EFFORT COORDINATION, POOLING ARRANGEMENTS AND FISHERY CO-MANAGEMENT: EVIDENCE FROM JAPANESE COASTAL FISHERIES MANAGEMENT

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ABSTRACT

Fishery co-management, where local fishermen form a group to manage the fishery in a collective manner, have recently garnered a considerable amount of interest among fishermen and regulators, both in developed and developing countries. Conceptually it is seen as an alternative to centralized command-and-control regulations, as well as individually privatized system such as ITQs. Despite the increasing attention by various stakeholders, fishery co-management has not been adequately studied in economics. Previous studies have relied on case studies which precludes systematic comparison across heterogeneous institutions. To address this problem, the paper analyzes fishery co-management organizations (FMOs) in Japan. Japan is an ideal setting to study these questions because there are 1,600+ FMOs with different management types. We focus on two types of management measures: effort coordination and pooling arrangements. We analyze the characteristics of these FMOs and their management performances and found that FMOs with both effort coordination and pooling arrangement outperformed FMOs with either only effort coordination or pooling arrangement, or none. However, with regard to the performance on resource management the results were indifferent.

Keywords: fishery co-management, effort coordination, pooling, Japan

INTRODUCTION

Co-management as a concept in fisheries has gained much attention in recent years. For example, there is some momentum behind movements to establish harvester cooperatives, which co-manage fisheries among other things, in a variety of North American fisheries. In developing countries, community-based fishery co-management has been actively promoted both by the local governments and international aid institutions, and may be the only hope for rational management when enforcement and monitoring infrastructure is weak. In Chile, for example, the entire false abalone (loco) fishery management was put under the co-management system since the early 1990s. Examples of co-management in fisheries around the world have attracted interests of many social scientists in an attempt to delineate factors for their success or failure (e.g., Wilson et al., 2003; Cunningham and Bostock, 2005).

The idea of co-management came about in response to the belief that centralized command-and-control approaches to fisheries management failed to meet their expectations. While consensus on the definition of co-management has not been reached among the scholars (Jentoft, 2003), one of the key features of this scheme, and the one this paper focuses on, is that fishermen form a group and manage the fishery in a collective manner.[1] We will refer to such fishermen groups as fishery management organizations, or FMOs hereon. The fact that FMOs require collective action by their members constitutes the foundation of an argument that co-management system is unlikely to succeed and endure. However, anecdotal evidence shows that there are many cases of successful fishery co-management, some with sophisticated harvest control and fishing effort coordination under some mutually agreed rules among the FMO members.

To understand the nature and the performance of fishery co-management, we looked to

the Japanese experience of its coastal fisheries management. Primary reason behind this choice is the fact that there are abundant cases of fishery co-management in Japan; virtually all coastal inshore fisheries in Japan are governed by the fishermen groups (Fishery Cooperative Associations, or FCAs). There are 1,669 FCAs along the coastline as of 2002 and 1,608 FMOs as of 2003 (MAFF, 2005), which most if not all are established as an affiliation to local FCAs. These FMOs differ across fishing gear type, targeted species and management regimes. However, to the best of the author's knowledge, there has not been a study that looked at the FMOs nationwide and analyzed their characteristics and performances utilizing the variations in their operations, management regimes and performance.

In an attempt to conduct such analysis for the first time, we conducted a mail survey to FMO managers in 2005. The survey focused on the two particular regimes employed by FMOs, namely the effort coordination and the pooling arrangement, which are explained in the next section. Total of 433 surveys were sent out and 116 usable responses were collected.

