

Report of the Workshop on Development of a Management Plan for Tomini Bay Fisheries, Indonesia



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FOREWORD

This document contains the report of the FAO/Government of Indonesia Workshop on Development of a Management Plan for Tomini Bay Fisheries, held in July 2003. The Conference was organized by the Ministry of Marine Affairs and Fisheries (MOMAF) and the FAO FishCode Programme. Principal funding was provided through FishCode component project GCP/INT/648/NOR, "Management for Responsible Fisheries". Conference planning and preparations were undertaken by Mr Purwito Martosubroto of FAO.

The FishCode Review series publishes results of studies, missions, consultations, workshops, meetings and other project activities undertaken through the Programme, in furtherance of the objective of facilitating implementation of the 1995 FAO Code of Conduct for Responsible Fisheries and related international fisheries instruments and plans of action. Individual issues in the series are distributed to appropriate governments, regional bodies, meeting participants and Programme partners. For further information on Programme background, publications and activities, please consult www.fao.org/fi/fishcode.

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Report of the Workshop on Development of a Management Plan
for Tomini Bay Fisheries, Indonesia.

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ABSTRACT

The FAO/Government of Indonesia Workshop on Development of a Management Plan for Tomini Bay Fisheries, held in July 2003, addressed fisheries management and the development of a fisheries management plan. Tomini Bay is a semi-enclosed sea exploited by fishers from the three bordering provinces of Central Sulawesi, Gorontalo and North Sulawesi. Various institutional and technical constraints hinder the sustainable development of fisheries in the Bay, among them the absence of a fisheries management body. Lack of staff in extension services has handicapped the dissemination of information in fishing techniques, fishery management, post-harvest technology and marketing. Concerted efforts are needed to enable the governments of the three provinces to work closely together to ensure sustainable fisheries development and management of the entire Bay.

Tomini Bay fishery resources are still generally considered to be underexploited, although annual catches have increased dramatically over the past ten years. Resources include large pelagic fishes (yellowfin tuna, skipjack and tuna-like fishes such as bullet and frigate mackerels, and kawakawa), small pelagic fishes (predominantly scads, scombrid mackerels and trevallies), demersal fish (including groupers and red snappers), crustaceans and molluscs. Fishing fleets operating in the Bay are mostly non-motorized vessels. Motorized vessels, both inboard and outboard, are mostly used for pelagic fishing and include seiners, gillnetters and lifnetters. Aquaculture in Tomini Bay is still almost completely undeveloped.

The workshop provided a starting point for addressing responsible fisheries issues and laying the groundwork for a fisheries management plan. Consultation with all stakeholders – including local fishers as well as the larger fishing and processing interest groups – was listed as the major priority.

Keywords: *Code of Conduct for Responsible Fisheries; fisheries management; coastal fisheries; marine fisheries; Southeast Asia; Indonesia*

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ABBREVIATIONS AND ACRONYMS

CCRF	Code of Conduct for Responsible Fisheries
CPUE	catch per unit effort
FAD	fish aggregating device
DGCF	Directorate General of Capture Fisheries (of Indonesia)
FAO	Food and Agriculture Organization of the United Nations
GOI	Government of Indonesia
GT	gross tonnes
IUUF	illegal, unreported and unregulated fishing
MCS	monitoring, control and surveillance
MOMAF	Ministry of Marine Affairs and Fisheries (of Indonesia)
MPA	marine protected areas
NGO	non-governmental organization
TVRI	Local Television Broadcasting Service
WG	Working Group

REPORT OF THE FAO/GOVERNMENT OF INDONESIA WORKSHOP ON DEVELOPMENT OF A MANAGEMENT PLAN FOR TOMINI BAY FISHERIES

Opening of the Workshop

1. The FAO/Government of Indonesia Workshop on Development of a Management Plan for Tomini Bay Fisheries was held in Palu Golden Hotel, Palu (Central Sulawesi) from 1–3 July 2003.
2. In order to allow active and full participation of delegates, the workshop was conducted in the local language (Bahasa Indonesian).
3. Thirty-seven participants representing various units within the Ministry of Marine Affairs and Fisheries (MOMAF) of Indonesia, the three provincial governments from around Tomini Bay (Central Sulawesi, North Sulawesi and Gorontalo), local universities, fishers' organizations and other NGOs attended the Workshop. The workshop agenda appears as Appendix 1 and the list of participants as Appendix 2.
4. The session was addressed in the first instance by the Chairman of the Organizing Committee, Mr Suharyadi Salim, Director of Fishery Resources of the Directorate General of Capture Fisheries (DGCF), who highlighted the objectives of the workshop and extended his gratitude to FAO for helping to organize it.
5. Dr Purwito Martosubroto gave a welcoming address on behalf of FAO.
6. Dr Gelwyn Yusuf, Special Advisor to the Minister of MOMAF, speaking on behalf of the Director General of Capture Fisheries, further highlighted the importance of the workshop. Special thanks were extended to FAO for the continuing support provided through the FishCode Programme towards implementation of the FAO Code of Conduct for Responsible Fisheries (CCRF). This support had already led to the development of a management plan for the Bali Strait sardine fisheries.
7. The workshop was officially opened with a special address by the Secretary of the Provincial Government of Central Sulawesi on behalf of the Governor, who described the importance of the fisheries sector in Central Sulawesi Province and the potential that the Province can offer. The Secretary also extended his thanks to the FAO/FishCode Programme for assistance in organizing the workshop.

Local media coverage

8. On the evening of the second day, Mr Mangga Barani (DG of Capture Fisheries), Dr Gelwyn Yusuf (Special Advisor to the Minister of MOMAF) and Dr Purwito Martosubroto (FAO), were invited by the local television broadcasting service, TVRI, to attend a forum for interactive discussion on various issues in fisheries relevant to the current workshop.
9. This short programme reflected the policy of local TVRI to take advantage of the presence of high-ranking officials from the central government. The programme was aimed at raising awareness among television spectators and the public at large.
10. Questions from the TV spectators indicated their concern about the problems related to fisheries development in the Province of Central Sulawesi: Viewers requested central government assistance for the small-scale fisheries sector in the region.

The fisheries of Tomini Bay

11. Tomini Bay is a semi-enclosed sea bordered by three provinces, namely, North Sulawesi, Gorontalo and Central Sulawesi. The Chiefs of the Fisheries Services of the three provinces bordering the Bay presented background papers on the status and trends of Tomini Bay fisheries, and these were followed by a general discussion.

12. Dr J. Widodo of the Research Institute for Marine Fisheries in Jakarta then presented a report that provided an overall picture of fisheries status and trends across Tomini Bay. This paper appears as Appendix 3.

13. Tomini Bay fishery resources are still generally considered to be underexploited. Non-mechanized vessels dominate the fishing fleets. The motorized vessels employ relatively simple technology, except for the purse seiners that work largely in the eastern part of the Bay. Such fishing practices employ fish aggregating devices (FADs) as a means to catch more efficiently.

