suisan* and other *zaibatsu* and their transoceanic network of local subsidiaries. At Formosa in the 1930s, for example, *Tobu Suisan*, a subsidiary of *Nippon Suisan*, conducted tuna fishing using motherships that extended the reach, scale, and duration of its industrial operations in the *Nan'yo*. The nature of this mothership system was quite elaborate. In the case of the Formosan subsidiary of *Nippon Suisan*, it involved a pair of 500-ton refrigerated vessels, the *Oi Maru* and the *Kitakami Maru*, and a number of 80-ton fishing boats that would continuously feed tuna to one of the motherships based at the fishing ground, where it would freeze the prized proteins in the form of fillets. The other mothership would transport the frozen catch to Takao, and replenish supplies and provisions for the fishing fleet at the distant grounds. After each cycle, the motherships would shift roles. These operations lasted for months with “fishing being done in the East Philippine Sea, the Celebes Sea, the Banda Sea, the Flores Sea, and the Indian Ocean area.”²¹

But in its third dimension, Japan’s maritime empire also extended across the Pacific Ocean to the protein-rich waters around Hawaii, Alaska, Mexico, Peru, and California. From the seas and shores of the Eastern Pacific, *zaibatsu* established canneries and used refrigerated motherships to haul prized salmon, sardines, lobster, abalone, crabs, shrimps, herring, and tuna back to Japan and its diasporic markets.²² In the 1910s, for example, Japanese migrants operated nearly 200 fishing

²¹ Hiroshi Nakamura, *Tuna Longline Fishery and Its Fishing Grounds* (Tokyo: Association of Japanese Tuna Fishing Cooperatives, 1951), 19-20.

²² See “A Labor Possibility,” *Garden Island* (March 25, 1921): 4; “Coast Guard Rescues Two Seamen on One Flight,” *Los Angeles Times* (February 3, 1941): 7; “Mexican Shrimp Ground Prized,” *Los Angeles Times* (October 3, 1940): 14; Conrad J. Bahre, Luis Bourillón and Jorge Torre, “The Seri and

boats out of Monterey Bay, landing salmon for the local canning industry that were then exported to Japan.²³ During this early stage of Monterey's canning industry, proprietors, several financed by Tokyo-based *zaibatsu*, looked abroad rather than home for their markets.²⁴

One of Monterey's most successful Japanese-owned firms was the Pacific Trading Company. For most of the interwar period, Pacific Trading managed a web of fishing and canning operations, supplying Japan with vital protein through a number of its local subsidiaries, including Western Wholesale, Pacific Mutual, the Del Monte Fishing and Packing Company, and the Great Western Sardine Company.²⁵ Pacific Trading also owned and operated several whaling stations between Monterey and San Francisco, where humpbacks and other species were processed for the Japanese market.²⁶

Like Monterey, San Pedro was part of Japan's vast empire of exploitation and export. Located near the naval yards and port facilities at Long Beach, California, San Pedro was about 340 miles south of Monterey and directly on the water. But whereas Japanese fishers working out of Monterey landed sardines and salmon, and dived for abalone, San Pedro was largely a transshipment port specializing in tuna,

Commercial Totoaba Fishing (1930-1965)," *Journal of the Southwest* 42,3 (Autumn 2000): 570; and, Carmel Finley, *All the Fish in the Sea: Maximum Sustainable Yield and the Failure of Fisheries Management* (Chicago: University of Chicago Press, 2011), 27-66.

²³ Arthur F. McEvoy, *The Fishermen's Problem: Ecology and Law in the California Fisheries, 1850-1980* (Cambridge: Cambridge University Press, 1986), 129-130. Canned products were also sent to Hawaii's plantations and Europe.

²⁴ M. Kathryn Davis, "Sardine Oil on Troubled Waters: The Boom and Bust of California's Sardine Industry, 1905-1955" (Phd diss., University of California at Berkeley, 2002), 5.

²⁵ Davis, "Sardine Oil," 31.

