Satoumi Ecosystems and a New Commons: Ecological and Institutional Linkages between Human and Nature

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Abstract

"*Satoumi*" is defined simply as a seascape with "high productivity and biodiversity in the coastal sea area with human interaction" (Yanagi, 2006). Unlike the *satoyama,* in which human interaction with nature can be recognized as a visible landscape, the *satoumi* seems to be an invisible seascape and uncertain without close observation. To demonstrate the concept and practices prevailing in the *satoumi* more concretely, ecological and institutional effectiveness is examined in small-scale fisheries in western Japan. The focus is access rights in historical continuation between pre-modern and modern periods leading to contemporary fisheries jurisdictions. Stationary fisheries such as bamboo weir, tidal stone weir, and set net fisheries found in Okinawa and the Seto Inland Sea are chosen to demonstrate biologically and institutionally positive effects on the *satoumi.* In stationary fisheries, conservation and productivity are generally positively realized through communal efforts to maintain the installations. Yet, in individualistic set net fisheries, efforts to conserve marine resources should be more elaborately promoted to avoid over-fishing. In debates on conservation of MPAs (marine protected areas), governance to mitigate serious contradiction among stakeholders is a primary concern. Yet, as it is often hard to reach a final decision in launching MPAs, a new concept of the commons is highly recommended to provide an effective framework for conserving biodiversity as well as promoting marine production.

Key words: commons, conservation, governance, MPAs, stationary fisheries

1. Linkage between Forest and Sea

It is important to consider ecological relationships linking forests with seas *via* rivers. A key to understanding these relationships within the ecosystem is *bona fide* water that links them together as the medium carrying nutrients, including nitrogen, phosphorus and dissolved iron. Plant and animal litter is also transported *via* water mass. The level of nutrients in any river system is affected by natural factors such as catchment geology, precipitation and vegetation. Furthermore, it is influenced by such anthropogenic factors as land use, agriculture, livestock breeding, industrial disposal and sewage, *inter alia* in urban areas. In this regard, estuaries and river mouths which are the terminal of rivers, are influenced by the over-all level of nutrients.

During the past decade, studies on management and production of coastal natural resources have focused on nutrient transport and material cycles from terrestrial ecosystems. For instance, it has been demonstrated that dissolved iron plays a significant role in the primary production of marine ecosystems, from a comprehensive study on the Amur River and Sea of Okhotsk (Shiraiwa, 2011). Shiraiwa concluded that the catchment of the Amur River provided "a huge fish-breeding forest." Yamashita (2007) and Tanaka (2008) claim the need for a synthetic study to link forest, river and sea. One NPO group also demonstrated efficient measures for the management of forests, rivers and seas as inseparable unities, from thirteen case studies in Japan (Committee of Citizen's Group for Promoting Nature Revival, 2005). These academic approaches were initially stimulated by an extensive campaign of tree planting of broadleaf species, *inter alia*, that was promoted by Hatakeyama (2006), who was engaged in coastal oyster mariculture in the Tohoku region of northern Japan.

Links between terrestrial and marine ecosystems are not always seen *via* river systems. Groundwater from forests often spurts from coastal sea beds, providing sufficient nutrients for the growth of algae, seaweeds and mollusca such as *iwagaki* (rock-oyster, *Crassostrea nippona*), *kaki* (oyster, *Crassostrea gigas*) and *hotategai* (scallops, *Mizuhopecten yessoensis*). Coastal areas with groundwater spurts are known to provide good harvests of seaweeds and mollusca. Taniguchi demonstrated that an abundance of rock-oysters was found even where

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rivers were absent on the land side in Yuza town, Yamagata Prefecture (Taniguchi, 2010). This suggests nutrients from forests are directly transported *via* groundwater.

2. The *Satoumi* and Sea Tenure in the Pre-Modern and Early Modern Periods

Yanagi (2006) defines "*satoumi*" as an area where there is found "high productivity and biodiversity in the coastal sea with human interaction." Unlike the *satoyama* where impacts of anthropogenic alteration upon terrestrial environments are clearly visible in the landscape, the *satoumi* gives us only a vague impression regarding how the *satoumi* seascape crystallizes the practical functions of provisioning services (productivity) and support and maintenance services (biodiversity). Although the *satoumi* has no explicit connotation in terms of biodiversity and resource management schemes, human cultural and institutional transactions may clarify the content of the *satoumi*. The land-based modernization process during the World War II period that occurred in the coastal environment was serious in bringing about a decrease in resource production and a loss of biodiversity; therefore, it is prerequisite for us to assess the past conditions of the *satoumi* in Japan during the pre-modern and early modern periods before modernization altered the coastal environment.

From this viewpoint, I will first examine the *satoumi* during the Meiji period of the early 20th century, using historical documents on Exclusive Fisheries Rights claimed by local fisheries sectors.

2.1 Background of the Meiji Registration Forms

During the pre-modern Tokugawa feudal period, fishermen in Japan were forced to pay taxes by providing marine products to the fief, *i.e.,* "*Zozei*" (miscellaneous tax), instead of rice, which was the standardized payment by farmers. Subsequent to the Meiji Restoration of 1868, the *Zozei* system expired in 1875. At that stage, the Meiji government proposed a new legislative reform to tax fishermen by subjecting them to rent for the fishing grounds, claiming them as the property of the government. This law was called the "Sea Rental System" (*Kaimen-Shakku-Sei*). However, due to strong objections to this idea, the law was rejected the following year (1876).

