



Local Wisdom in Utilizing Skipjack (*Katsuwonus pelamis*) and Scad (*Decapterus macarellus*) in The Regency of Sitiro Archipelago

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Abstract

Local wisdom is any form of knowledge, belief, understanding, or insight as well as custom or ethics that can guide human behavior in life in ecological community. The utilization of fisheries resources, especially skipjacks and scads in the Regency of Sitiro Archipelago has long been based on the custom hereditarily, which is considered as local wisdom. The aim of this research is to describe the mechanism of utilizing fishery resources based on local wisdom, border areas of fishing ground ownership, and its impacts on the fish resource management. Fishermen who have right to catch skipjacks are those who identified the fish first. While in fishing scads, fishermen are limited by an individual local ownership obtained hereditarily. Therefore, not all the fishermen get access to the areas. Local wisdom owned by fishermen community in the area of small islands has not yet been aimed at sustainable fisheries management. It is only limited to avoiding conflicts among fishermen and among villages.

Keywords: local wisdom; utilization; management; sustainable.

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1. Introduction

As an archipelago, Indonesia has 17,508 islands covering 5.8 million km² of seawater and coast stretching as far as 81,000 km, whose fishery resources potential is very big and varies. In utilizing the resources, Indonesians have many traditions or local wisdoms. Local wisdom may be defined as a form of knowledge, belief, understanding or insight as well as custom or ethics that guide human behavior in life in their ecological community. Traditional/indigenous knowledge is also a part of ethics and moral that helps human answering what should be done and how to do it, especially when dealing with environmental and natural resources management [1]. Local wisdom also refers to the way people interpret, understand and apply the meaning and their experiences to the world at large by referring to resources and ecosystem dynamics [2].

Local wisdom understanding of fishermen is considered as the main component of management collaborative scheme on the basis of community [3,4,5]. By this, fishermen are expected to involve in marine resource management, so an improving participation, compromise, responsibility, and capacity of stakeholders can be expected in the process of management [6]. Local wisdom, tradition and belief are also considered as an important tool to increase effective communication, environment education, and monitoring program [7], sustainability of marine conservation [8] and history of the existing specific species in nature [9,10].

Indo-Pacific people, including Indonesia, are globally acknowledged to have a close relationship with marine areas, including culture and custom control in utilizing marine resources. Custom control includes control system that defines access and rights to utilize specific species and temporary closing of fishing areas. This periodical closing is included in the custom institution of coastal areas in eastern part of Indonesia and some Pacific areas [11].

One area of small islands in the Regency of Sitaro Archipelago, North Sulawesi Province, consists of Buhias Island, Pahepa Island, Mahoro Island, Kapuliha Island, Masare Island and Laweang Island, have varied natural resource potentials, both fishery and non-fishery. Dominant fishery resource is skipjack (*Katsuwonus pelamis*), bullet tuna (*Euthynnus affinis*), scad (*Decapterus macarellus*), trevallies (*Selaroidessp*), jack trevallies (*Caranxsp*) and also green turtles (*Chelonia mydas*) spawn (in Masare Island), whereas the non-fishery resources are swiftlet nest (in Mahoro Island), breeding areas for some sea birds species (in Laweang Island) and maleo (in Pahepa Island and Masare Island).

In utilizing the fishery resources, especially skipjacks (*Katsuwonus pelamis*) and scads (*Decapterussp*), the fishermen in this area have a traditional custom or local wisdom. Fishermen have right to catch skipjacks when they see the fish shoal first. On the other hand, in catching scads, fishermen are limited by an individual fishing ground ownership obtained hereditarily, for others cannot enter the area.

The research is aimed at describe the mechanism of fishery resources utilization based on the local wisdom, borders of fishing area ownership, and its impact on the fishery resource management. Knowledge about the condition will benefits in the decision makingprocess of the fishing area management optimally.

2. Research Methods

This research was carried out in the Regency of Sitaro Archipelago, North Sulawesi Province, which includes six small islands, namely Buhias Island, Pahepa Island, Mahoro Island, Kapuliha Island, Masare Island, and Laweang Island (Fig 1). Three of the six islands are inhabited, namely Buhias Island, Pahepa Island, and Masare Island. Administratively those islands are divided into four villages: Buhias Village and Matole Village in Buhias Island, Tapile Village and Pahepa Village in Pahepa Island. Method used in this research was a descriptive method, aimed at making a systematic description, an illustration and a picture, and factual as well as accurate facts, features and relationship of the observed phenomena [12].

