Field Report

Fishing Grounds and Supply Lines in Indonesia Fishery Management Areas 573, 713, and 714

Part 5: Sumba

August 11, 2012
This publication was produced for review by the United States Agency for International Development.
It was prepared by Chemonics International (www.chemonics.com) and
People & Nature Consulting International (www.people-nature-consulting.com).

Version 0.1

Authors: Dr. J.S. Pet[1], Dr. Peter J. Mous[2], and Chairul Sasongko[3]

[1]People & Nature Consulting International, Bali, Indonesia, jspet@pnc-int.com
[2]Chemonics International, IMACS office, Jakarta, Indonesia, pmous@chemonics.com
[3]Chemonics International, IMACS office, Jakarta, Indonesia, csasongko@chemonics.com

TNC contributed to these surveys and reports in the context of its fisheries program through financial contributions from its Indonesia and California programs.

This document is optimized for double-sided printing

Contents

1 Introduction **1**
- 1.1 Survey period, spatial coverage, and target fisheries 1
- 1.2 Objective of this survey 2
- 1.3 Study area 2

2 Materials and methods **6**

3 Results **8**
- 3.1 General 8
- 3.2 Description of fisheries by landing site 9
  - 3.2.1 Pero 9
  - 3.2.2 Katewel 11
  - 3.2.3 Waikelo and Waitabula 12
  - 3.2.4 Memborong 12
  - 3.2.5 Waingapu 19
  - 3.2.6 Melolo 30
  - 3.2.7 Kawangu 34
  - 3.2.8 Hararu 36
  - 3.2.9 Wanokaka 36
  - 3.2.10 Waikabubak 41
  - 3.2.11 Salura Island 50
- 3.3 Maps of fishing grounds and supply lines 51
- 3.4 Google Earth survey of coastal fisheries 51

4 Opportunities for development of sustainable supply lines **56**

Bibliography **58**

A Local resource persons and data gathering events **61**

B Contact details **63**

C List of Indonesian, English, and scientific fish names 64

D Acronyms 67

List of Figures

1.1 Fishery Management Areas 3
1.2 Map of Sumba 4
1.3 Savannah landscape, Eastern Sumba 5

3.1 Pero, Google Earth 9
3.2 Pero, small purse-seiner 10
3.3 Waitabula fish market 13
3.4 Waitabula fish market 14
3.5 Waitabula fish market 15
3.6 Waitabula fish market 16
3.7 Waitabula fish market 17
3.8 Memborong 18
3.9 Memborong: Purse seiners and gillnetters 20
3.10 Memborong: Dug-out canoes, purse seiners, and gillnetters . . 21
3.11 Memborong: Boats from DKP 22
3.12 Waingapu: Large grouper and snapper 23
3.13 Waingapu: Fish market 24
3.14 Waingapu: Kampung Bugis 26
3.15 Waingapu: Google Earth imagery of Kampung Bugis and harbour 27
3.16 Waingapu: TPI at Kampung Bugis 28
3.17 Waingapu: Harbour 29
3.18 Waingapu: Harbour 31
3.19 Waingapu: Fisher and consumer 32
3.20 Waingapu: Google Earth imagery of Waingapu landing sites . 33
3.21 Malolo 35
3.22 Kawangu 37
3.23 Hararu 38
3.24 Hararu: Canoe and mangroves 39
3.25 Wanokaka: Handlines and fishers 40
3.26 Wanokaka: Handlines and fishers 42

3.27 Wanokaka: Handline and purse seine catch 43
3.28 Wanokaka: Gillnet and sharkfins 44
3.29 Wanokaka: Preparing fish for transport by motorcycle. 45
3.30 Wanokaka: Hairtails and ruby snapper. 46
3.31 Wanokaka: Pushnet fishery 47
3.32 Wanokaka: Pushnet fishery 48
3.33 Wanokaka: Pushnet fishery 49
3.34 Waikabubak: Selling fish by motorcycle. 50
3.35 Map: Fishing grounds and supply chains in the Western part of Sumba and surrounding waters. 52
3.36 Map: Fishing grounds and supply chains in the Eastern part of Sumba and surrounding waters. 53
3.37 Sumba in Google Earth 54

Chapter 1

Introduction

1.1 Survey period, spatial coverage, and target fisheries

This report covers a 5-day field survey to Sumba, conducted on 16-20 April 2012 by consultants from IMACS and PNCI. This survey is part of a series of field visits that aims to map fishing grounds, fisheries resources, supply chains, and infrastructure in Fisheries Management Areas 573, 713, and 714 (*Wilayah Pengelolaan Perikanan* or WPP) in Central Indonesia (Fig. 1.1).

This survey focuses on three groups of exported species. The first group is export-size and export-quality demersal fish from fishing grounds between 30 and 200 meter depth, including snappers, groupers, emperors and sea breams of various species and size groups. Fish from this group are mainly caught with bottom hook-and-line and bottom longline. The second group that the survey team looked at comprises large pelagics, including mostly yellowfin tuna and in some places mahi-mahi, with a small part of bigeye tuna. The fishery targets fish around Fish Aggregating Devices (FADs) as well as free-swimming schools with small-scale hook-and-line vessels. The third category that the survey team looked at is the combination of skipjack tuna, juvenile yellowfin tuna (commonly referred to as baby tuna) and Eastern little tuna that is landed mostly with purse seines and pole-and-line boats. The purse seine boats that target these fish also land varying quantities of schooling jacks and trevallies, Indian mackerel (*Rastrelliger kanagurta*), scads and other small pelagics.

This survey is the fifth in a series of surveys; the four earlier surveys focused on Sumbawa (December 2011), Kupang and Maumere (26-30 December 2011), West Flores (6-10 January 2012), and Lombok (27 February - 2 March 2012).

1.2 Objective of this survey

The objectives of this survey are to provide information on fishing grounds and the supply chains starting from these fishing grounds. This information may be used by:

- KKP, for planning of Fishery Management Areas and for development of fishery management plans;
- Private sector partners, for development of sustainable supply chains;
- Aid agencies and NGOs, for development and planning of fishery and marine conservation projects.

Whereas this survey collected most information from interviews at landing sites and fishing harbors, this survey aims to describe complete supply chains, starting from fishing grounds, and leading to exporters through a network of traders and fish processing plants. In this respect, this survey differs from studies that describe fisheries in terms of landings at a certain landing site or stretch of coastline. The focus on fishing grounds and supply chains is an interpretation of the Ecosystem Approach of Fisheries Management (Garcia et al., 2003; Pikitch et al., 2004), as it takes a holistic perspective on the fishing sector, starting from the marine ecosystem instead of harbour or administrative unit.

1.3 Study area

Sumba (9°40' S, 120°E, Fig. 1.2) (surface area[1] 10,711 km^2, human population 656,259), is one of the Lesser Sunda Islands, and it is part of the province Nusa Tenggara Timur. The capital of Nusa Tenggara Timur is Kupang, which is on Timur island. The two major population centers are Waingapu and Waitabula, which both have an airport. Sumba is subdivided in four districts (*kabupaten*): Sumba Barat, Sumba Tenggah, Sumba Timur, and Sumba Barat Daya.