Despite this, the government persisted in claiming that the sea was the property of the nation, and that only usufruct to the fishing grounds was transferred to the fishermen and their cooperatives. The idea was realized as the first Meiji Fisheries Law in 1901, which was revised in 1910. It is important to note that in the Meiji Fisheries Law, the former customary rules and practices were highly acknowledged (Ninohei, 1981). In other words, pre-modern customary practices were then followed even after the Meiji period up until the present time. In this sense, 'conservationism,' rather than 'revisionism,' was the major trend in the modern history of fisheries law in Japan (Akimichi & Ruddle, 1984).

Under the Meiji Fisheries Law, the registration of Exclusive Fisheries Rights and attached maps of the fishing grounds were formally acknowledged, with a set retained by individual Fisheries Cooperative Association (FCA). The process of registration commenced in early 1910 and has continued since then. As will be shown later, the content of the registrations well reflects the status of fisheries in ecological and technological terms during the early modern period, and thus it provides useful information in considering the concept and implementation of *satoumi* management.

2.2 Image of the *Satoumi* during the Meiji Period

According to my study of registration documents nationwide, the number of entries totaled 5,489, and each set of entry documents included the following information: registration number (*e.g.*, No.32), date of registration (*e.g.*, December 10th, 1909), kind of fishery (*e.g.*, coastal gill netting, harvest of abalone, top shell, hard-shelled mussel, *wakame* seaweed, *tengusa* seaweed (agar-agar), *nori* seaweed, *ogonori* seaweed, *umi-somen* seaweed), kind of target species, and fishing season (Fig.1).

As for the fishing season, coastal gill netting and harvests of sea urchins and mollusca are year-round while the seaweed harvests are seasonal: *wakame* (February 1 to July 31), *tengusa* (March 1 to August 31), *nori* (November 1 to March 31), *ogonori* (Mar. 1 to July 31) and *umi-somen* (May 1 to June 30), depending on the species' growth.

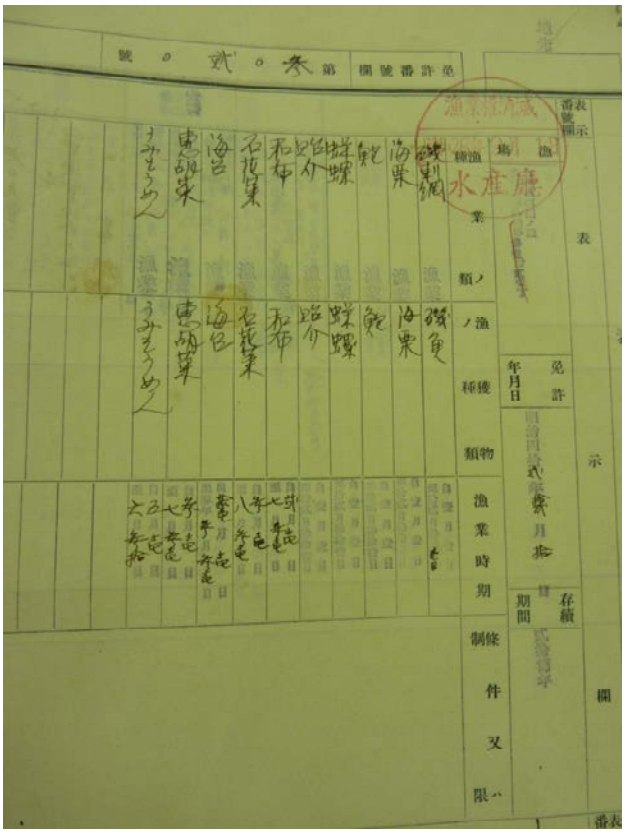

Fig. 1 Registration document of the Meiji Exclusive Fishing Rights Fisheries.

The number of entries varies conspicuously by prefecture (the administrative unit, of which Japan has 47). Amongst all, Nagasaki Prefecture had the most (434) in number, followed by Ehime (408), Mie (272), Niigata (240), Yamaguchi (229) and Shimane (210) Prefectures (Fig. 2). It should be noted that in these prefectures, similar kinds of fisheries were not always registered, but differed according to local conditions. Also, a marked difference in terms of fishery type by prefecture suggests local fisheries to have been more developed in western Japan during the early modern period.

The number of fishery types registered in each FCA varies extensively (Fig. 3). From 390 random samples investigated, it is apparent that FCAs claiming less than five entries are most dominant, and that the number of FCAs decreases as the number of fishery types increases. FCAs that claimed more than ten types of fisheries account for about 38%. Nevertheless, it must be noted that FCAs claiming more than 25 kinds of fisheries account for about 10% of the total. In other words, the number of fishery types reflects differentiation and/or specialization in fishing techniques employed and target species associated.

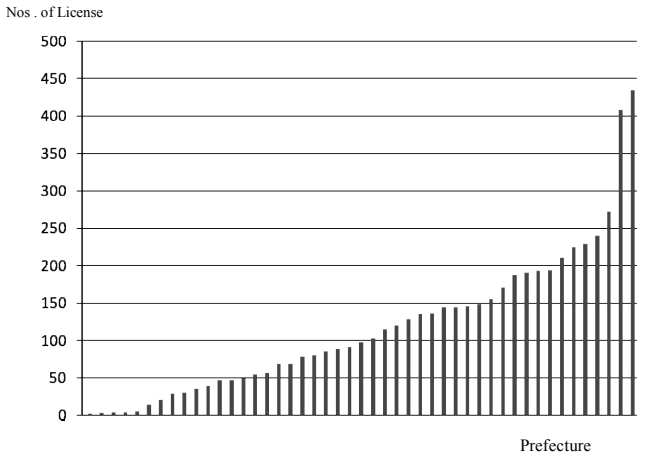

Fig. 2 Number of entry in fishery type in respective Fisheries Cooperative Association.