Working Group sessions and outcomes

14. Following presentation on the status of fisheries in Tomini Bay, Dr Purwito Martosubroto (FAO) highlighted two main topics relevant to the workshop, namely:

- Introduction to fisheries management; and
- Development of a Fisheries Management Plan.

15. The presentations served as a basis for ensuing discussion in working groups in order to acquaint participants with the concept of developing a fisheries management plan.

16. Late in the afternoon of the first day of the workshop, three working groups (WG) were formed to address issues of relevance to the common elements of the Fisheries Management Plan.

17. WG-I focused on the status of fisheries and current rules and regulations in place, including the responsibilities of various institutions.

18. WG-II addressed the objectives of management, operational management and information upon which to base management action.

19. Finally, WG-III addressed monitoring, control and surveillance (MCS) of the fishing and processing industries, as well as consultation with stakeholders.

20. A plenary discussion was held in the late afternoon of the second day of the workshop, in which the respective Chairs the WGs reported on the discussions that had taken place during the breakout sessions.

21. These reports presented elements of the management plan that had been assigned to each group, with the aim of obtaining responses from participants of the other WGs.

22. On the morning of the last day the elements of the management plan of the three WGs were considered together, and ranked in order of priority through a scoring process.

23. Consultation with stakeholders was considered the first priority among the elements of the management plan. This appeared to reflect the current situation in the region, which is characterized by relatively poor consultation between government and other stakeholders. The prioritized elements of the management are shown in Appendix 4.

Closing of the workshop

24. Mr Suharyadi Salim, DGCF Director, officially closed the workshop.

25. Delegates agreed that, although discussions would have benefited from greater participation of representatives of some stakeholder groups, particularly those representing local fishers and the larger fishing and processing interests, the workshop provided valuable knowledge and understanding to fisheries officers from the three bordering provinces on the importance of developing a management plan for Tomini Bay fisheries.

AGENDA
FAO/GOVERNMENT OF INDONESIA WORKSHOP ON DEVELOPMENT OF A
MANAGEMENT PLAN FOR TOMINI BAY FISHERIES

Palu (Central Sulawesi), 1–3 July 2003

Tuesday 1 July 2003

08.00 – 08.45 Registration of participants
08.45 – 09.00 Report of the Chairman of the Organizing Committee
09.00 – 09.15 Welcome Address by the representative of FAO
09.15 – 09.30 Welcome Address by the Director General of the Research Centre for Capture Fisheries
09.30 – 09.45 Special Address by the Governor of Central Sulawesi

09.45 – 10.15 *Coffee break*

Session I: Status and Trend of Fisheries in Tomini Bay

Chair: Mr Suharyadi Salim, Director of Fishery Resources (DGCF)
10.15 – 10.30 Joint introductory remarks by Chairman and Dr P. Martosubroto (FAO)
10.30 – 11.00 Presentation on the status and trend of fisheries by the Head of Provincial Fisheries Service of Central Sulawesi
11.00 – 11.30 Presentation on the status and trend of fisheries by the Head of Provincial Fisheries Service of North Sulawesi

Session II: Status and Trend of Fisheries in Tomini Bay (continued)

Chair: Mr Suharyadi Salim, Director of Fishery Resources (DGCF)
11.30 – 12.00 Presentation on the status and trend of fisheries by the Head of Provincial Fisheries Service of Gorontalo

12.00 – 13.00 *Lunch Break*

13.00 – 14.30 Current status of fisheries in Tomini Bay and their management by Dr J. Widodo (FAO consultant)

Session III: Fisheries Management

Chair: Dr Subhat Nurhakim, Director of the Research Centre for Capture Fisheries
14.30 – 15.15 Introduction to a Fisheries Management Plan by Dr P. Martosubroto (FAO)
15.15 – 16.00 Development of a Fisheries Management Plan by Dr P. Martosubroto (FAO)

16.00 – 16.30 *Coffee break*

Session IV: The Development of a Fisheries Management Plan: Working Group Discussion

Chair: Dr Subhat Nurhakim, Director of the Research Centre for Capture Fisheries
16.30 – 17.00 Guidance for the Working Group Discussion by Dr P. Martosubroto (FAO)
WG I: Description and jurisdiction
WG II: Objectives of management, operational management, research and stock assessment
WG III: Enforcement, industry, stakeholders consultation
17.00 – 18.30 *Break*

18.30 – 20.00 *Welcome Dinner*
20.00 – 21.00 General Fisheries Policy by the Director General of the Research Centre for Capture Fisheries
21.00 – 23.00 Working Group Discussion

Wednesday, 2 July 2003

08.00 – 09.30 Working Group discussion (continued)
09.30 – 10.00 *Coffee break*
10.00 – 12.30 Working Group discussion (continued)
12.30 – 13.30 *Lunch Break*
13.30 – 14.30 Working Group discussion (continued)

Session V: Working Group Presentation, Chair – Dr P. Martosubroto (FAO)

14.30 – 15.15 Presentation of WG I
15.15 – 15.45 *Coffee break*
15.45 – 16.30 Presentation of WG II
16.30 – 17.15 Presentation of WG III
17.15 – 18.30 *Break*
18.30 – 20.00 *Dinner*
20.00 – 21.00 Plenary discussion on identification of priority actions

Thursday, 3 July 2003

Session VI: Issues relating to Fisheries Management Plan

Chair – Mr Faisal, Head of the Provincial Fisheries Service of Central Sulawesi
08.00 – 08.45 Development of a management body for Tomini Bay
08.45 – 09.45 Preliminary listing of priority action for the management plan
09.45 – 10.15 *Coffee break*
10.15 – 10.45 Closure of the workshop by Mr Salim, Director of Fisheries Resources, (DGCF)

APPENDIX 2

LIST OF PARTICIPANTS

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CURRENT STATUS OF TOMINI BAY FISHERIES AND THEIR MANAGEMENT

Johanes Widodo¹

Executive summary

Tomini Bay is a semi-enclosed sea, the resources of which are exploited by fishers from the three bordering provinces of Central Sulawesi, Gorontalo and North Sulawesi. A total of 51 684 fisher households were recorded in 2001, of which 23 277 were in the Central Sulawesi Province, 17 927 in the North Sulawesi Province and 10 480 in Gorontalo Province.

Fisheries resources of Tomini Bay waters belong to three main groups, namely the large pelagic fishes comprising yellowfin tuna (*Thunnus albacares*), skipjack (*Katsuwonus pelamis*) and tuna-like fishes such as bullet and frigate mackerels (*Auxis thazard* and *A. rochei*) and kawakawa (*Euthynnus affinis*); the small pelagic fishes, which are dominated by scads (*Decapterus macarellus*, *D. macrosoma*), scombrid mackerels (*Rastrelliger kanagurta* and *R. brachysoma*) and trevallies; and demersal fish such as groupers, red snappers, crustaceans and molluscs.

Fishing fleets operating in the Bay are mostly non-motorized vessels equipped with handlines for both demersal and pelagic fish. Motorized vessels, both inboard and outboard, are mostly used for pelagic fishing and include seiners, gillnetters and liftnetters.