Sumba does not have any designated fishing ports, but some of the villages have a TPI (*Tempat Pelelangan Ikan*).

The Southwestern part of Sumba has rice and cashew nut culture, whereas the dryer Northeastern part has a savannah landscape (Fig. 1.3) with some husbandry of horses and cattle. Many villages retain a traditional lifestyle, centered around monumental grave sites. Whereas the tourism industry is

[1] Wolfram Alpha Knowledgebase 2012

Figure 1.1: Fishery Management Areas or *Wilayah Pengelolaan Perikanan* (WPP) 573, 713, and 714

.

still in its infancy, much of beachfront land has already been sold to tourism developers.

Sumba is among the poorest areas of Indonesia: 21% of the population of NTT are below the poverty line, which is the 4th highest among the 33 provinces of Indonesia. Consquently, Sumba is the focus of various foreign assistance projects.

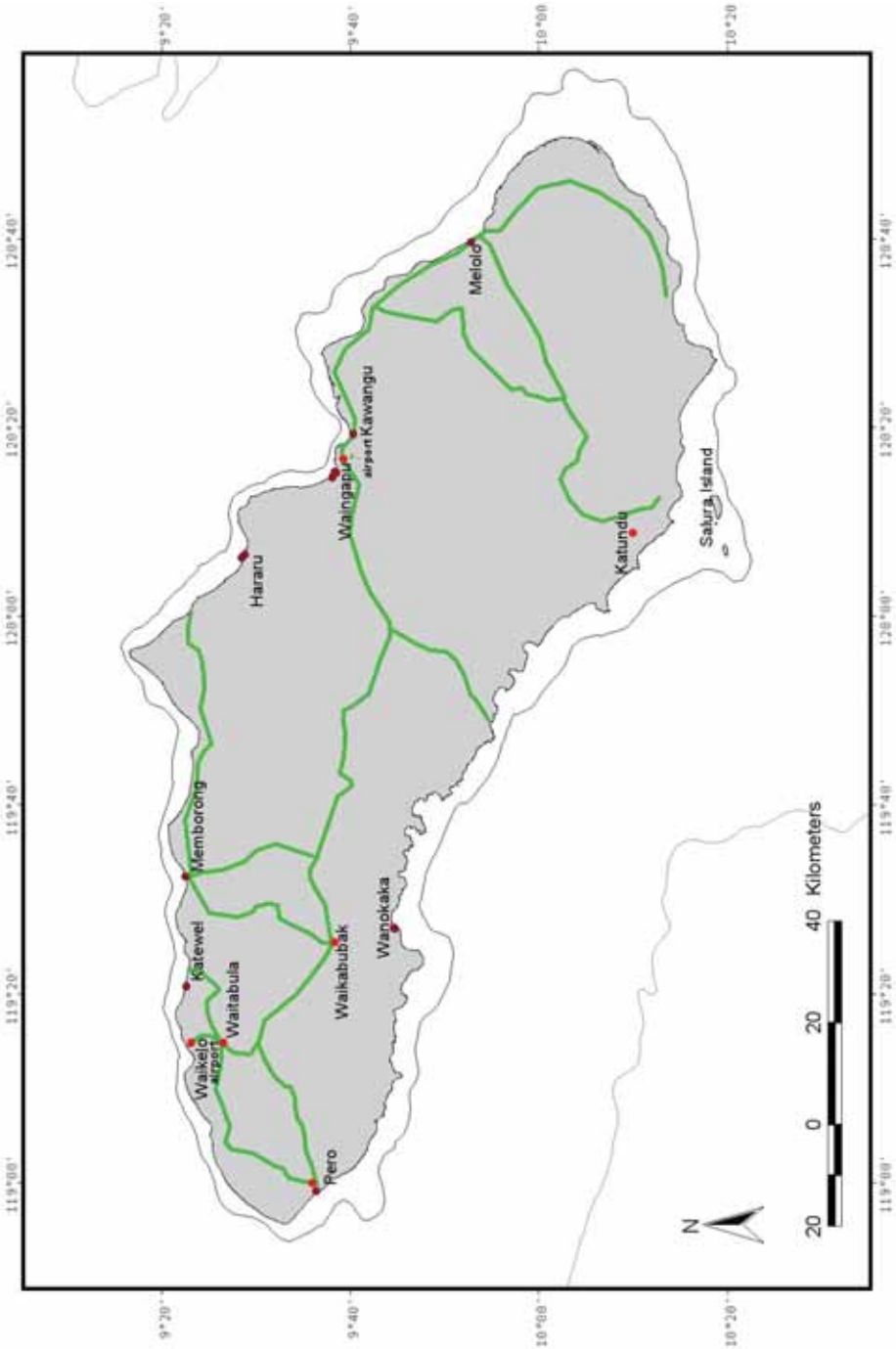

Figure 1.2: Topographic map of Sumba, indicating major roads and the sites that the survey team visited.

.

Figure 1.3: Savannah landscape of Eastern Sumba, with Waingapu in the background.

Chapter 2

Materials and methods

The survey team selected Sumba as a survey area because it is situated within the area of interest for this series of surveys, nl. WPP 573, 713, and 714.

The methodology that the survey applied during this survey is comparable to a Rapid Rural Appraisal or reconnaissance survey, facilitated by local experts who are often from the provincial fisheries service (DKP). The survey team asked the local experts for the locations of the most important fisheries centres, after which the survey team prepared an itinerary. For this survey, the team traveled by road from Pero in the Southwest to Waikelo, Waitabula, and Katewel in the Northwest, then from Waitabula to Memborong, Waingapu, Hararu, and Melolo. On the last field day, the team traveled from Waingapu to Wanokaka, and from there back to Waitabula for departure back to Bali and Jakarta.

The survey team interviewed fishers, traders, and fish processors at each site, often asking for contact details of other local experts or resource persons. Where possible, the survey team inspected storage facilities of traders and catches of fishers to determine species composition.

At each site, the survey team aimed to get a comprehensive overview of the local fisheries. The team first contacted people at the landing site asking general questions on the fishery to figure out which people were knowledgeable on local fisheries. Once a knowledgeable person was identified, the team ascertained the role of that person (fisherman, head of a fishermen's group, aggragator, processor, trader, cold storage owner, fisheries service official, etc.). Questions focused on:

- Scale of the fishing fleet (i.e. average size of the boats);
- Types of fishing gears;
- Number of boats by fishery type;

- Dominant species in the catch;
- Fishing grounds;
- Fishing seasons;
- Use of Fish Aggregation Devices;
- Prices of fish;
- Destination markets of fish.

Questions varied somewhat depending on the role and the expertise of the person being interviewed. For example, fishers usually have accurate knowledge on fishing grounds, but they do not always know in which markets their fish end up. Fish traders, on the other hand, do not always know where exactly the fishing grounds are. The survey team found that traders and aggregators who work with fishers (often by advancing operational expenses or by providing loans) have the most accurate knowledge of a large part of the supply chain.

The survey team used nautical charts (DISHIDROS) at a scale of 1:200,000 or 1:1,000,000 to describe fishing grounds, using a template map at a scale of 1:500,000 with shoreline and 200m depth contours to sketch fishing grounds. The survey team used a GPS receiver (Garmin eTrex or Garmin GPS72H) to confirm position of landing sites.