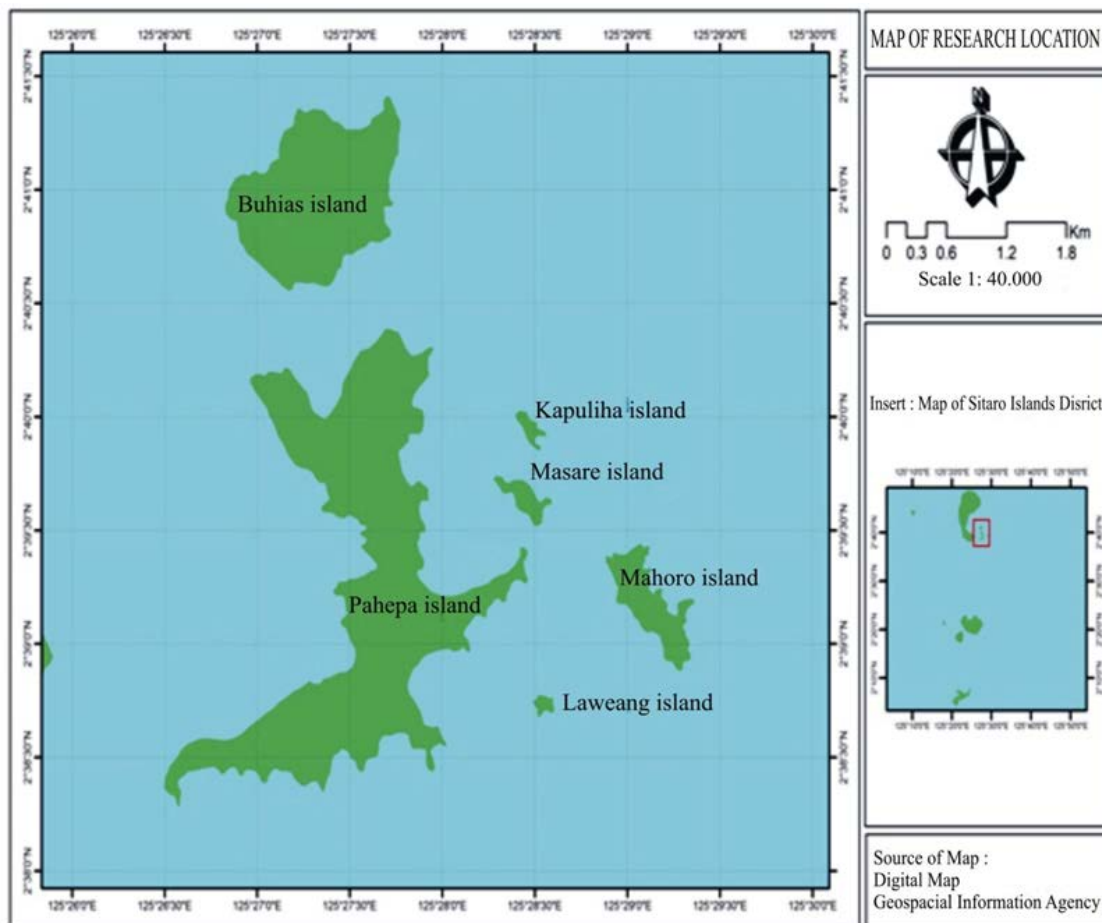


Fig 1. Research location

2.1 Data Collection

Data collected include primary and secondary data. Primary data obtained through focus group discussion (FGD) and interviewing the prominent figures in the community, the local government and the active owners of fishing gears in each village. The data collected include history of the forming of individual fishing area ownership, fishing areas and borders of fishing areas among villages, problems arising from that regulation, solutions to the problems, and fishing gears operation. Secondary data obtained from the village offices and related institutions were general condition of the research location and performance of captured fishery.

2.2 Data Analyses

Data analyzed by using quantitative descriptive analyses; an analytical technique that is carried out in the form of data/figures, then analyzed and interpreted into description [12].

3. Results

3.1 General Condition of the Location

The small island areas (Buhias Island, Pahepa Island, Mahoro Island, Kapuliha Island, Masare Island, and Laweang Island) are geographically located between 2°37'58" and 2°48'43" Northern Latitudes, and between 125°21'30" and 125°27'25" East Longitude (Table 1).

Table 1. Area of each island

Islands	Areas(km ²)	Information
Buhias	4.53	inhabited
Pahepa	12.61	inhabited
Kapuliha	1.16	unpopulated
Masare	1.25	inhabited
Laweang	1.15	unpopulated
Mahoro	2.28	unpopulated

Source: [13].

As can be seen from the table, Pahepa is the biggest island, whose area covers 12.61 km² and Laweang is the smallest island covering 1.15 km². Among the six islands, only three are inhabited, namely Buhias, Pahepa, and Masare. The topography of these areas is generally hilly and wavy, with a steep slope. Nevertheless, these areas are still used by the local people to grow plants, such as coconuts and nutmegs. The altitude of these small islands varies between 0 and 259 meters above sea level, as can be seen in the following table.

Table 2. Altitude of small islands region

Islands	Altitude (m above sea level)
Buhias (Gunatin)	0 – 259
Pahepa	0 – 211
Kapuliha	0 – 70
Masare	0 – 78
Laweang	0 – 55
Mahoro	0 – 138

Source: [14].

Table 2 shows that Buhias is the highest island, whose altitude reaches 259 meters above sea level, and the lowest island is Laweang, whose altitude is 55 meters above sea level. Inhabited islands are limited to lower lands in the coastal areas, whose altitude is ± 25 meters above sea level.

3.2 Description of round skipjack net (*Soma Hetung*)

Round skipjack net (*soma hetung*) is a special gear for fishing skipjacks (*Katsuwonus pelamis*). It is modified from gill nets by the fishermen at Buhias Village, and firstly used in 1954. This gear is rectangle, consisting of the main net and scoop or a lifting net called *sasile*. On the top of the main net, there are floats and in the bottom there are ballasts. Additional ballast, a stone weighing ± 10 kg is put every 5 to 7 m distance that connected by PE rope 10 mm and rolled in a bamboo called *talontong*(Fig 2).

