

# Two institutions for one fisheries management: Pooling period and individual operation periods in Wagu spiny lobster fishery

Hiroe Ishihara<sup>1</sup>, Kanae Tokunaga<sup>2</sup>, and Hirotsugu Uchida<sup>3</sup>

## Abstract

We studied a lucrative spiny lobster fishery in Japan operating under Territorial Use Rights in Fishery (TURF) through unique two-part periods with different institutions; i) pooling period followed by ii) individual operation period. In the first half of the season, when crowding inefficiency can be the greatest, this fishery operates as a group, i.e., full spatial fishing effort coordination, sharing the total revenue equally among the fishermen ('pooling'). In the second half of the season, the fishermen switch to individual-based regulated open access (ROA) operation. The two institutions operate within its designated and mutually-exclusive fishing zones, and the area of the group operation zone has gradually expanded over the years by taking ROA zones away. This case-study poses a fundamental question regarding the fisheries management: "why have fishermen chosen two separate management systems, i.e. institutions, for one fishery management?" Using a unique dataset of individual vessels' harvest volume and locations from 1991 to 1997 (i.e. prior to the introduction of the current regime), we argue that fishing grounds that had yielded a higher share of the catch at the beginning of each season were often designated as a fishing ground for a pooling system. Further, by using semi-structured interviews to all fishermen, we reveal that individual operation plays a vital role in reducing the discontent of younger fishermen and fostering the necessary and critical shared understanding of the socio-ecological condition for pooling system.

## 1. INTRODUCTION

### 1.1 Description of the fishery

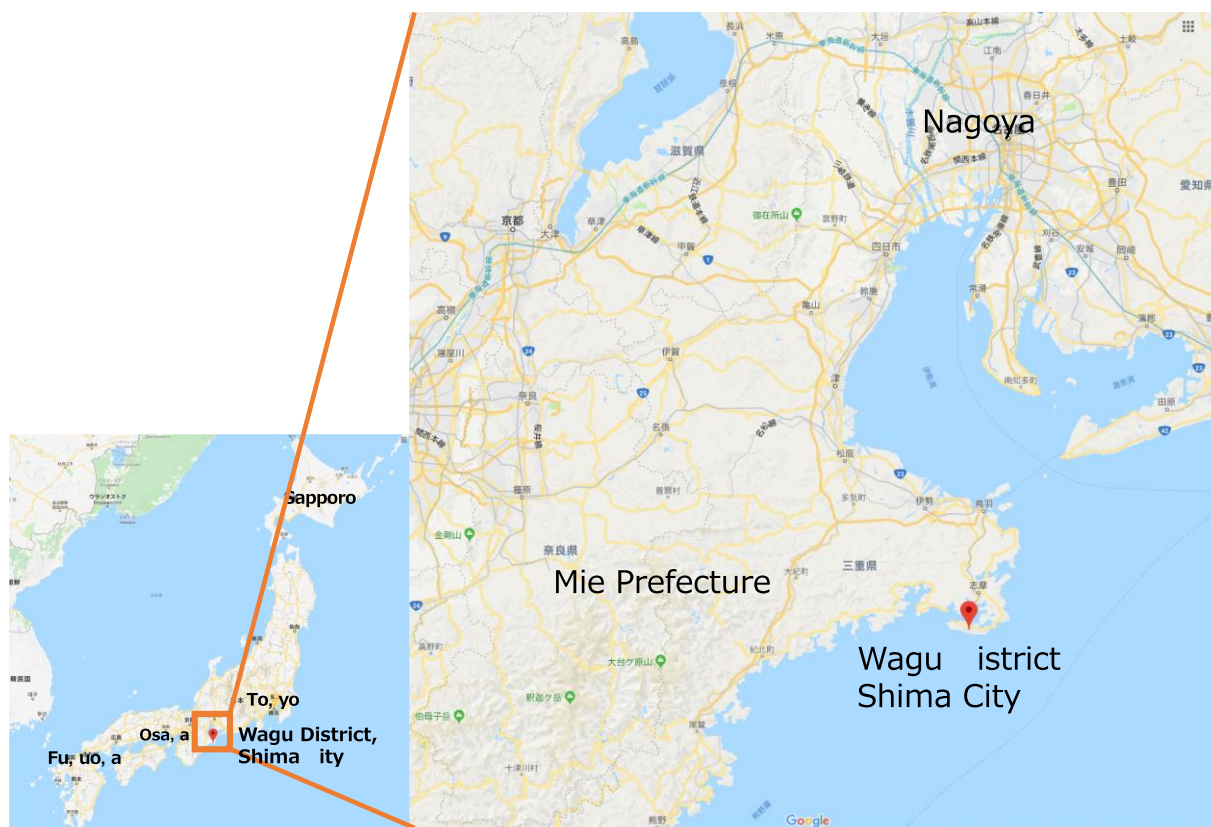
The Wagu district, in the Shima City of Mie Prefecture, is located at the centre of Japan as shown in Figure 1. The spiny lobster, trammel net fishing (the topic of this paper) is only one of the many kinds of fisheries conducted in the district. For example, there is dive fishery (called 'Ama' in Japanese) for abalone, top-shell and seaweeds; pole-and-line fisheries for skipjack tuna and three-line grunt; troll or trammel net fisheries for yellowtail, and offshore pole-and-line fisheries for skipjack tuna, other tunas and squid fly fishing.