The survey team did not use forms—This turned out to be impractical because each interviewed person usually had knowledge on a small part of the supply chain only, and because miscommunications often resulted in inconsistencies in answers between respondents, which had to be resolved by asking questions again to other respondents. In essence, each visit to a landing site resulted in a single narrative based on various interviews covering different or overlapping parts of supply chains. This method of data gathering can only yield accurate results if the interviewers are experts on the technicalities of capture fisheries in Indonesia and if they speak Bahasa Indonesia. For this reason, the core survey team consisted of highly experienced personnel: Dr. J. S. Pet, Dr Peter J. Mous, and Mr Budi Sasongko each have between two and four decades of experience in tropical fisheries, mostly in Indonesia.

In addition to the field survey, the survey team also used Google Earth to scan the coastline of Sumba for concentrations of fishing canoes and fishing vessels, which can be recognized easily for those areas where the quality of the imagery allows zooming in to a height of c. 500 m. Most of the imagery was of sufficient quality, only in the Southeastern part imagery resolution was too low to discern individual fishing vessels. (cf. Fig. 3.37).

Chapter 3

Results

Section 3.1 presents a general overview of the capture marine fisheries situation in Sumba. Section 3.2 presents descriptions of fisheries by landing site, starting from the Northwest corner of Sumba and moving clockwise around the island. Maps of fishing grounds and supply lines are in section 3.3), where each map relates to various landing sites. The last section in this chapter (section 3.4) presents results of the Google Earth assessment.

3.1 General

The two guides and vendors at the Waikelo fish market informed the field team that consumption fish is brought to Sumba by ferries from Sape (Sumbawa) to Waikelo and from Labuan Bajo (Flores) to Waingapu. Together with observations along the West and North coast on dispersed fisheries activities and high prices of fish in Sumba, this indicates that Sumba is a net fish importer. The only export product of some significance appears to be squid, which is exported from West Sumba to Lombok, Bali and Java. Squid is usually boiled and dried, but it is also exported fresh on ice if landings are high and shipments can be made on a daily basis. The team found one trader in Malolo who exported about 30-40 kg per week of high-quality demersal fish by plane from Waingapu, and one part-time trader who exported lobster from Karare. Most fishing from Sumba is done from motorized "ketinting" and hand-paddled canoes (often dug-outs), and some larger decked boats (up to 10 GT) operating with purse seines or with 1 km long surface-set gillnets for flying fish. Fishers working from canoes deploy a variety of gears: Handlines (with small hooks and feathers for small fish up to c. 20 cm length, and with larger hooks for demersal fish or for trolling), small-meshed gillnets (1-1.5"), and some large-meshed gillnets.(4-5") for bottom gillnetting of shark

Figure 3.1: Google Earth imagery, showing the river mouth near Pero village. Note the concentrations of boats and canoes lining the Northern shore of the inlet. The mouth of the inlet, not visible here, is to the South.

and large demersal fish. The team also encountered weirs, cast nets, and, in Wanokaka at the river mouth, push nets for catching migrating fingerlings. The canoes usually work in shallow water up to 120 m depth. The team did not find any deep-water longlining or droplining for large demersal fish. The team did not find any fishers targeting large tuna species, even though Sumba is surrounded by tuna fishing grounds where fishers from elsewhere (Lombok, Bali, Sulawesi) deploy Fish Aggregating Devices (*rumpon*).

3.2 Description of fisheries by landing site

3.2.1 Pero

Pero (9°36.446' S 118°59.147' E, Fig. 3.1) is on the Southwest coast of Sumba, near a river mouth not far from the village Bondokodi, about a one-hour drive from Waitabula. Pero is a center for squid fisheries, and there is also a small-scale fishery with hook-and-line and gillnets.

There are some 100 outrigger "ketinting" canoes (5.5 HP), which do day trips to fishing grounds close inshore with various types of gear, depending on season and availability of various species. They fish with small boat seines (*payang*), with gillnets and with trolling nets. The catch comprises sardines (*lemuru* and *tembang*), halfbeaks (*Hemiramphus* spp), Eastern little tuna (*Euthynnus affinis*, locally known as *tongkol*) and lots of squid in the squid season (starting in April, and peaking in July - September) during dark

Figure 3.2: Small purse-seiner in front of Pero beach.

moon phases. Fishing grounds are up to 0.5-1 hours (5-10 nm) away from the landing site.

A good squid catch during peak season may amount up to 700-800 kg per boat per day (multiple trips on one day), the average daily catch is 300-400 kg, whereas off-season catch-per-trip may amount to 20-40 kg.

There are also about 10 mini purse seiners of 4-10 GT (engine 24-30 HP) based in Pero, all fishing for small pelagics fairly close inshore. These small pelagics include scads (*layang*), sardines, halfbeaks, Indian mackerel (*Rastrelliger* spp., local name *kembung*) and *tongkol*.

The fishermen sell sardines at around IDR 20,000 per kg, halfbeaks at about IDR 12,000 per kg, and squid at around IDR 17,000-19,000 per kg (or IDR 50,000-70,000 as dried product). Drying of squid is a household industry here—Many of the houses have racks for drying squid and fish. *Tongkol* fetches around IDR 50,000 to IDR 100,000 per fish of 3-4 kg each, depending on availability. *Kembung* and *layang* fetch around IDR 20,000 per kg. All fish except squid are destined for local markets. The squid is shipped to Lombok, Bali, and Java (Surabaya), often via Sape in Sumbawa. Sometimes, boxes of squid are sent to Bali by airplane. There is a local trader in Pero who buys squid for export to other islands in the Indonesia

archipelago.

South of Pero is a landing place called Mambang where migrating fishermen (*nelayan andon*) from Sape (Sumbawa) operate a fishing camp. There are about 20 to 30 boats operating there in the squid season (July - September), and collector boats take the squid to Sape directly. Sape fishers were said to have fished here for lobsters in the past but have switched completely to squid since lobsters have been completely depleted here. The fishing camp is being monitored by local authorities, including DKP (fisheries service) and police.

3.2.2 Katewel

Katewel (9°22.688' S 119°20.826' E) is on a river mouth on the North coast of Sumba, along a broad white sand beach. Fish from the Ketawel landing site is for domestic consumption, and most of the catch is bought by local buyers, often women.

There are 12 decked vessels of 10 GT for purse seining. Fishing grounds of these purse seiners are up to 4 hours from the landing site (ca. 30 nm), at up to 1 nm from the shore. On the day of the field visit, one of these purse seiners was landing a catch of 10,000 sardines (ca. 500 kg), which were sold at IDR 2,000 per piece. This appears expensive, and it may be that the fishers inflated their pricing in the hope that the survey team would buy from them at that price. On the other hand, however, fish is generally expensive in Sumba. The catch also included small rainbow runners (up to 30 cm total length), which suggest that the fishers operated near a sea mount.