The size of main net is between 180 – 200 m long and 15 – 20 m wide. The main net is made from *polyamide* 210D/12 with the size of mesh 1.5 – 2 inches. The size of the lifting net (*sasile*) is 15 – 20 m long and 5 – 10 m wide, and made of *polyamide* 240D/12 with the size of mesh 1 inch. The net as well as mesh is functioned is to block the fish, not to ensnare. Boats used are made from wood of 8 m long, 1.75 m wide, 1 m high and using Yamaha 8 PK as an outboard motor.

- **Operating the fishing gear**

The areas for fishing skipjacks are located on the coastline of Buhias and Pahepa Islands. The time for fishing is all year long, and the peak season is July to September, during south winds. Fishing activities last during the day, depending on the existence of skipjacks, and carried out by approximately 75 people joining in one group.

The main boat carrying the net is tethered to the waters near the village. It should ready to be operated, so when the skipjacks are identified, the operation can be carried out easily. The main boat will chase the skipjacks, followed by small boats as soon the skipjacks are identified. As soon as the small boats reach the skipjacks, the fishermen will spread a net while those in the small boats will help by holding the extra ballast (*talontong*), so that the position of the net will be exactly on the fish. In this process some fishermen must dive in order to monitor the fish movement. If the fish go down into the bottom, the trawl will be stretched and sunk with the help of extra ballasts (*talontong*). On the other hand, when the fish return to the surface, the net will also be pulled by using extra ballasts (*talontong*). This process is carried out while leading the fish slowly to the shallow coast, so that the net will touch the bottom of the waters. Fish will be lifted to the boat by using a smaller net (lift net) called *sasile*.

If the yield is in a big number, the process of lifting fish will wait for the container boat from Bitung. It takes ± 4 days for waiting, and during those days, the fish will be kept alive inside the net. The fishermen take only dying fish to be sold to the local market or processed as smoked fish.

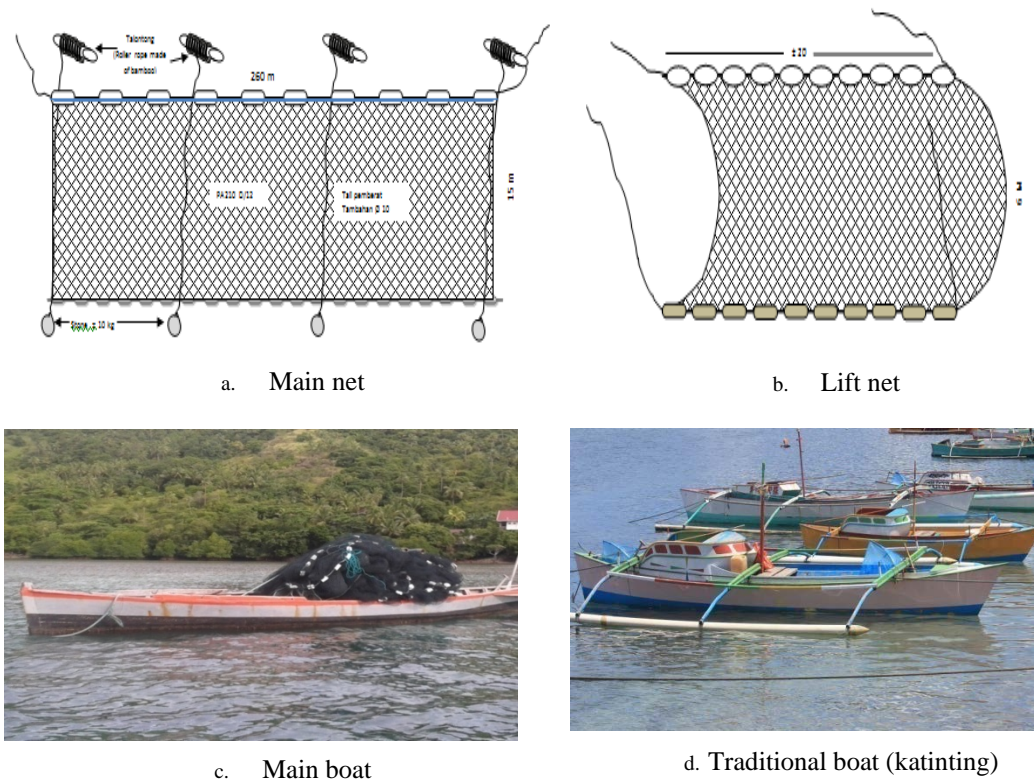


Fig 2. Round skipjack net (a). Main net, (b). Lift net, (c). Main boat, (d). Traditional boat (katinting)