A note on why it is worthwhile to study Japanese fishery co-management cases is in order. Japanese coastal fisheries management, and the operation of FMOs, hinges on two unique institutions. One is the aforementioned FCAs and the other is the fishing rights, analogous to territorial user rights for fishing (TURFs), which is protected by law. The historical evolution of these institutions and their administrative structure are well documented in the literature (e.g., Asada et al., 1983; Ruddle, 1987; Yamamoto, 1995; Makino and Matsuda, 2005). However, there seems to be an overemphasis on historical background of these institutions, which often led to a conclusion that Japanese success is mainly due to its traditional strength and thus has little relevance in regions that do not have such tradition. We argue that, while the two institutions themselves might be unique, the functions they perform can be thought as universal. Fish stock under open access can be characterized as impure public goods. According to the theory of clubs, it can be converted into club goods if three conditions are met: clearly defined geographical and membership boundaries, affordable exclusion method, and members are better off by forming a club ("privileged"). FCAs and fishing rights, with accompanying laws, function to meet the first two of the three conditions. This, in return, implies that any institution is applicable as long as its functions fulfill the first two conditions and it is suited to the region in terms of cultural and social norm characteristics (Uchida, 2004). The remaining piece is to ensure that club members are better off by forming a club which, in our context, is that the benefits of fishery co-management perceived by the FMO members are sufficiently high. This is an issue that has little relevance to tradition, and Japanese experience can provide hints for ways to meet this last condition.

EFFORT COORDINATION AND POOLING ARRANGEMENT

The management regime employed by FMOs can vary from simple to sophisticated ones. As a starting point, it must be remembered that simply having an allocation of allowable harvest assigned to a sanctioned group like an FMO does not necessarily get incentives corrected. One end of the spectrum is thus no different than a conventional limited entry program in which a limited group is given unallocated rights to a total allowable catch. We would expect this configuration to invite the race to fish incentives that are well documented in the literature. Simple co-management regime will thus be where operational and output restrictions are self-imposed while leaving the operational decisions to the individual fishermen. At the other end of the spectrum is the corporate, or sole-owner model, in which the operations of the FMO are completely coordinated to maximize total profits. Then there are a range of options in the middle,

characterized by group agreement on broad rules of behavior, leaving scope for individual initiative and decision making by participants.

Upon examination of some successful fishery co-management cases in Japan, we realized two interesting features: effort coordination and pooling arrangements. Effort coordination (EC) refers to where individual fishing operations are coordinated in aim to increase the efficiency of fishing effort. This includes, but not limited to, eliminating the race to fish and avoiding congestion at fishing grounds and potential damage and loss of fishing gear. Typical methods employed to achieve these objectives are fishing ground rotation and/or assignment, alternating fishing days, joint search/assessment of fish stock and, in some cases, joint ownership of vessels and gear. Through well-conducted effort coordination, FMOs are able to solve spatial and temporal issues regarding the efficient allocation of fishing effort. Pooling arrangement is an agreement among the FMO members by which harvest, revenues, or profits are pooled and then distributed back to the members.[2] The redistribution rule is typically either uniform, where all participating fishing units receive the same amount,[3] or weighted by indicators such as vessel size and number of crew members. The key element of pooling arrangement is that it separates the link between the individual fishing effort applied and the actual earning received. This dampens the incentive to compete aggressively, which is favorable in light of excessive fishing effort being applied under status quo. However, pooling arrangement is a "double sword" method: if the incentive dampening effect goes too far then the issue of shirking could undermine the FMO stability.

Pooling arrangement is typically thought as a supporting system of effort coordination (Gaspart and Seki, 2003; Hasegawa, 1985; Baba 1991). This is because in essence effort coordination is a restriction of individual freedom of fishing operation. Therefore, differentials in harvest resulting from effort coordination need to be addressed and adjusted. Pooling arrangement is a method to do just that. For example, under the fishing location assignment scheme one can be assigned to a ground with low fish stock level (cold spot). He would consequently have low harvest and would be unhappy if this was left as-is. With the pooling arrangement he will be compensated from his colleagues who were assigned to hot spots.

