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Marine Resource Use in the Bajo of North Sulawesi and Maluku, Indonesia

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INTRODUCTION

Marine resource management in the coastal zones has been one of the main issues in the anthropological and applied sciences during these few decades [RUDDLE and AKIMICHI 1984; RUDDLE and JOHANNES, 1985]. Especially, use of common-pool resources and its appropriate management in the developing countries is the key to the debates [McCAY and ACHESON 1987; OSTROM 1990].

Indonesia has been witnessed as an important field by both the policy-makers and scientists for the sustainable use and management of marine resources [BAILEY 1988; RICE 1991]. However, sufficient information has not yet been accumulated, perhaps due to environmental and cultural diversities found in a vast archipelagic country.

For a better understanding of the present-day marine resource use in Indonesia, this paper examines marine resource exploitation activities of the Bajo who live in coralline habitat of eastern Indonesia. As an introductory note, two important points useful for the analysis of contemporary small-scale fishing communities in Indonesia will be mentioned: ethno-network and coral reef foragers.

The majority of Indonesian fishermen engage in small-scale coastal fishing [BAILEY, DWIPONGGO and MARAHUDIN 1987] as fishermen do in other parts of Southeast Asia. A set of rather simple technologies and a less stratified socio-economic organization combine to produce a petty commodity [McCAY 1981]. These commodities are consumed, sold or traded, depending on local, regional and international demands through various economic and social networks. It is not surprising to find that in such networks, several individuals and groups of people who have distinct ethnic backgrounds or ethnicity, are involved. As will be demonstrated in this paper, each ethnic group appears to occupy a certain status in terms of the marine resource use, as the producer, retailer, middleman or exporter. Their status is not only the ethnic division of economic pursuits but also projections of interactions, conflicts and cooperation among them. Clarifying the

nature and role of these relations, namely the ethno-network [AKIMICHI 1994, 1995b], will lead to a better understanding of marine resource use in Indonesia.

In discussing marine resource use in Indonesia, it is important to touch upon the characteristics of fishing in tropical waters. In general, it is possible to distinguish two major ecological fishing zones in these areas: the coral reef system and the open waters outside of the reef.

The coral reef ecosystem abounds with many different reef fish species, despite a relatively low biomass. Most of them are sedentary, and their distribution depends on the current flow during a larvae stage.

In open waters of coastal and off-shore areas, there are both pelagic and demersal species. The former group includes both plankton-feeders, such as sardine and garfish, and large predatory fish, like tuna, skipjack, trevally, and wahoo. In the latter group, snapper, jobfish and shark, are included [SOEGIARTO and POLUNIN 1981].

As seen in many parts of the southwestern Pacific and Southeast Asia, large-scale fisheries have been devoted for catching either pelagic or demersal species, whatever the effect on the resource potential. For instance, bottom trawl fishery (Malacca Strait and South China Sea), purse-seine and longline for tunas (Southwestern and Central Pacific) have been widely used, and in certain areas, overfishing has posed a serious problem [BAILEY, DWIPONGGO, and MARAHUDIN 1991].

On the contrary, coral reefs have been exploited mostly by the artisanal fishermen. Despite its small-scale, a rich variety of fishing techniques are employed in line with the local customary practices. In these areas, large-scale fishery may not be consistent with the sustainable management goal. Also, in these artisanal fishing communities, various types of marine resource management practices have been conducted [BAILEY and ZERNER 1992; AKIMICHI 1995a]. However, these customary practices are being exposed to the external economic and social impacts as a result of which traditional systems are becoming unstable [AKIMICHI 1992; RUDDLE 1993].

In considering the above-mentioned framework, and on behalf of the ongoing research promoted by the Maritime group of the Indonesian Institute of Science in several locations of eastern Indonesia; *e.g.*, Sangihe-Talaud (Bebalang and Beo), Ambon-Seram (Hitu Lama and Saparua), and Irian Jaya (Tobati and Demta) [WAHYONO, WARDIAT and JU-LAN 1991; WAHYONO *et al.* 1992], it is timely and effective to conduct research on the marine resource use in the eastern Indonesia.

With the increasing need for synthesizing an integrated theory, we have focused on the Bajo who inhabit Sulawesi and Maluku. The Bajo or Bajau are known as a fishing people extensively using coral reef ecosystems in their fishing activities.