Katewel is also a temporary basis for two 10 GT decked vessels from Siwa in South Sulawesi, who fish for flying fish using surface-set gillnets of 1 km long, 3 m high, with a mesh size of 1.5". These fishers only work from Ketawel from January to June. These boats take up to two hours to reach their fishing grounds, which means that these fishing grounds are up to 20 nm from the landing site. A fishing day lasts from 08:00 to 16:00, and the fishers need about 2 hours to haul the gillnet. The average catch-per-trip is 150-300 kg, and the fishers usually sell their fish per *timba* of 15 kg at IDR 175,000 (nearly IDR 12,000/kg). According to the fishers, catches have been decreasing over the past years, and the average size of fish in the catch has been decreasing as well.

Finally, Katewel has 10 small vessels (3 GT) with small inboard engines for bottom gillnetting.

3.2.3 Waikelo and Waitabula

Waikelo, at the ferry harbour, only has small numbers (less than 50) of outrigger canoes fishing with drift gillnets for small pelagics. This fishery supplies the local market only.

A bit further land inward, towards Waitabula, is the main fish market for this part of Sumba (Figs. 3.3, 3.4, 3.5, and 3.7). Most of the fish here is not caught locally, but imported from Sape in styrofoam boxes on pickup trucks, which arrive by ferry (departure from Sape 21:00, arrival in Sumba 3:00). Some of the fish sold here is from nearby landing sites such as Katewel (cf. 3.2.2) (e.g., humpback red snapper (also known as paddletail) *Lutjanus gibbus*, which is a small reef-dwelling snapper, sold here at IDR 25,000/kg).

3.2.4 Memborong

Kecamatan Memborong, *desa* Wendewa Utara (9°22.628'S 119°32.473'E, Fig. 3.8) is a coastal village situated at a river mouth along a broad sandy beach. Memborong has *c.* 2000 households, but there are no local fish traders. The survey team did not see any landings at the time of the visit, nor was there any fish in storage.

Memborong is home to nine small purse seiners (24-30 HP, *c.* 10 GT), 11 small open boats (*c.* 1.5 GT) for surface gillnetting (Fig. 3.9), and three boats that use gillnets for catching flying fish (two from Memborong itself, and one from elsewhere). There are also various dugout canoes for handlining and gillnetting in nearby waters (Fig. 3.10).

The purse seiners operate in coastal waters up to Pero in the West, and up to Waingapu in the East. They usually make day trips, starting 6am and returning between noon and 6pm. Mesh size varies between 1 and 1.5", and species in the catch comprise Eastern little tuna *Euthynnus affinis*, *julung-julung* (needlefishes, garfish, and halfbeaks, comprising various species of the families Belonidae and Hemiramphidae), scads, sardines, and sometimes trevallies (e.g., bigeye trevally *Caranx sexfasciatus*). A typical purse seine catch comprises 300-500 (number) Eastern little tuna per trip, and less than 100 *julung-julung* and trevallies. Purse seine fishers sell small pelagics (scads and sardines) for IDR 300,000 per 30 kg (IDR 10,000 per kg). Eastern little tuna usually sells for IDR 25,000 per fish, and *julung-julung* for IDR 5,000 per fish. Larger trevallies of about 5-10 kg each are sold at IDR 50,000 per fish.

The boats fishing for flying fish go out a bit further offshore, operating on fishing grounds up to 60 nm away. The boats fishing for flying fish go out for one night or two nights.

Figure 3.3: Various reef fish, mostly from Sape (West Sumbawa), for sale at Waitabula fish market.

Figure 3.4: Most fish for sale at Waitabula fish market is imported with pick-up trucks from Sape, Sumbawa (top). As is common anywhere in Indonesia, the fish market of Waitabula does not meet basic hygienic standards (bottom).

Figure 3.5: Waitabula fish market: Selling dried fish (top), and vendor holding up a golden trevally (bottom).

Figure 3.6: Waitabula fish market: *Lemuru* (spotted sardinella *Amblygaster sirm*, a kind of sardine) (left), and mixed reef fish (right).

Figure 3.7: Waitabula fish market: Selling mixed reef fish from Sape (left), and styrofoam box with small pelagics (scads and Indian mackerel *Rastrelliger kanagurta*) (right).

Figure 3.8: Beach (top), and rivermouth (bottom) at Memborong village.

Gillnetters from Memborong use gillnets with three mesh sizes: 1", 2", and 2.5". The smallest mesh size (1") is used for sardines (*lemuru*), whereas 2" and 2.5" nets are used for Indian mackerel (*kembung*). The main fishing season for sardine is the dry season, whereas the main fishing season for Indian mackerel is the wet season. A typical gillnet catch in the wet season comprises 2,000-3,000 (number) sardines (mostly *lemuru*. *Sardinella longiceps*), and typical gillnet catch in the dry season comprises 200-300 (number) Indian mackerel. Fishers sell large sardine for IDR 1,000 per 10 fish, and Indian mackerel for IDR 5,000 per fish (off-season prices).

Fish from Memborong is marketed within Sumba, mostly in the districts Sumba Barat (especially Waitabula), Sumba Tenggah, and Sumba Barat Daya.

The fishers of Memborong received some support from the district *Dinas Kelautan dan Perikanan* (DKP) (Fig. 3.11): Three fibreglass boats and various fibreglass canoes. The fibreglass boats are only occasionally used. DKP also deployed a speedboat in Memborong, but this speedboat has not been operational for some time.

3.2.5 Waingapu

Even though Waingapu is one of Sumba's fisheries centers, capture fisheries are still of minor importance here. There is some small-scale fishing with purse seines, gillnets, and handlines, but the fisheries that are the focus of this series of field surveys (deepwater demersals and yellowfin tuna / skipjack tuna) are essentially absent. Similar to Waikelo, Waingapu imports some of its fish needed for local consumption from Labuan Bajo (Flores) and Sape (Sumbawa).

The fish market of Waingapu did have some large, locally caught snappers and groupers for sale (Fig. 3.12), but most of the fish were small pelagics and some small demersals such as paddletail *Lutjanus gibbus* (Fig. 3.13). A large red snapper *Lutjanus bohar* of *c.* 7 kg retailed for IDR 20,000/kg, and a grouper (probably *Epinephelus tauvina* of *c.* 2 kg) retailed for IDR 40,000/kg. These prices suggest a local market that is strong enough to absorb all locally caught fish, even the more expensive ones.

Waingapu has two ice factories, of which only one is operational. It has a capacity of 100 blocks of 40 kg each per day. There is a cold storage, but it is currently not in use. Two fishing companies used to lease the cold storage facility from DKP, but neither of them were able to sustain their business.

Figure 3.9: Memborong: Small boats for gillnetting (top), and boats for purse seining (bottom).

Figure 3.10: Memborong: Purse seiners, gillnetters, and dugout canoes in the village harbour.

Figure 3.11: Memborong: Speedboat of DKP and canoe donated by DKP (top), and two of the glassfibre fishing vessels donated by DKP (bottom). As in many other places, neither the surveillance speedboat nor the larger boats donated by DKP are fully operational.

Figure 3.12: Waingapu: A goldband snapper *Pristipomoides multidens* (left) and two groupers with two *Lutjanus bohar* (right) for sale at the fish market of Waingapu.

Figure 3.13: Waingapu: A giant trevally, two groupers, and two *Lutjanus bohar* (top), and a mix of small pelagics and small demersal fish (bottom) for sale at the fish market of Waingapu.