²⁶ Davis, "Sardine Oil," 32.

shrimp, and mackerel. As Japan's transpacific dominion took full form, Japanese fishers were producing nearly 40 percent of the total fish landings at San Pedro in the 1930s, including roughly 70 percent of albacore, 70 percent of bonito, 75 percent mackerel, and 35 percent of skipjack.²⁷ According to O. Hara, president of the Japanese Association at San Pedro's Terminal Island in 1931, "the Japanese dominate[d] and control[led] nearly all the fishing at San Pedro."²⁸ But illustrating their self-conscious role in feeding Japan's interwar empire and its spatial array, Hara advocated, in response to the violence associated with California's growing anti-Japanese climate, that their fishing future was not on the Pacific Coast but rather in the *Nan'yo*, explaining:

We must look forward to the future. Our only chance to develop the fishing occupation is to give up the local fishing district and extend into foreign districts. Right now, in my mind, the Hawaiian Islands, the Kingman Island, the Marshall Island, the Fanning Island, the Chastens Island, and the islands in the South Seas [*Nan'yo*], are our promising future fishing districts. Let us give up the local fishing district to the whites, as our district in the future will not be in this local ocean."²⁹

While Hara's vision for the future extended beyond "this local ocean," the Eastern Pacific nevertheless continued to figure as an integral part of Japan's imperial zone of fishery production. In the 1930s, for example, the dominance of San Pedro's Japanese fishers was exceeded only by the industrial presence of Japanese trawlers and motherships that transshipped their Pacific catch through San Pedro and onto Japan. At the forefront of these fishing operations was *Nippon Suisan*. In

²⁷ Kanichi Kawasaki, "The Japanese Community of East San Pedro, Terminal Island, California" (MA thesis, University of Southern California, 1931), 61.

²⁸ Kawasaki, "The Japanese Community of East San Pedro," 61.

²⁹ Kawasaki, "The Japanese Community of East San Pedro," 61.

1936, the 600-ton *Minato Maru* was the first industrial trawler to enter Mexican waters. Equipped with cold storage and “the latest fishing and scientific research devices,” the *Minato Maru* carried enough supplies for its crew of 36 men to last one year out at sea.³⁰ Caught fish were “iced, boxed, and returned to Japan.”³¹ By 1940, there were about 20 Japanese trawlers operating in Mexican waters and in the Gulf of California, half of which were owned by *Nippon Suisan*.³² These Eastern Pacific networks operated out of San Pedro, where *Nippon Suisan* and other fishing firms unloaded their catch for transshipment to Japan, overhauled their trawlers, and replenished their supplies.³³

Similar to Monterey, San Pedro, and the Eastern Pacific, as new fishing grounds of the *Nan'yo* (Southeast Asia and the Central Pacific) were identified by Japanese scientists and incorporated by their fishing fleets, Japanese fishery output grew to unprecedented levels, powering both nation and empire in the 1930s. By looking at the tuna fishing operations of *Nippon Suisan* in Philippine waters, and in particular its local subsidiary the Sea Foods Company, we can see how this vast geographical enterprise worked on the ground from a single base of production. In doing so, the features and mechanics of Japan's tuna fishing industry in Mindanao reflect, more broadly, the nature and culture of the imperial infrastructure linking together Southeast Asia, the Mandated Islands, the Eastern Pacific, and Japan in an interwar empire of transoceanic exploitation.

³⁰ “Japanese Fishing Trawler Detained at Mexican Port,” *Los Angeles Times* (January 26, 1936): 3.

³¹ “Japanese Fishing Trawler Detained at Mexican Port,” *Los Angeles Times* (January 26, 1936): 3.

³² “Mexico Changes Fishing Stand,” *Los Angeles Times* (June 17, 1940): 14.

³³ “Japanese Eye Mexico's Fish,” *Los Angeles Times* (October 22, 1939): 15.