The general aim of the present study is to identify contemporary systems of marine resource use that have been practiced in coastal waters of the eastern

Indonesia, and to provide fundamental information for the anthropological and historical studies of maritime cultures in Indonesia as well as for the appropriate implementation of the development program of the country.

1. STUDY AREA AND THE BAJO

Two Bajo communities were studied; Desa Bajo in Tilamuta of the Gorontalo, north Sulawesi, and Desa Guruapin Bajo, of Kayoa Island, north Maluku. In addition to these two communities, supplementary data were collected at Nain, an offshore island of Manado, north Sulawesi where the Bajo and the Sangihese live, and Posiposi and Laluin, two Bajo communities of Kayoa Island group (Figure 1).

1) Desa Bajo

Desa Bajo is located on the coast of Tilamuta of the Kecamatan Tilamuta, Kabupaten Gorontalo, Provinsi Sulawesi Utara. Tilamuta is situated in the equatorial zone (between 0.3°N and 1.0°S Latitude and between 121.0° and 123.3°E Longitude), covering 1520.4km^2 . The climate is tropical. From January

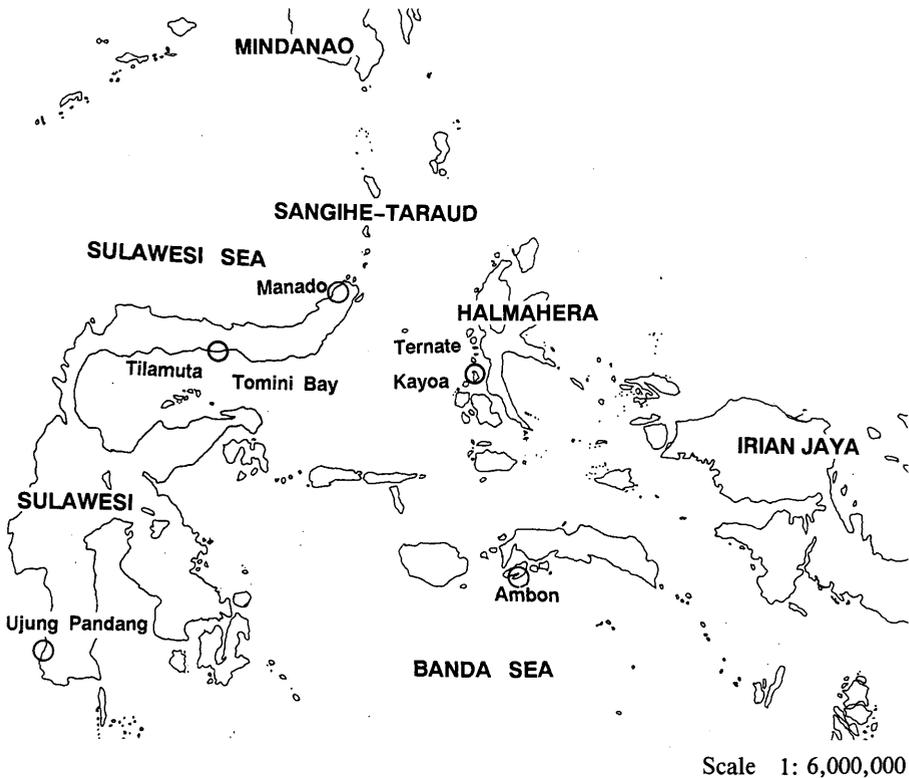


Figure 1. Sulawesi and Maluku

to July, it is rainy, and, between August and November, it is rather dry.

In the midst of the town the Tilamuta River flows south into the Tomini Bay. Along the river mouth and its vicinity, there are fishing villages both of the Gorontalo and the Bajo. Administratively, the former belongs to Desa Pentadu Barat, the latter to Desa Bajo. Desa Bajo is rather isolated from the town. It is behind a hill, a few kilometers from the sandy beach where Gorontalo fishermen work.

The coastal area of Desa Bajo is surrounded by mangrove swamps. Offshore, there are five small islets about several hundreds meters to a few kilometers from the coast, and these islets are surrounded by reefs. Only one islet is permanently occupied. The population of the Desa Bajo was 755 in August 1992.

Most of the Bajo houses are built on piles, in a traditional Bajo living style and only 23 % of the total 114 houses are located on the land. As there is no land to exploit, people of the Bajo solely depend on the sea for their living. It shows a striking contrast if compared with other farmer-fishermen in adjacent areas, where cassava, maize, banana, and coconut are cultivated. The Bajo keep domesticated chicken.

