Japanese coastal fishery co-management: an overview

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1. INTRODUCTION

This section presents the following co-management case studies of five Japanese fisheries.

i. Sakuraebi (small pink shrimp, *Sergia lucens*) fishery in Shizuoka prefecture, central Japan.
ii. Walleye pollack (*Theragra chalcogramma*) fishery in Hokkaido prefecture, northern Japan.
iii. Snow crab (*Chionoecetes opilio*) fishery in Kyoto prefecture, western Japan.
iv. Sandfish (*Arcotodcopus japonicas*) fishery in Akita prefecture, northern Japan.
v. Sandeel (*Ammodytes personatus*) fishery in Aichi and Mie prefectures, central Japan.

Each case offers distinctive features in terms of biological characteristics of the targeted species, the types of gear used, the degree of collaboration with outside parties and the adopted management measures among other factors. There were 1 608 co-management regimes across Japan, called fishery management organizations (FMOs), in November of 2003 (Ministry of Agriculture, Forestry and Fisheries, 2006). While examination of five cases cannot provide a comprehensive portrait of Japanese coastal fishery co-management, they do provide an indication of the wide range of approaches found within the overall Japanese system.

The coastal and offshore fisheries in which most co-management regimes arise are important sectors in Japan's fishing industry. In 2005, coastal fisheries landed approximately 1.5 million tonnes of marine fish, or 25.8 percent of total Japanese landings. Offshore fisheries landed approximately 2.4 million tonnes of fish, or 43.1 percent of the total (Table 1). In terms of value, however, coastal fisheries generated $US4 245 million, which accounts for 34.0 percent of total marine fishing revenue. The offshore fisheries earned $US3 230 million, or 25.9 percent of the total. These figures imply that coastal fisheries harvest relatively higher-valued species. In terms of employment, 94.7 percent of active fishers (defined as a fishery business owner, often a vessel owner, engaged in fisheries for more than 30 days in a calendar year), are involved in coastal fisheries.

TABLE 1
Marine fish harvest (volume and value) of Japan, 2001–2005

Volume (thousand tons)	Total				6 126	5 879	6 083	5 776	5 765
		Marine			6 009	5 766	5 973	5 670	5 669
			Catch		4 753	4 433	4 722	4 455	4 457
				Coastal	1 545	1 489	1 577	1 514	1 465
				Offshore	2 459	2 258	2 543	2 406	2 444
				High seas	749	686	602	535	548
			Aquaculture		1 256	1 333	1 251	1 215	1 212
		Fresh Water			117	113	110	106	96
Value (million US dollars)	Total				14 836	14 357	13 257	13 367	13 339
		Marine			13 905	13 458	12 373	12 502	12 488
			Catch		9 714	9 470	8 643	8 879	8 828
				Coastal	4 529	4 513	4 174	4 170	4 245
				Offshore	3 505	3 442	3 077	3 300	3 230
				High seas	1 674	1 511	1 388	1 409	1 350
			Aquaculture		4 191	3 988	3 733	3 619	3 660
		Fresh Water			930	899	883	862	852

Source: Ministry of Agriculture, Forestry, and Fisheries (2007).
Note: $US1 = 120 yen is used.

Despite their importance, the harvest levels of coastal and offshore fisheries have declined over the past few decades. One index that illustrates this point is the level of self-sufficiency of seafood in Japan. Japan was self-sufficient in seafood until 1975, but with the introduction of exclusive economic zones (EEZ) the level fell below 100 percent for the first time in 1976 (Ministry of Agriculture, Forestry and Fisheries, 2007). The establishment of EEZ's had a significant one-time impact, but the self-sufficiency level continued to fall as both coastal and offshore harvests declined throughout the 1980s and the 1990s, while the level of consumption remained mostly unchanged during that period. The self-sufficiency level was 57 percent in 2005, which was a slight recovery from all-time low of 53 percent in 2000–2002. For these reasons, sustainable coastal and offshore fisheries are critical, not only for biological health but also for economic success. The importance of successful fishery co-management cannot be overemphasized.