From 1937 to 1939, the Sea Foods Company landed a record number of skipjack (striped tuna), the choice fish for making *katsuobishi*. With a modern ice factory near the port and a fleet of four motorboats, the Sea Foods Company opened the rich tuna grounds of southwestern Mindanao with operations in Moro Gulf, between Jolo and Basilan Islands, around Tubbataha Reef, and off the eastern shores of Palawan.³⁴ Based on reports and observations made by Jose Domantay, the Sea Foods Company produced approximately 2,216,000 kilograms (2,216 metric tons) of skipjack over the span of 24 months.³⁵

Month and year.	Yellowfin.			Striped tuna.		
	Number.	Total weight.	Average weight.	Number.	Total weight.	Average weight.
1937		<i>Kg.</i>	<i>Kg.</i>		<i>Kg.</i>	<i>Kg.</i>
August.....	3,144	10,109	3.22	10,118	33,179	3.28
September.....	6,544	20,264	3.25	19,673	52,979	2.69
October.....	5,118	18,329	3.58	15,258	52,393	3.43
November.....	1,744	3,939	2.26	7,147	26,209	3.67
December.....	1,988	6,391	3.21	14,559	47,070	3.23
1938						
January.....	1,976	8,244	4.17	15,290	52,732	3.45
February.....	2,501	10,057	4.02	22,842	75,870	3.32
March.....	3,366	14,667	4.03	12,758	45,224	3.54
April.....	2,937	14,680	4.98	50,608	165,069	3.26
May.....	9,250	34,392	3.71	62,715	179,348	2.85
June.....	4,930	18,011	3.75	45,747	122,661	2.68
July.....	5,367	19,252	3.58	23,640	62,576	2.64
August.....	5,037	23,654	4.69	22,976	68,957	3.87
September.....	6,478	23,961	3.69	16,337	52,521	3.21
October.....	6,350	20,828	3.27	21,957	66,045	3.01
November.....	9,493	38,284	4.03	19,990	68,651	3.43
December.....	7,326	26,443	3.62	26,338	96,861	3.29
1939						
January.....	3,497	12,004	3.43	43,961	156,547	3.56
February.....	2,562	10,664	3.05	45,544	160,538	3.52
March.....	4,702	16,728	3.55	39,539	132,052	3.34
April.....	8,344	29,760	3.57	74,791	235,088	3.14
May.....	7,388	30,133	4.08	75,903	224,463	2.92
June.....	6,586	22,866	3.47	43,972	131,787	2.99
July.....	6,247	19,511	3.12	23,638	69,835	2.95

*Catches by the Sea Foods Company, a Philippine subsidiary of Nippon Suisan, 1937-1939.*³⁶

³⁴ Domantay, "Tuna Fishing in Southern Mindanao," 430.

³⁵ Monthly figures have been rounded up to the nearest 1,000 kilogram.

³⁶ Domantay, "Tuna Fishing in Southern Mindanao," 433.

The *Nan'yo* and its fisheries powered the growth of Japan's maritime empire during the age of tuna (1914-1941). Skipjack were the most targeted species of tuna because they became *katsuobushi*. With fishing fleets working the waters of Southeast Asia and the Central Pacific, Japan dramatically increased its *Nan'yo* skipjack output from 53 metric tons in 1927 to 14,268 metric tons in 1936.³⁷ This figure would continue to grow up to 1941.

Driving Japan's insatiable tuna demands and its imperial turn to the *Nan'yo* and Eastern Pacific was food culture and urban change. Seafood, particularly fish, was central to Japanese food culture and the public's health as marine goods constituted the bulk of Japan's protein intake. As in Southeast Asia, meat was rarely consumed. In 1900, for example, Japan's consumption of pork, poultry, and beef was essentially non-existent. Japan also had "no tradition of consuming dairy products" or eggs.³⁸ A recent study on Japan's dietary transition reveals that what was true for meat consumption in 1900 held true for most of the interwar period. "Regular meat eating," notes the study, "was not a part of the typical daily Japanese prewar diet."³⁹ While Japan's beef consumption remained low at about 0.6 kilograms between 1900 and 1935, seafood intake per capita rose from 36 kilograms to 57 kilograms in these same decades.

³⁷ Yutaka Imamura, *The Skipjack Fishery* (Tokyo: Japanese Fisheries Association, 1949), 7.

