How Urban fishers Listen to Nori Seaweed to Learn to Better Live with the Sea: The Importance of Ecological Reflexivity for Environmental Governance

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Abstract

Among the values of environmental governance such as sustainability, resilience, and adaptability, ecological reflexivity seems an essential but elusive value, both among practitioners and in academic literature. Ecological reflexivity is the capacity of an agent, structure, or process in contextualized social–ecological systems (SESs) to recognize and reconfigure themselves in response to their reflections on the interactive impacts of their performances by transforming their values and practices. Although promising, this essential value remains only in the early stages of inquiry, both theoretically and pragmatically, even as chronic and acute human impacts continue to alter earth systems across socioecological scales. How might we incorporate ecological reflexivity, its ethical processes, and its virtuous outcomes, into SESs? This question is central to this chapter.

Specifically, this chapter illustrates how fisher communities in the Seto Inland Sea in Japan developed methods and critical interactions related to ecological reflexivity for environmental governance during their long-term efforts at regenerating the health and resilience of the Seto Inland Sea SES. In this region, spatial environmental governance had been institutionalized since 1973, initially in order to manage forms of pollution and in service to the rehabilitation of the "clean sea." Despite early achievements in this rehabilitation, the chronic loss of marine productivity has led to persistent suffering among these fisher communities since the 1990s.

The exploration of historical trajectories of the sea as an SES, including the experiences of multigenerational fishers, and of knowledge and schemes to adapt and manage environmental changes in order to promote resilient incomes—all

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these led fishers to recognize that their historical aspiration to better live *from/with the sea* as an essential reference could bring about adapted practices and relations, leading to a localized sense of ecological reflexivity. In particular, the fishers' ongoing dialogue through working with *nori* seaweed came to support them in their efforts to enhance the rehabilitation and regeneration of current and future resilience in their livelihoods, as well as the mitigation of present-day uncertainties, related to *nori* production. The fishers have thus focused their intergenerational and still-evolving sense of how to better live *from/with the sea* as a contextualized reference for ecological reflexivity, adapting their socioecological practices and relations in service to achieving more resilient livelihoods. This case study is an illustration that contributes to clarifying and contextualizing the notion of ecological reflexivity as linked to near- and long-term SES resilience and thus how to better live *from/with the sea* in service to fishers and the sea, thereby helping stakeholders to assure themselves as connected, sustained, and prosperous in their own resilience.

Keywords

Adaptive governance · Resilience · Pollution · Ecological reflexivity · Social-ecological systems · Dialogues among human and non-human assemblages · Satoumi

7.1 Environmental Governance with Reflexivity

7.1.1 Essential Values for Environmental Governance

Environmental governance is a mechanism to influence the identities, relations, and trajectories of social–ecological systems (SESs). What constitutes foundational values in effective environmental governance has been explored and established (Chaffin et al. 2014; Erickson 2015; Folke et al. 2005; Kay et al. 2001). For example, to address complexity and uncertainty in SESs, adaptability and resilience have been seen as the leading values for adaptive governance, which in turn aids flexible and integrative forms of policy-making and management across scales (Folke et al. 2005; Olson and Gunderson 2006). Adaptive governance also intervenes in a continuous feedback loop of reconstruction, preservation, and disturbance, with such interventions further aimed at enhancing resilience and robustness (Chaffin et al. 2014; Kay et al. 2001; Olsson et al. 2006).

Additionally, to manage competencies and to develop collaborations among actors seeking shared futures, legitimacy functions as an underlying value, practice, and aspirational outcome for environmental governance. Amid such legitimatizing competencies and collaborations, we encounter vocabularies such as future-oriented scenarios, visions, and goals that are contested, refuted, negotiated, revised, and even replaced with ones newly and iteratively produced. The legitimatizing processes that stakeholders bring to questions and decisions about where these futures might go,

can be a co-creative social learning experience, and they can challenge the grounds for contributions to science, local values and norms, and even historical precedent (Armitage, De Loë, and Plummer 2012; Awung and Marchant 2018; Decaro et al. 2017; Fukunaga 2013). Furthermore, assuring that governance is democratic—open, fair, consistent, and just—in procedures, participation, and distribution is another penetrating value in practice and a virtuous goal in all stages and processes of environmental governance. While other essential components are instrumental for managing governance, fairness and justice represent core ethical practices and ethical outcomes that reflect how human society should be in SES relations and outcomes (Awung and Marchant 2018; Malin and Ryder 2018).

7.1.2 Ecological Reflexivity as a Core Value of and Ethical Aspiration for Environmental Governance

In efforts to achieve and maintain socioecological abundance and resilience, the transformative-ness of individual, group, institutional, and organizational actors has also been recognized as central in guiding social learning among environmental stakeholders (Castro-Arce and Vanclay 2020; Chaffin et al. 2016). Such transforming processes require being reflexive through dialogues with other actors; reflexivity is thus another core pragmatic value embedded in effective environmental governance (Hendriks and Grin 2007; Dryzek and Pickering 2017; Meadowcroft and Steurer 2018) and is associated with sociological reflexive theory (Beck et al. 1994). We face and live with uncertain, open, and problematic futures more than ever in late modernity, where spatial and meaningful boundaries of our cognitive and experiential worlds become subsumed or marginalized due to globalized mobilities of hegemonic forms of capital, commodities, state and corporate actors, and people. Both individual persons and social structures interactively monitor, reflect, reproduce, and then monitor again, seeking relevant narratives and identities, instead of organically enabling engagement and participation. Furthermore, in the Anthropocene, as human activities increasingly influence and change regional and global earth systems, such reflexive explorations face an urgent need to avoid path dependency, which has contributed to ecological degradation, exacerbated disruptive feedbacks, and marginalized and ignored the voices of nonhuman actors (Dryzek and Pickering 2017; Pickering and Dryzek 2019). In other words, the conditions that we now face amid the Anthropocene demand reflexivity through dialogues with nonhuman actors, which we must explore through our individual and shared narratives and identities, and through more cognitively and consciously engaged partnerships with nonhuman actors.

As for environmental governance, ecological modernization theory extended its theory to introduce an ecological orientation into conventional institutions such as markets, nation-states, and political systems for adapting to environmental changes and to near and long-term uncertainty. In the main, these extendings have too often focused on quick and effective institutional responses to changes in ecological

conditions and on forces to internalize motivations for creating innovative ecologically oriented structural changes (Mol 1996; Voß and Bornemann 2011).

Political scientists J. S. Dryzek and J. Pickering have engaged the concept of "ecological reflexivity," framing it as concerned with social–ecological systems rather than just human systems and human–actor-centered institutional changes as ecological modernization has evolved. They have defined ecological reflexivity as the ability to listen to and to interpret signals from the nonhuman world (Dryzek and Pickering 2017; Pickering 2019; Pickering and Dryzek 2019). With the revision of Dryzek's conceptualization of reflexivity, Pickering paraphrased ecological reflexivity as an analytical framework for human–actor to listen consciously to ecological voices, as follows:

> the capacity of an entity (e.g. an agent, structure, or process) to: recognise its impacts on social-ecological systems and vice versa; rethink its core values and practices in this light; and respond accordingly by transforming its values and practices. (Pickering 2019: 1150)

This conceptualization contains recognition of ecological contexts and sensitivity to ecological feedbacks, which can cultivate cognitive or conscious efforts to achieve ethical inter- and intra- generational human and nonhuman relations. At the same time, how to create relevant reflexive actions through dialogues with nonhuman actors requires more theoretical and empirical explorations, especially through an abundance of case studies. That is, how can we consciously create dialogues with nonhuman actors so that we may recognize heretofore unknown trajectories of relations, and how might we adapt these in service to near- and long-term abundance and resilience for humans and nonhumans and their habitats?