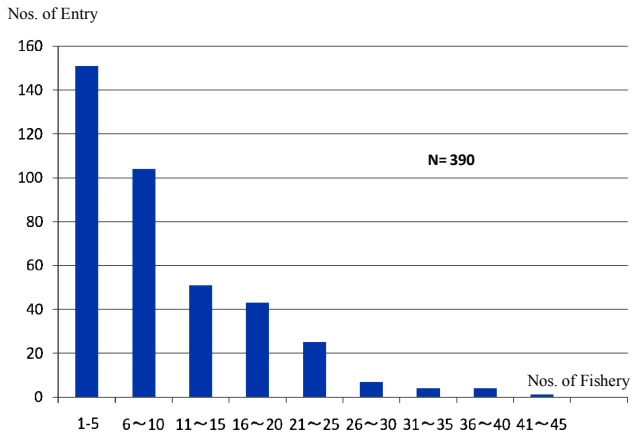

Fig. 3 A map showing the Exclusive Fishing Rights Fisheries Fishing Ground. It shows the case of Shikatayama, Mokurou Village, Suzu county, Ishikawa Prefecture.

Unlike net fishing and line fishing that can catch *de facto* various kinds of fish, registration for seaweeds and benthic animals are done for specific target species. As there are less than thirty kinds of benthos species harvested as a whole, Fig. 3 implies that many FCAs claim fisheries for benthos *inter alia* among their specified fishing practices.

Note that among seaweed harvests, except for the economically important *konbu* (kelp, *Laminaria* spp.), *tengusa* (agar-agar, Gelidiaceae spp.) and *wakame* (*Undaria* sp.), a fertilizer fishery is registered in which the target seaweed species are unspecified. This suggests that some unidentified kinds of seaweeds, perhaps those of *Sarggasum* spp. were used widely as an important source of fertilizer on agricultural fields until the postwar period when seaweeds were replaced by chemicals. By the early modern period, the *satoumi* delivered provisioning services to agriculture by which the *satoumi* and *satoyama* had close interconnections in terms of material cycles. It is also apparent that widely distributed sea-grass beds or *moba* along Japan's coasts enabled a sufficient harvest of seaweeds.

In addition to seaweeds, other unique fisheries existed: dugong and sea turtle hunting were conducted, particularly in southwestern Japan. Yet, dugong and turtle hunting are nowadays legally prohibited due to loss of habitat, environmental deterioration and over-hunting that have resulted in a serious threat to their populations. Sea worm or nereid collecting was common on the tidal flats of the Seto Inland Sea and elsewhere in providing bait for line fishing. Extensive use of sea worms implies that tidal flats existed extensively along coastal areas, especially in western Japan. Hence, data on fisheries during the Meiji period suggest that more diverse kinds of small-scale fishing practices were prevalent than today, in line with marine biodiversity. The extensive distribution of tidal flats and sea-grass beds contributed largely both provisioning and supporting services in coastal ecosystems. The loss of sea-grass beds and tidal flats that subsequently occurred due to land reclamation, sewage contamination and environmental pollution during the post-war period (Akimichi, 2004) meant the death of the *satoumi*.

A map that was attached with the Meiji registration documents shows the enclosed areas of the Exclusive Fisheries Fishing Grounds claimed by each FCA (Fig.4). The map indicates that the exclusive fishing area was determined based on definite geographical and administrative demarcation. Distances of seaward extension from the coastline at the lowest tide were not determined uniformly nationwide, but differed according to the respective FCA's local conditions, although the distances were generally between one and three kilometers.

In the case of isolated islands where only one FCA claimed the sea territory, the distance was longer than those of FCAs on mainland Japan. In Okinawa Prefecture, there are many isolated islands, as shown in the following examples. In the case of Yonaguni Island, the distance is

9.09 km from the coastline, and the sea territory claimed by the Yonaguni FCA was demarked by an imaginary contour line 9.09 km from the coast and included the sea area within (Fig.5).

The distance varies by island: Iheya and Izena Islands (3.7km), Tarama Island (1.8 km), Minna Island (2.5 km), Aguni Island (1.8 km), Tonaki Island (2.3 km) and Kudaka Island (0.9 km) (Akimichi & Ruddle, 1984). It is likely that the seaward extension differed according to each FCA's geographical and ecological factors, ranging ten times longer between Yonaguni Island and Kudaka Island, for instance.

On the other hand, the bilateral boundaries of each FCA's exclusive fishing grounds were decided *a priori* in accordance with administrative borders. It is reasonable to postulate that administrative demarcation coincided with fisheries territory to avoid boundary disputes between neighboring communities. This FCA sea territory model dates back to legislation in the pre-modern period, when the central government decided in 1737 that each *iso* (coastal area) belonged to the fishing community defined by the neighboring communities while each *oki* (off-shore area) was *iriai* (commons). The legislation of this period reflects frequent occurrences of boundary disputes (Akimichi, 1995).