Historically, conservation of marine resources in Japan has been administered under rules that fishermen imposed on themselves (Makino and Matsuda, 2005). Individual fishing villages established their own rules regarding the use of coastal resources in their area. In offshore fisheries, cooperative organizations were formed by involved fishermen. Such organizations have set rules on the number of boats, amount and type of gear, the extent of the fishing season, the limits of their fishing grounds, protection of coastal woods and penalties against violators. Most of the managerial power over and responsibility for, Japanese fisheries lies in the hands of fishermen.

Japanese fishery co-management and associated institutions, such as cooperatives and legally recognized fishing rights, have a long history. However, that history is not the end of the story, nor is that history determinative of Japanese success today. Rather, Japan faces fisheries management challenges that are similar to those of contemporary fisheries elsewhere. However, the breadth of experience with co-management in Japan can yield valuable lessons for other fishery management systems.

2. INSTITUTIONS FOR FISHERY MANAGEMENT

2.1 Fishery cooperative associations and territorial use rights for fishing

Japanese coastal fisheries are governed by fishery cooperative associations (FCAs). The associations' jurisdictional boundaries are defined geo-politically, rather than biologically on the characteristics of the targeted species. Members of these FCAs are mostly fishing households and "small" companies as defined by the number of employees and gross tonnage of the vessels owned. The functions of FCAs are similar

to other harvester cooperatives and include joint purchases of inputs (e.g, fuel, ice and boxes), administration of ex-vessel markets and provision of insurance and credit to members. FCAs also keep catch records, which are used to provide official statistics. In addition to such conventional functions, FCAs play one unique role—they manage fishing rights. Fishing rights are analogous to territorial use rights for fishing (TURFs) (Christy, 1982), which are granted by the government and protected by law. These two institutions, FCAs and TURFs, form the basis of Japanese fishery co-management.

FCAs are usually associated with specific coastal communities that historically have depended on fisheries resources. Each FCA typically encompasses all the fisheries within that community or communities, so a number of diverse fisheries are under the auspices of any FCA. FCA members are generally granted responsibility for managing all of the fishery resources within the FCA's jurisdiction. These often include sedentary shellfish resources such as clams and mussels, sea urchins and abalone and shrimp. They also include moderately mobile groundfish, including various flat fish and rockfish, and more mobile fish such as mackerel, herring and pollack. Members of any given FCA may employ a wide range of gear, which can include dredges, gill nets, seines, set nets, small trawls as well as diving.

The historical evolution of these institutions and their administrative structures is well documented in the literature (e.g. Asada, Hirasawa and Nagasaki, 1983; Ruddle, 1987; Yamamoto, 1995; Makino and Matsuda, 2005). Coastal waters were defined in Japan as public areas by legal codes dating back as far as the year 701 (Makino and Sakamoto, 2002). Under customary use rules, anyone could extract resources from coastal waters, as is the convention in many Western countries today. The idea of "fishing rights" in ancient Japan was thus nonexistent. During the feudal era in the seventeenth century, the rule changed such that only residents of coastal villages that did not have enough arable land on which to grow rice were permitted to fish. Such villages were given a certain area of coastal waters for exclusive use and harvester guilds were formed in the villages to protect the resource from outside poachers. In these coastal villages, a sense of territorial rights over the coastal waters emerged among the villagers and those rights were eventually recognized by the samurai lords (Asada, Hirasawa and Nagasaki, 1983).

In the late 1870s, the new Meiji government (established after the so-called Meiji Revolution) attempted to convert the fishery management system to a top-down style with fee-based licensing. This change met nationwide opposition, which eventually forced the government to reverse the process. Governance regressed back toward self-governance by local resource users. In 1901, enactment of the Fishery Cooperative Law legally recognized these *ad hoc* user rights. Fisher guilds were transformed into formal organizations that eventually evolved into FCAs. In 1948, the *Fishery Cooperative Law* established the legal foundation of FCAs with responsibility to administer the use of the rights (Yamamoto, 1995).