This chapter presents a case study of how fishers in Japan's Seto Inland Sea came to develop a contextualized and ethical ecological reflexivity comprised of intra-species and inter-species processes, relations, and interactions through their ongoing dialogues with *nori*, a form of seaweed that is farmed commercially in the region and which we can now posit as a kind of *SES indicator species*, a bioindicator of abundance, resilience, and thus health in the SES. This case study seeks to contribute to showing how ecological reflexivity can be theorized as embedded in and central to contextualized environmental governance, leading to bottom-up theoretical insights. Already, anthropological and sociological literatures have accumulated theories and illustrations on more-than-human agencies and multispecies politics and ethics, associated with actor network theories (Callon 1986; Haraway 2016; Swanson et al. 2018). This chapter further contributes to such more-than-human agencies and perspectives. In particular, it characterizes the political regimes inherent in environmental governance in the Seto Inland Sea SES and frames historical, contemporary, and future-oriented scenarios that fishers came to envision and enact through their intergenerational practices and relations with socioecological actors such as the *SES indicator species*, *nori* seaweed.

7.1.3 Case Study: Dialogues Among Fishers and *nori* Seaweed Co-Creating Ecological Reflexivity

The case study illustrates how the essential practices and relations that define ecological reflexivity arose among local fishers in their cognitive and conscious efforts for better environmental governance in the Seto Inland Sea region of Japan. Due to fishers' historical experiences of acute and chronic environmental degradation after World War II, their efforts to establish effective spatial marine governance have included relevant local-to-national stakeholders in the service of rebuilding and sustaining their resilience in their livelihoods. These long-term efforts have included, since the early 1970s, the goal of the ecological regeneration of the Seto Inland Sea's marine ecosystems. Amid this historical involvement in the regeneration of the sea, the fishers came to recognize *nori* seaweed farming as a symbolic and pragmatic facilitator that could contextualize their efforts to imagine and create future scenarios that assured the long-term resilience of their livelihoods. In the words of one fisher, "the sea can feed fishers enough, particularly fishers who can care and keep the productivity both for the sea and for human."

Nori seaweed farming has composed much of the fisheries production incomes of the coastal fishers in the Seto Inland Sea since the 1960s. *Nori* seaweed can be simultaneously a facilitator to establish and enhance habitats for other nonhumans, influencing such important ecological variables such as water temperature, nutrient flow, tidal current systems, and seabed biophysical complexity. Their restoration efforts helped to establish processes to co-contextualize ecological reflexivity among stakeholders and to embed it as an essential and normative component of and for effective environmental governance. That is, these efforts served to recognize historical social–ecological relations within multiple SES contexts, helping the fishers to rethink their previously core values and practices and thereby to reimagine SES scenarios, transforming relevant values and practices for humans and nonhumans in service to long-term abundance and resilience.

This chapter presents a case study exploration of ecological reflexivity and in particular how it can mutually co-constitute and enhance stakeholder-generated exploratory SES scenarios for abundance and resilience. Data for this article are drawn selectively from a larger research dataset that historicizes aquaculture governance in postwar Japan, archival research of official documents, personal notes of experts and policymakers, semi-structured interviews with fishers, and ethnographic observation during ongoing fieldwork from 2012–2016.

I particularly focus on the historical archival resources from panels and meetings held by local and national governments and their efforts at reviving the Seto Inland Sea, as well as the processes of relevant political regime actors and future scenarios that led marine governance. Along with the analysis of archival research, to understand how stakeholders, especially local fishers, has evolved a language to express their historical and experimental ideas of a desired status for the Seto Inland Sea, I conducted ethnographic observation and semi-structured interviews, mainly focused on Sumaura Fishers Club (SFC, *Sumaura Ryōyūkai*), a local branch of the Kobe Fishing Cooperative. Their livelihoods are sustained mainly through *nori* seaweed

farming, gill net fishing, and boat fishing. The focus on this harvesters' organization enabled empirical characterizations of the ways in which they form, use, and update their notions of their "sense of how to better live *from/with the sea*" (*umi to no seikatsu-kankaku*) as ethical practices and aspirations themselves tied closely to fishers' evolving notions of ecological reflexivity.

7.2 Regenerating the Sea: The Antipollution Scenario for *kirei na umi* or "Clean Sea"

7.2.1 The Waters Once Called "the Dying Sea" and Fishers as the Canary in a Coal Mine

Sumaura fishers have long been the canary in a coal mine linked to socioecological degradation of the Seto Inland Sea despite generations of communally managing their multipurpose coastal resources. Beginning in the early 1950s, forms of industrial pollution began to threaten their resilient livelihoods as socioeconomic rehabilitation and rapid industrialization came to dominate postwar Japan. Among industrial coastal sites in Japan at the end of WWII, the Seto Inland Sea contained five coastal industrial zones. Given the region's historically well-known advantageous conditions for industrial siting, such as proximity to transportation, ability to build on coastal reclaimed lands, and accessibility to large urban economic hubs, these zones were rapidly redeveloped after the war, including the addition of multiple petrochemical complexes. Already by the end of the 1950s, many FCAs in the Seto Inland Sea were having trouble with devastating damage to clam harvesting and *nori* seaweed farming due to polluted waters, which they called *akusui* or "bad water," as well as fish kills and falling market prices for locally caught fish. By 1956, Japan's Fisheries Agency had already come to understand the acute devastation of the fishing industries, and the harm to the fisheries had doubled since 1945 (Inoue 1961, 1963). Amid this socioecological devastation, a rising antipollution movement and fishers taking on industries and governmental agencies began to increase noticeably.

Despite such movements, under a nation-wide developmentalist mandate that placed top priority on seeking additional economic breakthroughs beyond the immediate postwar recovery, voices of these industrial pollution victims were too weak to influence the political status quo. The fisheries industry had very little weight in Japan's gross national product as well as within the national government strategy for economic growth. In this light, policymakers at the time recognized the sufferings of fishers and the degradation of coastal environments as acceptable sacrifices for the sake of national economic development. "*The abandoned*," the victims called themselves. Such an attitude penetrated political relations, even after the official recognition that widespread ecosystem- and livelihood-threatening pollution, including the now-famous Minamata disease, had led to many deaths and intergenerational suffering (Funabashi 1997; Fukunaga 2013).

Prioritizing rapid reindustrialization in turn led to lapses in regulatory oversight, governance, and the management of pollution. Despite the establishment of Japan's

Clean Water Act and Factory Wastewater Regulation Act in 1958, these legislations could not stop the expansion and aggravation of industrial pollution problems (Harada 1985; Iijima et al. 2007). In 1967, the Basic Act for Environmental Pollution was established to integrate and control pollution measures nationally, but the act also dictated that measured compensations for and the prevention of pollution would be "harmonious" with economic activities. This sentence was soon criticized as "the harmony article," as it showed that the government placed more weight on economic development than environmental protections. Pollution continued, unabated.