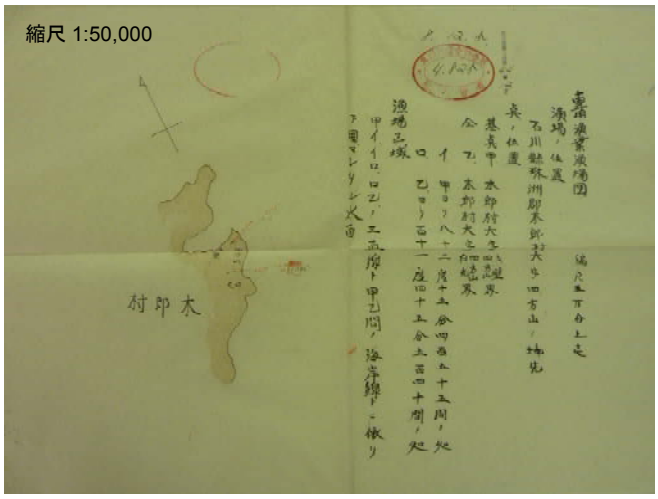

Fig. 4 Distribution of Number of Entry for the Exclusive Fisheries Rights by Prefecture. The figure indicates that Niigata Prefecture includes 240 entries.

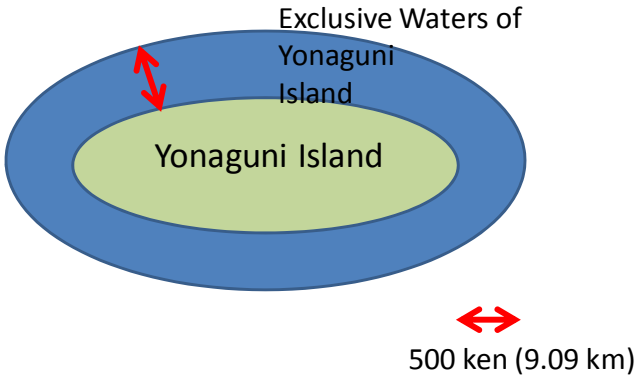

Fig. 5 Schematic Representation of the Exclusive Fisheries Rights in the Island. It shows a case, based on Yonaguni Island.

Each FCA had the hegemony to control the access to marine resources, particularly of benthos, in terms of fishing season, fishing area, gear restriction, size limits and quotas. Consensus was sought through formal and informal meetings when any problems or disagreements among FCA members emerged. Sometimes, decision-making was expanded to the prefectural level, at which stakeholders from far more diverse fields attended the meetings. Unlike benthos harvests that could often be managed at the local FCA level, serious disputes often arose over entry rights or allocation of resources for migratory fish across prefectures (Kaneda, 1979). Although these issues were generally beyond the *satoumi* framework, we must consider more empirical cases to understand *satoumi* conservation issues with reference to fish ecology and communality in fisheries.

3. Stationary Fisheries and the *Satoumi*

Human intervention in the marine environment poses the initial questions relevant to the concept and guidelines of the *satoumi.* As shown in the first section, what kinds of anthropogenic impacts upon coastal environment and how they are made should be clarified. In this regard, I will examine below cases associated with biodiversity and marine productivity, using the stationary fisheries of tidal stone weirs, bamboo weirs, and small-scale set net fisheries as examples.

3.1 Tidal Stone Weirs (TSW) in the Yaeyama Islands

A tidal stone weir (TSW) is an installation constructed by piling up rocks and stones in a U-shaped or semi-circular pattern in shallow waters (Kishaba, 1977). Sometimes, it is rectangular in shape (Fig. 6).

The TSW takes advantage of tidal fluctuations to trap fish that fail to retreat to deeper water beyond the wall of the TSW and are then harvested by hand, scoop net or spear. TSW fisheries seem to have a long tradition, dating back to olden times (Nishimura, 1975, 1987). Tidal stone weir fishing is widely distributed not only in southern Japan but also Korea, Taiwan, Southeast Asia, Oceania and even Europe (Tawa, 2002, 2008). TSW constitutes a non-destructive and sustainable fishing practice, as the structure is made only of natural rocks, and aims at fish that fail to escape. However, TSW installations are vulnerable to strong wave actions and incessant repair work on the wall is necessary. Also, construction of a TSW requires communal labor, particularly when it is large in size.

TSW is generally termed *ishihimi* (lit., stone + dry up + to see) or *uogaki* (lit., fish wall). In the Yaeyama Islands of Okinawa, there are different terms for TSW locally, island by island: *nagaki, kakii* (Ishigaki and Kuroshima Is.), *ingaki*, *uogaki, kashi* (Taketomi Is.), *kashii* (Iriomote Is.), *hashii* (Aragusuku Is.), *kumi* (Yonagumi Is.) or *kachii* (Shiraho on Ishigaki).

Fig. 6 Tidal stone weir in Komi, Iriomote Island, Yaeyama. Upper during the ebbing tide, lower during the retreating tide.

Evidently, TSWs have played an important role in providing fish and other marine animal resources for daily food, *i.e.*, provisioning services. Also, it is known that the first harvest of the year used to be offered to the sacred shrine (*utaki* or *ugan*) within the community. The fish was then buried in the ground and community members prayed for a good catch that year.

During feudal times (between 1602 and 1848), dugongs (*Dugong dugon*) were captured in a particular TSW at Kohama Island. As dugong meat was an important item for tributes to the king of the Ryukyu Kingdom and the local government head, exclusive use rights of particular TSWs were given to certain kin groups. It is evident that dugong harvested from TSWs played economic, social and ritual functions as various ecosystem services.