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<sup>1</sup> The University of Tokyo (contact information: a-hiroe@mail.ecc.u-tokyo.ac.jp)

<sup>2</sup> Environmental Defense Fund

<sup>3</sup> University of Rhodes Island



**Figure 1. Location of Wagu district, Shima city, Mie Prefecture.**

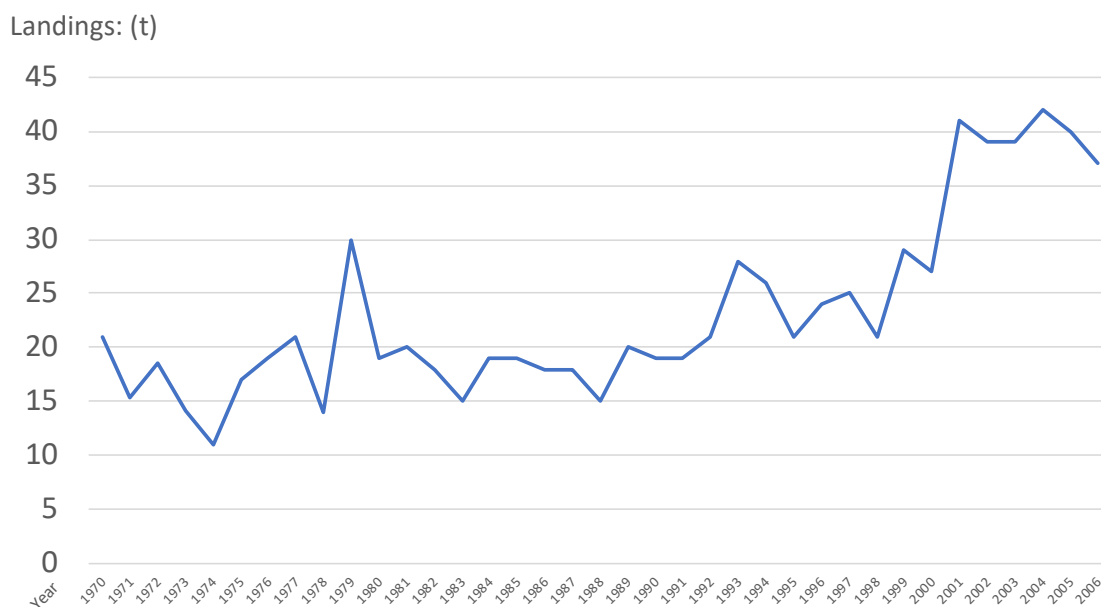
*Source:* the authors created from Google Maps.

Shima Peninsula, where Wagu is located, is one of the top two producers of spiny lobster in Japan along with Boso Peninsula in Chiba Prefecture. The Wagu district alone produces around 20-40 metric tons annually with a production value of USD 1.8 million. Figure 3 shows the shift in landing of spiny lobster in the Wagu district from the 1970s. Currently, 26 households conduct the spiny lobster fishing using trammel nets (see Figure 2). All these fishermen are required to belong to the Spiny Lobster Fishermen's Union ('Ebi-ami Domeikai') under the Mie Gaiwan Fisheries Cooperative Association (FCA). Those who belong to the Union are the only ones who are permitted to fish within the area assigned to them as territorial user rights fishing (TURFs) ('kyodo-gyogyoken gyogyo'). Further, the Union decides the management schemes that are additional to government regulations, as described in Section 2.1.