Are effort coordination and pooling arrangement always employed as a pair? Can one conclude that the case where only one scheme is employed, if it exists, is an exception? These questions still remain unanswered. The literature on effort coordination and pooling arrangement is dominantly studies on selected cases (e.g. Gaspart and Seki, 2003; Baba 1991) and does not provide cross-sectional overview of how these schemes are employed. Fishery Census, which is conducted every five years by the Ministry of Agriculture, Forestry and Fisheries, collects data on pooling arrangement but not on effort coordination. This led us to conduct our own survey in aim to answer the questions raised above as well as to analyze for the general characteristics of FMOs with effort coordination and/or pooling arrangement.

THE SURVEY RESULTS

The survey was sent to the managers of FMOs in late 2005 and early 2006. The challenge was to identify which FMOs to send the survey. Since FMOs are typically an autonomous organization the formal contact information of an FMO does not exist. The survey thus needs to be sent to the FCAs (cooperatives), but there are many cases where two or more FMOs are formed within a single FCA. In addition, we were advised that a survey sent to generic recipient tends not get responded. For these reasons, and also in order to make sure that we get enough responses from FMOs with effort coordination and pooling arrangement, we utilized the list of FMOs that

responded to the different survey conducted in 1997. In the end 433 surveys were sent out, and we received 116 usable responses.

Among the several types of effort coordination mentioned above, in subsequent analyses we defined effort coordination is defined as fishing ground rotation or location assignment, as these are most likely require pooling arrangement to be implemented together. Based on this definition, Table I shows the number of FMOs in our sample by the combination of effort coordination and pooling arrangement. It shows that there are FMOs with only either effort coordination (Type B) or pooling arrangement (Type C), with significant number of counts for them to be considered as an exception.

Table I: Number of FMOs by types

Type	Effort coordination	Pooling arrangement	Count
A	X	X	38
B	X		29
C		X	18
D			31
Total			116

The key questions thus are: What are the characteristics of FMOs in each type, and how do they differ? Are their any differences in each type's performance? Lastly, how do Type B FMOs adjust the potential harvest differentials resulting from effort coordination? The existence of Type B FMOs is interesting as it suggests that effort coordination can be implemented without also having the pooling arrangement that could cause shirking problem.

Comparison of key characteristics

We first examined the membership size of an FMO in each type. Since Olson's seminal book (Olson, 1965), the consensus in the literature is that the smaller the group size the better chance of successful collective action. We would hence expect that the average membership size of Type A to be relatively smaller and that of Type D to be larger.

Figure 1 shows the distribution of FMOs by their membership size (i.e. the number of fishing units participating in an FMO) for each type. For all types there are more FMOs the smaller the membership size. We can also observe that there are two outliers in Type B and D, which need to be adjusted in order to make meaningful comparisons among the types. After the adjustment, average membership size in our sample was 54.3 for Type A, 34.4 for Type B, 26.1 for Type C and 57.4 for Type D. The pair-wise differences in means were statistically significant at 5% level between types A and C, B and D, and C and D.

The survey result, however, does not suggest clear association between the management regimes and the membership size. Two types that are thought to be most distinctive, namely Type A and D, have similar average membership size. Both Type B and C had significantly smaller membership size compared to Type D, which by themselves suggest that FMOs with more sophisticated regime are smaller in size. However, when compared with Type A such relations no longer exist; on the contrary Type A is larger in size than Type B and C.