In terms of biodiversity, it has been demonstrated that TSWs provide artificial habitats for not only mollusca and crustaceans, but also small fish and fingerlings, thus contributing to the enhancement of potential species abundance. Indeed, after construction of a *kachii* at Shiraho, counts of both mollusca and fish increased in the successive five years (WWFJ, 2009).

In the Yaeyama Islands, TSWs were widely constructed using coral rocks within fringing reefs since olden times. TSWs are, indeed, reported from several villages on Ishigaki Island (History of Ishigaki City Editorial Committee, 1994; History of Kabira Village Editorial Committee, 1976; History of Shiraho Village Editorial Committee, 2009; History of Ohama Village Editorial Committee, 2001; History of Ishigaki City Editorial Office, 1999), Kohama Island (Yano, 2008) and Iriomote Island (Akimichi, 2011). However, most of them were abandoned several decades ago. According to my survey, the last TSW located in the Komi village area on the western coast of Iriomote Island was used until 2007. The reason for its abandonment was the death of the owner, with no successor to care for the TSW.

Similarly, at Kohama Island, there used to be twenty-seven TSWs. According to an investigation conducted in 1972, six TSWs were in use, twelve were abandoned but piles of stone still existed, and the other nine TSWs were known only from past memory (Yano *et al.*, 2002). In other cases, the reasons for the abandonment of TSWs include one or more of the following: (1) decline of catch due to fishermen from Itoman expanding activities in many parts of the Yaeyama coastal waters (Akimichi & Ruddle, 1984), (2) migration of village people to urban cities, (3) over-fishing, (4) changes in fishing techniques from traditional to modern ones, including development of fine-meshed nets, and (5) decline of communal labor practices for repairing TSW walls. Overall, given the regular use of TSWs as an important factor in the persistence of the *satoumi*, external impacts and modernization have led to the decline of fish yields in TSWs.

Despite the declining trend of TSWs in Yaeyama during the past few decades, the Shiraho community, located along the east coast of Ishigaki Island recently launched a program to reconstruct TSWs within the community's fringing reefs in 2006 with the advise of local resident WWFJ members (Kamimura, 2007). In Shiraho, there used to exist sixteen sets of TSWs, covering a total area of approximately 3,300 m². Each TSW was owned by either families belonging to the same kinship group or the community as a whole.

3.2 Bamboo weir fishery at the Nakatsu tidal flat

Bamboo weir fisheries are similar to tidal stone weirs. A bamboo weir is constructed so as to make 'V' shape, in the central part of which a bag net is set to collect fish. In retreating tidal movements, the bamboo fence drives fish towards the bag net. The technique is quite similar to that of the stone weir, but it can harvest fish more effectively than a stone weir as the bag net is the only check point when landing the catch.

In Japan, bamboo weirs used to be constructed in tidal flats in western Japan as well as the Seto Inland Sea, where tidal fluctuation is large. The Suoh Sea and Ariake Bay in Kyushu are major fishing areas still using the technique. Formerly, before land reclamation resulted in development of Kojima Bay in Okayama Prefecture and the Seto Inland Sea, similar *kashiki-ami* fisheries were conducted there too (Yuasa, 1969).

In the coastal zone of Nakatsu city in Oita Prefecture, which is located westerly, at the border with Fukuoka Prefecture, an extensive tidal flat is well conserved. The Nakatsu tidal flat stretches for about 10 km along the shore and extends 3 km offshore, with a total area of about 1347 ha. Despite the decline and disappearance of tidal flats typically observed during the post-war period, the Nakatsu tidal flat fortunately has survived. As the Nakatsu tidal flat extends beyond the prefectural boundary area where the Yamakuni river flows between the two prefectures. For the management of the river system to avoid flooding and increased sedimentation, it would have been difficult to develop the coastal land through reclamation and alteration.

Tidal flat zones are known to provide various kinds of ecosystem services such as nutrient dispersal, material cycling, waste decomposition, primary production and purification of water. At the Nakatsu tidal flat, various kinds of biological species are recorded, amounting to at least 655 species in thirteen phyla. It should be noted that 229 of the total 655 species have been identified as extinct at other tidal flat environments in Japan, the data being assessed with special references to lists in the Red Data Books of the Ministry of the Environment, Fisheries Agency and IUCN. Fauna included in these lists contain, *inter alia*, rare species of mollusca, crustaceans and goby fishes.

Tidal flats are also known as bird sanctuaries where migratory birds visit seasonally for wintering and feeding. Indeed, various kinds of migratory birds have been observed at the Nakatsu tidal flat, some of which are reported as threatened or endangered.

Despite the ecological benefits, on the other hand, tidal flats appear to give the least benefits to coastal fisheries. However, bamboo weirs used to be operated, making wise use of tidal fluctuation. Small-scale set nets using bamboo weirs at Nakatsu are locally termed *sasahibi*, which literally means "bamboo + dry up + to see." Until the mid 1960s, *sasahibi* fishery was a common practice at the Nakatsu tidal flat. According to a map showing the location of *sasahibi* installations in the 1960s, there were at least fourteen *sasahibi* and two sets of tidal stone weirs where the sea bottom was harder than in areas where the *sasahibi* were installed.