³⁸ Vaclav Smil and Kazuhiko Kobayashi, *Japan's Dietary Transition and Its Impact* (Cambridge: MIT Press, 2012), 2.

³⁹ Smil and Kobayashi, *Japan's Dietary Transition*, 49.

*Japan's Meat and Seafood Consumption, 1900-1935.*⁴⁰

Year	Chicken (kg/capita)	Pork (kg/capita)	Beef (kg/capita)	Seafood (kg/capita)
1900	--	--	0.5	36
1925	--	0.7	0.6	49
1935	--	0.7	0.6	57

Urbanization was another key factor fueling Japan's endless quest for more tuna supplies and new fishing grounds in the Nan'yo and Eastern Pacific. From 1900 to 1940, the Japanese population grew at an unprecedented rate as its society became more urban. As a consequence, provisionment became a national security priority for sustaining urban and industrial growth at home and imperial expansion abroad. With coastal seas suffering from extensive exploitation, Japanese fishers looked to the *Nan'yo* after 1914. They pursued skipjack and other tuna in order to feed "Japan Proper" and its expanding world of resource frontiers (abaca, sugar, and copra), imperial settlements, and naval bases.⁴¹ By 1941, Japan's overseas fishing ports reflected a maritime empire built on the geography of oceanic protein. As the map below shows, these fishing ports spanned the Indo-Pacific Ocean, with bases at Halmahera, Bitung, Ternate, and Ambon in the Netherlands Indies. There were fishing stations established at Davao, Zamboanga, and Aparri in the Philippines. British North Borneo had a Japanese fishing port at Tawau. Formosa maintained several bases at Takao, Taito, Keelung, and Suo (Taihoku). Covering the Mandated Islands, there were Japanese tuna stations at Ponape and Truk in the Caroline

⁴⁰ Smil and Kobayashi, *Japan's Dietary Transition*, 50, 38.

⁴¹ Katsuzo Kuronuma and Sidney Shapiro, *The Japanese Tuna Fisheries* (Washington D.C.: Fish and Wildlife Service, 1948), 50. The Natural Resources Section of the Supreme Commander for the Allied Powers in Tokyo originally published this report as No. 104. Katsuzo Kuronuma of the Tokyo Central Fisheries Experimental Station compiled the data and procured the information.