**Figure 2. Gillnet for spiny lobster.**

*Source:* Photos taken by the author.



**Figure 3. Annual landings of spiny lobster in Wagu district.**

The spiny lobster fishing is conducted from 1 October to 30 April. Fishermen leave the port to set the trammel net either at 15:00 or 14:00 depending on whether it is during the pooling period or the individual operation period (for the details of the periods see Section 2.1.). The vessels used differ according to the period, too – during the pooling period small boats with an outboard engine are used, whereas during the individual operation season, bigger vessels with an inboard engine are used (see Figure 4). They come back in an hour or so to the port, and the next morning trammel nets are picked up around 7:00-7:30 AM. The local seniors and relatives help to remove the lobsters and repair the nets (see Figure 5). These helpers are compensated with the by-catches (various fish that are caught in the trammel nets) rather than cash.



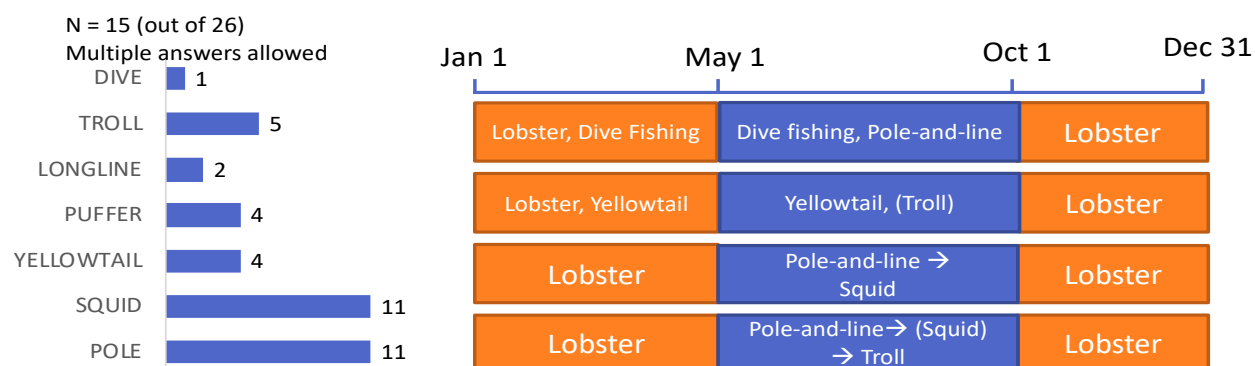
**Figure 4. Vessels used individual operation season to set the gillnets.**

*Source:* author.



**Figure 5. Next morning: the landing of the lobsters and helpers taking out the lobster from the net.**  
Source: author.

During the off-season for the spiny lobster fishing (1 May to 30 September), the fishermen mainly engage in squid fishing, pole-and-line fishing, and troll net fishing for yellowtails (based on author's interviews and surveys conducted in April 2017 – see Figure 6).



Source: Interview & survey (April 2017) conducted by the presenters

**Figure 6. Alternative fishing conducted by the spiny lobster fishermen.**

The main conflict of the trammel net spiny lobster fishery comes from dive fishing, which targets spiny lobster along with abalones, sea cucumber, and seaweeds. Sometimes, the trammel nets get entangled with the divers. This creates a serious job hazard for the divers. In order to avoid this, once the diving season starts (in April), the spiny lobster fishermen are not allowed to set the net before 15:00.

### 1.2 Economic contribution and social implications of the fishing activity

The Wagu district, with a population of 5 400, is heavily dependent on fishing activities due to a lack of land suitable for agricultural production. From the 1920s, it has depended on dive fishing, skipjack tuna fishing and pearl aquaculture. According to the Fisheries Census in 2008, there are 253 male and 176 female fishers. The rate of full-time fishers (69.4 percent) is much higher than the national average of 37.5 percent in 2005. There are 219 households in the Wagu district which have joined the Gaiwan FCA, out of which 26 are spiny lobster fishermen. This constitutes less than 15 percent of the total fisherman in the district.