Across much of the Seto Inland Sea, water pollution soon led to eutrophication and habitat loss due to sand extraction, dredging, reclamation, and engineering. These developments continued to impact coastal marine environments, and by the late 1960s, locals had given the sea such names as "the dying sea." The color of the sea lost its creamy deep blue-green, becoming instead "dark brown, just like soy sauce" (Seto naikai kankei gyoren, gyokyō renraku kyōgikai 2012). Red-brown and blood-colored industrial wastewater flowed directly into the sea, and concrete-engineered coastlines and land reclamation activities were rapidly and permanently changing the coastal seascape and its ecosystems. Fishers noticed early on the impacts of water pollutants, as the algae around the very edge of the sea where fish spawn had disappeared. Then, clams were gone, and fish started to emit an oily odor. Their shapes showed deformities. Oily, dark sludge accumulated in the sea, giving off noxious gasses. Fishers were scared of diseases caused by direct industrial pollution, which greatly decreased the prices of their fish in the market (Setonaikai osen Sōgō Chōsa Jikkō Iinkai ed. 1972). To maintain their income, the fishers increased aquaculture of fish such as yellowtail through compensation funds from the government, but toxic red tides and hypoxic water often caused consequential declines in both boat fishing catches and aquaculture production. For example, 14 million farmed yellowtail died in 1972 due to a toxic red tide, further projecting the image of a "dying sea" to the wider Japanese society.

For fishers, changes in watercolor and smell embodied the whole spectrum of negative impacts on the sea. Of course, the fishers were not alone in recognizing these changes. Already by the middle of the 1950s, even the children near Sumaura noticed that something was wrong in the sea where they played. When they swam in the sea, black dots like oil balls with a strange smell stuck to their chests and bodies. The distance between the sea and nearby residents grew physically and mentally because of the chronic bad odors emanating from the water, strange watercolor, disappearances of beaches due to reclamation, and reduced physical access to the coastline increasingly fenced by industries.

7.2.2 The *kirei na umi* (Clean Sea) Scenario as an Antipollution Policy

The situation began to change after a national legislative session on pollution was held in 1970, responding to heightened political dissent. The Basic Act for Environmental Pollution was revised, and "the harmony article" was deleted. Among the

14 legislative acts on the environment that were revised or established in this session was the Water Pollution Prevention Act (*Suishitsu Odaku Bōshihō*), which also initiated water-improvement programs both at national and local government levels. These laws began to more strongly prohibit, control, and manage water pollution.

Learning from these new moves, in 1971 the Governors and Mayors Alliance Conference for Environmental Protection of the Seto Inland Sea (GMAC, *Setonaikai Kankyō Hozen Chiji Shichō Kaigi*) established the Seto Inland Sea Environmental Protection Charter (the Seto Charter, *Setonaikai Kankyō Hozen Kenshō*) to protect the economic, sociocultural, and aesthetic values of the Seto Inland Sea, thereby more fully representing local stakeholders' voices. Behind this action, the claims and lobbying by FCAs to both national and local administrators dramatically increased, and together, such efforts moved relevant administrators and politicians to acknowledge the seriousness of the 'dying' of their sea and local sea-based industries, including fisheries. The conference members included the governors of all 11 prefectures bordering the Seto Inland Sea, as well as the mayors of its three major cities. The conference called for the establishment of a new law for comprehensive and cross-jurisdictional measures to protect the environment, recognizing that heretofore specialized and segmentalized laws could not provide effective measures for environmental protection. Moreover, they wanted more proactive measures for environmental protection and prevention that would better control the expanding powers and desires of industries. In other words, the conference wanted to establish a legally effective spatial management scheme and to restructure the heretofore segmentalized laws toward more comprehensive governance and for more practical outcomes for environmental health.

GMAC lobbying of Japan's EPA, the Ministry of the Environment, its head, the Minister of the Environment, and members of Japan's national legislature pushed them to establish the Seto Conservation Temporary Act (*Setonaikai Kankyō Hozen Rinji Sochihō*) in 1973, which became a permanent law in 1978 as the Seto Conservation Act (Act on Special Measures concerning Conservation of the Environment of the Seto Inland Sea, *Setonaikai Kankyō Hozen Tokubetsu Sochihō*). The law contained the following targets: the establishment of a spatial environmental governance system, integrated water pollution control, regulation and control of landfill and industrial reclamation, and the establishment of nature protection areas. The law established the first experimental shape of spatial environmental governance, undertaken through a collaboration among national agencies, prefectures, and their local agencies. With its institutionalization, each prefecture was given the legal responsibility to develop an operation plan every five years and to submit an official report of its results. In particular, the Seto Conservation Act developed more stringent water pollution standards than the previous Water Pollution Act and required local governments in designated areas to install and operate total volume control of nitrogen (TN), phosphorus (TP), and oxygen demand (COD). This method was introduced back into the Water Pollution Control Act in 1978 and led it to be revised. Since then, the control of industrial-polluted water and improvement of household sewage systems have undergone further development in each local district under the supervision of the Ministry of the Environment.

Fig. 7.1 Sumaura Fishers Club in Osaka Bay, and near-shore land reclamation history (Adapted from Setonaikai Kankyo Hozen Kyokai 2017: 43)

However, when it comes to controls on spatial conservation by landfills and industrial reclamation and the establishment of natural protected areas, economic interests continued to be prioritized via "special exemptions." These special exemptions were applied by developers and local governments to landfills of garbage and reclamation sites for industrial land and airports, once again rationalized as economic development (see Fig. 7.1, land reclamation map, for details). Their justification was on the grounds of contribution to the betterment of water quality or solutions for other environmental problems, such as noise mitigation (Gotoh 1999; Nakayama 2002). Although it may sound contradictory, demanding water quality improvement and the desire for development through landfills and land reclamation were logically associated with each other by national and local jurisdictions. The waterfront development through landfills and reclamation was expected to enhance environmental aesthetics, converting the visual landscape of polluted water and its degraded ecological productivity into modernized tourism scenery with promising estimated economic productivity. In this context, officials created and implemented their own aspiration of and scenario for a "clean sea (*kirei na umi*)" as one of the components of beautiful waterfront scenery. Thus, the socioecological regime of a "clean sea (*kirei na umi*)" came to define environmental governance after the Seto Conservation Act was established.

7.3 Cultivating Essential Dimensions of Ecological Reflexivity

7.3.1 Recognizing What the Regime of a "Clean Sea (*kirei na umi*)" Achieved

Efforts at water quality control in the Seto Inland Sea first appeared toward the end of the 1970s. Water quality improved, especially COD and subsequently also TN and TP. Except for the inner part of Osaka Bay where the water had been compartmentalized by companies and contained dysoxic and even anoxic areas, the pollution control policies under the regime of a "clean sea (*kirei na umi*)" were well implemented, and the scientific evidence soon showed great improvement in water quality (Abo et al. 2018; Tanda et al. 2014). In response to that, fish catches and aquaculture production in the Seto Inland Sea achieved new peaks during the 10 years from 1975 to 1985. The combined reasons for this achievement included the results of water pollution control, such as the decrease of toxic red tides, but also included fishing mechanization, the introduction of scientific–technological devices such as fish detectors and aquaculture technology development.

Fishers recognized the return of cleaner waters. One old-timer in the fisheries remembers his day-by-day realization of the improvement.

> Fish tasted good, smelled good again. The wind conveyed the smell I had remembered in childhood. The soy sauce color has gone, and the creamy green color came back. Fish were everywhere, so you could drop a gill net and get as much fish as you wanted.[1]

They used the word "clean," taking it to mean a state of water presenting improved color and smell, and production capacity returning to what they and older generations had known before the pollution. As such, efforts at restoring cleaner water became the representative expression for the rehabilitation of the fisheries grounds.