In the past ten years, total landings of small pelagic fishes in the Central Sulawesi Province of Tomini Bay have more than doubled from about 11 000 tonnes in 1990 to 25 000 tonnes in 2000. This increase of total landings was in direct proportion to the increase of fishing effort from 208 000 operational days in 1990 to 536 000 operational days in 2000.

The fisheries in the Gorontalo and North Sulawesi Provinces of Tomini Bay demonstrate a slightly different trend. Total landings have increased from 12 000 tonnes in 1991 to 16 000 tonnes in 2000, while fishing effort has increased only slightly, from 161 000 days in 1991 to 179 000 days in 2000. It is probable that landings of the pelagic fishery in the northern part of the Bay have been levelling off.

The aquaculture sector in Tomini Bay is still in its infancy. A total area of 14 175 ha has been estimated as the potential for fish culture, of which a total area of 3 750 ha is located in the Poso Regency of Central Sulawesi Province.

A number of institutional and technical constraints hinders the sustainable development of fisheries in Tomini Bay, among them the absence of a fisheries management body. In addition, lack of staff in extension services has handicapped the dissemination of information in various fields, such as fishing techniques, fishery management, post-harvest technology and marketing. Concerted efforts are needed to enable the governments of the three provinces to work closely together to ensure sustainable fisheries development and management in the entire Bay.

Description

General background

Tomini Bay is a semi-enclosed sea covering an area of 59 500 km² connected to the Maluku and Sulawesi Seas to the east. (see Figure 1). Surface water temperature ranges from 29° C to 30° C, with salinity of 33.8–34.0 ppt (Widodo *et al.*, 1999). The rainy season lasts for seven to nine months each year; precipitation, which peaks in April, falls at a rate of more than 20 mm (Salasah, 2000).

¹ Research Institute for Marine Fisheries, Jakarta.

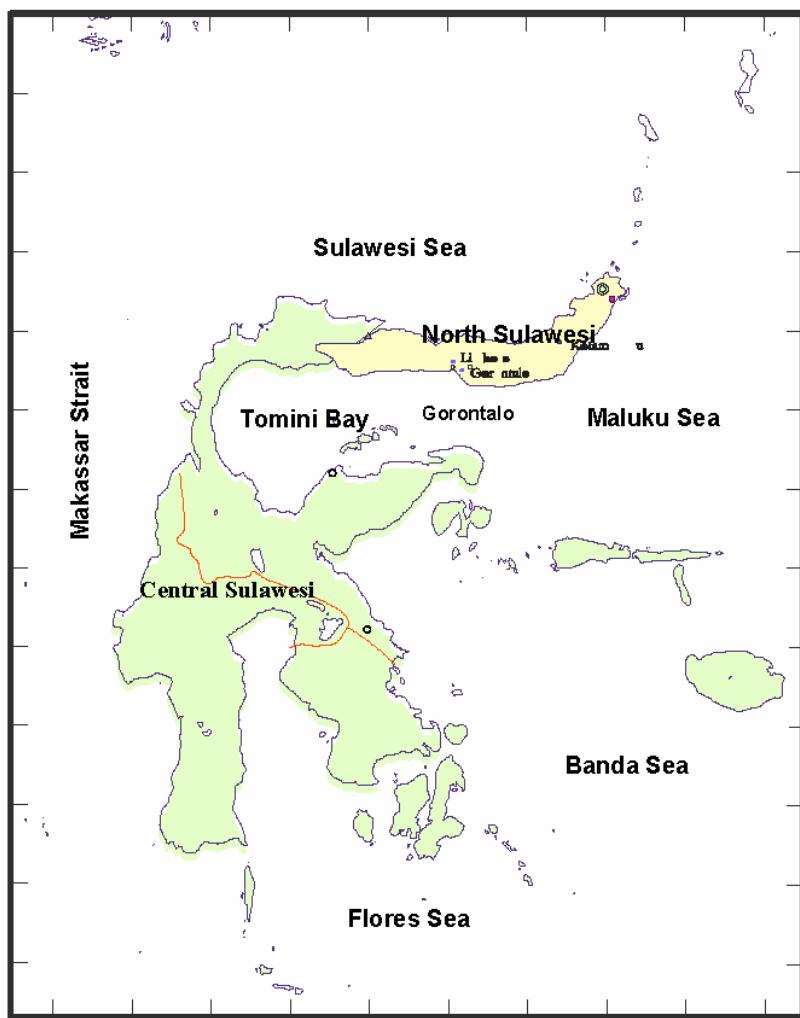


Figure 1. Tomini Bay and adjacent waters

An extensive area of coral reefs is found in the Togian Islands. Two atolls are located in the west of Batukada Island at a depth of 20–50 m, with their flat surface encircling a shallow lagoon (Whitten *et al.*, 1984). There is also a barrier reef reaching up to 200 m in depth located approximately 5–15 km from the shore, which is covered by uniform soft coral reefs. Sea grasses and mangroves of the genus *Rhizophora* grow quite well along the entire cost of Tomini Bay.

Fish resources are exploited by fishers of the three provinces bordering the Bay – Central Sulawesi, Gorontalo and North Sulawesi. Small pelagic fish are exploited by boats of 16.5–21.0 m in length equipped with ringnets, fish holds and fish boxes to keep the catch fresh (Salasah, 2000). The fishing boats also carry a fish aggregating device, locally called *rumpon*, made of coconut leaves, as well as two to four kerosene lamps.

During 1995–1999, scads (*Decapterus spp.*; 88 percent), followed by tuna-like fishes (8 percent) and trevallies (3 percent) were the predominant landings among the small pelagics. Fishing for small pelagics continues year round, with concentration from June to December, the peak season being in October (Salasah, 2000).

Scad mackerel, *Decapterus macarellus*, have been exported to Japan and South Korea in recent years for bait in the longline fishery. During the five-year period 1995–1999 the volume of scad mackerel exports fluctuated from 750 tonnes in 1995 to 250 tonnes in 1997

and 1 341 tonnes in 1999 (Salasah, 2000). The national market for scad mackerel includes those used for bait in longline fishing.

In tuna fisheries, some products are exported to the Asian market (Thailand, Japan and others) in the form of fresh fish and smoked products (katsuwobushi). The local demand for skipjack (cakalang) is relatively high in Sulawesi, and average fish consumption per capita is higher than the national average.

The 51 684 fishing households in Tomini Bay include 23 277 households in Central Sulawesi Province, 10 480 in Gorontalo and 17 927 in North Sulawesi Province.

The aquaculture sector in Tomini Bay has not yet been extensively developed. Some 14 176 ha are estimated as potential aquaculture development. In the Central Sulawesi Province, the coastal waters of the Poso District are the most likely area for mariculture; current estimates indicate an area of 3 750 ha that could potentially be developed.

Natural resources of Tomini Bay

Mangrove forests

Mangrove forests can be found along most parts of the Sulawesi coast; the densest area of mangroves is found in South Sulawesi Province. Nineteen species of mangroves belonging to six families are found in the Central Sulawesi Province, including those growing in Tomini Bay (Darnaedi and Budiman, 1984; see Table 1).