Since mariculture business has been recognized as more profitable, coastal waters have come to be claimed as demarcated fisheries for *nori* seaweed (*Porphyra* spp.) and mollusca, including the common orient clam (*hamaguri*: *Meretrix lusora*) and Japanese littleneck (*asari*: *Ruditapes philippinarum*). Due to economic changes in the fisheries sector, fishing grounds for *sasahibi* fisheries have been replaced by fisheries for mariculture. In other words, due to the expansion of seaweed and mussel culture fisheries, the territory of *sasahibi* fisheries has been largely reduced. Despite the fisheries' transformation in the tidal flat environment, another problem has emerged, that is a sharp decline in mollusca production by both mariculture and natural harvesting since around 1986 (Fig. 7).

At the same time, increased garbage along the coast of Nakatsu has come to be quite often reported. Furthermore, it has been a serious issue for seaweed mariculture fishermen, coping with the incessant fluctuation of seaweed production. As *nori* seaweed (*Porphyra* spp.) is vulnerable to environmental conditions such as water temperature, rainfall, salinity and so on, and also as the unit price of *nori* per sheet fluctuates between 1 and 20 Japanese yen, *nori* is often called "*bakuchi-gusa*" which means weed for gambling. If the unit price is 15 yen, there is almost no profit for the fishermen. On one such occasion, an NPO group "*Mizube de Asobu Kai*" (Enjoy Playing at the Seaside) supported *nori* fishermen financially by purchasing *nori* products at a price of 18 yen per unit, thus contributing an extra three yen for the fishermen. Also, this NPO group has tried to supply local seafood for lunch menus at primary schools, thus linking the fisheries industry with the education sector.

Under these changing conditions, a project to recreate *sasahibi* installations has been launched. This was initially planned in 2008 as one of the projects of the Fisheries Agency of the Japanese Government to promote coastal fisheries production while benefiting biodiversity. The Nakatsu tidal flat was selected as one of five sites for creating a new *satoumi*. In 2008, twenty-seven sites in sixteen prefectures were selected for demonstration projects for conservation of tidal flats, sea-grass beds and coral reefs (Fisheries Agency, 2009).

In constructing one *sasahibi* installation, about 12,000 stalks of bamboo (*Phyllostachys bambusoides*) that grew in the forest area of the Yamakuni River watershed were prepared.

Since the completion of the *sasahibi*, cooperative fishing has been conducted not only by Nakatsu FCA members, but also primary school children and their parents. *Sasahibi* harvests served for identification and nature education, and were then consumed at the beach. Students came from not only nearby Nakatsu City area but also distant cities and towns in Kyushu.

Mizube de Asobu Kai also organized extensive environmental activities such as beach cleaning, small octopus pot making and experimental use in fishing, consumption of local fish, etc.

Overall, the new trial *sasahibi* project has brought

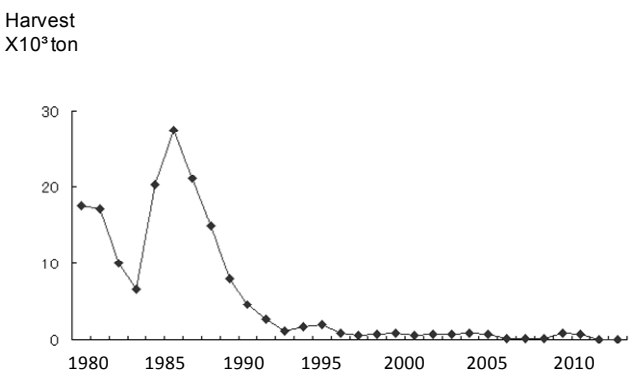

Fig. 7 Annual change in the production of Asari.

about positive effects on the ecosystem and local fish production. The ecosystem services it supports include the following: (1) the *sasahibi* fishery provides rich coastal resources as provisioning services, (2) it provides nursery beds for fish and habitats for mollusca as supporting services, (3) it prevents predation on mollusca by voracious stingrays (*Aetobatus flagellu*) as a regulating service, and (4) it gives good opportunities for environmental education, bird watching, participatory education and eco-tourism as cultural services.

In addition to the above-mentioned effects, the following ecological and social benefits are obtained: (5) local empowerment through cooperative works among fishermen of the Nakatsu FCA with governmental bodies, including national (Ministry of Land and Transportation), prefectural (Oita Prefecture) and local (Nakatsu City); women's clubs, and private sector organizations, *via Mizube de Asobu Kai*; and finally, (6) a wise utilization of forest products, with use of bamboo for *sasahibi* from abandoned forest areas creating a link between the *satoumi* and *satoyama*.

3.3 *Masu-Ami* Fishery in Yaeyama

In the Yaeyama Islands, a small-scale set net fishery is conducted in shallow waters. It is locally called *masu-ami*, and the net itself is pentagonal-shaped with three bag nets. A fence net is set in front of the entrance to the *masu-ami* (Fig. 8).

The *masu-ami* fishery is licensed by the governor, and conducted year-round except during the typhoon season and for the repair or cleaning of the bag nets. Unlike a large-scale set net fishery, the location of this small-scale set net operation is not fixed. Yet, once a certain location is occupied by any *masu-ami* fisherman, the spot is *de facto* occupied by the person in charge for as long as the fishing season continues. At present, nine groups engage in *masu-ami* fishery.

The major catches are reef fish, squid and cuttlefish.