3.3 Roundscad net (*Soma Talang*)

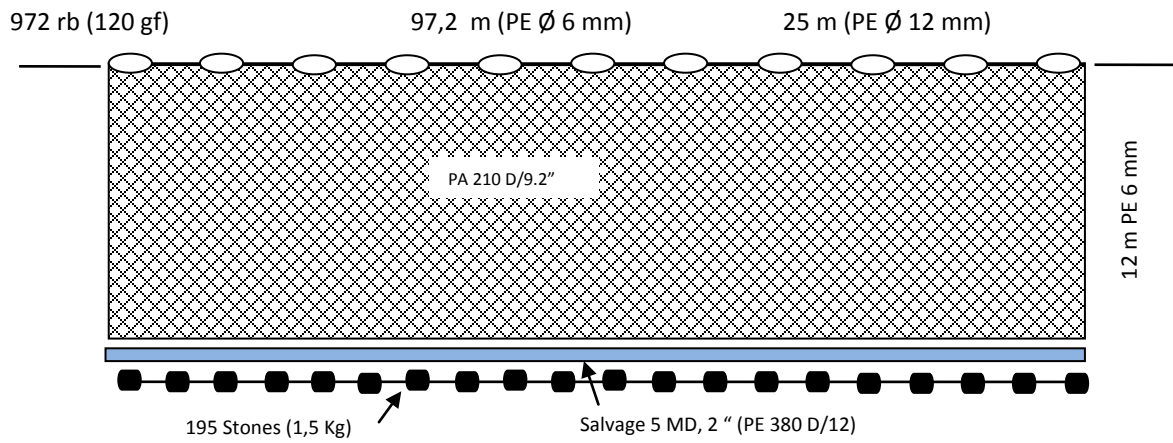
First type of round scad net (*soma talang*) in Pahepa Island is called *seke*, a kind of bamboo fence to lead a shoal fish to the shallow waters. It was very popular in Sangihe Island before a net is available. This natural fiber-round scad net had been used since 1950s, and replaced by synthetic fiber in 1960s. These gears consist of main net, leader net, and lift net or scoop [16].

The size of main net varies from 90 – 150 m long and 6 – 12 m wide, made from *polyamide* 210D/6. Its mesh size is 1.5 – 2 inches. Leader net is made from *polyamide* 210D/6 and its mesh size is 2 – 3 inches. The length of floating rope is about 95 meters or more, and its depth is between 4 – 6 m (Figure 3). Lift net or scoop (*sasile*) is used to lift the yield after it is tightened by the main net. *Sasile* is made from *polyamide* 210D/6, sized about 15 m long and 6 m wide, and its mesh is 1 inch. Boat used is made from wood, called *pamo* weighing 4 – 7 GT, operated by an external machine with 15 – 25HP or semi internal machine 5 HP, or paddle or if the fishing area is near the coast.

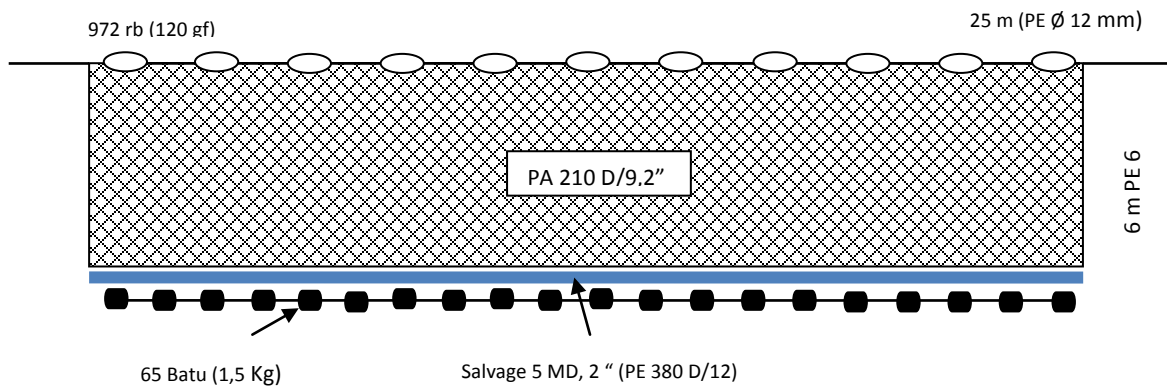
- **Operating the fishing gear**

This gear (Fig 3) is specifically used for fishing scads (*Decapterus macarellus*) near the area of coral reefs in the depth of 5 – 15m. Its fishing season is from October to June each year, depends on the climate. In the south winds (July to September), fishermen usually lessen their fishing activity.