The physical structure and high productivity of the mangrove forest play an important role in the life of many organisms, including the highly-valued penaeid shrimp species, bivalves (e.g. *Anadara granosa*), clams (e.g. *Crassostrea*), crabs (e.g. *Scylla serrata*), shrimps (e.g. *Acetes*), and a number of fish species like milk fish (*Chanos chanos*), barramundi (*Lates calcarifer*), groupers (serranids), and rabbit fish (*Siganus*), etc.

Table 1. Sulawesi Island: Mangrove species (including those in Tomini Bay)

Family	Species
Avicenniaceae	<i>Avicennia alba</i> <i>A. marina</i> <i>A. officinalis</i>
Combretaceae	<i>Lumnitzera littorea</i> <i>L. racemosa</i>
Euphorbiaceae	<i>Exoecaria agallocha</i>
Meliaceae	<i>Xylocarpus granatum</i> <i>X. mollucensis</i>
Rhizophoraceae	<i>Rhizophora apiculata</i> <i>R. mucronata</i> <i>R. stylosa</i> <i>Bruguiera cylindrica</i> <i>B. gymnorhiza</i> <i>B. parviflora</i> <i>B. sexangula</i> <i>Ceriops tagal</i>
Sonneratiaceae	<i>Sonneratia alba</i> <i>S. caseolaris</i> <i>S. ovata</i>

Source: Darnaedi and Budiman (1984).

Sea grass

Sea grasses are marine plants of the families Hydrocharitaceae and Potamogetonaceae. In the waters surrounding Sulawesi, the family of Hydrocharitaceae is represented by three genera, namely *Enhalus*, *Thalassia* and *Halophila*, and the Potamogetonaceae by four, namely *Halodule*, *Cymodocea*, *Syringodium* and *Thalassodendron*. Organisms feeding in the sea grass environment include groupers, sea turtles, marine mammals (dugong) and a number of sea urchins with bacteria capable of decomposing cellulose through digestion. Only some 5 percent of the sea grass is directly eaten. Most of the consuming organisms depend on the decomposing sea grass for the large quantities of micro-organisms that are produced by the sea grass ecosystem.

Coral reefs

Coral reefs often serve as wave barriers in the coastal environment. Fisheries in the coral reefs exploit the aquatic resources that live in close association with and are dependent on the reefs. The largest coral reef fisheries in Indonesia are in Sangkarang Islands, about 80 km off Makassar, which support thousands of people with food and also income. Moreover, coral reefs are important for the tourism industry in the region; North Sulawesi Province has promoted marine tourism as the main programme in developing the sector in this area.

Coral reefs are home to a large number of aquatic animals that interact with each other and build complex communities. The large number of coral reefs around Sulawesi is concentrated in the following localities.

- Taka Bone Rate (2 220 km²) is the third largest atoll in the world; it is located southeast of the Selayar Islands and north of Bonerate (anon., 1982a).
- Sangkarang Islands (Spermonde; 16 000 km²) consist of about 160 isles off Makassar (Nève 1982b).
- Togian Islands in Tomini Bay are the most unique in terms of their coral reef environment. Sea grass as well as *Rhizophora* mangrove trees flourish along the coast (anon., 1982a).
- Bunaken Islands, north of Manado, are coral reefs that attract a large number of tourists. International tourist agencies are promoting these reefs as a year-round attraction. The increased rate of tourist activities around the islands has unfortunately degraded the environment of this site.

The coral reefs of the Togian Islands number 115 species of *scleractines* (hard corals) of 59 genera; there are 262 species of 78 genera in the coral reefs of Sangkarang Islands and 58 genera in the Bunaken Islands. This biodiversity reflects a highly complex reef community (anon, 1982a).

Invertebrates

Coastal communities exploit a wide range of invertebrates living in the coral environments. These include the giant clam, whose meat is a source of food and shells for ornamental decoration. Residents of Bajau, Sulawesi, have exploited sea cucumbers for centuries. Makassar serves as a centre for collection and export of such invertebrate products as pearl clam (*Pinctada* sp.), *Trochus* and sea cucumbers. Shrimp and squid are also exploited by Tomini Bay fishers.

Seaweed

While the coral reef environment hosts numerous animal species, some 75 percent of the biomass is composed of plants of various kinds. These plants vary from micro-algae to seaweed and from macro-algae to hard-calcified red seaweed. Several species of seaweeds

are being cultivated and processed to produce chemical additives for the food, cosmetic and chemical (paint, insecticide) industries (Chapman, 1970). Red seaweeds such as *Gelidium* and *Gracilaria* produce agar, which is used in fish and meat canneries to prevent deterioration of tissues, as well as in ice cream, milk drinks, bread, jam and cosmetics. Other red seaweeds such as *Eucheuma* produce carrageen, which is similar to agar but more concentrated. There are many potential areas for seaweed production around Sulawesi Island, and one of the centres of carrageen production in the Province of Central Sulawesi is Menui Island (Mubarak, 1975).

Coral reef fishes

Fish populations are highly varied in coral reef habitats with from 200–250 species per hectare; this figure is much higher than for other marine habitats. The unique shape and colours of many coral reef fishes provide a special attraction for visitors to aquaria in the reef areas. Reef fishes can be broadly classified into those that live in the water column around and above the reefs, and those on the surface edge as well as on the slope of the reefs. Fish species that live on the edge of the reef are mostly large-sized offshore species, including carangids (*Carangidae*), lutjanids (*Lutjanidae*), sharks and morays (*Muraenesocidae*).

Nearly all ornamental fish are associated with the reef environment. No fewer than 250 species of ornamental fish are found in Indonesia (Whitten *et al.*, 1987). Makassar is the main centre for ornamental fish collection, followed by Kendari and Manado. Most of the ornamental fish are shipped to Jakarta as the main destination for further export. Ornamental fish in Tomini Bay are collected mainly on the reefs of Togian Islands (Salm and Halim, 1984).

The impact of the collection of ornamental fishes from wild stocks is difficult to assess. However, experience indicates that of every 1 000 individual fish captured, only 70 percent survive to market, and only 50 percent are still alive six months after being sold (anon., 1986).

Pelagic and demersal fishes

Pelagic fish resources in Tomini Bay consist of tunas, skipjack and tuna-like species such as longtail tuna, kawakawa, frigate mackerels and small pelagics such as scads, Indo-Pacific mackerels and sardines. Demersal fishes include red snappers, groupers and red sea breams; and crustaceans.

Central Sulawesi Province

Three districts of the Central Sulawesi Province, namely Donggala (under-district of Ampibabo), Poso (under-districts of Malenge and Ampana) and Banggai (under-district of Pagimana) are located on Tomini Bay.

Four fish landing sites were built between 1993 and 2001. Upgrading of the sites to fishing harbours is already planned. The management of seven units for fish auctions has been handed over to the district governments from the provincial government. Unfortunately these facilities have not been equipped with supporting structures such as ice plants, cool rooms or cold storage.

About 23 227 households are associated with coastal marine fisheries, 480 with open water fisheries, 1 785 with brackish water fisheries, and 1 596 with fish farming.