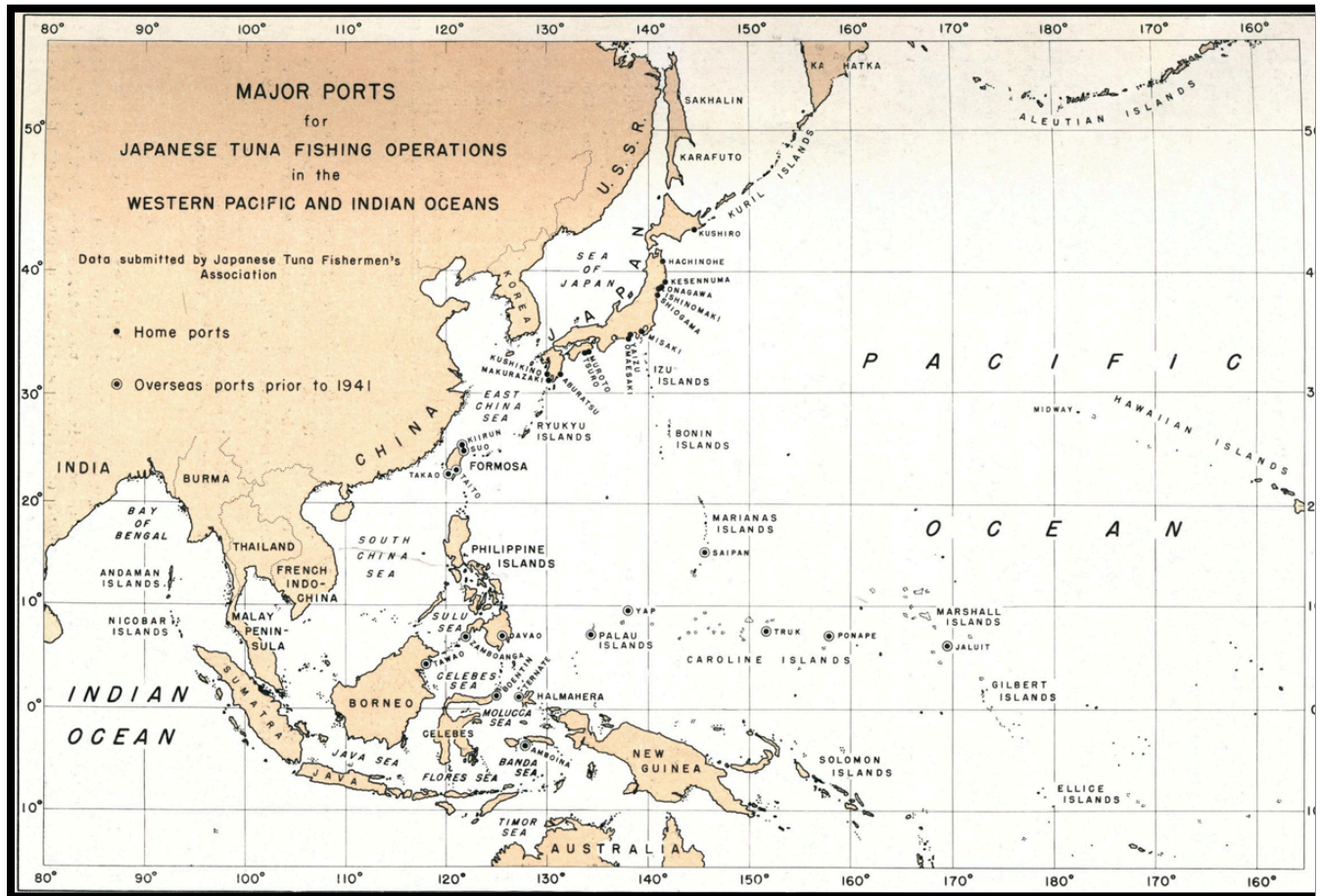
Islands; Yap and Koror in the Palau Islands; Saipan in the Mariana Islands; and, at Jaluit in the Marshall Islands.

Year	Japanese Coast	Japanese Offshore	Taiwan	South Seas	Total
1927	3,597,194	19,257,967	786,495	14,120	23,655,778
1928	2,971,176	17,559,195	861,120	43,658	31,435,149
1929	3,196,382	16,040,225	870,924	125,200	30,232,731
1930	2,967,021	15,377,896	550,885	356,200	19,252,002
1931	3,031,434	18,394,324	494,086	751,148	22,670,992
1932	3,655,125	14,250,971	278,001	1,296,736	19,480,833
1933	3,241,694	17,347,258	567,312	1,826,504	23,009,768
1934	4,260,064	18,384,660	517,968	2,388,406	25,551,098
1935	2,911,153	16,524,676	541,712	3,125,981	23,103,522
1936	4,062,218	22,880,510	438,448	3,804,739	31,185,915

*Distribution of Total Skipjack Catch by Fishing Grounds, 1927-1936.*⁴²

While in 1927 Japan's coastal waters supplied approximately 13,500 metric tons of tuna, a vast majority of its skipjack production came from offshore grounds and the *Nan'yo*, totaling nearly 76,000 metric tons. From 1927 to 1936, the remarkable share of Japan's skipjack supplies came from these offshore seas and the *Nan'yo*, constituting nearly 85 percent of the overall production for this period. The most striking fishery change occurred in the *Nan'yo*, where the weight of caught tuna grew from about 53 metric tons in 1927 to nearly 15,000 metric tons by 1936.

⁴² Yutaka Imamura, *The Skipjack Fishery* (Tokyo: Japanese Fisheries Association, 1949), 7.