Despite these early successes, fishers once again started to face a decline of marine productivity by the 1990s. Early on, fishers thought that overfishing was the cause, and so they put more effort into rearing artificial stocks to enhance natural stocks. In 1962, marine-ranching stock enhancement projects, advanced by Japan's Fisheries Agency, began as a part of compensation for fishers as victims of pollution, as well as for aquaculture development. The project aimed to release farmed juveniles to the sea to increase natural fishery stocks with popular and high-value market commodities such as clams, Japanese tiger prawns, and sea bream. Despite persistent efforts and increasing numbers of fish releases throughout the 1990s, fish and clam catches kept decreasing. By 2000, these catches were down to half of the 1985 catches in the entire Seto Inland Sea. Moreover, by the middle of the 1990s, *nori* seaweed farming also faced the problems of discolored *nori* and decreased production. These problems started from the west side of the sea and then spread to

[1] 2013, August 13, in the semi-conducted interview with a retired fisher in his 80s in Kobe.

the eastern areas by around 2000. Though farmed *nori* seaweed should be glossy black as a commodity in the market, the *nori* seaweed farmers found the color had become an almost transparent green that could never be marketed or eaten. The *nori* seaweed farmers started reflexively to explore for explanations for these new realities despite their "clean sea" achievements and started to explore different pathways for ecological rehabilitation from these new realities.

7.3.2 Exploring Historical and Enduring Ways to Better Live *From/With the Sea* in Service to Living with Nonhuman Assemblages

7.3.2.1 Situating Fishers' Historical Senses of How to Better Live *From/With the Sea* in Service to Living with Nonhuman Assemblages

Why were the "clean sea" efforts not able to renew abundance and resilience in fishing and in *nori* seaweed farming? The Sumaura fishers also faced the loss of production of *nori* seaweed in the early 2000s, and some of the individual *nori* farmers in the SFC quit *nori* farming due to chronic losses in earnings. They were some 200 strong fishers around 1975, but by 2000 only 14 fishers were involved in *nori* farming. Amid chronic declines in *nori* production, fishers started rethinking their methods by asking the old-timers about the past to understand how "clean" their sea was—how the water smelled, what color it was, and how much and what fish they could catch. The *nori* production crisis led them to undertake their own historical research, which increasingly involved reflexive ways of exploring and thinking. In parallel, they recalled their own younger days with the sea at that time and remembered former generations of fishers in the community. Their reorganization and understanding of historical changes in the realities of fishing came to shape their explanatory discourses, such as:

> In my father's generation, they did not have to think about their skills. As for flounder, as you know, they were just there on the beach. When you were tired of swimming, just set your foot on the sand below the water, and you could easily step on a flounder in the sand. That's a quite common story that everybody his age experienced. I did, too. Maybe less than at his age, though. In their words and with my experiences helping them in my childhood, I would say, they could catch a decent number of fish wherever they set their gill net. Not like the easiness in his days, but until around 2003, we could still assure ourselves of a good gill net catch. I even earned a million yen in a day once, and the average was 100 thousand yen a day in those days. Now I can only get 50 thousand yen, which actually means a deficit. Whether you can judge what is good and bad about the sea depends on one's current gut-feeling of how to live *from/with the sea* (*umi to seikatsu suru kankaku*), that we have gotten somehow.[2]

[2] 2014, June 7, fisher B in SFC in his 50s, in the SFC office.

According to the old-timers' stories, not only the amount of fish catch, but also changes in the species caught since around the 1970s were obvious, as well as changes to physical ecological system variables such as beaches, river water flows, tidal currents, rainfalls, and even winds and moisture coming from land.

Continued explorations of their historical and current gill net fishing led the fishers to identify and begin to adapt their "sense of how to better live *from/with the sea* (*umi to seikatsu suru kankaku*)," practices that had sustained their resilient livelihoods as well as their identities as knowledge holders of the sea they have lived with and lived from. That is, fishers re-recognized that their identity as boat fishers sustained through boat fishing and how those operations required, cultivated, and identified them as the experts of the sea. As such, they came to amend their "gut-sense of how to live *from/with the sea*" as fishers, seeing it as a reimagining their practices and relations with nonhumans, not just as an anthropocentric "living *from the sea*."

> Listening to the old-timers and reflecting on my own experiences, such recurrent practices have given me a lot. Including, so to speak, a kind of intuition and sense for livelihood (*seikatsu no kan*). I can know, or sense, how the fish behave, what they think, what they want. Then I can make my strategy on how to fish for my living. Of course, the practices give us a lot. Experience will not always be successful, but you cannot experience if you do not have any old-timer around you, who sustained their resilient livelihoods *with* and *from* the sea.[3]

Fishers soon came to realize that they held, as a set of practices and aspirations, an affective and necessary sense of how to better live *from/with the sea*, and they found that old-timers also held a similar sensibility. This has enabled fishers to equip their cognitive and conscious abilities to better perceive how the nonhuman assemblages of marine life surrounding them live—what habitat a certain species requires and likes, and how they could earn their incomes within these ecological realities. It is not a simple ecological sensibility, but rather an assemblage of awareness and sensibilities that enable them to live an abundant and resilient life *from* and *with* the sea.

The old-timers had developed a rich and nuanced vocabulary to express knowledge about micro-habitat conditions in the sea, and they literally could sense them. When they said the wind from the southeast conveys a stormy sea here soon, surely it did. The most recent generation of fishers has learned to listen to the old-timers' knowledge, combining it with their insights from the latest technology, for example, using smartphone weather apps to raise the precision of the forecast. Also, fishers came to discern nuances in the topography of the bottom of the sea—and thus its localized conditions and habitats—as readily as if they were seeing the landscape in terrestrial areas, describing rivers as currents, springs, forests, sands, rock hills, little caves, and mountains in the water. In short, by combining the narrative explorations of former fisher generations with their own,

[3] 2014, June 7, fisher A, the leader of the SFC in his 50s, in the ship of gill net.

contemporary fishers came to learn that they have been knowledge holders of local ecological knowledge that has accumulated inter- and intra- generationally, enabling them as practical, adaptive users of these forms of knowledge in their everyday fishing and aquafarming operations. Through these shared insights and understandings, they started to recognize their inter- and intra-generational stories as being in close alignment with an ethical and necessary sense of how to live *from/with* the sea, such that they could merge these stories with scientific evidence to renew abundance and resilience in their livelihoods.

7.3.2.2 Fishers' Evolving Sense of How to Better Live *From/With the Sea*—Seeking the Ethic of an Abundant Sea (*yutaka na umi*)

With the increasing recognition that their sense of how to better live *from/with the sea* would benefit sustainable and ethical SES relations, fishers also came to trust these sensibilities in recognizing and working toward the meanings of the sea as an expression of an "abundant sea (*yutaka na umi*)." Along with exploring old-timers' stories, the fishers started to collaborate with other FCAs and other research facilities, private company laboratories, prefectural and city research agencies, and even a local aquarium, in order to collect data on water quality, nutrition and marine salinity, flows and tidal dynamism, and marine organisms and their habitats, in littoral and benthic habitats. Besides investing in natural stock rehabilitation in marine ranching for targeted species, the SFC started to verbalize their own and old-timers' experiences and shared intuitive understandings and practitioner senses in service to recognizing detailed changes in the sea and thence to find causes.