The fishing rights apply only to coastal fisheries. Offshore and high-sea fisheries are typically governed by a licence system that is managed by either the central or the prefectural government. For coastal waters, there are three categories of fishing rights: common, large set net and demarcated. Demarcated fishing rights are granted for aquaculture and large set nets are treated separately from small set nets, which fall under common fishing rights, because the impacts of large set nets are potentially substantial (Asada, Hirasawa and Nagasaki, 1983). Common rights are granted by prefectures only to FCAs, with nominal ten-year terms. Demarcated rights and large set net rights are granted to FCAs, to organisations other than FCAs composed of many fishers and directly to individuals from prefectures (the priority is given in this order), with five-year terms. Prefectures are required to consult Prefectural Fisheries Regulation Committees in granting of all three types of rights, so fishers have a substantial voice in this process. The renewal of these rights is usual but certainly not

guaranteed. If there are serious issues such as noncompliance with regional and internal rules, the renewal of these fishing rights may be denied.

The focus of this study is on common fishing rights, which include all coastal fishing operations other than large set nets and aquaculture. Hereafter, we use the term TURF to refer to this particular type of common fishing rights. While most fishery management organisations (FMOs) are for these coastal TURFs, FMOs do exist for aquaculture licensees, large set net licensees and offshore licensees.

TURF area boundaries are typically seaward extensions of municipal boundaries on land. How far they extend varies; some are one kilometre or less while others extend more than five kilometres. This distance is a function of the targeted species, the type of gear used and the topography of the ocean floor. Again, the Prefecture, acting on advice of its Fisheries Regulatory Commission, determines the geographic extent of these rights (Yamamoto, 1995).

2.2 Fishery management organizations

Co-management of coastal fisheries is carried out by fishery management organizations (FMOs). An FMO is a group of fishers who share the same fishing ground and/or operate in the same fishery and are collectively engaged in resource and/or harvest management according to mutually agreed rules (Ministry of Agriculture, Forestry and Fisheries, 2001). FMOs are autonomous organizations and some of Japan's FMOs have been in operation for decades. These management regimes were codified and implemented as Japan's national fishery policy in the early 1980s. The FMOs still remain as autonomous organizations that have no legal status, unlike their parent FCAs. However, now that the central government has recognized them as an effective tool for fishery management, it actively promotes them by disseminating descriptions of successful cases nationwide. The recent expansion of FMOs reflects this policy change (Table 2).

TABLE 2
Total number of FMOs, 1962–2003

Year	Old definition of FMOs	New definition of FMOs
1962	508	-
1967	670	-
1972	811	-
1977	970	-
1982	1 128	-
1988	1 339	-
1993	1 524	1 133
1998	1 734	1 312
2003	-	1 608

Source: Ministry of Agriculture, Forestry and Fisheries (1991, 1996, 2001, 2004).
Note: The new definition only includes formal FMOs, i.e. those whose rules are written and documented. The old definition includes both formal and informal FMOs.

TABLE 3
Types of operating bodies for FMOs, 1998

Operating body	Number of FMOs
FCA	413
Subgroups within an FCA	1 011
Alliance of FCAs	109
Other than above	75
Total	1 608

Source: Ministry of Agriculture, Forestry and Fisheries (2006).

FMOs and FCAs are interrelated in a number of ways. Nearly 95 percent of Japan's FMOs are operated by an FCA or by an affiliate organization. There are several types of operating bodies for FMOs (Table 3). For example, if the local FCA is small in terms of the number of fisheries, gear types and targeted species that need to be managed, then such an FCA can add fishery management – the task of an FMO – to its responsibilities. The top row in Table 3 corresponds to this case; there are 413 FCAs that also function as FMOs.

If an FCA is large in scale and administers multiple types of gear targeting various species, fishermen often form a subgroup by the type of gear or targeted species (e.g, a pelagic trawlers' group or abalone harvesters' union) to serve for the benefit of that group. If, for example, management for abalone becomes necessary, the harvesters' union will assume that task and become an FMO. If no such subgroup exists at that time, which sometimes happens, then an appropriate subgroup will be formed (second row of Table 3).