*Major Ports for Japanese Tuna Fishing Operations in the Nan'yo and Japan, 1941.*⁴³

But it was Japan's changing demographic profile that mobilized these distant-water fishing operations in the early twentieth century. For example, Tokyo's population grew from 1.5 million to 6.8 million in the span of four decades.⁴⁴ During this same period, Osaka's population expanded from 931 thousand to 3.3 million; Nagoya's population went from 250 thousand to 1.4 million; and, Kyoto's population

⁴³ Katsuzo Kuronuma and Sidney Shapiro, *Japanese Tuna Fisheries* (Washington: Fish and Wildlife Service, 1948), 7. The Natural Resources Section, General Headquarters, Supreme Commander for the Allied Powers, Tokyo, originally prepared this study as report no. 104, issued in March 1948. Katsuyuki Kita drafted the map.

⁴⁴ Kojima Reikichi, "The Population of the Prefectures and Cities of Japan in Most Recent Times," *Far Eastern Quarterly* 3,4 (August 1944): 320. Edwin G. Beal translated Reikichi's study, which was originally published as *Toshi Mondai Pamphlet No. 41* by the Tokyo Institute for Municipal Research in 1941.

shifted from 371 thousand to 1.1 million by the end of the interwar era. The number of Japan's cities nearly doubled to 200 in a single decade from 1930 to 1940, with 45 of these cities home to populations of 100,000 or more.⁴⁵ Overall, Japan's rapid development led to an urban share of the total population expanding from 14 percent to 40 percent in the first half of the twentieth century.⁴⁶

Population growth and urban change necessitated a radical increase in Japan's food supplies, thus linking the demands for oceanic protein to the logistics of urbanization, industrialization, and imperial expansion. What followed, then, were the opening of the *Nan'yo* to Japanese science and industry and the unprecedented production of skipjack for the mass consumption of *katsuobushi*. For Japan's dominant food culture, there was in the interwar past, and remains in the postwar present, no other seafood product as important as *katsuobushi*.⁴⁷ Fish were at the heart of Japan's modern nation and its maritime empire, and fish in the form of fillets or *katsuobushi* were consumed on a scale unmatched by any other country. From 1900 to 1935, the average daily per capita intake of protein was 66 grams, nearly all of which came from a combination of fish, *katusobushi*, and other ocean products.⁴⁸

⁴⁵ Pradyumna P. Karan, *Japan in the 21st Century: Environment, Economy, and Society* (Lexington: The University Press of Kentucky, 2005), 246.

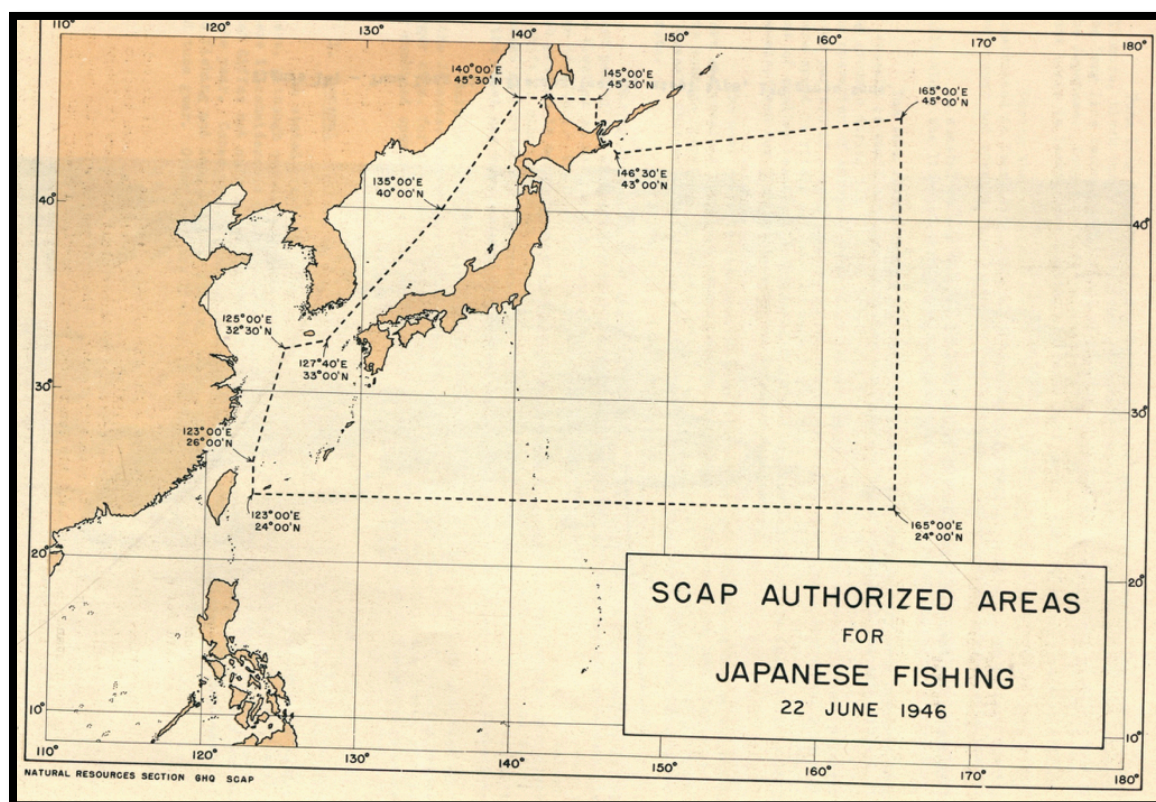
⁴⁶ Smil and Kobayashi, *Japan's Dietary Transition*, 74 and Reikichi, "The Population of the Prefectures and Cities of Japan," 320.