Such explorations about possible causes of decreased fish catches resulted in finding accumulated environmental damages that had only appeared several years after the completion of reclamation projects, dredging, and gravel extraction. For example, the Kobe Port region that includes Sumaura has been continuously developed as an urban-industrialized waterfront since the postwar era. Sumaura fishers historically contextualized those development records and recognized in particular that the artificial island development called the second stage Kobe Port Island development in the very late 1980s—which created urban waterfronts and the international port—had been the turning point. The first stage of its construction had started in 1966, creating 443 ha of reclaimed lands, but from the fishers' experiences, the southern construction in the second stage that started in 1987 and landfilled 390 ha had more impact on water flows and fish passages. Furthermore, to maintain the international port, continuous dredging for tanker access was also causing widespread and consequential damages underwater. During this time, the artificial island for Kansai International Airport was being built in the south of Osaka Bay. Adding to those accumulated environmental changes, in 1999, the reclamation for Kobe Airport in the south of Kobe Port island started and had an even greater impact on the marine ecosystem. Fishers explored such historical changes and concluded that degraded critical marine conditions caused by reclamation and dredging had reduced and were continuing to reduce marine productivity. According to one fisher:

> This sea, as an urbanized body of water, is now continuously losing its possibilities and abilities of production. We did not notice this until the fish told us with their disappearances, some three or five years after we created the landfill islands. Ten years later, we live our everyday lives as fishers with a lot of regrets, asking ourselves why we allowed reclamation. Twenty years later, we see something negatively impacting fish now spreading across the entire sea. [. . .] When we allowed dredging and gravel extraction 20 years ago, we had never imagined what a huge negative impact on the environment it would give. Continued dredging of tanker-channel depths to 12m, 14m, and now to 16m have been changing the tidal flows and the landscape of the bottom of the sea. Now we think that dredging is much worse than reclamation. And, we now know that tidal flow is very important for marine productivity. I say, after 10 billion yen worth of development, we need 10 billion yen worth of rehabilitation for the sea to be an abundant sea (*yutaka na umi*). We have harvested these marine resources as the result of thousands of years of work by nature, and we have extracted too much of what we had wanted in too much of a selfish way, only caring for ourselves.[4]

With these narratives, the leaders of the SFC asked themselves what responsibilities they should have taken before reclamation, dredging, and gravel extraction occurred. Then, they made a declaration that they should work for the cultivation and regeneration of marine productivity itself.

To express the state of the sea that they want to regenerate, they chose the expression "the abundant sea (*yutaka na umi*)." The adjective "*yutaka na*" had been used for the national and prefectural projects of marine ranching (*saibai-gyogyō*, cultivation for/of fishing) in the aftermath of pollution in the 1970s. For fishers, the marine-ranching projects designed to enhance natural stocks had been an effective and experientially proven measure to increase fish catches. Since the Fisheries Agency started the first marine-ranching projects, regenerating an abundant sea (*yutaka na umi*) was the core concept and represented the desired state of the sea. Abundant sea means a sea of enough marine productivity to sustain fishers' incomes, their sociocultural ways of life, and self- and local respect as fishers (Matsuda 2017). Furthermore, in the context of marine ranching, to cultivate marine productivity means not only assuring sustained increases in profitable fishes, but also regenerating their habitats, such as seaweed beds, fish reefs, and tidelands, with ecological engineering (Ohshima 1994). An abundant sea should be a source of power and possibilities of productivity and rich biodiversity with sufficient ecological habitats to sustain them. These can enhance fishers' livelihood strategies, in close moral and ethical alignment with their virtuous sense of how to better live from/with the sea—aspirations for an abundant and resilient SES. The adjective "abundant" contains such conceptual expansion outward from its direct meaning of abundant fish resources.

The expression is now a part of their everyday language, and sits in strong contraposition with "clean sea" when the fishers explain both the current and desired state of the sea. The SFC has experience-based events for education and local communities such as beach seining and *wakame* seaweed aquaculture ownership

[4] 2014, December 12, fisher A, the leader of the SFC in his 50s, in the SFC office.

activities. In such events, fishers often explain the current and desired state of the sea to participants. Their usual explanations include such statements as:

> Look, such transparency! Clean water means that it contains almost nothing. No nutrients, planktons, or anything. We fishers want an abundant sea, not a clean sea. We need fish.[5]

7.3.2.3 *Nori* Seaweed Farming Further Cultivates Fishers' Evolving and Ethical Sense of How to Better Live *From/With the Sea*

How can we understand, socioecologically, essential meanings of abundance in relation to the Seto Inland Sea? For this question, Sumaura fishers came to recognize *nori* seaweed as a signifier to complement their maturing sense of how to live *from/with the sea* and for how to characterize and build in abundance. Although boat fishing has been central to local ecological knowledge production, to fishers' cultural identities, and as a signifier of relations among fishers and nonhumans for a hundred years, currently *nori* seaweed farming occupies 95% of the yearly income and the remaining 5% comes from the gill net fishing done by SFC fishers. As Fig. 7.2 shows, their main operations have been multiple and have changed, intimately associated with market prices, industrial structural changes, labor mobility, and marine resources fluctuation. *Nori* seaweed farming started in 1961 for supplementary income in winter during the seasonal decrease in fish catches (Fig. 7.3). In 1965, large production and machine processing was achieved, and since then, *nori* seaweed farming has been a stable seasonal job in winter, complementing summer

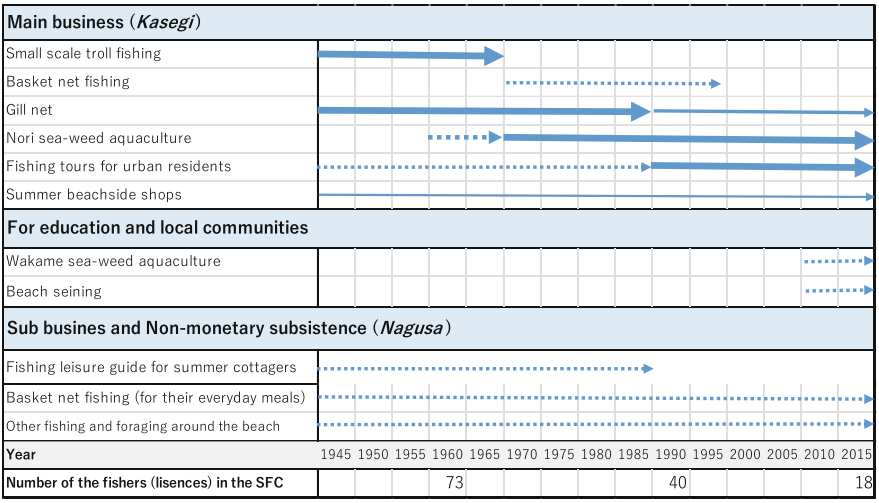

Fig. 7.2 Historical changes of the fishing operations in the SFC

[5] 2015, February 14, in the field observation of *wakame* seaweed aquaculture ownership event. Fisher B explained the current situation of the sea to a university student group.