Spiny lobster fishery contributes to maintaining a network within the Wagu district and beyond the community. For example, as mentioned previously, the helpers who support this fishery by taking off the lobster from the net are not paid in cash. Rather, they are compensated with by-catches resulting from lobster fishing. When the spiny lobster fishing season is over, the vessel owner often hosts a small party or exchange of gifts during the end of the year (*'seibo'*) or in August (*'chugen'*), as a token of appreciation. This shows that social ties are kept without the exchange of money.

An interesting and more recent effort involves the use of spiny lobster and its fisheries to create new networks with urban populations. For example, the youth group in the FCA has started a new festival called the 'trammel net owner system' (Figure 7 shows the poster and owner's ticket of this system). This is a system to invite the urban population to the district. An individual can purchase a trammel net for a day with JPY 15 000 (around USD 130). On a specific day in October when the festival is held, the individual can experience the spiny lobster fishing and can get all the catches from the trammel net. This event is held not just to sell the spiny lobster, but to disseminate the information regarding Wagu district and its fishing in general.

The figure consists of two parts. On the left is a recruitment poster for the 'Trammel net owner system'. At the top, it says '三重ブランド認定第一号 伊勢志摩和具漁港' (First No. 1 Brand Certified by Mie Prefecture, Ise-Shima and Kōgū Fishing Port). The main title is '伊勢海老刺し網オーナー 大募集!!' (Ise Lobster Trammel Net Owner Great Recruitment!!). A yellow starburst says '大好評につき 10年目' (Great popularity, 10th year). The collection period is '【募集期間】 8月18日～9月15日'. Details include: '★網揚げ実施日 11月18日(土) 受付 午前8時 志摩市 和具漁港' (★ Net lifting implementation date: 11/18 (Sat) Reception: 8 AM, Shima City, Kōgū Fishing Port); '★募集口数 80口' (★ Number of recruitment spots: 80); '★オーナー料金 1口 15,000円' (★ Owner fee: 1 spot 15,000 yen). There are three text boxes: '刺し網オーナーって' (What is a trammel net owner?), '刺し網オーナーになるに' (How to become a trammel net owner?), and '網揚げ・網さばき体験 & パーベキュー' (Net lifting, net mending experience & barbecue). On the right is an owner's ticket. The title is '伊勢志摩和具港 伊勢海老刺し網オーナー証' (Ise-Shima and Kōgū Fishing Port Ise Lobster Trammel Net Owner Certificate). The owner's name is '徳永 佳奈恵 様' (Ms. Tokunaga Kanami). The boat name is '豊幸丸-10'. The date is '出漁日: 平成29年11月18日(土)' (Fishing date: 11/18 (Sat), Heisei 29). At the bottom, it says '御食つ国 志摩の海人がこだわる本場の本物「伊勢海老」大漁を祈願しております。 三重外湾漁協 和具青年部' (We pray for a great catch of the real 'Ise Lobster' from the local area that the people of Shima care about. Mie Outer Bay Fishing Association, Kōgū Youth Group).

Figure 7. (Left) Poster of 'Trammel net owner system'; (Right) Owner's ticket.

Source: authors.

## 2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

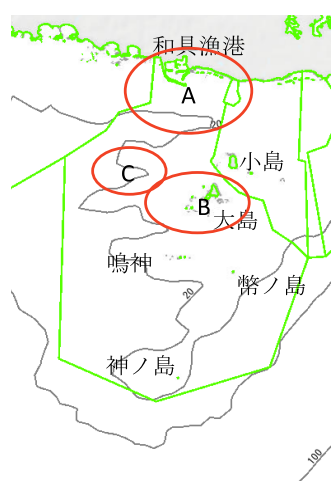
### 2.1 Management of the fishery

In general, TURF claims the ownership over a certain area of coastal water. The green area in Map 2 shows the area that the fishermen in Wagu district are given exclusive access to through fishing rights. The fishermen who use this area are required to be members of the Wagu Branch of Mie Gaiwan FCA. Wagu branch has 5 Unions: i) Spiny Lobster Fishermen's Union, ii) Pole-and-Line Fishermen's Union, iii) Skipjack Tuna Fishermen's Union, vi) Dive Fishermen's Union and v) Squid Fishermen's Union. In order to use each of the fisheries, fishermen have to take part in these unions. The unions make the rules for the management while controlling and monitoring each fisher's action.