a. Main net



b. Leader net



c. Lift Net

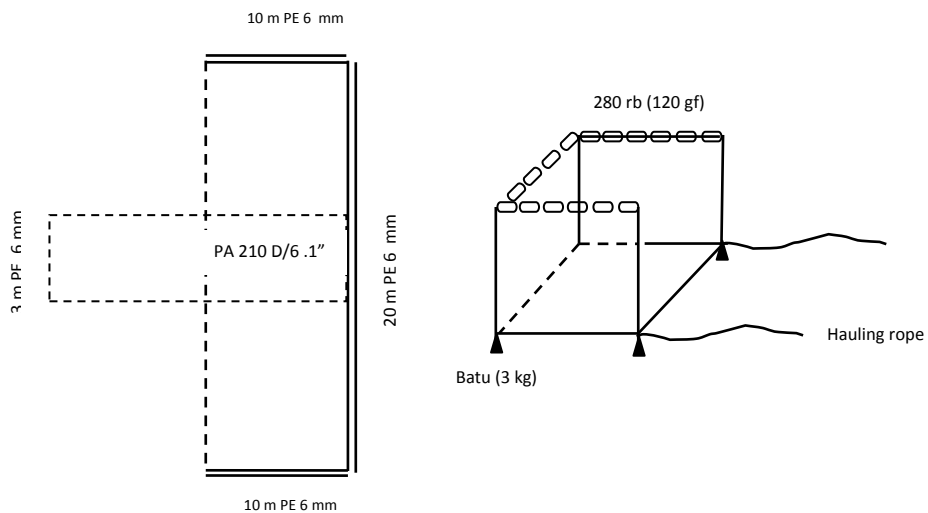


Fig 3. Roundscad net (a) Main net, (b) Leader net, (c) Lift net

Fishing is carried out in the morning, where the net is set at 4 am by 8 to 12 fishermen. Before setting the net, 2 or 3 fishermen dive by using goggles to see the location of scads and watch the current direction [16].

The leader net functions to block fish migration along the coast. Afterward, the main net is connected to the leader net, set to a semicircle and faced the coast. The extra floats are added when there is a strong current. Five divers guide a shoal fish into the main net, and then lock the net by pulling one side of the main net and circle the fish. During this process, the divers repeatedly release the ballast from the net. Finally the lift net is circled into the main net and the yield scooped into the boat.

3.4 Investment and profit sharing system

Investment of the two fishing gears and the gross income as well as the net income per year can be seen in the following table.

Table 3. Investment, cost and income of the skipjack and scad net

Fishing gear	Investment (Rp)	Cost (Rp)		Gross income (Rp/yr)	Net income (Rp/yr)
		Variables	Fixed		
Round Skipjack net	72,500,000	1,485,000	23,250,000	238,920,000	237,435,000
Round Scad net	32,000,000	10,200,000	10,225,000	90,000,000	83,580,000

Source : Primary data processed in 2012

As can be seen in Table 3, there is a big different investment in the two fishing gears. It is due the size of the tools and thread used in each different net. The machine used is also different; the round skipjack net uses Yamaha 8 PK as an outboard motor, whereas round scad net uses traditional boat (*katinting*).

The variable cost spent for the scad net is much higher than for skipjack net, due to a different fishing frequency of both gears. Round skipjack net operates more than 11 trips/year, while round scad net 120 trips/year. The average yield of skipjack net is 2,270 kg/trip and the price Rp 10,000/kg, whereas the average yield of scad net is 100 kg/trip at Rp 7,500/kg. Therefore, gross and net income of both gears are very much different. Skipjack net gets Rp 238,920,000/year and Rp 237,435,000/year, while scad net gets Rp 90,000,000/year and Rp 83,580,000/year.

3.5 Local Wisdom

In utilizing skipjacks (*Katsuwonus pelamis*) and scads (*Decapterus macarellus*), fishermen in these small islands in the Regency of Sitaro Archipelago, have a local wisdom that includes individual ownership of fishing areas by each village. The fishing areas for skipjacks owned individually by using a skipjack net spread from Pahepa Island, Mahoro Island, Laweang Island and Kapuliha Island (Figure 5). The ownership of individual fishing areas does not exist in Buhias Island; however, the fishermen in Buhias Village and Matole Village in Buhias Island own fishing areas in Mahoro Island and Pahepa Island.