Finally, most FMOs cover only their own TURF areas. But since some targeted fish species migrate across TURF boundaries, management within a single TURF area is not always appropriate and effective. In such cases, fishers from two or more FCAs jointly manage such fisheries (third row of Table 3). FMOs in all but one case, the snow crab fishery in Kyoto, described in this book are of this type. The last category "Other" includes, for example, the case where processors'

cooperative associations acquire demarcated or large set net rights and engage in commercial fisheries. If these groups actively manage the resource, such as escapement control in fixed net fisheries, then they will be regarded as FMOs. Also, while FCAs are region-specific there are trans-regional fishers' organizations, such as Prefectural Federation of Bottom Trawl Fishery, and in some cases these organizations engage in fishery management. The effect is similar to joint management of multiple FCAs, except it is conducted through a different channel that does not involve FCAs. The snow crab fishery in Kyoto is one such case.

There are many types of self-imposed measures that an FMO can employ. The fishery census categorizes these measures into resource management, fishing ground management and fishing effort control (Table 4). Most FMOs have rules adopted from each of the three categories. However, it is interesting to observe that for each category certain specific measures within a category are more popular than the others, which in turn indicate the top priority issues from fishers' perspectives and their choice of solutions. For example, one can deduce from Table 4 that congestions on prime fishing grounds is a priority issue and as a solution many FMOs have adopted various rules specifying how to use grounds in a orderly manner. One example of such usage rules is the rotation system, where fishers are divided into several groups and rotate access to multiple fishing grounds on a fishing-day basis (e.g. the walleye pollack fishery).

TABLE 4
Number of FMOs by the type of self-imposed measures adopted as of 2003

Regulation type	Number of FMOs	(%)
Resource management	1 361	(84.6)
Stock assessment	527	(32.8)
TAC establishment	477	(30.0)
Stock assessment + TAC	254	(15.8)
Hatchery	1 067	(66.4)
Other	112	(7.0)
Fishing ground management	1 472	(91.5)
Protection	627	(39.0)
Enhancement	433	(26.9)
Usage rule	1 168	(72.6)
Monitoring	885	(55.0)
Other	19	(1.2)
Fishing effort control	1544	(96.0)
Fishing season	1 026	(63.8)
Fishing method	668	(41.5)
Number of vessels	278	(17.3)
Vessel and engine size	158	(9.8)
Fishing gear	796	(49.5)
Days at sea	715	(44.5)
Fishing hours	1 007	(62.6)
Number of crew	265	(16.5)
Harvest (species' size)	855	(53.2)
Harvest (landing volume)	452	(28.1)
Other	59	(3.7)
Total number of FMOs in 2003	1 608	(100)

Source: Ministry of Agriculture, Forestry and Fisheries (2006).
Note: A FMO can adopt various combinations of management measures.

An FMO typically adopts combinations of management measures listed in Table 4. Some FMOs simply set limits to fishing effort (such as days-at-sea or vessel size), while others adopt sophisticated fishing effort coordination measures as if the group is behaving as a sole resource owner. For example, the *sakuraebi* fishery (pink shrimp) in Shizuoka prefecture established a committee that makes decisions on fishing operations and fishing coordination in a centralized manner. The walleye pollack fishery in Hokkaido prefecture does not have such a committee but has developed a complex fishing ground rotation scheme for spatial coordination of fishing effort. Season closures and setting marine protected areas to protect both spawners and juveniles are becoming common measures; all five fisheries documented in the book have these as well.