Currently, the Union imposes voluntary management measures, such as gear restrictions (thickness of the net, and the number of nets per fishermen), no harvesting rules during the full moon, and a release rule for lobster under 100 g in the designated areas. On top of these measures, there are two separate management system operating during two periods: i) pooling period (from 1 October to end of

December or beginning of January) and ii) individuals operation period (from the end of December/beginning of January to 30 April).

During the pooling period, the fishermen operate in four groups (called '*hama*') of 4-6 fishermen. Each fisherman sets two nets in designated areas for the pooling period. Who sets the nets where is decided by the council, called '*Nen-gyoji*,' which is composed of the Union's president, vice-president as well as the leaders of each group. Each group will use a small boat with an outboard engine to set and collect the net. The fishing grounds used during this period are the area closer to the shore, indicated as A, B, C in Figure 8. These are highly productive. The revenues from the spiny lobster during this season are shared equally among the 26 fishermen leading to low competition (Uchida, 2017). Although there is a fluctuation in daily landing from 250 kg to 500 kg, the daily revenue is more stable at around JPY 2 million per day (around USD 18 000; see Figure 9).

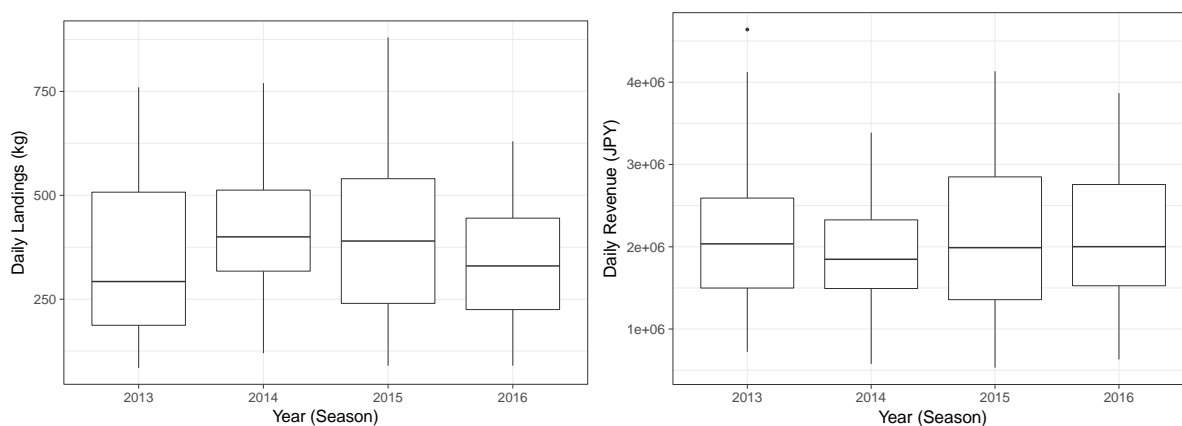


- A: Newly created in the 1990s
- B: Traditional (cultural significance)
- C: Productive



**Figure 8. Map of fishing grounds used during pooling period.**

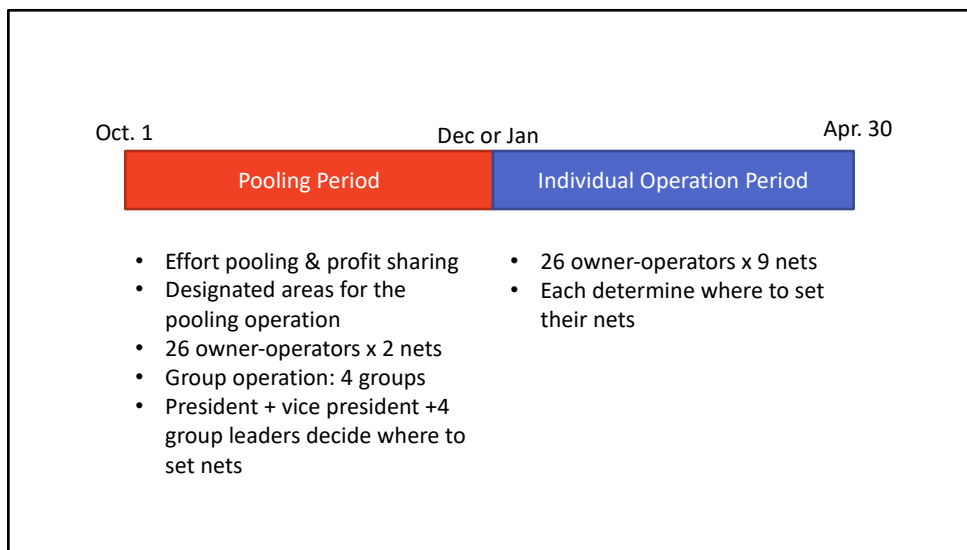
Source: Mie-Gaiwan FCA.