⁴⁷ Smil and Kobayashi, *Japan's Dietary Transition*, 40.

⁴⁸ Smil and Kobayashi, *Japan's Dietary Transition*, 82.

Conclusion

While World War II disrupted the fishing operations that fed and fueled Japan's urban growth and imperial expansion, it was the spatial restrictions imposed by the Supreme Commander of the Allied Powers (SCAP) in 1946, which directly sought to break up this modern maritime empire. As part of its systematic dissolution of Japan's prewar "total empire," SCAP banned distant-water fishing in the *Nan'yo* by limiting Japanese exploitation to a fixed area bounding the country, the so-called MacArthur Line.



*SCAP Authorized Areas for Japanese Fishing, 22 June 1946.*⁴⁹

⁴⁹ Katsuzo Kuronuma and Sidney Shapiro, *Japanese Tuna Fisheries* (Washington: Fish and Wildlife Service, 1948), 36. The Natural Resources Section, General Headquarters, Supreme Commander for the Allied Powers, Tokyo, originally prepared this study as report no. 104, issued in March 1948. Katsuyuki Kita drafted the map.

With a fraction of its prewar fishing zone coupled with mass reparations from Manchuria, Formosa, Southeast Asia, and the Mandated Islands, occupied Japan entered a period of critical food shortage. Since Japan's coastal waters were largely overfished by the outbreak of World War II, exploiting them in the wake of the MacArthur Line yielded insufficient supplies to meet society's postwar needs. On November 30, 1945, and as a quick fix with long-term implications, SCAP authorized and promoted industrial whaling in the seas close to Japan.⁵⁰ Under SCAP, whale meat came to constitute 46 percent of Japan's total meat consumption.⁵¹

But more than a forgotten imprint of SCAP or the myopic vision of an empire on the rise, the MacArthur Line foreshadowed a fundamental turn in the ocean politics of a modern world. It presaged the coming cultural wars over the protection of whales as iconic species of the global marine environment. And as we know from today's headlines about the South China Sea, this postwar marking set the stage for waves of geopolitical tension and decades of resource depletion in a different era run by nation-states, their industrial fishing fleets, and naval patrols in a perpetual contestation over the ocean's protein wealth, surprisingly reminiscent of prewar exploitation and imperial expansion.

⁵⁰ Smil and Kobayashi, *Japan's Dietary Transition*, 76 and "Japanese Whaling in the Bonin Island Area," *Commercial Fisheries Review* 9,12 (December 1947): 36.

⁵¹ Jakobina Kirsten Arch, "Bringing Whales Ashore: Oceans and the Environment in Early Modern Japan, 1600-1900" (PhD diss., Harvard University, 2014), 228.

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