Capital investment in the fisheries sector up to 2000 amounted to an estimated 46 849 656 000 Rupiah, 15 609 000 000 Rupiah of which comprised national investment and the balance of which comprised foreign investment.

Fisheries profile

The fishing fleet of the Central Sulawesi Province is generally comprised of vessels of less than 5 GT, which are mostly concentrated in the District of Donggala. Over half of the largest vessels of 21–30 GT are operated in Tomini Bay (Table 2).

The inventory of fishing equipment in the province includes 14 215 units of canoes, 4 959 units of non-motorized boats, 1 706 units of outboard engine vessels and 1 362 units of inboard vessels. In terms of fishing gear, 6 488 units have been reported. These include 58 units of Danish seines, 21 units of beach seines, 53 units of ringnets, 71 units of drift gillnets, 269 units of set gillnets, 40 units of trammel nets, and 272 units of drift and set liftnets. Units based on hooks, traps and other gear make up the bulk of the total.

Table 2. Central Sulawesi Province: Number of fishing vessels by weight (GT)

District/Waters	< 5 GT	5–10 GT	11–20 GT	21–30 GT	Total
Donggala/Makassar Strait waters	85	20	17	13	135
Tolitoli and Buol/Sulawesi Sea waters	12	8	3	4	27
Poso and Morowali/Tomini Bay waters	82	16	5	26	129
Banggai and Banggai Islands/ Tolo Bay waters	98	20	5	4	127
Total	277	64	30	47	418

Source: Fisheries Statistics, Central Sulawesi Province (2001).

Within the past two decades, fish landings of the Central Sulawesi Province in Tomini Bay have increased twofold from 11 285 tonnes in 1990 to 25 021 tonnes in 2000. Within the same period, landings showed some fluctuations, as demonstrated by yearly catch per unit of fishing gear (see Table 3). Taking into consideration the type of gear utilized, the highest catches were made with drift liftnets, followed consecutively by encircling gillnet, Danish seines, set gillnets and ringnets.

The number of days-at-sea for the main fishing gear has increased two-and-one-half times within the past decade, from 208 007 days in 1990 to 563 073 days in 2000 (Table 4). A yearly variation in the number of days-at-sea has been demonstrated by gear type. On average, the encircling gillnet was utilized for the greatest number of days-at-sea (105 720), and the ringnet for the least (5 000).

Within the period 1991 to 2000, the catch per day-at-sea did not demonstrate any significant variation. While fishing effort in terms of days-at-sea increased over this interval, so did overall landings.

So far, monitoring, control and surveillance (MCS) of the fisheries has been poorly implemented for lack of personnel. This situation has been exacerbated by lack of awareness among stakeholders regarding the needs for enforcement. As a result, violations of rules and regulations have increased in recent years.

Table 3. Tomini Bay: Landings of small pelagic fishes (tonnes) by fishing gear in Central Sulawesi Province (1990–2000)

Gear	Year	Small pelagic fish landings (tonnes)						Mean				
		1990	1991	1992	1993	1994	1995					
Danish seine	811	878	924	2 840	3 926	4 076	4 143	3 233	3 287	4 694	5 013	3 075
Ringnet	1 292	1 405	1 625	985	867	1 784	2 692	3 163	2 845	4 241	4 871	2 343
Drift gillnet	1 787	2 030	2 131	1 890	1 445	1 715	1 662	1 866	1 528	1 052	1 011	1 647
Encircling gillnet	695	1 166	2 084	2 310	3 355	4 425	4 783	5 262	5 092	5 005	5 345	3 593
Set gillnet	2 823	3 068	3 245	3 106	2 603	2 449	2 255	2 542	2 543	3 027	3 233	2 809
Set lift net	89	97	128	136	155	163	436	376	353	275	293	227
Drift lift net	3 788	4 132	4 150	3 479	3 596	3 987	3 280	3 680	4 859	4 921	5 255	4 102
Total	11 285	12 776	14 287	14 746	15 947	18 599	19 251	20 122	20 507	23 215	25 021	3 075

Source: Analysis of fisheries statistics, Central Sulawesi Province (1991–2000).

Table 4. Tomini Bay: Central Sulawesi Province: Number of days-at-sea, pelagic fisheries, by types of fishing gear (1990–2000)

Gear	Year	Days-at-sea						Mean				
		1990	1991	1992	1993	1994	1995					
Danish seine	11 418	13 217	18 506	28 672	34 811	36 244	35 249	38 368	33 057	49 669	50 166	31 762
Ringnet	3 903	6 450	7 344	5 283	3 740	3 159	3 097	4 624	5 971	5 751	5 809	5 012
Drift gillnet	37 940	45 619	57 934	60 814	37 244	44 240	52 115	61 100	66 546	75 560	76 315	55 948
Encircling gillnet	21 740	42 152	49 646	83 300	97 821	135 833	129 740	162 787	141 520	148 447	149 932	105 720
Set gillnet	98 151	167 586	181 287	176 475	97 391	123 352	136 149	134 763	160 815	195 560	197 516	151 731
Set lift net	2 135	3 749	3 681	4 376	3 084	3 250	2 325	6 695	5 849	10 639	10 745	5 139
Drift lift net	32 720	40 119	41 555	40 166	49 866	52 344	46 042	44 421	45 138	45 590	45 590	40 308
Total	208 007	318 892	359 953	358 920	323 957	398 422	404 717	452 758	458 896	531 216	536 073	31 762

Source: Analysis of fisheries statistics, Central Sulawesi Province (1991–2000).

Gorontalo and North Sulawesi Provinces

Gorontalo Province

Gorontalo Province is bordered by the Central Sulawesi Province in the west, Sulawesi Sea in the north, North Sulawesi Province in the east and Tomini Bay in the south. The province has a coastline of 330 km on the Tomini Bay side and 230 km on the Sulawesi Sea side (Nirwan, 2002). The province of Gorontalo was established only recently (2000); formerly it belonged to North Sulawesi Province. The fisheries profile of Gorontalo Province is thus based on the old data of North Sulawesi Province.

Some 10 480 fishing households are located in the province, with 1 140 in Gorontalo District, 3 900 in Gorontalo Municipality and 5 440 in the districts of Boalemo and Gorontalo.

North Sulawesi Province

North Sulawesi Province comprises three districts and two municipalities: Minahasa, Bolaang Mongondow and Sangihe Talaud Districts, and Manado and Bitung Municipalities. A total of 17 927 fishers' households are located in North Sulawesi Province, including 12 006 households in Bolaang Mongondow District and 5 921 in Minahasa District. Because Tomini Bay is located relatively far from them, the fishers from Sangihe Talaud District do not fish in Tomini Bay.

Fisheries profiles

Fishing activities in Gorontalo Province are still primarily coastal, as they are concentrated in areas close to the landing places. In 2000, out of 5 617 units in the fishing fleet, 4 754 units were non-motorized (see Table 5). These figures were essentially the same in 1999: 4 700 non-powered boats, 830 vessels with outboard engines and 34 vessels with new inboard engines.