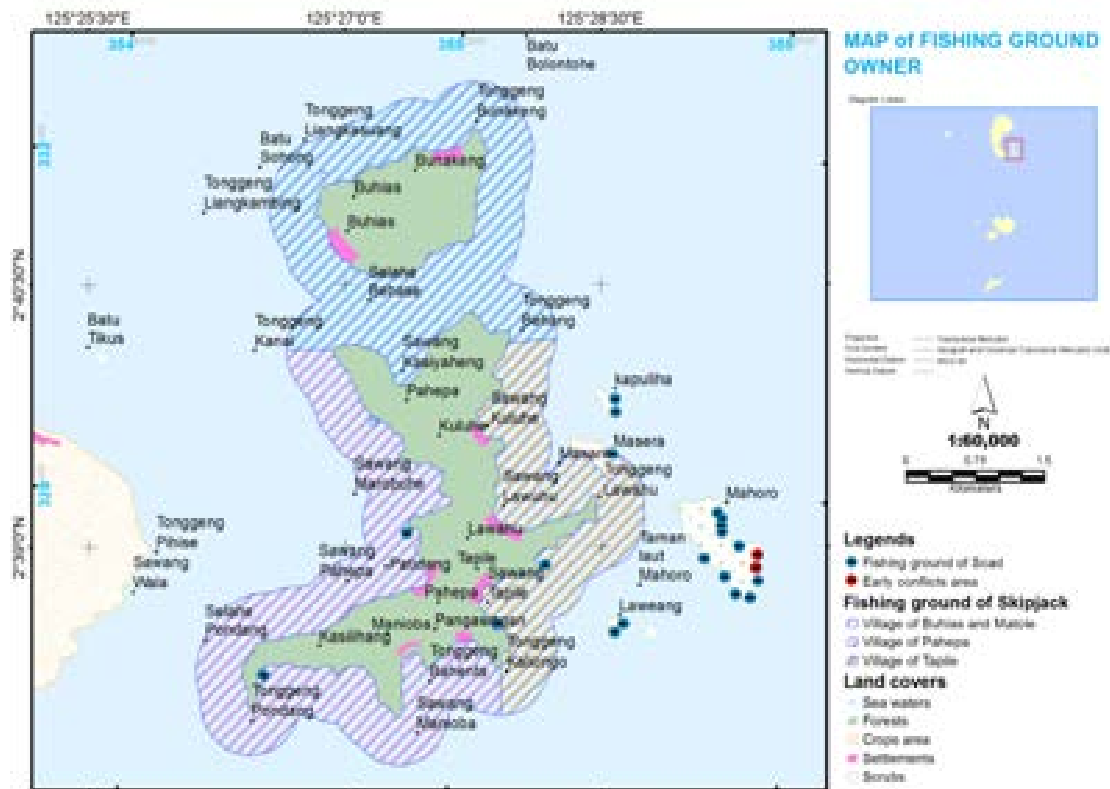


Fig 4. Fishing ground border among villages and individual fishing ground

A fishing area ownership practice is essentially in accordance with *Territorial Use for Fishing* (TURF). TURF is defined as someone's right to use (or own) and isolate the fisheries resources in a certain area and time. These rights also include responsibility to maintain and manage the resources, and the limitations of the rights to use the areas and exclusiveness. Therefore, TURF involves certain areas and the implementation of the rights related to fishery in those areas [17]. The arrangement of TURF areas can be related to the surface, below, or all over water areas in a certain place. The measure of the areas will be different depend on the exploitation, harvested resources and geographical characteristics. The areas must be maintained and protected by laws and state institutions, and the borders of the areas must be clear and identifiable [18]

Individual territorial for fishing has been going on hereditarily, since the Government was a kingdom (Siau Kingdom). An ownership process started when a fisherman found a fishing ground especially for scad (*Decapterus sp*). The fishermen then reported it to the custom leader and the village authorities about this new finding fishing ground. Based on the consensus among the fishermen community in those small islands, an unwritten decision stating that the newly found fishing ground belonged to him will be made.

At that time, a gear used to catch fish was only bamboo fence (*seke*), functioned to lead scad (*Decapterus sp*) to a shallower area. In line with the changing of fishing gear from *seke* to fiber net as well as the increasing of the number of nets, there was a dispute or conflict among the families or fishermen community due to this territorial use for fishing. This can be seen from the written report made by an owner of territorial use for fishing to the District authorities of Siau dated July 14, 1973, concerning the robbing of his fishing territory in Batu Lubang

and Batu Pedi in Mahoro Island since July 1971. The conflict could be avoided and did not spread to other fishing areas because the two parties could control themselves, and there was no confrontation between them. This problem could be solved in 1995. To prevent further conflict, a consensus among fishermen community, custom leaders, the village authorities and the District government of Siau Timur was made on June 9, 1995, in which they agreed on the following three rules:

- Forbid anyone, individually or group to dominate and own places for fish for their own sake, individually or group (Instruction of BKDh level II S/T No.63 Year 1983 dated 9 July 1983),
- Manage to take turn the use of fishing territory or to use it together according to the consensus in the community,
- Those who plan to make a new net (*soma*) can do so, if they have found a new area and must report it to the custom leader and the Head of Buhias Village or the Head of Pahepa Village.

This consensus was successful to stop conflict and to avoid further conflict, seen from the fishermen's attitude to obey the consensus. Furthermore, it is explained that if one area or fishing territory is owned by some fishermen that are beneficiaries or descendants of the owner of the fishing territory, fishing activities are arranged alternating in the related families. If a related fisherman could not do as scheduled, he can offer it to another fisherman and get 15% of the captured fish for the replacement gets.

Border area of skipjack territory between villages has been applied since 1980s. The purpose of it was avoiding conflict among net groups (*soma hetung*), which involves people from each village. Prior to 1980s, skipjack fishing in this area had not been limited to village administration border. Fishermen from one village could enter any villages in the small islands without any problems. Chasing skipjacks process by using non-motor boats at that time often resulted in losing because of their fast swim. It is also very often that hunts had not been caught already got into another village's fishing territory. The increasing of number of nets (*soma hetung*), could also increase conflicts among fishermen. Nowadays, when the skipjacks have been seen by the local people, they will shout to the group telling the presence of the fish, and they will chase the fish. However, when the uncaught shoal skipjack passed other village and the fishermen from that village see and shout to their group and chase the same fish to the first fishermen group without knowing that fish was also chased by the fishermen whose village was first passed by the fish. This can trigger conflicts among fishermen among village.

In fishing skipjack by using net (*soma hetung*), fishermen in this area have already had some rules though they are unwritten. The rules are: 1) if one group has chased the skipjacks, another group is not allowed to chase the same fish, 2) the first person who sees the location of a shoal of skipjacks will get 10 – 15% of the captured fish in accordance with the existing rules in the group. So far these rules have been applied effectively in each village. However, if the skipjacks have gone beyond the border of the village, the first rule will no longer be effective; the first fishermen who chase the fish are not allowed to continue chasing. The chase will be continued by the fishermen from the second village where the fish pass, and the fisherman who first sees the shoal still gets the portion according to the existing rule, that is 10% - 15% of the captured fish.