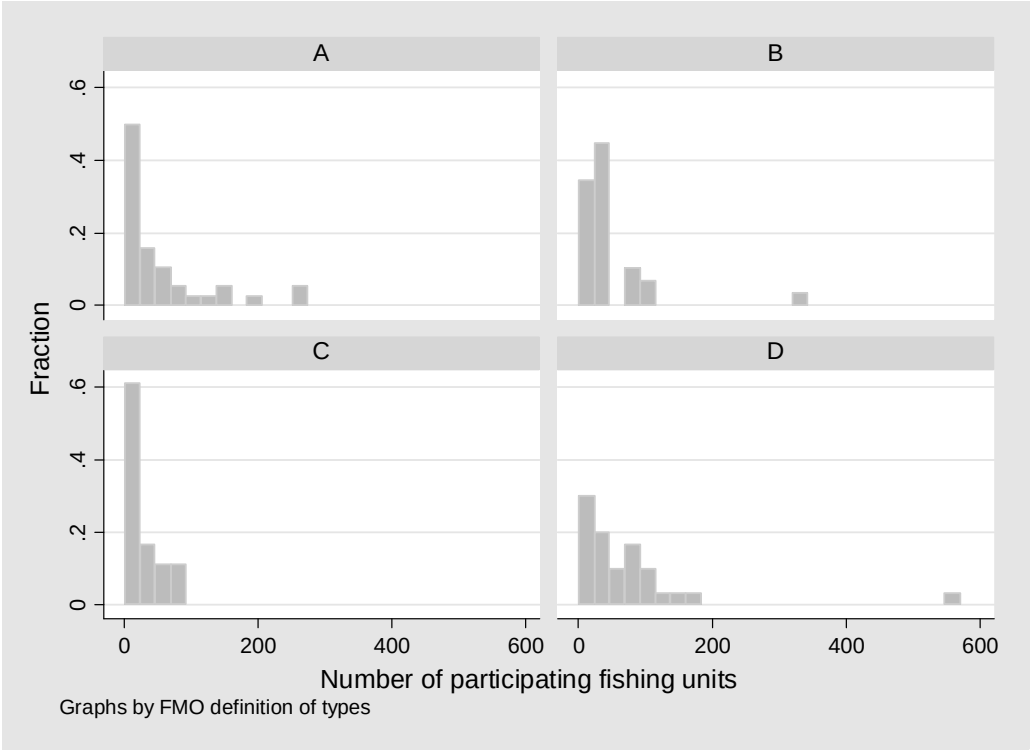

Figure 1. The distribution of FMOs by their membership size

Next we examined the fishing gear/method and targeted species of each type. Intuitively, one would expect that co-management is more suitable for immobile species and simple fishing methods. Survey result was consistent with this intuition regarding the targeted species; dominant species for types A, C and D was shellfish and that of Type B was spiny lobsters.

The gear type/fishing method results were interesting and puzzling (Figure 2). Firstly, diving being the dominant fishing method for Type C and D was expected as this is the simplest fishing method among the list. Small bottom trawl was the dominant fishing gear for Type A, which is also intuitive since this method will benefit greatly from coordinated operation so as to avoid entanglement of gear. Type B's dominant fishing gear was gill net, which should also benefit from coordination. The puzzle is that there seems to be a relation between gill net fishery and not having a pooling arrangement. As Figure 2 shows, Type D, which is another group without the pooling arrangement, also has gill net as a second dominant fishing method. What could be the explanation for this relation? Is it the gear-type per se or other factors associated with the gear-type, such as ability of selective harvesting? We do not have the answer at hand; further fieldwork might be able to provide one.

We also compared the income dependency of FMO members on managed fishery, defined as the ratio of managed fishery income and total income (from other fisheries and/or non-fishery occupations). There are two opposing views about how this income dependency will influence the success of FMOs. One view is that the more dependent the members are, so that sustaining the fishery is critically important for the maintenance of their livelihood, the more likely the FMO success. Another view is that the lower income dependence is necessary for the success. The reasoning behind the second view points out to the fact that fishery management generally accompanies harvest restriction that often leads to a dip in fishery revenue. This is particularly

true in the short-run after the management measures are put into place, and also as the management scheme become more stringent and sophisticated. Thus, fishermen with low income dependency on the fishery are more likely to accept (and comply) to such management measures because s/he can compensate the dip from other income sources.