Table 5. Tomini bay: Number of fishing vessels in Gorontalo Province, (1991–2000)

Year	Non-motorized	Outboard engine	Inboard engine (GT)			Total
			0–5	5–10	10–20	
1991	4 685	821	0	0	0	5 506
1992	5 526	836	0	0	0	6 362
1993	4 391	783	0	0	0	5 174
1994	4 355	762	0	1	1	5 119
1995	4 350	760	0	1	1	5 112
1996	4 344	775	0	1	1	5 121
1997	4 476	782	1	1	1	5 261
1998	4 517	789	1	0	1	5 308
1999	4 735	828	13	18	1	5 595
2000	4 746	835	15	19	2	5 617

Source: Fisheries statistics, North Sulawesi Province (1991–2000; published yearly).

In Manado Municipality of North Sulawesi there are 70 vessels under 10 GT equipped with poles and lines, encircling gillnets and tuna longlines. There are 105 vessels under 3 GT equipped with handlines for catching demersal species. The fleets fish in quite extended areas including the Sulawesi Sea, Tomini Bay and the Maluku Sea, and targeted species are pelagic fishes.

In the Minahasa District of North Sulawesi there are 200 units of *funai* (a small-sized pole-and-line vessel); a number of *pajeko* (a small sized ringnet) and pump boats of less than 10 GT. Fishing gear used in these fleets are poles and lines, encircling nets and tuna

longlines for pelagic fishing. Additionally, there are a number of fishing boats under 3 GT used for catching demersal fishes with droplines. Some fishers from Minahasa District also fish in Tomini Bay as well as in the Maluku Sea waters.

In Bolaang Mongondow District of North Sulawesi there are 67 units of *funai*, *pajeko* and pump boats under 10 GT equipped with poles and lines, encircling nets and tuna longlines. There are also 3 765 fishing vessels under 3 GT equipped with droplines. Most of the fishers of Bolaang Mongondow District work in Tomini Bay and in the Maluku Sea.

Gear used by the Gorontalo and North Sulawesi fishers in Tomini Bay may be classified into three groups, including:

- encircling nets comprising beach seines, Danish seines, and ringnets;
- gillnets comprising set, drift and encircling gillnets; and
- driftnets comprising drift and set driftnets.

Within the last decade (1991-2000) the total number of each type of fishing gear was relatively constant although some were declining, while the number of ringnets increased from 49 units in 1991 to 98 units in 2000. Similarly, beach seine increased from 45 units in 1991 to 62 units in 2000. Serial data on gear are presented in Table 6.

Table 6. Tomini Bay: Annual count of fishing gear by type in North Sulawesi (including Gorontalo) Province (1991–2000)

Gear	Year	No Units								
		1991	1992	1993	1994	1995	1996	1997	1998	2000
Danish seine		115	111	76	77	76	76	76	76	86
Beach seine		45	57	55	56	55	55	53	52	52
Ringnet		49	61	72	73	90	88	87	86	98
Drift gillnet		205	135	155	157	165	155	150	145	145
Encircling gillnet		49	49	45	46	46	32	25	19	25
Set gillnet		279	130	185	152	164	164	164	165	175
Drift liftnet		177	210	155	157	157	157	140	135	135
Total		919	753	743	718	753	727	695	678	742

Source: Fisheries statistics, North Sulawesi Province (1991–2000; published yearly).

From 1991 to 2000, landings of small pelagic fish in the Provinces of North Sulawesi and Gorontalo showed a slight increase (25 percent), which was the result of higher catches using ringnets and gillnets. From Table 7, it is clear that the main catch derives, on average, from drift liftnets, followed by ringnet and Danish seine. There was also a tendency to increase the number of days-at-sea – from 161 400 in 1991 to 179 271 in 2000 (Table 8). Only Danish seine, encircling gillnet and liftnet showed a decreasing trend on this measure.

Average productivity of the individual gear was estimated using the data in Tables 6 and 7. Results presented in Table 9 show that the productivity was highest for ringnets (56 tonnes/unit/year), drift liftnets (35 tonnes/unit/year) and Danish seines (28 tonnes/unit/year).

An analysis of catch and effort data derived from PT Usaha Mina, a state fishery enterprise for tuna fishing, shows that the catch per day decreased drastically from 1998 to 2001 (Table 10). The decrease in the catch per day of the dropline fishing around the deep-sea *rumpon* FADs reached as high as 60 percent during the same period.

On the subject of the relationship between *pajeko* and *rumpon* (the local fish aggregating device) in Gorontalo Province, Luasunaung (1999) has pointed out that the number of *rumpon* set out by fishers exceeds the optimum number specified for maximum economic returns of fisheries. The fishing area of the *pajeko* was so limited, and so close to shore that the deployed *rumpon* were too close to each other.

Table 7. Tomini Bay: Landings (tonnes) by fishing gear, pelagic fishes, North Sulawesi (including Gorontalo) Province (1991–2000)

Gear	Year	Small pelagic fish landings (tonnes)						Mean
		1991	1992	1993	1994	1995	1996	
Danish seine	2 210	2 386	2 143	2 913	3 629	4 346	2 541	1 806
Beach seine	371	523	783	561	602	642	683	688
Ringnet	2 533	2 620	4 195	4 468	4 486	4 503	4 521	4 882
Drift gillnet	731	526	416	264	382	500	224	277
Encircling gillnet	123	184	118	103	200	296	325	230
Set gillnet	486	458	550	481	554	626	699	1 151
Drift liftnet	5 911	6 436	6 056	6 463	5 607	4 751	4 142	3 532
Total	12 365	13 133	14 261	15 253	15 460	15 664	13 135	12 566
								14 630
								15 774
								14 224

Source: Fisheries statistics, North Sulawesi Province, 1991–2000 (published yearly).

Tomini Bay: Number of days-at-sea by types of fishing gear, pelagic fisheries, North Sulawesi (including Gorontalo) Province (1990–2000)

Gear	Year	Days-at-sea						Mean
		1991	1992	1993	1994	1995	1996	
Danish seine	34 662	22 837	20 027	22 893	20 920	21 360	21 580	21 800
Beach seine	11 726	13 623	19 278	19 250	8 042	13 261	15 871	18 480
Ringnet	14 486	16 173	20 218	19 746	20 977	19 666	19 011	18 355
Drift gillnet	16 228	15 726	16 281	15 892	19 125	25 241	28 299	31 357
Encircling gillnet	5 040	6 400	5 750	4 975	9 624	7 149	5 912	4 674
Set gillnet	17 523	21 770	25 725	24 561	38 997	39 585	39 879	40 172
Drift liftnet	61 735	51 675	47 870	47 807	48 036	47 922	47 979	47 951
Total	161 400	148 204	155 149	155 124	165 721	174 184	178 531	182 789
								175 750
								179 271
								167 612

Source: Fisheries statistics, North Sulawesi Province, 1991–2000 (published yearly).

Table 9. Tomini Bay: Annual productivity by pelagic fishing gears in North Sulawesi (including Gorontalo) Province (1991–2000)

Fishing gear	Mean productivity per gear (tonnes/unit/year)
Ringnet	56
Drift liftnet	35
Danish seine	28
Beach seine	12
Drift gillnet	3
Set gillnet	5
Encircling gillnet	10

Source: Analysis of fisheries statistics, North Sulawesi Province (1991–2000).