The border lines of skipjacks (*Katsuwonus pelamis*) area among villages in the small islands shown in Figure 5. Buhias and Matole Villages located in Buhias Island have the same fishing territory, and not yet been divided, due to Matole is a village development from Buhias Village in 2011. The fishing area stretches from Tonggeng Kanai (Cape Kanai) to TonggengBehang (Cape Behang) in Pahepa Island to the north, which includes Buhias Island. In Tapile Village, the skipjacks territory stretches from Cape Behang to Cape Kaliongo in the east of Pahepa Island, and includes small islands around it (Kapuliha, Masare, Mahoro and Laweang). In Pahepa Village, the fishing territory stretches from Cape Kaliongo to Cape Kenai from the south to the west of Pahepa Island.

Border area of fishing territory among villages and its ownership shows directly the sea cluster by the fishermen community in these small islands. Globally every inch of international seawaters anywhere is clustered and regulated by an international organization. Regulations in each organization include the number of fish captured, kinds of fishing gears, who can fish, and so on. However, there is a philosophical value in the marine and fishery globalization that is the importance of maintaining global fish resources, so that the next generation can also benefit the nature resource [19].

Clustering seawaters in Indonesia applied after the issue of the Decree of the Ministry of Agriculture No. 67/1976 concerning three zones fishing lanes. The purpose of the decree was to protect traditional fishermen, but in reality it was not effective because there was no law enforcement. In this context, the ownership of individual fishing territory in these small islands happened prior to the decree [19].

Seawaters clustering conservatively is also applied in Japan through development of *Fishing Right System* (FRS), where each fisherman has *fishing right* to make use of the resource in his coast area whose border lines are clear, among villages as well as among cities. FRS arranges types of caught species, catching time, fishing gears, and catching methods. Clear border lines make fishermen more responsible for the existing resources; for they are realize to carry out sustainable fishing activities. Local small fishermen are protected from outsiders and benefit the rich nature resources [19]

In a comprehensive right system, right categories can be isolated and allocated into a whole or a part, into individual or group [20]. The rights are as follows:

- Access and withdrawal: the rights to enter and extract the products of a defined physical resource (e.g., fish, water, wood, etc.).
- Management: the right to regulate internal use patterns and transform the resource by making improvements.
- Exclusion: the right to determine who will have an access right, and how that right may be transferred.
- Alienation: the right to sell or lease the above rights.

The rights above can be taken individually, and not influence each other. By this means, an individual or group can hold one right well but unable to have the whole rights at the same time. The holder of access right may not have the right to utilize the area. The holder of utilization right may not have the right to arrange, or they may

have the right to arrange, but they do not have the exclusiveness right, and they may have the exclusiveness right without the right to transfer. In other words, an individual or group can hold and carry out one right well, but he or she cannot have the five rights at once [21].

The fishermen of round skipjacks net (*soma talang*) in the small islands region in the Regency of Sitaro Archipelago have the five rights at the same time; right to access and withdrawal, management, exclusion, and alienation (Table 4). Nevertheless, their right to manage is limited to fishing schedule and allowing someone to carry out fishing. It has not led to the quality and quantity improvement of the resources through fish stock enrichment and environmental maintenance and restoration.

Table 4. Relation of types of fishing gears and ownership right in the small islands areas in the Regency of Sitaro Archipelago

Types of fishing gears	Right Owners			
	Owner ^{d)}	Proprieter ^{c)}	Claimant ^{b)}	User ^{a)}
Hand line				√
Gill net				√
Round Skipjack net		√	√	√
Round Scad net	√	√	√	√
Purse seine				√

Source: interview results 2013

Notes:

- a) An individual who has right to access and get product or benefit from the fishery resources.
- b) An individual who has similar right as resource users, and right to arrange and manage.
- c) An individual who has right to access, utilize and exclusiveness towards a community property resource.
- d) An individual who has all collective rights beside rights to access and utilize the resource.

Round skipjack net fishermen have rights to access, utilize, arrange and exclusiveness. It can be seen from their consensus, whether it is among fishermen or between village authorities that arrange the areas for skipjack catching since 1980s. Right to arrange or manage skipjack (*Katsuwonus pelamis*) catching is limited to fishing areas and has not yet led to maintain the quality and quantity of fish resources through stock enrichment as well as to maintain the environment. The exclusiveness right can be seen from an individual or group that can catch the skipjacks.

Fishing area border among villages and ownership of individual fishing area has becomes a culture or local wisdom of the fishermen community in the area of small islands. It is aimed at avoiding conflicts among fishermen or villages. In fact, this local wisdom is also expected to ensure the sustainability of fish resource and business. This can be understood due to the thinking pattern of the fishermen community that considers fisheries resources are replaceable. On the other side, fishing activities also give bad impacts on coral reefs because the fishing area is on the coral reefs area.

Scad are assumed to migrate to shallow coral reef waters to breeding [16]. This condition attracts the government attention to give counseling to the fishermen community, for they will involve in arranging and controlling the closing of fishing areas regularly. The purpose of it is giving the chance for fish to carry out breeding. Without broad knowledge about local ecosystem and fish behavior, fishermen will never become prosperous [22].