Fig. 7.3 Sumaura Fishers as *nori* seaweed farmers in the urbanized water

fishing incomes (see Fig. 7.4). The SFC has had demarcated fishing rights that ensure them the ability to communalize their beaches and waters. *Nori* seaweed farming sites are in these demarcated areas, and until 2014, individual fishers with a license in the SFC negotiated with each other, including to rent the spatial use of the partitioned sites from the SFC in the demarcated areas for farming. The proportion of seaweed farming in fishers' yearly incomes had increased because of its higher economic stability than the fluctuating gill net catch particularly after the early 2000s, when gill net fishing started running a deficit due to declining catches. Yet simultaneously, the production of *nori* seaweed farming also started to decrease. Out of 18 fishers, 14 fishers followed the combination of *nori* seaweed farming and gill net fishing, and the other four run fishing tours all year round. Reflecting on these "new normal" realities, the Sumaura fishers decided to communalize the *nori* seaweed activities and made a joint business venture in 2014 for more inclusive fisheries and farming grounds management, with aiming to foster regeneration as well as to streamline management.

Ongoing historical explorations of their social–ecological relations through boat fishing to determine the causes of decreased fisheries production have brought Sumaura fishers a new recognition of *nori* seaweed farming. They noticed that

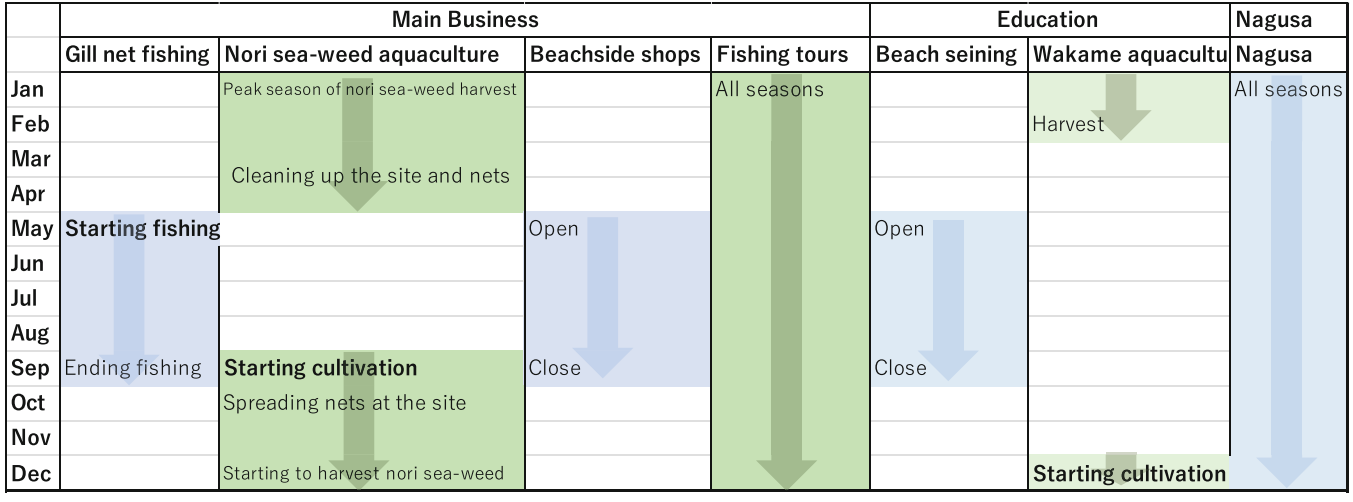

Fig. 7.4 Seasonal activities of Sumaura fishers in SFC

cultivating better habitats for fish requires understanding broader complex ecological dynamics in the bay, including tidal and nutrients flows. From the experiences of *nori* seaweed farming, until then, fishers already had understood that they needed to take care of the tides and watershed dynamics that convey nutrients from mountains to the coasts in order to produce good-quality *nori* seaweed. These understandings seemed to fishers to be logically connected. The *nori* seaweed farming site is about 3 ha in waters near their beach, and they carefully manage the site and which direction they spread the net, observing the tide and currents flows, especially from the estuaries, every year. Particularly, Sumaura's *nori* farming method is called a floating type (*ukinagashi*) that spreads the net horizontally under the water, different from a prop type that uses the vertical interval between the ebb and flow tides. The fishers know to carefully choose the site where they spread the net:

> To find a better site for *nori* seaweed is very essential. How the site can catch nutritious water decides the quality of *nori* seaweed of that year. For gill-net fishing, we observe different aspects of the tidal flows from what *nori* seaweed needs, thus seeing different things. But they are also all part of the dynamism of the current flows.[6]

As this insight shows, the fishers also noticed that knowledge for gill net fishing and for *nori* seaweed farming is complementary and connected ecologically. As for the seasons, they can observe all the seasonal changes when they operate their works; from spring to autumn for gill net fishing, and from autumn to spring for *nori* seaweed farming. Gill net fishing obliges that they move around making ecological observations, and *nori* seaweed farming offers them fixed-point observations. Gill net fishing asks them to understand fish habitats, and *nori* seaweed asks them to grasp the nutrient conditions in the bay. In turn, understanding food chains for fish correlates with the nutrient system that *nori* seaweed needs, also enhancing conditions much lower on the food chain for desired fish species. Thus, different organisms, their ecological needs, and the relationships among them shape fishers' dynamic understandings of the sea, further integrating their particular SES knowledge and understandings. Now, Sumaura fishers recognize that *nori* seaweed is another essential facilitator, a kind of *SES indicator species*, for monitoring and recreating better conditions for marine productivity.

7.3.3 Rethinking What an Abundant Sea (*yutaka na umi*) Means

Tracing trajectories of social–ecological relations and exploring fishers' evolving senses of how to better live *from/with the sea* in service to assuring resilient lives has led fishers to rethink what needs to be at the core of their work for their resilient livelihoods and for sustainable marine governance, in other words, how and as whom they want to live. This also shapes the central idea of what an abundant sea

[6] 2015, December 6, fisher B in the field observation of *nori* seaweed farming. Fisher B, C, and D (D is in his 20s) took me to watch the net check.

means and what they can challenge and adopt as they continue to transform their actions and ideas for the betterment of their resilient livelihoods.

For Sumaura fishers, the current versions of their core values are to be a guardian of productivity of the sea; to be a producer of the commons for locality and a cultivator of a local, sustainable sense of how to live *from/with the sea*; and to work toward intergenerational inclusion and support for future generations.

Fisher A, as a leader of the SFC and an individual from an old fishing family in the community, repeatedly recounts the following narrative as a way to gain legitimacy as a stakeholder and one whose opinions should have weight in the decision-making process of marine governance. We can see in his statement that fishing activities provide specific practices of noticing and forms of ecological memory that can create unique practices of reflexivity:

> Once we quit having fishers in the area, it becomes extremely difficult to restore fisheries as an industry in this site. Fishing needs human resources with knowledge and skills as well as the investment of equipment. Just like agriculture, once you quit, it becomes very difficult to restart. In that sense, we are the representatives of local history, and we also recognize ourselves as the guardians of the sea of resources, the sea of production. [...] People have more concerns about the sea of leisure, and very few concerns about the sea as a productive site, especially in these urbanized waters. I enjoy that so many people who can visit our sea find their ways of enjoying and recognizing our sea as beautiful, joyful, and recreational. However, for us, as fishers, and, I would like to say, for us as humans, the sea is a more fundamental part of our lives. We live with the sea every day. Every day with the sea is what our livelihood is.[7]

In this context, production does not only mean the physical products of fisheries, but also the spatial co-production of local social, cultural, and political capital and assets. Sumaura has kept their beaches, while other beaches in the Osaka Bay were converted to a hardened industrial waterfront. This occurred partially because Sumaura's beach scenery has been inherited as a local cultural asset, one that appeared as long ago as a seventh-century poem, as well as in the famous classic novel written in the early eleventh century, *The Tale of Genji*. After the war, Sumaura became a typical urbanized suburb as part of metropolitan Kobe. The mobility of the population is high due to its popularity as a residential area, and a partial reason for this popularity lies in Sumaura's natural richness around the beach as an amenity value. Moreover, it has functioned as an urban summer leisure site as the nearest swimming beach for residents of metropolitan Osaka and Kobe. As such, the communal property of the SFC has reproduced sociocultural spaces and values beyond the territory of fisheries grounds. In that sense, their manifold relationships with the sea cultivate ethical practices and aspirations for making their livelihood. Truly, every day with the sea is what their livelihood is, binding fishers' sense of how to live from/with the sea with an abundant, resilient sea central to what they have been, to who they are, and to that to which they aspire.