Kampung Bugis

Kampung Bugis (9°38.418'S 120°15.344'E) in Sumba's major population center Waingapu is situated along a coast with mudflats and mangroves (Fig. 3.14), bordered to the West by Waingapu's main harbour and jetty (Fig. 3.15).

The main fisheries operating from Kampung Bugis and from the harbour are a purse seine fishery (sometimes combined with, or switching to gillnets) and a gillnet fishery for small pelagics. There are also handliners, usually operating from open boats with small inboard engines or canoes. The local DKP constructed a *Tempat Pelelangan Ikan* (TPI), which apparently has never been used as such—Unfortunately, this is common throughout Indonesia (Fig. 3.16).

There are between six and ten purse seiners (*c.* 10 GT, with HP 25 engines) operating from Waingapu harbour, who make up to two trips per day (Fig. 3.17). Occasionally, the purse seiners fish during night time. Sometimes, purse seiners from elsewehere (e.g., Pulau Ramut near Flores) also use Waingapu as a base. At the time of the visit, the purse seiners were catching mostly *tongkol*, which is sold at local markets via small-scale traders. The nets are about 600 m long and 20 m deep, with a mesh size of 1". The fishing season is from May to November, peaking in July-August. A typical catch during peak season is about 400-500 kg per trip, comprising Eastern little tuna, sardines, and halfbeaks. The fishing grounds are nearby, up to 2-3 hours away from Kampung Bugis.

Kampung Bugis is the basis for seven decked bottom handliners, each 15 m long and 2.5 m wide, with an inboard engine of 24 HP. The handlines have 7-11 hooks per line, baited with sardine or squid. Fishing takes place throughout the year, except during the Westerly monsoon (January-May). The average catch, comprising groupers, snappers, and trevallies, is now about 50 kg per trip, but this used to be 100-150 kg per trip. The handliners reach their fishing grounds within 2-4 hours. They now sell their catch at local markets, but when catches were still high the handliners sold their catch to Damarina, a fishing company that operated a cold storage.

Besides the seven handliners described above, there are about 100 small boats, canoes, and dug-outs, who usually fish at night, landing around 6am. They catch small demersal fish and small *tenggiri* (Spanish mackerel).

There are about 25 gillnet boats in Kampung Bugis, each measuring about 3 GT, powered by an inboard engine of about 16 HP. They use 1" gillnets for catching sardines (*lemuru*) and 2" gillnets for Indian mackerel. Sardines are caught during the dry season, Indian mackerel during the wet season. A typical catch is about 100 (number) Indian mackerel per trip

Figure 3.14: Waingapu: Mudflat with small open boats in front of Kampung Bugis (top), and main road along the shore of Kampung Bugis (bottom)

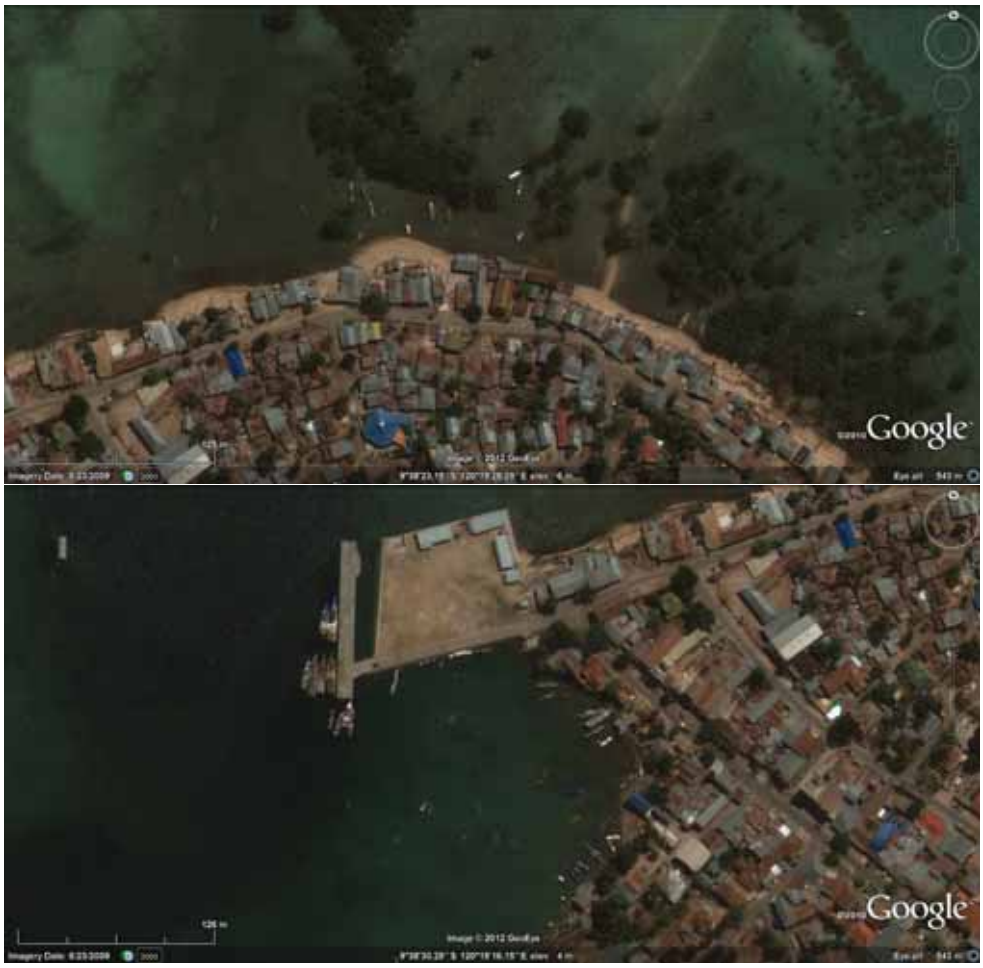

Figure 3.15: Waingapu: Google Earth imagery of Kampung Bugis (top) and harbour (bottom).

Figure 3.16: Waingapu: Facilities at *Tempat Pelelangan Ikan* of Kampung Bugis.

Figure 3.17: Waingapu: Bay to the South of the main harbour and jetty of Kampung Bugis (top), and mini purse-seiners moored at the main jetty of the Kampung Bugis harbour (bottom).

during the wet season, and about 200-300 sardines per trip during the dry season. Sardines typically measure 25-30 individuals per kg, and Indian mackerel measure about 8-12 individuals per kg. During the field visit, on the early morning of April 18, the survey team witnessed small-scale gillnetters landing at the harbour near Kampung Bugis and sites just South of that harbour (9°38.608'S 120°15.278'E, Fig. 3.18, 3.19). The gillnets used were small-meshed (1-1.5"), and catches varied between 20 and 40 kg of small pelagics (mostly scads) per landing. Each boat had two crew. Fishers sold their catch for IDR 100,000 per 10 kg.

Ferry terminal of Waingapu, and other sites

Near the ferry terminal of Waingapu (9°38.163'S 120°14.740'E), at *desa* Temo of *kecamatan* Konantang there was a small fleet of *c.* 20 canoes, which fish with gillnets for small pelagics, and with handlines for demersal fish up to a depth of 40 m (Fig. 3.20 top and middle). There were no fish landings at the time of the visit.