New entries to the fisheries are typically tightly controlled. First, most coastal waters are included in TURFs belonging to FCAs and hence it is illegal to fish commercially within these waters unless you are a member of administering FCA. Thus, the first barrier to new entry is at an FCA level, i.e. new membership control (for details, see Uchida and Wilen, 2004). Among the legal fishers, entries to specific fisheries are often restricted by the licence system administered by either the local or central government; in fact, all five fisheries documented in this book are under the licence system. However, the pressure exists to allow all fishers who were historically engaged in that fishery to join the FMO. Consequently, certain rotation schemes are designed to reduce the number of fishers operating on any given day while maintaining everyone

in the business. This policy can be interpreted as a limitation of FMO-schemes in terms of achieving economic efficiency, but can also be viewed as achieving social objectives, such as sustaining the community by keeping everyone in the industry.

Last, more and more FMOs are getting involved in market coordination activities. This is clearly seen in the sakuraebi, walleye pollack and snow crab fisheries. Specific activities include controlling the landing volume in accordance with processors' inventory levels, developing and advertising private brands and general quality control. FMOs that are actively engaged in marketing activities tend to earn higher revenue per member (Uchida, 2007).

3. ISSUES WITH THE JAPANESE CO-MANAGEMENT SYSTEM

3.1 Weaknesses

There are two main weaknesses within the current Japanese co-management system. First, discrepancies may exist between the area in which a fish species reproduces and migrates and the jurisdictional boundaries assigned to managing FCAs and FMOs. Second, scientific information to support co-management is insufficient and underutilised. These two fundamental weaknesses create specific issues and limitations within Japanese co-management

Despite the recent trend toward ecosystem-based management, as opposed to single-species-based management, the Japanese system remains geared toward the latter. Most of Japan's co-management regimes target a single species and often the choice of species is driven by the species' market value rather than by its ecological importance. A few attempts have been made to incorporate ecosystem considerations into fishery management, such as an experiment in Shiretoko Peninsula in Hokkaido, northern Japan (Makino, 2007). In general, however, the industry lacks the scientific knowledge necessary for effective management based on multiple species and that vacuum impedes development of ecosystem-based management regimes.

Co-management is executed by FMOs, which are typically affiliates of parent FCAs that control areas defined by TURFs. The area covered by a TURF will not necessarily coincide with the area in which the targeted species occurs. One example, described by Uchida and Watanobe (this volume) is the walleye pollack fishery managed by an FMO in the Hiyama region of Hokkaido. This FMO's jurisdiction covers only a portion of the pollack's migration area. There are institutions established for multi-jurisdiction management, such as area and wide area fisheries coordinating committees (AFCCs) (Makino, 2005), but they are rarely used because of the lack of supporting scientific information. Such a mismatch generates conflicts regarding whether benefits are fairly appropriated to those paying the cost, not only for conventional efforts to manage the fishery but also for restoration projects such as release of larvae and juveniles.

The substantial authority and responsibility given to local fishers under the decentralized fishery management system may also have a negative impact. For example, local fishers and the general public may not agree on which species of fish are most important to protect. Yet there are few venues, if any, in which the public can influence such decisions. That decisions must be unanimous, as is typical in these organizations, also means that they tend to be slow in implementing new technologies and/or in adjusting to changing natural and social conditions. For example, suppose as a result of scientific research it was determined that increasing the mesh size of gill nets is strongly recommended from a fishery management point of view and so it was proposed to an FCA. Observing the recommendation inevitably incurs cost, as all fishers need to purchase new nets with wider mesh. Further, suppose that there was one fisher who is unable to afford a new net and he opposes the proposal. Because of the unanimous rule, an outcome such that all but this single fisher implement the new net does not occur. Rather we observe that the change is blocked or delayed until a unanimous agreement can be reached.

3.2 Collaboration among fishermen, regulators and scientists

Collaboration among the three key players in fishery co-management – fishermen (resource users), regulators (authorities) and scientists – is an important factor for successful co-management. There are many advantages when fishermen manage their own resource, which includes the value of their extensive experience. However, solid scientific support is indispensable for ecologically sound management. Regulators can also contribute to this venture by coordinating and facilitating multi-jurisdiction management arrangements.