[7] 2014, December 12, fisher A, the leader of the SFC in his 50s, in the SFC office.

Fisher C, in his 30s and a leader of the youth division of the SFC, was not from Sumaura community originally. As a new inhabitant arriving to become a fisher, he sees that reproducing locality with intra- and inter-generational socioecological heritage is what they should do as fishers living with the resources here:

> Our leader [*fisher A] always says to us, we owe our assets to the former generations, from the present generations who give us the lead in governance of this beach and sea, and from the future fishers and residents who rely on us for what they will have. These assets include the negative ones as well as positive ones, apparently. Historically, the beach was a communal asset, and gradually I understand what our leader says, that we physically occupy this local livelihood space. [. . .] I would like to express how the fishers can consider the locality itself and would like others to know how we are trying to sustain it as something common in this area.[8] (*author added)

What does it mean for fishers to occupy local livelihood spaces that co-produce and reproduce cultural and social values? The fishers recognize themselves as producers of local cultural and social values and sensibilities that offer residents important connections with the sea. Furthermore, we can say that the fishers produce public values and goods in this broader context. If they were to quit being fishers, the local community would lose an essential context and pathway to communicate and be in relationship with the sea, which has produced rich sociocultural assets, today and in the future. Sumaura fishers believe that for their own business, it would more effective to localize themselves and take responsibility for being fishers. In this context, to localize means to continue offering local tastes with the Seto Inland Sea fish and *nori* seaweed as well as offering good sociocultural spaces for leisure and related amenities.

Above all, Sumaura fishers place the most priority on cultivating and sharing these moral and ethical perspectives on, practices for, and aspirations of how to live from/with the sea among fishers and also among residents. Both communities need an abundance of nonhumans in the sea, and they need the abundant and resilient ecological power of the sea in order to sustainably ensure sufficient fish and *nori* seaweed. As for the fishers themselves, they have developed appropriate training systems for youth and new members who are not originally from the district, so that these newcomers may adopt their ethically and morally infused practices and aspirations. As we have already seen, these senses of how to live from/with the sea recognize the historical trajectories of social–ecological relations, their qualities and particularities, and how human livelihoods can be resilient within such ecological assemblages. In this context, Sumaura fishers are eager to have educational leisure events for residents and consumers. Beach seining with experts from local aquariums, the *wakame* seaweed ownership in which visiting local residents can experience the whole process of farming *wakame* seaweed, the local festival management to empower locality, and class tours for school education—all these help

[8] 2015, January 8, fisher C, a leader of young SFC members in his 30s, in the seaweed processing factory.

visiting local residents to share and to further cultivate virtuous senses of how to live from/with Sumaura's local Seto Inland Sea. The fishers see how these community events have become local business promotions and how they cultivate markets for future generations. Moreover, they believe that for effective and enduring environmental governance, these activities and relations constitute the most direct path– to nurture ongoing life from/with the sea in ways that foster care for both humans and non-human—even as they might seem to be long, roundabout, and time-intensive.

7.4 Ecological Reflexivity Embodies Ethical Practices and Ethical Outcomes Toward Effective Multispecies Environmental Governance

7.4.1 Further Reflections on Fishers' Resilient Livelihoods from and with the Sea

While Sumaura fishers explore their abundant vision of the sea for resilient livelihoods, the political regime of marine environmental governance in the Seto Inland Sea has changed since 2010. Beginning in the 1990s, under the international influence of the concept of biodiversity that sustains the cultural diversity of human society, the Japanese concept of *satoyama* started to embody a desirable vision of socioecological mosaics of mixed terrestrial landscapes in Japan. This vision of resilient livelihoods also provides collective and individual imaginaries for senses of home and place, becoming nationalistic nostalgia, intimately associated with governmental agencies and field sciences such as conservation ecology and green planning (Takeuchi et al. 2001).

In response to that movement, in 1997, *satoumi* was coined as *satoyama*'s analogy in coastal marine areas by the marine engineer Tetsuo Yanagi, who has contributed significant scholarship in service to the Seto Inland Sea (Yanagi 2005, 2007). With his long history of staying with local fishers who had fought against pollution and for the sea's rehabilitation, Yanagi's coining of the word had a clear aim to design the concept that underpins and provides the practical framework and methods for the regeneration of cultural and biological abundance and resilience for local fishers and their communities. The combination of *sato* (villages) and *umi* (sea) represents a mosaic set of socioecological seascapes whose places and ecological conditions have formed under relations of coevolution and interactions among human and nonhuman communities and which contain beaches and shallow waters for walking (*se*), tidelands (*higata*), rock reefs (*iwaba*), and seaweed beds (*moba*) amid them. In other words, *satoumi* conceptualized the embodiment and lived experience of temporal–spatial maritime and coastal socioecological relations among humans and nonhumans.

In the same period, the problems of reduced fish catches and poorer *nori* seaweed production expanded, affecting large numbers of fishers in the Seto Inland Sea. Fisheries science experts in both academia and in prefectural agencies started to criticize the already-weaker ecosystem capacities and potentials of productivity in

the Seto Inland Sea, and they asked the political regime to shift their attention and efforts from pollution control or environmental protection to the regeneration of ecological productive power. GMAC, the political-administrative alliance of prefectures and cities circumscribing the Seto Inland Sea, turned to *satoumi* as the core concept for their shared new political regime for collaborative spatial environmental governance in order to regenerate inclusive productivities, including marine and terrestrial productivity, for harvesters, and for ensuring the productivity of cultural identities and shared values for residents. In response to such movements, the Ministry of the Environment started to hold public meetings and empanel expert committees in 2010 to explore the possibility of shifting the primary management goal, "from a clean sea to regeneration of an abundant sea."[9] In 2015, the Seto Conservation Act was revised with these arguments, expressing the regime shift from a clean sea to an abundant sea. Besides promotion of the restoration and rehabilitation of wetlands and seaweed beds, efforts also began to improve nutrition control (particularly TN and TP) in order to increase productivity, targeting *nori* seaweed production. This proactive nutrition control has led to the partial loosening of the regulations that had been in place since the 1970s for controlling pollution. Hyogo prefecture, to which Sumaura belongs, started to manage the nutrient flows from land in order to increase watershed nutrient flow and thus exert a positive control on an essential ecosystem variable.