Just opposite of the harbour of Kampung Bugis, Google Earth imagery shows a small landing site at 9°38.67'S 120°15.03'E, which the survey team was unable to visit (Fig. 3.20, bottom). It is likely that this landing site is similar to the ones visited by the survey team, with small boats fishing with gillnets and handlines for small pelagics, and one or two somewhat larger boats fishing with mini purse-seines.

3.2.6 Melolo

Melolo (9°52'50.56"S 120°39'40.73"E) is a small landing site situated along a river (Fig. 3.21). It features a *Tempat Pelelangan Ikan* (TPI), which was constructed by DKP Sumba Timor, in 2010. The TPI did not show any signs of frequent use.

The survey team interviewed a group of fishers and the head of a local surveillance group (POKMASWAS), who were invited to come to the TPI by the DKP official, Ibu Ijen. The fishers appeared to provide inflated estimates of catch-per-trip, perhaps to make the local fishery appear more significant than it really is. Hence, the survey team decided not to record these estimates. There were no landings at the time of the field visit, and there was no fish in storage.

There are two mini purse-seiners (10 GT, 24 HP engine), who use nets with a mesh size of 1". They fish throughout the year, except during the westery monsoon at times when there is too much wind. The purse-seiners fish in nearby waters, within 3 hours sailing from the harbour. The catch

Figure 3.18: Waingapu: Gillnet boats landing in the bay to the South of the main harbour and jetty of Kampung Bugis (top), and part of their catch (bottom).

Figure 3.19: Waingapu: A gillnet fisher taking his catch of small pelagics ashore (left), and a housewife who just bought a bonito *Sarda orientalis*, locally known as *tongkol gigi*.

Figure 3.20: Waingapu: Landing site near the ferry terminal (top), and Google Earth imagery of the ferry terminal with a small-scale landing site (note the canoes lining the southern side of the jetty) (middle), and another landing site to the South of the ferry terminal (bottom).

comprises sardines, *julung-julung* (halfbeaks and needlefishes), and a typical catch is about 700-1,000 kg per trip of three days.

According to the interviewed group of fishers, Melolo has about 150 non-motorized and about 30 motorized open boats or canoes. Many of the vessels have engines donated by DKP. The most common gear are handlines, for fishing to depths up to 60-100 m, using sardine (*lemuru*) as bait. Local fishers tried fishing with bottom-set longlines, but they stopped this practice because their longlines got entangled in rocks too often.

The main fishing season is May-September, whereas the fishers do not fish during October-April due to bad weather. Also during the time of the visit of the survey team, most fishers stayed at home. The fishers usually go out around 4pm, and they land around 7-8am the following morning. Fishers reach their fishing grounds in 2-3 hours, and they need about 6 L of fuel for a trip. Sometimes, fishers go out for two nights. They normally bring 10 plastic bags (10 kg in total) of home-made ice for cooling.

The handline fishers say they frequently catch deepwater snappers (ruby snapper, Chinaman fish, jobfish, etc.), which they sell per piece, not per kg. The price usually averages out at IDR 10,000 per kg. A 12 kg *tenggiri* (Spanish mackerel) fetches IDR 250,000, or IDR 21,000/kg.

There are only two traders who ship groupers and snappers on ice in styrofoam boxes to Bali. One of them is Ibu Ijen herself, but she only trades fish infrequently and in small quantities (up to 50 kg per week in peak season). Ibu Ijen specializes in lobster from Katundu near Karera, in the South of Sumba. The other collector is Aji Yeni Iriawan, who ships about 30-40 kg per week from Malolo to Bali by plane.

3.2.7 Kawangu

Kawangu (9°40.399'S 120°19.298'E) is a small landing site near Waingapu at a river mouth (Fig. 3.22). At the invitation of DKP Sumba Timur, six fishers showed the survey team their catch of the day: Three trevallies. As in Malolo, the fishers appeared to give inflated estimates of their catch-per-trip, and therefore the team did not record these estimates.

Kawangu has 11 non-motorized canoes for handlining. Fishers usually go out between 6am and noon, and they reach their fishing grounds within one or two hours. There are also 25 canoes using gillnets, of which only two are motorized. Gillnet fishers usually operate between 6am and 6pm, and they catch sardines (*lemuru*) with a size of 40 g each (25-30 fish per kg). A sportfishing boat used to fish in the river mouth, apparently casting along the mangroves for mangrove snapper.

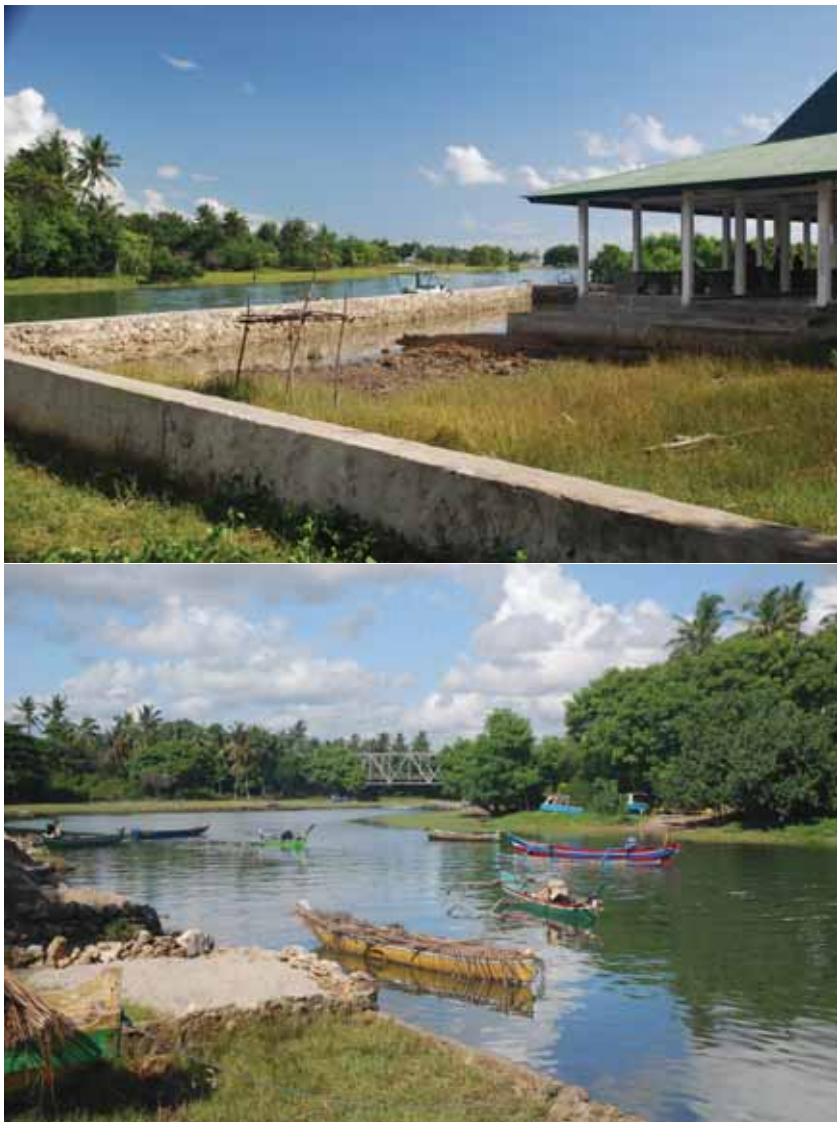

Figure 3.21: Malolo: *Tempat Pelangan Ikan* of Melolo (top) and land-inward view along the river (bottom).