The Bajo utilize a variety of fishing techniques, using small-scale, double outrigger canoes. Dugout canoes are also used. Only four large canoes are equipped with out-board engines, and a majority of vessels (69) are either paddled or sailed.

2) Desa Guruapin Bajo

Desa Guruapin Bajo is located on the central west coast of Kayoa Island of Kecamatan Kayoa, Kabupaten Maluku Utara, Propinsi Maluku. The island of Kayoa is situated on the equatorial zone as is Desa Bajo in Tilamuta, and its location is just on the Equator and 127°E Longitude. The land area of Kayoa Island is 130.60km². Climate is tropical and while the rest of the year is rainy, throughout August and September, it is dry.

Kayoa Island is a raised coral island. A number of medium and small-sized islands are scattered in adjacent waters. To the south, are the islands of Waidoba, Wairoro (large and small) and Tuaduk. To the west, there are more islands, such as Gafi, Laigoma, Siko, Gunange, Talimau, Lelei, Tameti, Guraici, and Moari. These islands are fringed or surrounded by coral reefs. Mangroves grow extensively on some islands.

The Bajo on Kayoa live separately in three island villages: Guruapin on Kayoa, Lalin on Waidoba, and Posiposi on Tuadak Island. The Bajo on Kayoa are also a sea-oriented people and their houses are generally built on the water. However, they have access to the land for cultivating cassava and coconut. The population of Guruapin Bajo in July 1992 was 1547 (male 766 and female 781).

The Bajo are skillful fishermen and employ several fishing techniques such as gill net, cast net, harpoon, spear, hook and line, and fish poison. Collecting trepang and shellfish is also a common activity. Only one set of *sero* or a bamboo fence, and *bagan* or a stationary or movable liftnet apparatus, are utilized in the

area, respectively. Dugout canoe is usually employed, and few are equipped with outboard engines.

2. APPROACH AND METHOD

In studying Bajo fishing, the following two key concepts are prerequisites for the analysis: commodity-production and migration.

1) Commodity-Production

The Bajo in Indonesia have been generally known as sea-nomads, a migratory boat-dwelling people who subsist on the sea [NIMMO 1972; SOPHER 1977]. However, it does not mean that their life is isolated in remote peripheries and preoccupied by hand-to-mouth subsistence activities. On the contrary, they have frequent contacts with the outside world for obtaining daily necessities, such as rice, cassava, vegetables, cloth, tobacco and other goods. Also, as Sopher suggested, Bajo fishing activities are directed not only to meet their own daily needs but also to the production of commercial goods for sale [SOPHER 1977].

For instance, such marine resources as trepang, shark-fin, tortoise-shell, and pearl shells are known to be exploited for commercial purposes. The high commercial value of these marine products has ensured the use of such simple technologies as spear, gill net, and fish poison (for fishing), harpoon (for turtle), a simple hook (shark and reef fish) and weighed hook (for trepang). In other cases, diving is a common method, for collecting benthic animals.

Given these conditions, is the economic importance of marine products uniform among several groups of the Bajo? This must be examined, taking into account the ecological, technological and historical factors.

2) Migration

Maritime people do not usually stay at one place like sedentary farmers, but move (*berpindah-pindah*) for the exploitation of marine resources. The migration pattern depends on duration, motivation and socio-cultural backgrounds and may even occur over several months. The causes of migration are associated with several parameters, such as the ecological change of tidal rhythms, wind direction, migration of marine animals, factors related to warfare, population pressure, economics, and other socio-cultural reasons. Migration may be either institutionalized or irregular and opportunistic (ex. *merantau* of the Minangkabau) [LUCARDIE 1980]. The Bajo are reported to have their own unique migratory pattern, which has, however, not been studied fully so far in the anthropological studies. The comparative analysis of migration patterns and its regional and socio-economic causes appear significant.

For collecting information, interviews were conducted. Measurements of fishing gear were taken using scales and photographs. For collecting fish names, an illustrated book on tropical fish was used [MASUDA, ARAGA and YOSHINO

1980]. Several documents and statistical data were derived from record books kept in the village office, head office of the kecamatan and statistical offices of the area.

3. RESULTS AND DISCUSSION

1) Fishing Technology Complex

The Bajo of Tilamuta and Kayoa employ several sets of fishing techniques. First is net fishing by means of various types of net. These are summarized as follows in Table 1. and 2.