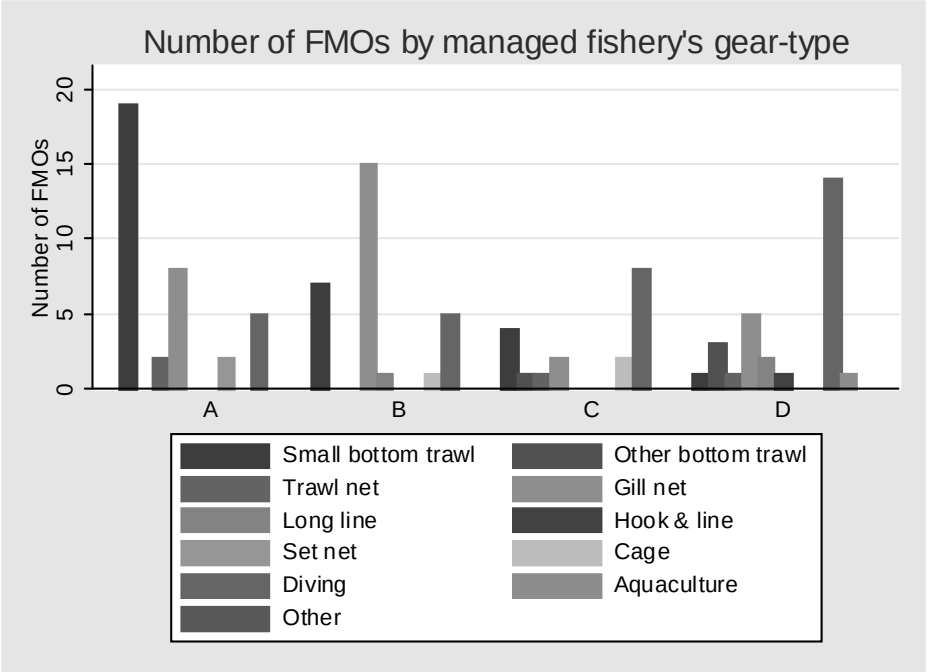

Figure 2. Number of FMOs by gear type of managed fishery

Figure 3 shows the distribution of FMO members by the dependency level of their income from the managed fishery. Type D FMOs clearly shows the trend consistent with the first view that higher dependency facilitates co-management. On the other hand, the patterns in Type A and C are closer to the second view, and Type B does not show apparent trend.

The pattern of Type A might be suggesting the following. If the status quo (i.e. prior to co-management) conditions were such that there was excessive fishing effort then effort coordination would seek to curtail such excessive effort. Given the nature of typical fishing communities, however, forcing fishermen to retire completely is often not a feasible option. Instead, an FMO might opt to jointly cut back fishing days. This frees up time for fishermen who then can seek to engage in other occupation. In another words, effort coordination induces the diversification of income sources, which lowers the income dependency on the fishery. If this is the case, then it is the opportunities for an alternative employment are the important factor that affects the success of co-management.

Note, however, that above reasoning and the second view of income dependency and co-management implicitly assume that the managed fishery is significantly profitable. Otherwise, there will be no motivation for FMO members to manage the fishery or quit operation altogether. This leads to our next survey result of revenue per unit of effort, as shown in Table II. Type A FMO members have the highest revenue per unit of effort, which suggests that their fisheries are more profitable than those of other FMO types.