Besides the trevallies, there were no landings during the time of the visit, and there was no fish in storage.

3.2.8 Hararu

Hararu (9°28.897'S 120°6.530'E) (*desa* Mondu, *kecamatan* Kananba) is a small landing site at a broad white sand beach near a river mouth (9°28.560'S 120°6.202'E) to the West of Waingapu (Figs. 3.23, 3.24). Hararu has 40 non-motorized canoes and 3 fibreglass canoes (7 m long, 1.25 m wide) with 6 HP engines.

There were no landings at the time of the visit, and there was no fish in storage. The only fishing activity the team observed was cast netting at the river mouth. There were also some weirs.

Fishers from Hararu use two geartypes: Surface gillnets and handlines. The gillnet fishers use nets with a 1" mesh size for sardines (*lemuru*) and nets with a 2" mesh size for Indian mackerel (*kembung*). Fishers usually fish between 5am and 9am at nearby waters (up to 2 hours from the beach). During the peak of the dry season (August-September), fishers catch 1,000-2,000 (number) sardines, and during the wet season they catch 200 (number) Indian mackerel per trip. Fishers sell sardines for IDR 5,000 per 40 fish, and Indian mackerel for IDR 2,000-3,000 per fish.

Handlining is done from the three glassfibre canoes, working up to a depth of 50 m, using handlines fitted with five hooks. Fishing grounds are up to 1.5 hours from the beach, and a fishing trip lasts from 18:00 to 9:00. The fishing season for handlining is between March and May. The catch comprises snappers, groupers, and emperors, varying in size between 0.3 and 5 kg each. Fishers sell small fish for IDR 15,000 per bundle of 6 fish, and large fish for up to IDR 100,000 per fish.

There is no ice for cooling. Local traders come to Hararu to buy fish, and they sell at local markets.

3.2.9 Wanokaka

Wanokaka (9°44.764'S 119°26.959'E) (*desa* Wihura, *kecamatan* Waikabuba) is a fishing village on the southern shore of Sumba. It is situated near at the river mouth, surrounded by rice fields and mountains. Wanokaka, like many other villages in Sumba, still has traditional houses (Fig. 3.25), and many of its boats are propelled by paddle or by sail.

There are about 20 mini purse seiners, of which only seven are currently operational. The vessels are 10 GT, with a length of 15 m and a width of 3.1 m, powered by inboard engines of 30 HP (main) and 23 HP (auxiliary).

Figure 3.22: Kawangu: Mangrove lining the river shores (top), and survey team interviewing fishers (bottom).

Figure 3.23: Hararu: Broad white sand beach (top), and part of the survey team (bottom). The survey team of that day comprised, from left to right, Mr Budi Sasongko (IMACS), Dr Jos S. Pet (PNCI/TNC), Ibu Ijen (DKP Sumba Timur), and Dr Peter J. Mous (not on this picture). The people to the left of Ibu Ijen are Hararu villagers.

Figure 3.24: Hararu: Canoe on the beach of Hararu (top) and mangroves lining the river shore (bottom). The name of the canoe, "Percuma", is perhaps indicative of the status of local fisheries: It means "For Nothing", or "In Vain".

Figure 3.25: Wanokaka: Traditional house (top), and Mr Budi Saongko interviewing fishers while they are repairing a purse seine net (bottom).

The nets are 500 m long, with a depth of 25 m, and a mesh size of 1". Fishing takes place between 5am and 6pm, and the catch comprises Eastern little tuna (*tongkol besar*), bullet tuna *Auxis thazard* and frigate tuna *Auxis rochei* (both known as *tongkol kecil*), sardines (*lemuru* and *tembang*), Indian mackerel (*kembung*), and small trevallies and scads. The purse seiners target each species depending on its availability. A typical catch per trip of Eastern little tuna is about 800-1000 fish, of *tongkol kecil* about 2,000-3,000 fish, of sardines about 300-600 kg, and of Indian mackerel about 450 kg. The purse seiners do not own Fish Aggregating Devices, but they sometimes operate near Fish Aggregating Devices of other fishers, some 7 nm out. Fishing grounds are about three hours sailing from the beach, and a fish trip may last up to two days. The fishing season is April-November.

There are 20 motorized "ketinting" canoes, and about 80 non-motorized canoes, which handline at depths between 40 and 120 m depth for demersal fish, often using sardine as bait. Operating within the 200 m depth line, they also trol for large pelagics, including Spanish mackerel, sailfish, and trevallies. Tuna is caught only rarely. The fishing season for hook-and-lining is May-September.

At the time of the visit by the survey team, a small group of between five and ten *sampan* (non-motorized canoes) brought in about 40 kg of small demersal fish, including two ruby snappers *Etelis carbunculus*.

One of the fishers uses large-meshed gillnets to catch shark and snappers at depths up to 50 m. He sells the dried sharkfins to a trader in Waikabubak (Fig. 3.28).

All large pelagics are sold at local markets. Demersal fish and small pelagics are also sold at local markets, or just along the road by motorcycle traders who pick up the fish at the village (Fig. 3.29). A sailfish of 30 kg fetches IDR 400,000. Groupers and red snappers are all sold by piece rather than by weight, at prices of about IDR 25,000-30,000/kg.

At the time of the survey team visit, many of the villagers were fishing with pushnets for fingerlings of an unidentified fish species that was apparently migrating upriver (Figs. 3.31, 3.32, and 3.33). This fishery takes place in February-April only. The fingerlings are sold for IDR 10,000-15,000 per "mok" (about 200g).

3.2.10 Waikabubak

Much of the demersal fish caught on the western half of the south coast of Sumba appears to end up with small-scale traders who use motorcycles to bring their fish to the district capital Waikabubak (Fig. 3.34). In Waikabubak these fish are sold directly at the roadside. The survey team es-

Figure 3.26: Wanokaka: Various handlines (top), and small, unmotorized canoes for handlining (bottom). The handlines with small feathered hooks (left) are used for small pelagics, the one in the middle is used for small demersal fish, and the one to the right is used for mid-sized and large snapper and grouper.

Figure 3.27: Wanokaka: A fresh handline catch (top), and yesterday's purse seine catch of scads (bottom). There is no ice in Wanokaka, so this fisher has to make do with sea water to keep his fish somewhat cool.

Figure 3.28: Wanokaka: Large-meshed gillnet (top), used for catching shark and other large demersal fish. Fins of shark are sun-dried (bottom), and transported to Waikabubak.

Figure 3.29: Wanokaka: Preparing the catch of the day for transport by motorcycle.

Figure 3.30: Wanokaka: Catches of hairtails (left) and ruby snapper with various other small demersal fish (right).

Figure 3.31: Wanokaka: Villagers fishing with pushnets at the mouth of the river (top), to catch fingerlings migrating upriver (bottom).