From the two tables, it becomes evident that net fishing is divided into three distinct types according to target species. These are gill net for reef fish (emperors, parrotfish, goatfish, squirrelfish), drift net for surface swimmers (fusilier, garfish, mullet, flyingfish), and two specific types of net for sharks and milkfish fry. Scoop net for milkfish fry has recently been introduced. Also, *pajeko*, small-scale purse-seine, has just been introduced in 1991, and six groups

Table 1. Net Fishing among the Bajo (Guruapin)

| Bajo (Guruapin) | | | | | |
|--------------------------------------|-----------------------|----------------------------------|-----------------|-----------------|-----------------|
| Type of Net | Sub-Type | Fish Species | L ¹⁾ | D ²⁾ | M ³⁾ |
| <i>ringgi tubba</i> (shallows) | <i>r. rurua</i> | Lethrinidae | 25 | 1.2 | 2.7 |
| | <i>r. pale</i> | Scaridae, Siganidae, Mullidae | 25 | 1.1 | 3.0 |
| | <i>r. bagar</i> | Carangidae, Turtle | 20 | 1.3 | 3.5 |
| | <i>r. nener</i> | Fries of <i>Chanos chanos</i> | 20 | 0.45 | 0.3 |
| <i>ringgi lankong</i> (deep seas) | <i>r. furie</i> | | 120 | 6.1 | 1.2 |
| | <i>r. ruruma</i> | <i>Rastrelliger</i> | 33 | 4.6 | 3.25 |
| | <i>r. tandotureng</i> | | | | |

¹⁾Length: fathom (=1.8m), ²⁾Depth: m, ³⁾Mesh size: cm

Table 2. Net Fishing among the Bajo (Tilamuta)

| Bajo (Tilamuta) | | | | | |
|------------------------|-----------------|----------------------------|-----------------|-----------------|-----------------|
| Type of Net | Sub-Type | Fish Species | L ¹⁾ | D ²⁾ | M ³⁾ |
| <i>ringgi tutue</i> | | Excoetidae | 500 | 1.5 | 12 |
| <i>ringgi tutue</i> | <i>kangkang</i> | Excoetidae | | | |
| <i>ringgi binna</i> | | Sharks | 200 | 12-18 | 1.5 |
| <i>ringgi batu</i> | | Lethrinidae | 200 | 1.58 | 1.0 |
| | | <i>Caesio</i> , Mugillidae | | | |
| <i>ringgi angke</i> | | Scaridae | | | |
| <i>ringgi kambule</i> | | <i>Caesio</i> | | 3.4 | |
| <i>ringgi timbaloa</i> | | Hemiramphidae | | 4.6 | 3 |

¹⁾Length: fathom (=1.8m), ²⁾Depth: m, ³⁾Mesh size: cm

have utilized it in Guruapin.

By means of hook and line, various kinds of fish are caught; groupers, drummers, trevally, sharks, tunas, wahoos, and skipjacks. In Lalin of Kayoa, longline for *aizame* shark (*Squalus* spp.) has recently been introduced in the mid 1980s and 16 groups use this fishing method at present. *Aizame* is a Japanese word for *Squalus* shark.

A spear-gun and a spear are aimed for individual fish and target species include a variety of reef species such as surgeonfish, sweetlips, moray eels, boxfish and wrasse. A spear-gun is a single-barbed tool and varies in size according to target species. A spear is generally either single-barbed or multi-pronged. It is between 3 to 6 meters long.

Diving for trepang and shellfish are common in both areas. In particular, many kinds of trepang are collected. Diving is conducted not only in the daytime but also during the night using a lamp. A hooked weight is often used for thrusting trepang from the boat or under water [SUBANI and BARUS 1988/89].

Bagan is not common and is conducted by one (Kayoa) and five groups (Tilamuta), respectively. This is particularly for small sardine-like fish for human consumption as well as chicken feed.

Fish traps (width: 105–150 cm, length: 100–270 cm, depth: 34–55 cm) are also used for catching reef fish by one group (Kayoa) and four groups (Tilamuta). Poison fishing with *Derris* sp. is known but rarely conducted.

2) Economic Importance of Marine Resource

A variety of marine resources utilized by the Bajo are not solely for home consumption but are sold. How the individual kinds of marine resource is utilized varies primarily according to the species, amount, and economic importance. Tentatively, they can be classified into several groups by the differences in economic transaction.