**Figure 9. Comparison between daily landing and daily revenue.**

Unlike the pooling period, fishing during the individual operation period is highly competitive. There is no allocation of areas to set the net; it is based on the rule of 'first come, first served.' During this period, the fisherman can use a maximum of eight nets (as of 2018). Each fisherman decides individually where to set nets and how many to set, weighing the size of the boat's engine and the

number of helpers he is able to convene. The number of helpers is a crucial factor because some of the fishing grounds that are highly productive tend to be places where the tide is fast. This means that the net is likely to collect many by-catches (including rocks and occasionally trash) and require a lot of repairs. Fishers without enough hands aren't able to set nets in these places. The main differences between the pooling period and the individual operation period are summarized in Figure 10.

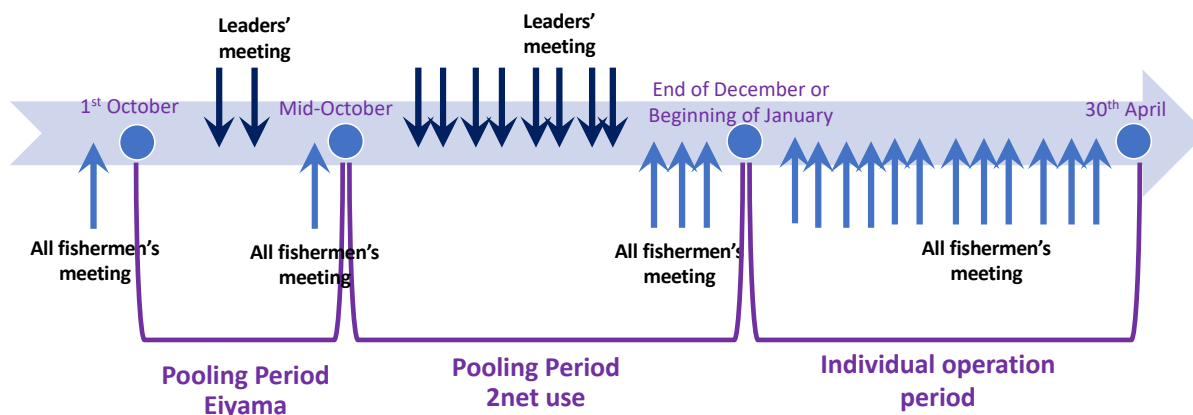


**Figure 10. Main difference between the pooling period and the individual operation period.**

It is important to note that, even during the individual operation period, there are precise coordinations set by Spiny Lobster Fishermen's Union. For example, during this period, all fisherman meetings are held every day to decide on when to go fishing and when not to. Important decisions about the time to switch from pooling to individual operation, and about the modification of management rules, are made during these fishermen meetings. Figure 11 shows how these two different types are held during the fishing year.

### • Two type of meeting for decision making mechanism:

1. All fisherman's meeting
2. Leaders' meeting: Chair/ Vice chair + group leaders



**Figure 11. Meeting held during the spiny lobster fishing season.**

## 2.2 Brief history of the former rights-based approaches used in the fishery

The TURF has been implemented since the Edo-period (1603-1868) as a customary right. The Meiji government, which succeeded the Edo government in 1868, tried to abolish TURFs and to introduce central government control on fisheries. However, it was met by strong resistance from the local communities all around Japan (Makino, 2011). As a result, the central government had to institutionalize the TURF in their new modernized legal system.