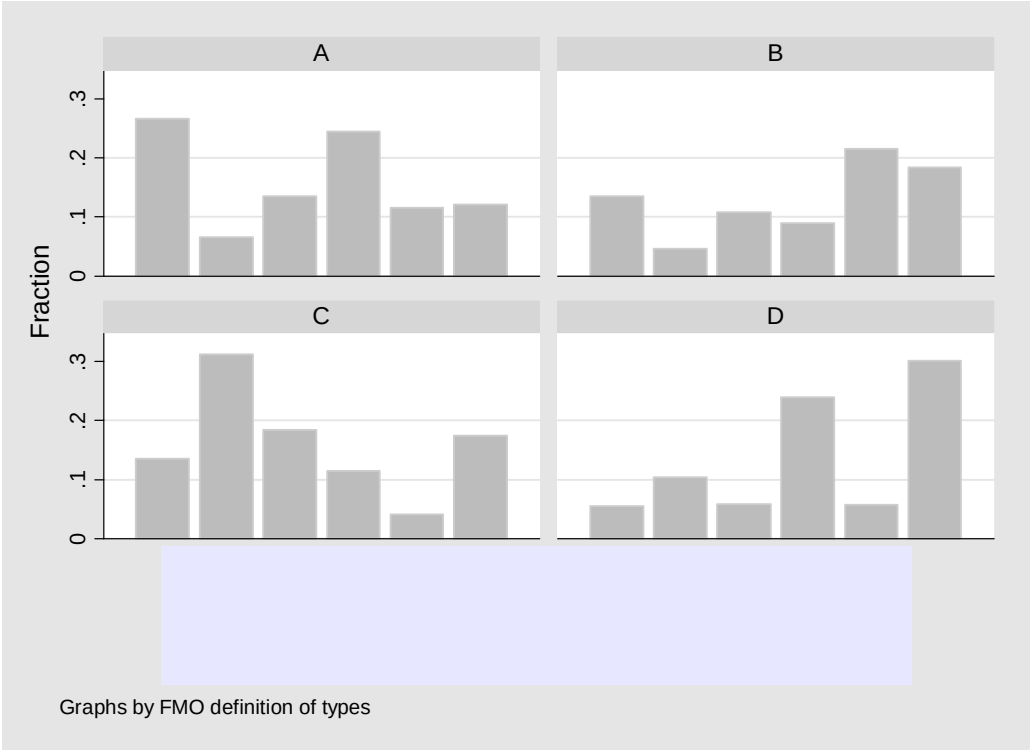

Figure 3. Distribution of FMO members by their income dependency

Table II: Average revenue per unit effort

	A	B	C	D
Average revenue from managed fishery	47,721	13,028	7,641	34,206
Average fishing days in a season	67	107	83	126
Average fishing hours per day	5.3	4.9	5.3	9.5
Average revenue per fishing hour	110.7	26.5	54.9	26.0

Type A FMOs might be performing well in terms of revenue but how about the resource stock recovery? We included in our survey a question asking the managers to give their subjective opinion on how the status of resource stock has changed in recent years as a result of their co-management. The number of responses that said the stock level has worsened or improved did not differ across four types. In another words, Type A did not experience a great success in resource management compared to other types, indicating there could be a limitation of their management scheme with regard to resource management.

To assess the overall performance of FMOs we looked at whether the group has younger members. In general, Japanese coastal fisheries are suffering from the lack of successors. This is not only because other occupations pay higher salary but also the economic conditions surrounding fisheries deteriorated over the years in general. Therefore, the fact that there are many young members indicates that the fishery is perceived to have good future prospect, and this could be the result of successful management. Figure 4 clearly shows that Type A FMOs have more young members than other three types, which suggests that overall FMOs with effort coordination and pooling arrangement are performing well.