(1) Export Commodity

First, there is a set of marine resource exclusively used as a commodity for export. These include trepang, shark (liver oil and fin), Trochus shell, mother-of-pearl shell, seaweed and reef fish. These are either processed into secondary products or kept alive in a small enclosure until sent to towns for export.

Trepang is boiled in seawater and then smoked and sun dried. Trochus shells as well as mother-of-pearl shells are processed only by extracting meat. Shells are boiled and the meat is consumed by the local people. The giant clam (*Tridacna* spp.) meat is processed after extraction and sundried (Lalin and Tilamuta).

Shark is the source of shark-fin and crude oil extracted from the liver. The idea of liver oil extraction has recently been introduced to Lalin Bajo of Kayoa and it is exported to Japan.

Seaweed (*Eucheuma* spp.) is an item commonly maricultured in shallow waters of Southeast Asia. In the southern Philippines, the Sama people has also

engaged in seaweed aquaculture [NAGATSU 1994]. It is harvested and dried under the sun and then sent to town.

Jellyfish caught in waters adjacent to Bacan Island which is located to the south from Kayoa, by the Bajo of Kayoa is processed locally, and then becomes an export commodity. Swallow's nests, although not a marine product, is also collected as an expensive export product. These can be harvested only on some islands of Kayoa.

Live fish, especially wrasse and grouper, is a favorite food fish for the Chinese. These fish are caught by the licensed foreign vessels, mainly from Hong Kong. Sometimes, local Chinese people work as middlemen to buy from the Bajo who keep the fish temporarily in a cage. There were such cases in the Bajo settlement of Nain Island, north Sulawesi.

These secondary products are sold to middlemen who live in the village. In both villages the Buginese work as middlemen. These middlemen then send products to larger towns such as Ternate and Ujung Pandang, where they are then transported to Surabaya or Jakarta for export. A list of sales prices of the marine products is shown in Table 3.

(2) Local and Regional Market

A second group is reef fish that are sold locally. The economic situation varies among the areas, and processing depends on the species caught. In Kayoa, groupers and parrotfish are usually salted as *ikan garam* and then sent to Manado, the capital city of north Sulawesi. This is in good contrast to the Bajo in

Table 3. Local Price of Main Products for Export

| English Name | Export Commodity Indonesian Name | Price/kg Indonesian Rupiah |
|----------------|-------------------------------------|-------------------------------|
| Sea-cucumber | <i>Trepang nanas</i> | 17,000 |
| " | <i>T. dio</i> | 5,000 |
| " | <i>T. hitam</i> | 15,000 |
| " | <i>T. bintik</i> | 9,000 |
| " | <i>T. sutra</i> | 3,000 |
| " | <i>T. guankuli</i> | 60,000 |
| " | <i>T. alolo</i> | 1,000 (T) |
| Jellyfish | <i>Bulo</i> | 1,500-2,000/20-30 individuals |
| Black-lips | <i>Japing-japing</i> | 8,000 |
| Green Snail | <i>Batu laga</i> | 90,000 |
| Tridacna | <i>Kima</i> | 15,000 |
| Trochus shell | <i>Lola</i> | 50,000-75,000 |
| Swallow's nest | <i>Sarang burung</i> | 600,000 |
| Shark fin | <i>Ekor ikan hiu</i> | 75,000-160,000 |
| Salted fish | <i>Ikan garam</i> | 15,000 (T) |

(T): Price at Tilamuta. The others are sales prices at Kayoa

Tilamuta. In Tilamuta, five to ten middlemen (*tibo-tibo*) visit the village every morning to buy fresh fish from the fishermen as they return from the sea. These people are the Gorontaloese who live in the town area. They come by bicycle equipped with two baskets attached to the rear wheel of the bicycle. Since the start of a fish market along the coast of Tilamuta area, the fishermen themselves have started to sell fresh fish. In Kayoa, processed fish are transported by the middlemen (the Bajo and/or the Buginese).

(3) *Exchange and Barter*

Third, fish has been used as important items for barter trading with farmers in adjacent areas. Fish is exchanged with such items as rice, vegetables, sugar, chilli peppers and other food-stuff. Before, barter was the sole means to obtain staples, but at present, cash is also used for transactions. Such an exchange is locally called *siselo* among the Bajo of Kayoa, where fish is exchanged with food produced by the Makianese. Food exchange between the two groups appears to be based on the mutual agreement that land and sea should be protected by the *makajaga* (Makianese) and *sijaga-an* (Bajo) against intruders from outside.