During the 19<sup>th</sup> century, the fishermen in Wagu district were given a TURF for spiny lobster fishery, and in the 20<sup>th</sup> century, the different rules were set up to regulate the use of fishing grounds. The Wagu FCA was established in 1903 and later integrated into Mie Gaiwan FCA. However, Wagu FCA remains as a branch under Mie Gaiwan FCA and still manages the TURF in Wagu district through the five aforementioned unions.

During the 1960s, the Mie prefectural government implemented two projects. One was to improve the fishing grounds for spiny lobsters; the other was to increase the size of the marine protected areas (*'Kinryo-ku'*) to conserve their breeding grounds. During the 1980s, the fishermen agreed to restrict the mesh size, the thickness of the net, and the number of nets that the fishermen can possess. These voluntary restrictions were not implemented on scientific foundation but rather came from conventional wisdom (Nishimura, 2013).

However, from the 1990s, the national government implemented a project to establish science-based management of spiny lobster stock in this region. Despite the fact that stock assessments were conducted in 1991 and 1992, it was not easy to convince the fishermen to reduce the number of nets and to release the smaller size lobsters. During this period, a committee composed of 23 representatives from FCA, government and researchers, was convened to discuss the management of spiny lobster. After several meetings, the fishermen came to consensus in conducting three voluntary measures: i) to release the lobsters which are under 70 grams, ii) no fishing during the full moon, and iii) to restrict the time to set the net (during the pooling period after 15:00 and the individual operation period after 14:00).

During the 2000s, Wagu lobster fishermen decided to take additional measures such as the pooling period. According to our interviews, the origin of the pooling period is not certain. However, it started as fishing for special communal occasions, such as festivals and New Year's bonus. Originally, it was conducted in a small protected area, though this area gradually expanded to include October and November. It was further agreed that the fishermen would use only two nets per household to reduce the labour cost. These measures were taken in order to adapt to the social context of the community – it is an ageing community with a smaller number of young residents who engage in fisheries. According to our interviews, many fishermen mentioned that the pooling period is conducted to 'gain profit with minimum effort' (*Rakushite Moukeru*).

## 2.3 Rights-based approach: allocation and characteristics

According to the current management system, during the pooling period, the harvest revenue from the spiny lobster is distributed equally among the 26 fishermen, which is around JPY 77 000 daily (around USD 675). The sharing of costs is more subtle. For example, each group leader usually provided the vessel to be used, and the cost of fuel is not shared. However, since all 26 fishermen take a turn to be the group leader, the cost is also born equally by the fishermen. The opportunity cost during this period, defined as the cost that the fishermen must forego to attend the spiny lobster fishery, is nevertheless high during this period for some particular fishers. Because of the pooling system, all 26 fishermen are required to participate in the lobster fisheries, even when it might be more lucrative for fishermen to go to other kinds of fisheries.



During the individual operation period, all the fishermen go out at 15:00 together with the command by the president of the Spiny Lobster Fishermen Union. During this period, the fishing ground is decided by the 'first come, first served' principle. Unlike during the pooling period, fishers are also able to switch to other types of fisheries if they wish. However, this does not mean that there is no control or management. What to do for spiny lobster is decided collectively with the all fishermen meeting as indicated in Figure 11. If one fisher breaches this rule and goes on to fish when they are not supposed to, they will be banned from fishing for the next couple of days. What must be noted is the combination of the pooling and individual operation function to ameliorate some of the fishermen's discontent. (for details, see Section 3.3).

### **3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY**

#### **3.1 Sustainable use of the resources**

It is difficult to assess the relationship between the rights-based approach and the ecological sustainability of the spiny lobster due to a lack of stock assessment since 1991-1992. Further, the biology of spiny lobster itself makes it difficult to assess this relationship. The life cycle of spiny lobster starts with spawning in April to October around the Pacific Ocean side of Japan; however, once it becomes *Phyllosoma* larvae, they travel to the Mariana trench. As they develop into *Puerulus* larvae, they come back along the Black Current (Kuroshio) east of the Philippines, and settle in the Pacific Ocean side of Japan. Due to this long-distance travel and wide habitat, there is a high level of uncertainty in stock (Yamakawa, 1997).