Table 10. Tomini Bay: Catch per day-at-sea of handline fishing operations of large pelagic fishery by PT Usaha Mina based in Gorontalo (1991–2000)

Year	Landings (tonnes)	Days-at-sea	CPUE (kg/day-at-sea)
1997	44 280	474	93.42
1998	394 042	611	644.91
1999	609 037	995	612.10
2000	429 157	1 596	268.90
2001	251 127	1 209	207.71

Source: PT Usaha Mina, Gorontalo Branch (1997–2001).

Fish stock assessment

A fish stock assessment carried out in 1997 for the Tomini Bay and Maluku Sea areas provided a potential sustainable yield estimate for the seven major fish groups as shown in Table 11 (Widodo *et al.*, 1998). The highest potential yield was 379 440 t/year for the small pelagic group, followed by large pelagics (106 500 t/year) and the demersal fish group (83 840 t/year); other groups were not significant. A more recent assessment made in 2001 focused on the rate of exploitation for main individual groups (Central Research for Capture Fisheries and Central Research for Oceanology, 2001).

On the basis of this information, future development was estimated as shown in the table. There still seems to be development potential for the large and small pelagic groups as well as for squids. On the other hand, there seems to be no prospect for development of the demersal group, coral reef fishes or lobsters. It is quite probable that this situation has resulted from the intensive exploitation of the reef fishes because of the high demand for live fish in the international market (e.g. Hong Kong and Singapore). The estimated exploitation rates were derived from the landings data recorded by the local fisheries services in the past. Unfortunately, activities to record catch in landing places have been drastically reduced in the past five years, which may influence the accuracy of the statistics.

Table 14. Tomini Bay and Maluku Sea areas: Estimates of potential yield, landings and exploitation rate of major fish species groups, 1997 and 2001

Fish resources	Year	
	1997*	2001**
Large pelagics		
Potential yield ('000 tonnes)	106.5	106.5
Landings ('000 tonnes)	39.42	37.46
Exploitation rate (%)	37.0	35.2
Small pelagics		
Potential yield ('000 tonnes)	379.44	379.44
Landings ('000 tonnes)	139.80	119.43
Exploitation rate (%)	36.8	31.5
Demersal fishes		
Potential yield ('000 tonnes)	83.84	83.84
Landings ('000 tonnes)	63.00	32.14
Exploitation rate (%)	75.1	>100
Coral reef fishes		
Potential yield ('000 tonnes)	9.55	12.50
Landings ('000 tonnes)	8.35	4.63
Exploitation rate (%)	87.4	>100
Penaeid shrimps		
Potential yield ('000 tonnes)	0.90	0.90
Landings ('000 tonnes)	0.40	1.11
Exploitation rate (%)	44.4	>100
Lobster		
Potential yield ('000 tonnes)	0.30	0.30
Landings ('000 tonnes)	0.08	0.02
Exploitation rate (%)	26.7	>100
Squid		
Potential yield ('000 tonnes)	7.13	7.13
Landings ('000 tonnes)	2.12	2.85
Exploitation rate (%)	29.7	40.0

* Widodo *et al.* (1998).

**Central Research for Capture Fisheries and Central Research for Oceanology (2001).

Issues, constraints and opportunities for fisheries development

Infrastructure

The fisheries in Tomini Bay are undergoing development but that progress is slow. Facilities for fishing, post harvest and marketing are still not adequate and port facilities are minimal. Infrastructure for land transport is also limited. Fish product exporters still rely on air transport, or else ship products by sea to the Kendari fishing port (located in Southeast Sulawesi Province) for further transport to Java, where there are good domestic markets.

Legal and institutional arrangements

With the enactment of the Autonomy Law 1999, delegation of authority from the central to district level government has begun. However, local governments still need assistance from the central government. Resource assessments have been conducted primarily by the research institutions based in Jakarta; research at local universities is very limited. Meanwhile, the assistance of banks in providing financial support to fishers is also minimal in comparison to the assistance provided by banks to the agricultural sector. Assistance is

greatly needed in various technical matters in the area of fishing, as well as in post-harvest technology.

Both the central and provincial governments are actors in the development of fisheries of Tomini Bay, as shown by the laws and regulations currently in place. However, enforcement of fisheries legislation has not been fully effective. The Government of Indonesia (GOI) has been working with FAO in an attempt to update the Fisheries Law to take into account current global development, including the adoption of the FAO Code of Conduct for Responsible Fisheries (CCRF). In addition, GOI has also put some efforts into strengthening capacity in monitoring, control and surveillance (MCS) as part of the management strategy to combat illegal, unregulated and unreported (IUU) fishing in Indonesia.

The inadequate number of fisheries extension officers, who should ideally serve as communicators with stakeholders, is another constraint among the fisheries in the districts surrounding Tomini Bay. The concept of responsible fisheries is insufficiently appreciated by stakeholders, and the central government should strengthen efforts to build public awareness for it. Upgrading and improvements in the fishing skills (technology, processing or marketing) have been quite minimal. Efforts should be made in these areas so that they become priorities for the Department of Fisheries in central and provincial governments in the immediate future.

Recent initiatives

A memorandum of understanding has recently been signed by the governors of the three provinces as a step to promote regional collaborative efforts in the future, in particular with regard to development of the marine sector. Moreover, regional collaboration in the fisheries sector has been initiated through cooperation with the Ministry of Marine Affairs and Fisheries (MOMAF). Recent initiatives include:

- Fishing licenses
- Fishing zones
- Community-based control in fisheries
- Marine protected areas (MPAs)
- Technical guides for fisheries officials in the area of fishery law enforcement
- The use of logbooks as a means of licensing control

This cooperation is scheduled to be reviewed yearly among the three provinces to help monitor operations at the local level.

References

Anon. 1982a. Marine conservation potential, Togian Islands, Central Sulawesi. In: Whitten, A.J., M. Mustafa and Hendersen, G.S. (1987). *The ecology of Sulawesi*. Gadjah Mada University Press. Yogyakarta. 777 p.

Anon. 1982b. Taka Bone Rate: assessment of marine conservation value and needs In: Whitten, A.J., M. Mustafa and Hendersen, G.S. (1987). *The ecology of Sulawesi*. Gadjah Mada University Press. Yogyakarta. 777 p.

Anon. 1986. Coral reef fishes – a case for trade control. *Oryx* 20: 137.

Chapman, V.J. 1970. *Seaweeds and their uses*. Methuen, London.

Darnaedi, D. and A. Budiman. 1984. Analysis on mangrove forest of Morowali, Central Sulawesi. *Proceedings of the Second Mangrove Ecosystem Seminar*, pp. 19-28. Research Institute of National Oceanography, Jakarta [Bahasa Indonesia].

Provincial Office of Fisheries and Marine Affairs of Central Sulawesi. 2002a. Concept of regional development fisheries and marine affairs of Sulawesi [Bahasa Indonesia].