As one of the representatives of Fishing Cooperatives, Sumaura fishers supported the activities to revise the Seto Conservation Act in order to prioritize nutrition management for regenerating the sea's productivity. They have been quite active among other fishers in the Kobe Fishing Cooperative, and furthermore, beginning in 2017, they have enhanced and expanded the shoals of local beaches based on stories from the old-timers as well as from the insights of coastal engineering experts. The restoration plan of the shoals had arisen in their minds from their exploration of the historical trajectories of their social–ecological relations that came from the stories of old-timers and their own experiences as residents and fishers. In the explanation of the event, we can see the fishers positioning *nori* seaweed farming and old-timers' stories about the beaches as an ecological (and thus a social) reference—a kind of *SES indicator*—and then linking it to the desired status of their sea, situating it as a keystone from which others can also cultivate new senses of how to live from/with the sea that further enhance its abundance and resilience:

[9]The word 'abundant' appeared in the final report of the expert hearings for the future of the water environment in the Seto Inland Sea, which was held 5 times during from September 3, 2010 to March 7, 2011. It was used as a symbolic word indicative of a new direction, opposed to that of the previous regime of a 'clean sea.' The official documents including conference notes and delivered documents in each conference can be downloaded from the following site: https://www.env.go.jp/water/heisa/seto_comm.html (last viewed March 29, 2020).

> What is a healthy sea? We fishers have and share certain images, because of our experiences, but it is difficult to verbalize for other people to understand it. I do not have any confidence I can explain mine to others by language, no. Well, so, abundant – oh, that's it! I know it! Such a 'nodding' understanding never comes from a wordy explanation. [...] So, what do you think, if you were to eat a such a great-tasting seaweed that you have never had before in your life? Or, for ordinary life with such a good-tasting *nori* to be normal for you, but extraordinary for others, and they say, wow! Isn't it special? If you step on a flounder when you pause briefly while swimming? That tells you everything about abundance, right? And so, too, I have come to understand how to sense what we should have for our beaches.[10]

Sumaura fishers do not use the word *satoumi*, but instead want to share a deeper social learning process with their urban residents that goes beyond merely acknowledging the concept. They want the urban residents, including potential consumers, to cultivate their own sense of how to live from/with the sea (*umi to seikatsu suru kankaku*) so that they can recognize what resilient living can mean for those who live from and with the sea of Sumaura. Even those who are not fishers can share the sea of Sumaura as a space and a time in their lives and have their paths to communicate with the sea and Sumaura as a member of this local community. The transformation of the physical environment is a direct response for nonhumans to regenerate their habitats. Furthermore, this aims to enhance the senses of how to live from/with the sea and—for residents and consumers—to enable them to better recognize the social–ecological assemblages and relations that sustain their everyday lives.

7.4.2 Co-Creating Senses of How to Better Live *From/With the Sea* As Contextualized References for Ecological Reflexivity

Nurturing and maintaining ethical senses of how to live from/with the sea (*umi to seikatsu suru kankaku*) mean orienting one's cognitive and conscious abilities to perceive the nonhuman assemblages surrounding them—to notice, for example, what habitat and conditions a certain species requires and prefers, and how fishers can earn their incomes from and through these ecological abundances and relations. Moreover, when we focus on the word "to live (*seikatsu suru*)" in its historical context in Japan, we can recognize why the fishers use this word as the reference point for their evolving senses of ecological reflexivity.

The word "to live a life (*seikatsu suru*)" started to be used often in the early twentieth century when rapid, Western modernization drastically changed people's lifestyles and livelihoods in Japan. The word started to be used frequently in Japan as notions of quality of life and its meaningfulness became a question of how to live a life, adding to the meaning of the reproduction of life and subsistence activities for living (Iwamoto 2019). It in part reflected ideas translated from the English and German terms "life" and "Leben" (Iwamoto 2011). In turn, early works of ethnology

[10] 2014, December 12 fisher A, the leader of the SFC in his 50s, in the SFC office.

and sociology focused on *"seikatsu suru*" and phenomena related with it, in particular arguing the epistemological and practical breaks and connectivity between what was suddenly modern and what was rapidly defined as pre-modern (and quickly becoming erased) in Japanese society. These works illustrated how people were adopting and adapting to these external life changes, such as new kinds of transportation, technological equipment, and economic and government institutions, by implementing internal changes through the creation and reconstitution of customs, subsistence activities, and collective and individual mores, values, and virtues (Ariga 1969; Yanagida 1993; Iwamoto 2009). These studies showed that, among Japanese people, to "live a life (*seikatsu suru*)" had meant to exercise the abilities of people to transform themselves and their environment to adapt to such rapid, drastic, and ongoing changes in their surroundings and situations in an effort to realize the betterment of their lives.

Sumaura fishers found such meaning in the capacity and creative ability to explore, adapt, and transform their senses of "how to live" in relation to the term *seikatsu*. Therefore, their senses of how to live *from/with the sea* came to include efforts to transform and adapt themselves in order to negotiate with other nonhumans, all in service to maintaining their resilient lives and livelihoods from/with the sea. Exploring the historical trajectories of making their livelihoods *from/with* the sea as they experienced the reduction of their gill net and *nori* seaweed production in the early 2000s enabled the fishers to recognize how they had adapted to the external changes of the environment and led them to rethink what they have held as core values for their livelihood sufficiency: ensuring their abilities to make their resilient livelihoods *from/with the sea* and maintaining the quality of their lives with their sociocultural inheritance in their manifold relations with the sea. Particularly, amid the adaptive transformations of their fishing and aquafarming, not only did *nori* seaweed farming become an avenue for the fishers' main income-earning, but also *nori* seaweed became a kind of socioecological signifier, an *SES indicator species*, to monitor and recognize the historical and current situation of their SESs, and served as a reference for their work toward a desired ecological condition for the sea. By rethinking their own marine governance through these essential ethical practices in service to more virtuous outcomes, and by cultivating essential and enduring senses of how to live from/with the sea that also support the sea, both fishers and local community members came to recognize this core virtue: the need to persist in working for a sea of abundance, one that ensures continued potential abundance for future generations. As such, for Sumaura fishers, ecological reflexivity has come to be acquired through recurring contextualized explorations of, references to, and their own evolving sense of how to live from/with the sea.

Positioning *nori* seaweed farming in the fishers' lives updated their local ecological knowledge (LEK) production and the scope of their LEK. It certainly aided fishers in making more expansive observations in the field, which they then combined with scientific knowledge, specifically about watershed nutrient flows and tidal current systems of the sea, as well as the connected freshwater flows and their nutrient loads. To listen to the voices of the seaweed-as an SES indicator species- is to respond to the voices of the non-human assemblages that surround both human

and nori seaweed. The fishers' rapidly evolving practices in *nori* farming led them to have stronger sensibilities of growing and cultivating life than they had before through only boat fishing, so that the new regime of "an abundant sea (*yutaka na umi*)" based in part on cultivation and nurturing, not just harvesting, could arise and be accepted as an effective socioecological resource regime for expressing the desired status of the sea.

While it can seem quite ambiguous as a normative expression, 'an abundant sea' nevertheless matters in fostering the ability to recognize and to act in response to both the historical and current status of the sea as an SES, to rethink a desired status of the sea in the light of these evolving practices and aspirations at the core of their resilient livelihoods, and to adaptively transform and negotiate with oneself, with one's colleagues, with the larger society, and with nonhuman assemblages, all in service to mitigating uncertainty and changes surrounding them.

In this light, fishers' evolving senses of how to live from/with the sea are both a conceptual and a pragmatic contextualized reference for ecological reflexivity to give voice to those abilities and to act on them. In other words, how stakeholders in environmental governance cultivate, hold, and exercise such abilities is at the core of ecological reflexivity, and the contextualized reference to express it is critical for achieving the ethics not only of ecological reflexivity in environmental governance but also of enduring abundance and resilience in local socioecological systems.

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