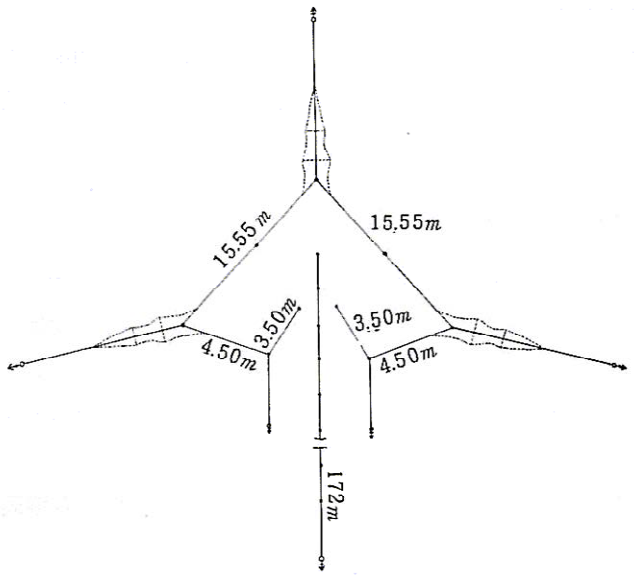

Fig. 8 Plan of *Masu-ami.*

Set net fishing is generally said to be sustainable in terms of catch composition and with regard to the cost and maintenance of the fishing installation. This is because small fish tend to escape through large mesh-sized nets, and the net can be set throughout the year.

However, it may not be sustainable if fishermen discard fish at sea which are too small to sell.

In solving this problem, one *masu-ami* fisherman in Ishigaki Island, has invented a new strategy for a sustainable fishery.

The process is simple, consisting of alternative strategies: (1) economically important fish, if under-sized, are released back to the sea on the spot, (2) aquarium fish as well as salable-sized fish are sold to the fish market and aquarium shops, after being temporarily stored in tanks on a fishing boat. As shown above, even in the individual-oriented set net fishery, an elaborated strategy of sorting fish may enhance the effect of biodiversity and marine production in the long run, although it requires twice as much time, according to an interviewed fisherman.

Together with tidal stone weirs (*ishihimi*), bamboo weirs (*sasahibi*), the *masu-ami* fishery meets the concept and guidelines of the *satoumi*. In terms of biodiversity, these stationary fishery installations have the potential to create habitats for fish and benthic animals. It is apparent that stationary installations are selective as some fish move to deep waters or escape beyond the obstacles and walls, *i.e.*, rocks, bamboo fences, and nets. In the *masu-ami* fishery, sorting of fish would be an effective procedure in ecological and economic terms.

Another issue we should discuss is access rights to stationary fishing installations. As bamboo weirs and tidal stone weirs are usually constructed by collaborative efforts. Access rights and usufruct to stationary fishing installations are therefore shared appropriately among stakeholders.

4. Consensus Making in Conservation

For the goal of implementing a sustainable *satoumi,* conservation is a key issue. This section examines how consensus making is realized for conservation measures, using examples of fishing bans in small-scale fisheries.

The first example is closing of fishing grounds during the spawning season of coral reef fish in the Yaeyama Islands. In Yaeyama, the idea for a fisheries ban during the spawning aggregations of emperor fish (*Lethrinus* spp.) and grouper fish (Epinephelinae) has emerged, as these kinds of fish drastically decreased in the late 1990s. Then, the Okinawa Prefectural Government proposed the closing of several spawning sites in Yaeyama in order to avoid resource depletion. A moratorium seemed the best strategy, but the idea was rejected by many members of the Yaeyama FCA as they depended largely on these fish species for their livelihood. Therefore, the focus of the discussion turned to the duration and locations of spawning sites to be closed.

Spawning aggregation sites, located in reef channels

30-40 m deep between Sekisei Lagoon and the deep seas, are well recognized by experienced fishermen. The phenomenon of spawning aggregations of some coral reef fish is also well-known in the Indo-Pacific area (Sadvoy & Colin, 2012; Sadvoy *et al*., 2008; Domeier & Colin 1997). To decide on practical locations and durations for closing, the stakeholders, including fishermen affiliated with the Yaeyama FCA, government officials, Ishigaki city officials and marine biologists attended the meetings. It is noteworthy that the fishermen were engaging in a variety of fisheries, *i.e.*, fish drives, gill netting, long-line, trapping and scuba diving to pursue aggregating fish. Owners of recreational tourist shops were also requested to attend for a public hearing, but were criticized because they ignored the rules and regulations of the Yaeyama FCA and were guiding recreational anglers to "good fishing spots" only for economic profit.

After a long discussion, an agreement was reached that four sites would be closed for three months. In this case, a debate on a fisheries ban spotlighted the difficulty in consensus-making, as stakeholders had various opinions (Akimichi, 2001). Likewise, in establishing the MPAs (Marine Protected Areas), collaboration among different fishermen's groups, and between fishermen and non-fishermen are absolutely necessary to achieve a sustainable fishery and conservation goals.

Another example is the case of a fisheries moratorium for *hatahata (*Japanese sandfish, *Arctoscopus japonicus*) in Akita Prefecture, northern Japan. As *hatahata* landings collapsed in 1976 after a rapid rise in catches in the 1960s (Fig. 9), the Akita Prefectural Government initially proposed a *hatahata* conservation policy by means of a fisheries ban.

Yet, opinions among the local FCAs opinion diverged and it was not easy to reach a conclusion. To reach a mutual agreement, meetings were held at different levels from individual to nationwide, including fishermen's informal gatherings, local districts in fishing areas, FCAs, working groups, Fisheries Leagues, Sea Districts and the Ministry of Agriculture, Forestry and Fisheries of the Japanese Government.