4. Conclusion

In exploiting fishery resources, fishermen in the Regency of Sitaro Archipelago, North Sulawesi Province, has a local wisdom, which is individual territory use for fishing and border area of fishing among villages. This local wisdom lasted hereditarily since the local Government formed Kingdom (Siau Kingdom). During its development the individual territory use for fishing ownership faces problems such conflict among families and community. However, the conflict can be solved through consensus dated June 9, 1995.

Local wisdom owned by fishermen community in the area of small islands has not yet been aimed at sustainable fishing activity management. It is only limited for avoiding conflicts among fishermen as well as villages.

References

- [1] S Stanis, Supriharyono, "Pengelolaan Sumberdaya Pesisir dan Laut Melalui Pemberdayaan Kearifan Lokal di Kabupaten Lembata Provinsi Nusa Tenggara Timur". A.N Bambang. *Jurnal Pasirlaut*, Vol. 2, No. 2. 2007.
- [2] L.S Evans. "Ecological Knowledge Interactions in Marine Governance in Kenya". *Ocean and Coastal Management*. Vol 53. pp 180-191. 2010.
- [3] F Berkes. "Alternatives to Conventional Management: Lessons From Small-Scale Fisheries". *Environments*. Vol 31(1). pp 7-19. 2003.
- [4] R.E Johannes, B Neis. "The Value of Anecdote". In: N Haggan, B Neis. I.G Baird (Eds.). *Fishers' Knowledge in Fisheries Science and Management*. UNESCO Publishing. Paris. 2007.
- [5] R.J Hamilton, M Giningele, S Aswani, J. L Ecochard. "Fishing in the Dark-Knowledge, Night Spear Fishing and Spawning Aggregations in The Western Solomon Islands." *Biological Conservation*. Vol 145. pp 246-257. 2012.
- [6] F Berkes. "Rethinking Community-Based Conservation." *Conservation Biology*. Vol 18(3). pp 621-630. 2004.
- [7] D Malleret-King, A Glass, I Wanyonyi, L Bunce, B Pomeroy. "Socio-Economic Monitoring Guidelines for Coastal Managers of The Western Indian Ocean". SocMon WIO. CORDIO: East Africa Publication (Version 1) 108. 2006.

- [8] L.C Gerhardinger, E.A.S Godoy, P.J.S Jones. "Local Ecological Knowledge and The Management of Marine Protected Areas in Brazil." *Ocean and Coastal Management*. Vol 52. pp 154–165. 2009.
- [9] E Rasalato, V Maginnity, J.M Brunnschweiler. "Using Local Ecological Knowledge to Identify Shark River Habitats in Fiji (South Pacific)." *Environment Conservation*. Vol 63. pp 16-23. 2010.
- [10] C.A Zappes, A Andriolo, P.C Simões-Lopes, A.P.M Di Benedetto. "Humandolphin (*Tursiops Truncatus Montagu*, 1821) Cooperative Fishery and Its Influence on Cast Net Fishing Activities in Barra de Imbé/Tramandaí, Southern Brazil." *Ocean and Coastal Management*. Vol 54. pp 427 – 432. 2011.
- [11] P.J Cohan and S.J Foale. "Sustaining Small-Scale Fisheries with Periodically Harvested Marine Reserves." *Marine Policy*. Vol 37. pp 278 – 287. 2013.
- [12] M Natsir. 2011. *Metode Penelitian*. Ghalia Indonesia.
- [13] [Bappeda Kab. Kep. Sitaro] Badan Perencana dan Pembangunan Daerah Kabupaten Kepulauan Sitaro. *Rencana Tata Ruang Wilayah Kabupaten Kepulauan Sitaro 2008 – 2028*. 2008.
- [14] [KKP] Kementerian Kelautan dan Perikanan. *Undang-Undang Republik Indonesia Nomor 45 Tahun 2009 Tentang Perikanan*. 2009.
- [15] E Reppie and A Luasunaung. "The Status of Roundscad Net (Talang) in Pahepa Island, Sangihe Talaud, North Sulawesi." *Proceeding of International Symposium on Fisheries Science in Tropical Area*. Faculty of Fisheries and Marine Sciences – IPB. Bogor Indonesia, August 21 – 25, 2000.
- [16] T Panayotou. "Territorial Use Rights in Fisheries." *Preliminary Report in Workshop on Territorial Use Rights in Fisheries (TURFs)*. Rome. 1982.
- [17] F.T Christy Jr. "Territorial Use Rights in Marine Fisheries: Definitions and Conditions". *FAO Fisheries Technical Paper 227*. Food and Agriculture Organization Of The United Nations. Rome. 1992.
- [18] A Satria. *Ekologi Politik Nelayan*. Penerbit PT LkiS Printing Cemerlang. Yogyakarta. 2009.
- [19] M Bradi and S Waldo. 2009. "Fixing Problems in Fisheries—Integrating ITQs, CBM and MPAs in Management." *Marine Policy*. Vol 33. pp 258–263. 2009.
- [20] V.P.H Nikijuluw. *Rezim Pengelolaan Sumberdaya Perikanan*. Penerbit PT Pustaka Cidesindo. Jakarta. 2002.
- [21] N Haggan, B Neis and I Baird. "Fishers' Knowledge in Fisheries Science and Management." UNESCO Publishing, Paris. 2007.