Provincial Office of Fisheries and Marine Affairs of Central Sulawesi. 2002b. Management of capture fisheries in Central Sulawesi Province. Paper presented in the Meeting on Coordination Forum on Management and Development of Fish Resources Regional III. Cirebon, 12–14 August 2002 [Bahasa Indonesia].

Provincial Office of Fisheries and Marine Affairs of Gorontalo. 2002. Management of capture fisheries in Gorontalo Province. Paper presented in the Meeting on Coordination Forum on Management and Development of Fish Resources Regional III. Cirebon, 12–14 August 2002 [Bahasa Indonesia].

Jabbar, M.H. 1998. Analysis on several factors of stock of “malalugis biru” (*Decapterus macarellus*) in Bitung waters, North Sulawesi. Scientific paper for Fisheries University, Jakarta, Indonesia [Bahasa Indonesia].

Kirwan. 2002. Management of capture fisheries in Gorontalo Province. Paper presented in the Meeting on Coordination Forum on Management and Development of Fish Resources Regional III. Cirebon, 12–14 August 2002 [Bahasa Indonesia].

Luasunaung, A. 1999. "Soma *funai*" (ringnet) fishery: Interaction between “malalugis biru” (*Decapterus macarellus*) and "rumpon" (an FAD) in Molibagu waters, Tomini Bay, North Sulawesi. Master's thesis. Bogor Agriculture University, Bogor, Indonesia [Bahasa Indonesia].

Mubarak, M. 1975. Experiment on sea grass cultivation of *Eucheuma spinosum* (*Rhodophytes: Gigartinales*) in Samaringa Island, Menui Islands District, Central Sulawesi. *Marine Fisheries Research Report*: 78-101 [Bahasa Indonesia].

Nève. G.A. de. 1982. Development and origin of the Sangkarang reef archipelago (South Sulawesi, Indonesia). *Proceedings of the PIT X Ikatan Ahli Geologi*, 8–11 December 1981, Bandung, pp. 102-111.

Research Centre for Capture Fisheries and Central Research for Oceanology. 2001. *Fish stock assessment in Indonesian waters*. Research Centre for Capture Fisheries and Research Centre for Oceanology, Jakarta. 125 pp. [Bahasa Indonesia].

Salasah, R. 2000. Analysis on biological and fisheries aspects of “malalugis biru” (*Decapterus macarellus*) in Ampana waters of Tomini Bay, Central of Sulawesi. Scientific paper for Fisheries University, Jakarta, Indonesia [Bahasa Indonesia].

Salm, R.V. and Halim, M. 1984. *Marine conservation data atlas*. World Wildlife Fund, Bogor.

Suwarso, Dharmadi and Widodo, J. 1999. Distribution, abundance, and population structure of "malalugis biru", *Decapterus macarellus* (Carangidae) in North Sulawesi waters. Seminar on Management Plan of Tuna and Skipjack Fisheries in Sulawesi Sea and its Adjacent Waters. Bitung, 24–25, March 1999 [Bahasa Indonesia].

Suwarso, Dharmadi and Widodo, J. 2000. Biology and fisheries of "malalugis biru" mackerel scad, *Decapterus macarellus*, in North Sulawesi waters of Indonesia, pp. 552-557. Proceedings of the JSPS-DGHE International Symposium on Fisheries Science in Tropical area, Bogor, August 21–25, 2000.

Whitten, A.J., Mustafa, M., and Hendersen, G.S. 1987. *The ecology of Sulawesi*. Gadjah Mada University Press. Yogyakarta. 777 pp.

Widodo, J., Aziz, K.A., Priyono, B.E., Tampubolon, G.H. Naamin, N., and Djamali, A. (eds.). 1998. Potential yield and distribution of marine fish resources in Indonesia. National Commission on Fisheries Stock Assessment. Indonesian Institute of Science (LIPI). 251 pp. [Bahasa Indonesia].

Widodo, J., Dharmadi, W.A. Pralampita, M. M. Wahyono and Manadiyanto. 1999. Studies on biology, ecology, potential yield, distribution and abundance, and a number of physical characteristics that influence the "malalugis" (scads, *Decapterus*, family Carangidae) fishery in Sulawesi Sea, Maluku Sea and Tomini Bay, pp. 6-8. In: *Abstracts of Marine Fisheries Research*. Research Institute for Marine Fisheries, Jakarta, Indonesia [Bahasa Indonesia].

APPENDIX 4

CURRENT ISSUES IN THE MANAGEMENT PLAN FOR TOMINI BAY FISHERIES

Issues	Action	Priority ranking
I. Description <ul style="list-style-type: none"> • Insufficient basic data and information • Imbalance of fishing pressure in the region 	<ul style="list-style-type: none"> • Improve data collection • Improve monitoring and evaluation system • Make use of stock assessment network 	3
II. Jurisdiction <ul style="list-style-type: none"> • Lack of follow-up on joint agreement among the three provinces 	<ul style="list-style-type: none"> • Establish Task Force • Task Force to develop work programme 	6
III. Objectives of management <ul style="list-style-type: none"> • Increase production • Improve fishers' income • Secure sustainability 	<ul style="list-style-type: none"> • Improve fishing techniques • Provision of credit • Improve marketing • Promote public awareness 	2
IV. Operational management <ul style="list-style-type: none"> • Potential conflict of interest among institutions • Lack of infrastructure • Capacity building • Lack of data and information 	<ul style="list-style-type: none"> • Strengthen legislation • Strengthen extension • Improve infrastructure • Provision of credit • Improve training, extension and on-the-job training • Establish data and information system 	8
V. Research and other information <ul style="list-style-type: none"> • Lack of research on various aspects to support management 	<ul style="list-style-type: none"> • Conduct research on resources and environment • Enhance research on socio-economics 	5

Issues	Action	Priority ranking
VI. Law enforcement <ul style="list-style-type: none"> (a) Legal aspects <ul style="list-style-type: none"> • Weak enforcement • Lack of coordination among institutions (b) Infrastructure <ul style="list-style-type: none"> • Weak infrastructure • Lack of reliable data and information (c) Personnel <ul style="list-style-type: none"> • Lack of trained staff • Lack of public participation (d) Traditional rules <ul style="list-style-type: none"> • Lack of understanding of traditional rules • Conflict between formal and traditional rules 	<ul style="list-style-type: none"> • Identify conflicting law and regulation • Improve communication and coordination • Provision of landing centres and patrol boats • Establish information network • Develop training • Increase staff capacity • Promote public awareness • Promote awareness • In-depth study of written and unwritten rules 	4
VII. Fisheries Industries <ul style="list-style-type: none"> • Fishing is still labour intensive • Processing is largely traditional • Inadequate processing facilities 	<ul style="list-style-type: none"> • Introduce new gear and enhance training • Improve processing facilities • Accreditation of quality product 	7
VIII. Stakeholders' Consultation <ul style="list-style-type: none"> • Lack of consultation • Weakness of fishers' organizations 	<ul style="list-style-type: none"> • Develop regular consultation • Encourage interest and strengthen organizations 	1