After a long discussion and debate, a final decision on a moratorium of three years was made for the period from Oct. 1992 to Aug. 1995. Even after the resumption of *hatahata* fisheries in Sept. 1995, meetings have continued. Throughout the pre-moratorium, moratorium and post-moratorium periods, some 250 meetings were held (Akimichi & Sugiyama, 2012).

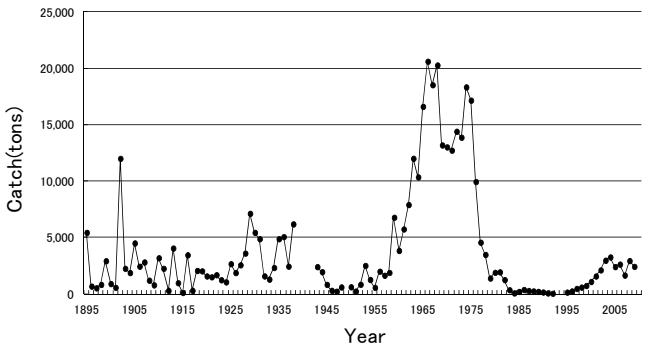

Fig. 9 A Long-term Fluctuation of the Sandfish Catch in Akita Prefecture (1895-2009).

5. The *Satoumi* and a Local Commons

As described in the previous section, the *satoumi* includes two important factors to be reflected; one is access rights to fishing gear and fishing grounds. The second is resource management measures in which the consensus making process becomes the key to reaching a final decision and responding to on-going changes.

In this concluding section, I will argue for the future status of the *satoumi* as an arena for a new commons.

On Ishigaki Island, a time-consuming and serious debate on the construction of a new airport in the Shiraho area has continued since 1979, with inhabitants of Shiraho splitting into pro and anti factions. People favoring construction want the economic development that would accompany construction of a new airport while the opposition want to conserve the environment of the coral reefs, particularly the *Acropora* corals that are found abundantly in the Shiraho area. A decision was reached to shift the new airport site inland and it has been under construction since 2005.

Through their experience with the airport construction issue since 1979, the people of Shiraho have become aware of the value of coral reefs with regard to both environmental conservation and their own livelihood. This has triggered the creation of a new *satoumi* by reconstruction of a tidal stone weir (Kakuma & Kamimura, 2012). The TSW is expected to serve multiple functions: provisioning food fish, a positive effect on marine biodiversity, environmental education, and enhancement of community-based networks and ecotourism.

In Okinawa where coral reef systems are a major component of the *satoumi*, sustainable use of coastal reefs is a primary concern. According to Japan's formal Fisheries Law, coastal coral reefs are claimed for use only by the associated FCA members while intruding local inhabitants who do not have fisheries rights are considered trespassers.

Yet, the people of Shiraho have claimed the harvesting rights that they traditionally inherited as a fundamental right. Indeed, the people of Shiraho have used reefs extensively for subsistence and small commodity production. Harvests of marine resources include seaweeds, mollusca, octopuses, and reef fish. Small-scale gill nets, cast nets, nighttime torch-light spearing, tidal stone weirs, and coastal gleaning are the major techniques employed. Furthermore, local inhabitants have used the coast for rituals and feasts. White coral gravel was scattered in front of the shrine. In this regard, access rights by inhabitants should be acknowledged as a local commons, shared among people of the area, which coincides with the *Soyu-Sei* or *Gesamteigentum* (joint ownership). This idea regarding local fisheries rights is independent of the authorized Fisheries Rights of the

Japanese Government (Kumamoto, 1995).

Claims to *inoh* (lagoons within the fringing reefs) are also recognized as self-evident by local farmers and fishermen on Iriomote Island. On Iriomote island, the sea area inside the fringing reefs is generally called *sunah*. *Sunah* is further divided into *pamonah* (sandy beach), *inoh* (fringing reef) and *pihn*i (surf break). The area outside surf breaks is termed *ubutuh*. Local community members of Iriomote have recognized that *sunah* is an area where community members have equal rights of access to marine resources while *ubutuh* is where full-time fishermen from outside can harvest (Ishigaki, personal communication, 2009). In the Yaeyama Islands, such recognition of divisions of reef systems and the off-shore sea gives an important insight into how the use of coastal waters has been considered part of the s*atoumi* system.

Theoretically speaking, there are various techniques and measures for achieving sustainable resource management goals in the *satoumi*. Restrictions and national/ international enforcement by determining total allowable catches (TAC) and establishing Marine Protected Areas (MPAs) are regarded as influential conservation measures. A ban on destructive fishing practices is also recommended by APEC as an effective means, for instance (APEC, 1998). Yet, such bans cannot be so easily realized, as suggested by reports that poaching and illegal fishing have been prevalent everywhere. Furthermore, consensuses to reducing fishing efforts are often difficult to realize among relevant stakeholders.

What is important, then, is to seek an alternative approach to evaluating local commons for integration. From opinions raised in the related discussions, we know it has become more and more important to realize who shares the local commons for the sustainable use of resources, and how outsiders are allowed to enter or are prevented from entering the fishing grounds. Indeed, to avoid the tragedy of the commons, diverse kinds of local institutions should be evaluated (Feeny *et al*., 1990; Ostrom, 1990).

This notion is inevitable particularly in coastal areas of the Tohoku region where the tsunami disaster destroyed almost all of the functions and infrastructures. At present, only hardware systems such as fishing boats, fishing equipment, fishing ports, fish processing wares and seawalls against tsunami are taken into consideration but no effective future design has been drawn for rebuilding a new fishing community as an integrative unity. Now is the time to consider seriously a new commons.

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