In Tilamuta, the Gorontaloese farmers visit the Bajo village twice a week with chilli peppers, vegetables, and cassava. Bartering used to be practiced, but cash has become common as an exchange medium. This exchange is locally called *paselo*.

(4) *Home Consumption*

Fourth, fish are consumed as daily food by the Bajo. It should be noted that even small children are often observed to sell the catch to villagers in Kayoa.

3) *Fishing Trip*

Bajo fishing is not a daily activity. More often than before, people go on long fishing trips to nearby islands and even farther, spending a few weeks to months. Although there is no observation data available extending over a year, documents and information from fishermen highlighted some important points.

In Kayoa, there are two distinct types of fishing expeditions; those conducted within the Kayoa waters and those conducted in waters outside of the Kayoa area. Administratively speaking, the former covers roughly the area of Kecamatan Kayoa whereas the latter does the outside of Kecamatan Kayoa.

In the former case, the Guraici Islands and islands to the south are favorite locations where fishermen stay in temporary huts to produce salted fish. A fishing trip is usually organized upon request from the Buginese middlemen who live in Ternate. They come to the village to request the people to provide salted fish or fresh fish. The *Buku Expedisi* (Expedition Book) kept by the village head gives information on the frequency and areas visited by individuals or groups of fishermen. This is to authorize fishermen to conduct fishing and a letter is issued (*surat jalan*) to permit the fishing trips. Table 4 and 5 shows the frequencies and

Table 4. Fishing Expedition to Maluku and Halmahera (The Guruapin Bajo)

| | | No. of Days Reported | No. of Groups | BA | No. of Groups by Area | | | | |
|------|-----|----------------------|---------------|-----------------------------|-----------------------|----|----------|----------|-------------|
| | | | | | GB+BA | GB | LO TE | BA TE | IB KD |
| 1988 | May | 5 | 25 | 15 | 8 | | 1 | | 1 |
| | Jun | 3 | 4 | 3 | | | 1 | | |
| | Jul | 1 | 6 | 6 | | | | | |
| | Aug | 2 | 4 | | | | | | (no record) |
| | Sep | 9 | 22 | 5 (17 cases are unreported) | | | | | |
| | Oct | 5 | 27 | 9 | 9 | 1 | | 8 | |
| | Nov | 2 | 7 | | 6 | | | 1 | |
| 1989 | Jan | 3 | 18 | | | | | | (no record) |
| 1991 | Oct | 1 | 2 | 1 | 1 | | | | |
| | Nov | 6 | 16 | 2 | 4 | | 7 | | 3 |
| | Dec | 4 | 7 | 5 | 2 | | | | |
| 1992 | Jan | 1 | 2 | 2 | | | | | |
| | Feb | 5 | 13 | 6 | 5 | | 1 | | 1 |
| | May | 6 | 10 | 9 | 1 (OB) | | | | |
| | Jul | 1 | 1 | 1 | | | | | |

BA: Bacan, GB: Gane Barat, LO: Loloda, KA: Kayoa, TE: Ternate, OB: Oba, JA: Jailolo, HA: Halmahera, KD: Kedi

Table 5. Fishing Expedition to Maluku and Halmahera (The Luluiin Bajo)