#### **3.2 Economic viability of the fishery**

The current management system described in Section 2.1. was designed to mitigate the effect of an ageing community. As with other parts of rural Japan, the Wagu district is ageing rapidly. In the 1990s, there were 36 fishermen in the Union, but currently, there are only 26. Among these, only four households have a young generation willing to succeed the spiny lobster fishing. The other issue is that, given the community's age, it is becoming difficult for some of the fishermen to gather helpers to take off the lobster from the net. The pooling period was designed to mitigate these issues by reducing the cost of operation by only using a small boat of the group leader, the number of helpers by only using two nets; at the same time, obtaining a stable income using the pooling of the revenue. This what the fishermen express as "gain profit with minimum effort" (*Rakushite Moukeru*).

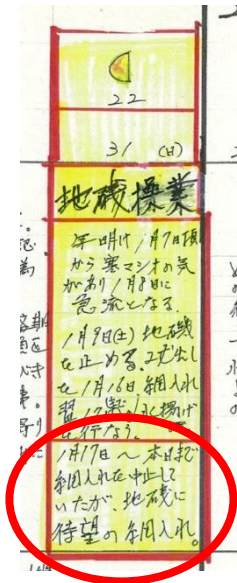
Further, this pooling of revenue acts as a certain type of social welfare system. As some fishermen have indicated during our fieldwork, as long as the fisherman (no matter how old he may be) can come in the morning to collect their nets, they can receive the revenue. Some mentioned that at one point, the union representative had to retire one fisherman because it was becoming dangerous for him to come to fishing even during the pooling period. The function of pooling period, however, is seen as one of the sources of discontent by young fishermen, as we see in the next section.

#### **3.3 Social equality**

As discussed in the previous section, the income is distributed equally during the pooling period. There seem to be no significant issues in terms of social equality. However, as mentioned previously, the pooling period is a source of discontent among younger fishers, despite its function as social welfare. This is because of the heterogeneity among the generation in terms of income needs. The fishermen, who are above 65, receive a pension from the national pension scheme. The older fishermen are empty-nesters, whereas the young fishermen are supporting a young family and they need a lot of money. As such, the pooling period serves as a substantial burden, prohibiting movement to other, potentially more lucrative fisheries.

At present, the individual operation is functioning to ventilate some of this discontent, as we see in figure 13 (below). It is taken from the day that the fishermen started the individual operation period.

The writer wrote about the ‘long-awaited start of the individual operation period.’ Further, as we see in the meeting schedules, shown in Figure 11, the time to switch from the pooling to the individual operation is carefully discussed in all the fishermen’s meetings. Currently, the combination of the pooling period and individual operation period is functioning well to create a ‘fit’ between the heterogeneous demands of the different fisher generations.



**Figure 13. Fishing diary of one fisherman.**

Source: author.

## 4. MAIN CHALLENGES AND WAY FORWARD

### 4.1 Challenges for the fishery

The main challenge to this fishery is its ageing population. As we have mentioned previously, only four households have successors who are willing to inherit the spiny lobster fishing business. Further, it is becoming more and more difficult to find helpers too. Although the introduction of the pooling period was a way to adapt to this ageing community, if the ageing continues at the current pace, further institutional reform will unlikely to deal with it. Some of the FCA members are already relaxing the rules so that the Spiny Lobster Fishermen’s Union can accept new members who are not necessarily inheriting the family business as they enter spiny lobster fisheries. However, as described in Section 2.2, agreeing upon the new institution took a long time; many discussions within the committee and with the fishermen were undertaken to build consensus. The challenge lies in the question of whether it is possible to come to agreement among the people who are heterogeneous in their needs and motivations for fisheries.

### 4.2 Improving fishery sustainability in the future

The management of fisheries in Japan poses a unique question, which is very different from that of developing countries where over-exploitation is a measure problem. Rather, our case study shows how to maintain social sustainability as well as the ecological sustainability of the spiny lobster fishing. It is our understanding that, in order to improve fisheries’ sustainability, it is not sufficient to discuss the ecological sustainability or the sustainable management of the stock. Rather, we need to include social sustainability to think about meeting people’s needs and aspirations. It is our sincere hope that the present case study is one of the first steps in this direction, as we move to discuss the socio-ecological sustainability of fisheries.