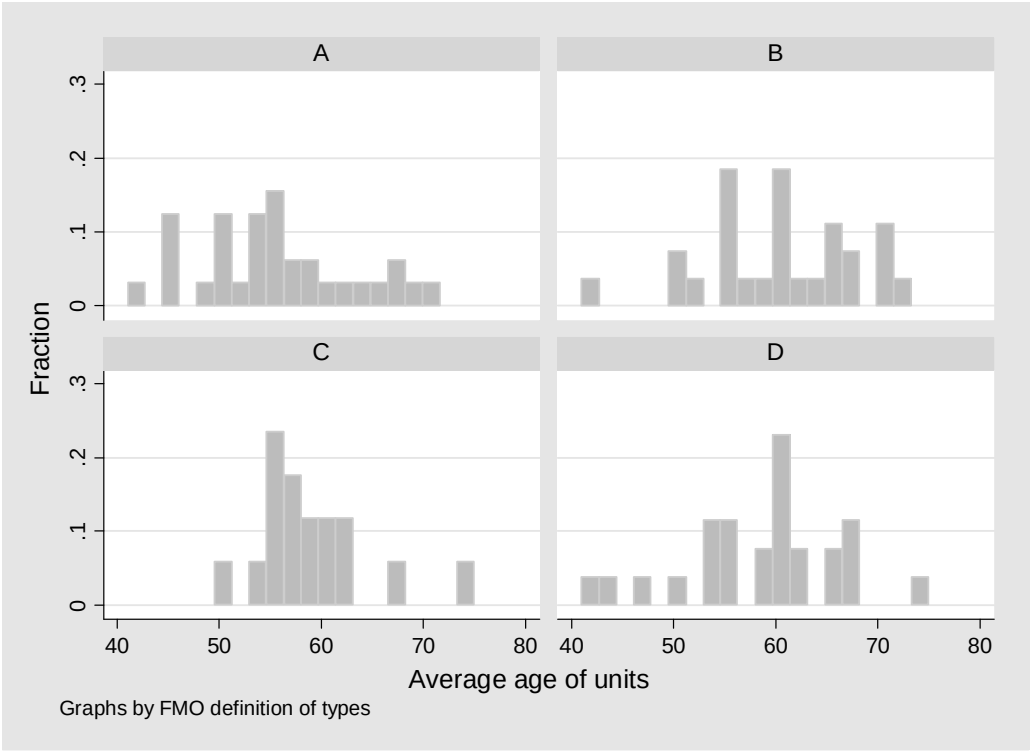

Figure 4. Distribution of average age of FMO members

CONCLUSION

In this paper we analyzed qualitatively some of the characteristics and management performance of FMOs, the fishery co-management organization of Japanese coastal fisheries. We focused particularly on two regimes that seem to be associated with successful co-management, namely the effort coordination and pooling arrangement. Effort coordination shifts fishing operation decisions from the hands of individual fishermen and puts it into a group decision in aim to increase the efficiency. Pooling arrangement was thought to be a vital supporting scheme for effort coordination.

The results from our survey, which was conducted to the managers of FMOs nationwide, found that first of all there are FMOs with only effort coordination and only pooling arrangement. Thus, it is not necessary to have a pooling arrangement to pursue effort coordination, however the performance could be enhanced by having both. Survey results confirm that in terms of economic performance: Type A FMOs, which have both effort coordination and pooling arrangement, had higher per unit effort revenue than the other three types. With regard to resource stock recovery, however, such advantage in Type A FMOs was not detected.]

In terms of the characteristics of FMOs across the four types, firstly the membership size did not show apparent relationship between the size and the level of management. Our results suggests that although smaller membership size do favor better co-management, groups with large membership size also have good chance of succeeding in fishery co-management. All four types mostly targeted immobile or sedentary species, which is consistent with our intuition. Gear-type choice left with one puzzle, that gill net seems to be associated with not implementing

the pooling arrangement. Income dependency had a distinct pattern between Type A and D, suggesting that for more sophisticated management schemes to be implemented the opportunity for alternative employment in other fisheries or outside of fisheries is important.

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ENDNOTES

1. Other often cited definition of co-management involves certain power-sharing, or collaboration, between the central authority and the local resource users. This paper focuses on the self-governance of local resource users and thus the involvement of authorities is excluded from our definition of co-management.

2. Pooling considered here does not include the insurance purposes, as in risk pooling.

3. Fishing unit refers to an operational unit of fishing, i.e. vessel owner, skipper, and crew members. Thus, the redistribution rule under the pooling arrangement considered here does not refer to how the proceeds are shared among the constituents of a fishing unit.