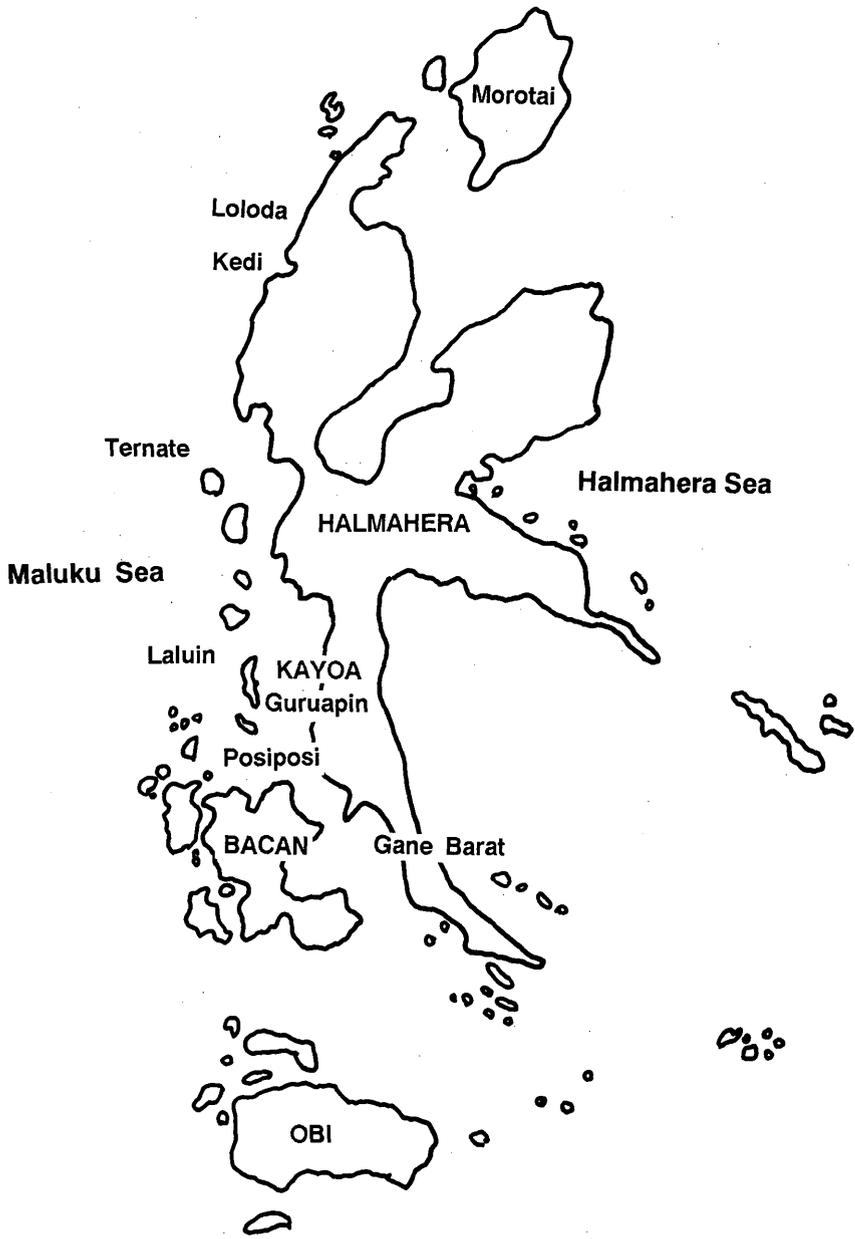
| | | No. of Days Reported | No. of Groups | No. of Persons | No. of Groups by Expedition Area | | | |
|------|-----|----------------------|---------------|----------------|----------------------------------|-------|-------|-------|
| | | | | | BA/OI | GB | KA/HA | BA |
| 1992 | Jan | 1 | 1 | 9 | 1 | | | |
| | Feb | 1 | 1 | 3 | | 1 (a) | | |
| | May | 1 | 1 | 8-10 | | | 1 (b) | |
| | Jun | 2 | 2 | 7 | | | | 1 (c) |
| | Jul | | | 11 | | | | 1 (d) |
| | Aug | 1 | 1 | 2 | | | 1 (e) | |

1 (a): Shark fishing, 1 (b) and 1 (c): Sea-cucumber collecting, 1 (d): Setting of *Bagan* at Waioji, 1 (e): Supply sea-cucumber and live grouper into *tambak*.

BA: Bacan, OI: Obi, GB: Gane Barat, KA: Kayoa, HA: Halmahera.

area of fishing by the Bajo from Kayoa to several places.

Fishing trips for shark are also organized among the Bajo of Luluiin and Posiposi in Kayoa. Sharks are caught by net and the fins are dried on board. Shark meat is partly consumed but mostly discarded into the sea. Areas exploited are Bacan, Oba, Obi and Halmahera and sometimes extend to Irian Jaya (Figure 2). According to one report, some 400 kg of shark fin (dried weight) was brought back to the village after a fishing expedition.



Scale 1: 2,250,000

Figure 2. North Maluku and Halmahera

DISCUSSION

1) Coral Reef Foragers

Major fishing technologies employed by the Bajo are nets and diving. These have enabled the people to catch reef fish, sharks, trepang and shellfish. The techniques employed characterise the Bajo use of the coral reef system. Shark fishing is, on the contrary, an offshore oriented fishing. The Butonese and the Buginese are also known as shark fishermen in eastern Indonesian waters [REID 1992; Fox 1992]. How these people exploit shark should also be considered as a political issue between Indonesia and Australia.