The relationships between regulators and fishermen are fairly close in Japan. One of the functions of FCAs is to inform their members of new and changing national fisheries policies. Committees such as the area fisheries coordination committees (AFCCs) are comprised of representatives of both industry and regulatory agencies. There are a number of venues in which fishers and regulators can exchange opinions and negotiate specific policies and regulations.

The weak point is collaboration between scientists and the other two parties. For example, compared to the degree of integration of scientific information in determining total allowable catch (TAC) levels in the U.S., the Japanese TAC system remains far behind. The importance of integration of scientific information into Japan's fishery management schemes for success of co-management is discussed in some of the cases in this volume, such as for the snow crab fishery in Kyoto (Makino), the sakuraebi fishery in Suruga Bay (Uchida and Baba) and the sandeel fishery in Ise Bay (Tomiyama *et al.*, 1998). These three, and to some extent all five Japanese cases in this volume, illustrate the connection between successful co-management and active integration of scientific information into management design.

The integration of scientific information occurs in two stages. First, reliable information must be obtained. The lack of such information is the main impediment to its use. Second, because it is local fishermen who deliver the resulting management, scientific information must be translated into terms that fishermen can comprehend. This process of knowledge translation is best depicted in the sandfish management case in Akita prefecture (Suenaga, this volume).

4. DISCUSSION: WHY STUDY JAPANESE CASES?

There were 1 608 FMOs in Japan in 2003 (Ministry of Agriculture, Forestry and Fisheries of Japan, 2006) and most were established in affiliation with a local FCA. These FMOs vary in terms of the type of fishing gear used, targeted species, membership size and the management measures they have implemented. Given such diversity and heterogeneity in various factors, Japan's extensive system provides examples of most types of management regimes. Because these various local approaches function within the same overarching legal and social context, the variety of Japanese experience represents a natural experiment that can be used to examine many co-management issues.

An argument is sometimes made that the Japanese experience is based on the country's unique historical, cultural and social characteristics and thus has limited applicability to other regions. However, anyone who interviews active Japanese fishermen quickly realizes that these fishermen are as competitive as any other entrepreneur and no more cooperative than fishermen elsewhere. Cohesiveness of the community surely would enhance the likelihood of cooperation and compliance, but this social characteristic of small coastal communities is readily observed outside Japan. That Japanese fishermen are more cooperative or that their social and cultural characteristics are dominant factors that enable successful co-management are false generalizations.

Japan's fishery co-management and FMOs do hinge on two unique institutions: FCAs and TURFs, which are protected by law. But the literature has overemphasized the historical background of these institutions in concluding that Japan's success in co-management is due mainly to the tradition of these institutions and thus has little

relevance for regions without such a tradition. Uchida and Wilen (2004) argue that, while FCAs and TURFS may be unique to Japan, their functions are universal.

Fishery resource stocks under free entry can be characterized as impure public goods – rivalrous (you cannot have the fish someone else has caught) and non-excludable (anyone can harvest). If such an impure public good can be made excludable and if members are better off than non-members, then the potential for economically efficient use of the impure public good exists (Buchanan, 1965). Excludability requires clearly defined geographical and membership boundaries and an affordable exclusion method. FCAs and TURFs, with their accompanying rules and legal authority, function to set boundaries and create exclusion. Any institution that suits cultural and social norms is applicable if it functions to meet the requirements of clearly defined boundaries and affordable exclusion methods. The remaining need is to ensure that members are better off than non-members, which is determined in our context by the benefits of fishery co-management being perceived by FMO members as sufficient. This is an issue that has little relevance to tradition and the Japanese experience can suggest how to meet these conditions elsewhere.

In sum, a number of Japan's fishery co-management regimes have been successful *despite* fishermen being just as competitive and no more cooperative than other fishermen around the world. Japanese fishermen have adhered to their co-management regime because it served their private interest – doing so brought more benefits than doing otherwise. The benefit may be short-term, but in many cases it is more long-term in the sense that fisheries are operated in a biologically and economically sustainable manner. The fact that these benefits were generated and that fishermen were able to appropriate them via functions provided by FCAs and TURFs is the key lesson of the Japanese experience.

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