Given that the Bajo are coral reef foragers, how do these people perceive the new techniques and business brought from the outside? As is clear from the cases mentioned above, there seems to be differentiation according to area. In Kayoa, the use of compressors and longline to catch sharks and trepangs, replacing netting, hook and line, and diving shows an example of technological innovation. Scoop-net fishing of milkfish fry, small purse-seine, and *bagan* have started in the last 10 years. These new techniques have mostly been brought by the Buginese. In Tilamuta, sales of fresh fish in the fish market have enabled the people to sell fish without processing such as salting and drying. Nevertheless, trepang and shark fins are sold *via* the Buginese merchants after being processed. Thus, the Bajo fishing has only been moderately influenced by the new technologies.

Transfer of technology in the case of trepang and sharks appear to be smooth since these are traditional products for them, while the use of *bagan*, purse-seine and fry fishing are totally new to their technological complex. Alternative use of fishing grounds, time allocation and reorganization of the fishing group have imposed some difficulty. Without considering the holistic meaning of such technological introduction, any technological transfer will prove unrealistic.

As mentioned above, the Bajo carry out fishing trips of many weeks and much longer duration with target species such as trepang, reef fish or shark. It should be noted that these fish are processed even during the fishing expedition to be readied for sale. Marketability of these products has eventually encouraged the Bajo to conduct fishing trips over a wide geographical area and for a longer period of time than other fishermen.

What do such a migratory pattern of activity imply? In terms of the renewability of marine resources, extensive exploitation may avoid depletion, when compared with the intensive use of the same fishing grounds over a long period of time. However, such sedendary resources as trepang and shellfish are vulnerable to overexploitation. The commercial value of shark-fin also encouraged them to exploit much wider areas than before. This may bring about serious overfishing and illegal fishing beyond the international boundary. Also, conflicts between the local people and the Bajo may emerge in the future. Despite these worries, no one can stop the Bajo migratory practices which is part of their

group identity.

2) Ethno-Network

The Buginese and the Gorontaloese who either settle in the village of the Bajo or visit daily to buy fish, play an important role to connect the Bajo and the consumers of marine products.

Also in Manado, the Gorontaloese work as retailers selling salted fish. Salted fish sold here are not only from the Bajo but also the Sangihelese. It is noteworthy that salted reef fish are mostly processed by the Bajo. Small-sardines (taken by *bagan*), flying fish and scad (*Decapterus* spp.) are brought by the Sangihelese. Differences of species well reflect the fishing techniques employed by the two groups. The Bajo use the gill net and the Sangihelese use the small purse-seine and drift net. Marine products for export are dealt, on the contrary, by the Indonesian Chinese and the Buginese, and then sent to Ujung Pandang, Surabaya and Jakarta for export to overseas markets, *i.e.*, Hong Kong, Singapore, Taiwan and Japan.

The important role of ethnic groups in fish marketing is apparent even from this case study. Relations between the ethnic group is primarily economy-oriented. In north Sulawesi, the Buginese rent out the scoop net for milkfish fry to the local Sangihelese fishermen and receive priority to buy the catch in return. Even within one Sangihelese village, the practices of mutual aid and reciprocal exchange when loaning money for buying nets and engines are reported as important when considering economic relations of the same ethnic group [MANTJORO and KATAOKA 1991]. Further study on this subject is crucial to clarify the inner structure of ethno-network.

CONCLUSION

Bajo fishing is focused in the coral reefs. Resources exploited include reef fish, and such sedentary species as trepang, shellfish and seaweeds. Thus, the Bajo are typical coral reef foragers. Sharks are one exception and other groups like the Butonese and Buginese also engage in this fishery.

Bajo fishing activities are strongly interconnected with the international market. Between the Bajo and overseas consumers, several ethnic groups play important roles, especially the Buginese, Gorontaloese and Indonesian Chinese. The highly migratory fishing activity and limited target species of the Bajo will be a good indicator to test appropriate marine resource use in coral reef environments.

The introduction of large-scale fishery to coral reef systems is not acceptable, regardless of the national and international origin.

The results of the present study suggest that there exists an ethno-network among the small-scale fisheries in the eastern part of Indonesia. The internal economic relations and conflicts between these groups have not been fully described. This will be covered by future studies in the same area taking more

groups into account.

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