Figure 3.32: Wanokaka: Villager handling a pushnet.

Figure 3.33: Wanokaka: Women and children sorting and cleaning a pushnet catch (top), and rivermouth with pushnet fishers (9°44.710'S 119°27.049'E).

Figure 3.34: Waikabubak: Small-scale traders selling fish by motorcycle on the roadside of Waikabubak.

timated that there were about 20 fish traders on motorcycles operating in Waikabubak, each bringing about 40 kg of small demersals. About 10% of these demersals are of export quality, including ruby snapper, various other species of red snappers, and groupers (mostly *Variola spp.* , *Cephalopholis sonnorati*, and other small groupers).

3.2.11 Salura Island

According to Ibu Ijen (*Dinas Kelautan dan Perikanan* Sumba Timur), fishers from Tanjung Luar (Lombok) use Salura Island on the South coast of Sumba as a staging site. Fishers camp there on their way to fishing grounds, they offload their catch (mostly demersal fish) to collecting vessels, and they get supplies. This confirms information from interviews with fishers conducted by the survey team in Tanjung Luar, Lombok. Fishing grounds include waters shallower than 200 m on the Eastern part of the South coast of Lombok. The survey team did not have time to visit Salura Island during this field trip.

3.3 Maps of fishing grounds and supply lines

Summarizing findings from landing sites described above, we categorized the main fisheries that land in Sumba as follows:

- Fisheries operating from the Western part of Sumba (Fig. 3.35) comprise a squid fishery operating from Pero and Mambang, a dispersed fishery with mini purse-seiners supplying local markets, and a dispersed fishery with surface-set gillnets for small pelagics or with handlines for small demersals. In addition, there are a few somewhat larger boats fishing with surface-set gillnets for flying fish from Katewel and Memborong.

- Fisheries operating from the Eastern part of Sumba (Fig. 3.36) comprise a dispersed fishery with mini purse-seiners supplying local markets, and a dispersed fishery with surface-set gillnets for small pelagics or with handlines for small demersals. There is some export-grade reef fish from Melolo, and a little bit of lobster from Katundu, but these fisheries turn over low volumes only (couple of hundred kg per month at the most).

- Fishers from Tanjung Luar (East Lumbok) use Salura Island, to the South coast of Sumba, as a staging area for fishing trips to fishing grounds to the East of Sumba.

Most of Sumba's local consumption is covered by import of fish from Sape (Sumbawa) and Labuan Bajo (Flores).

3.4 Google Earth survey of coastal fisheries

A visual inspection of the coastline of Sumba using Google Earth reflected the same major patterns as observed during the field visit (Fig. 3.37): There are only a few scattered landing sites, and fishing activity is generally low. Because many of the landing sites are in mangrove areas, they do not always show up in Google Earth.

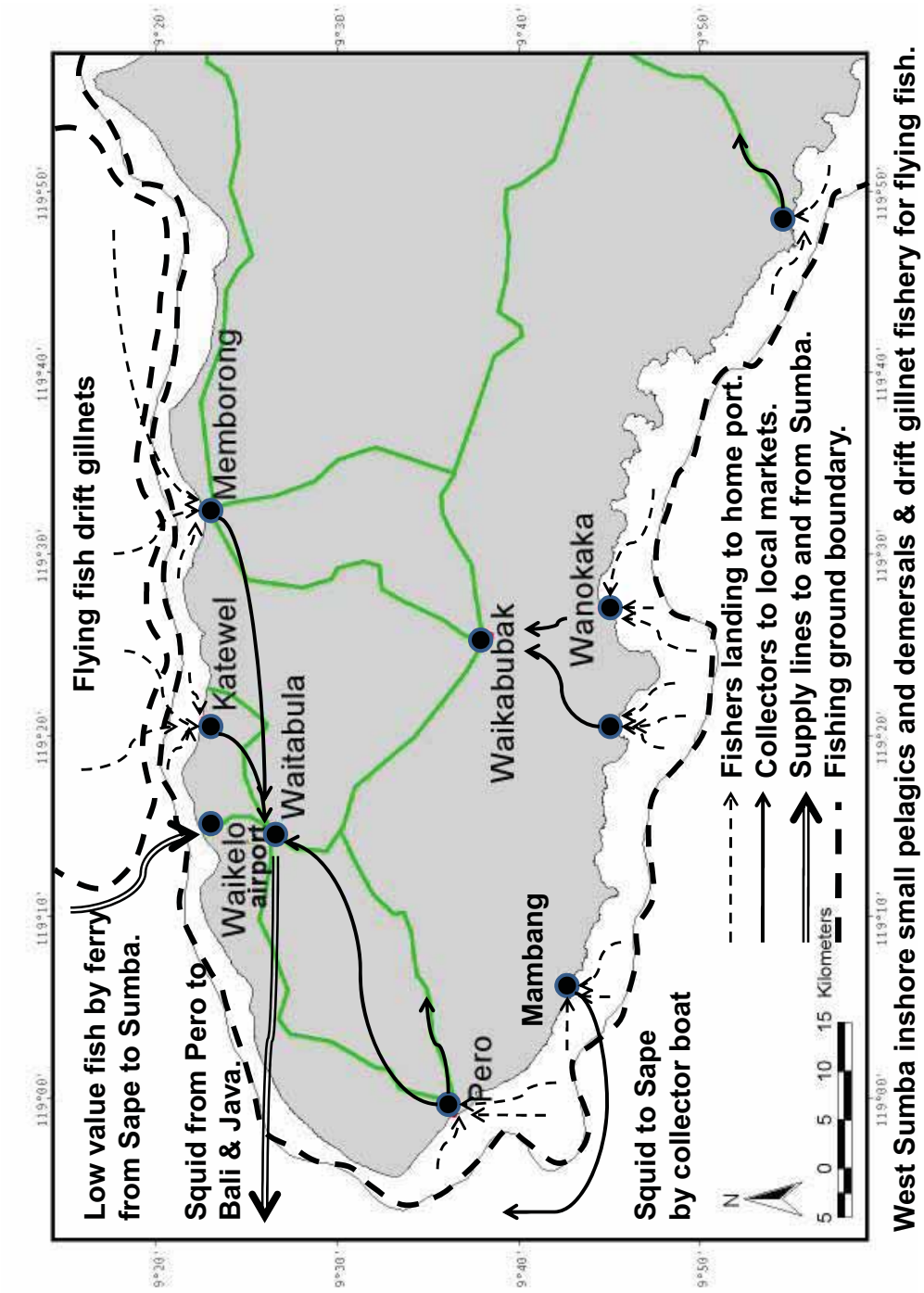
Flying fish drift gillnets
Low value fish by ferry from Sape to Sumba.
Squid from Pero to Bali & Java.
Memborong
Katewel
Waitabula
Waikelo airport
Waikabubak
Wanokaka
Mambang
Pero
Squid to Sape by collector boat
Fishers landing to home port.
Collectors to local markets.
Supply lines to and from Sumba.
Fishing ground boundary.
N
5 0 5 10 15 Kilometers
West Sumba inshore small pelagics and demersals & drift gillnet fishery for flying fish.

Figure 3.35

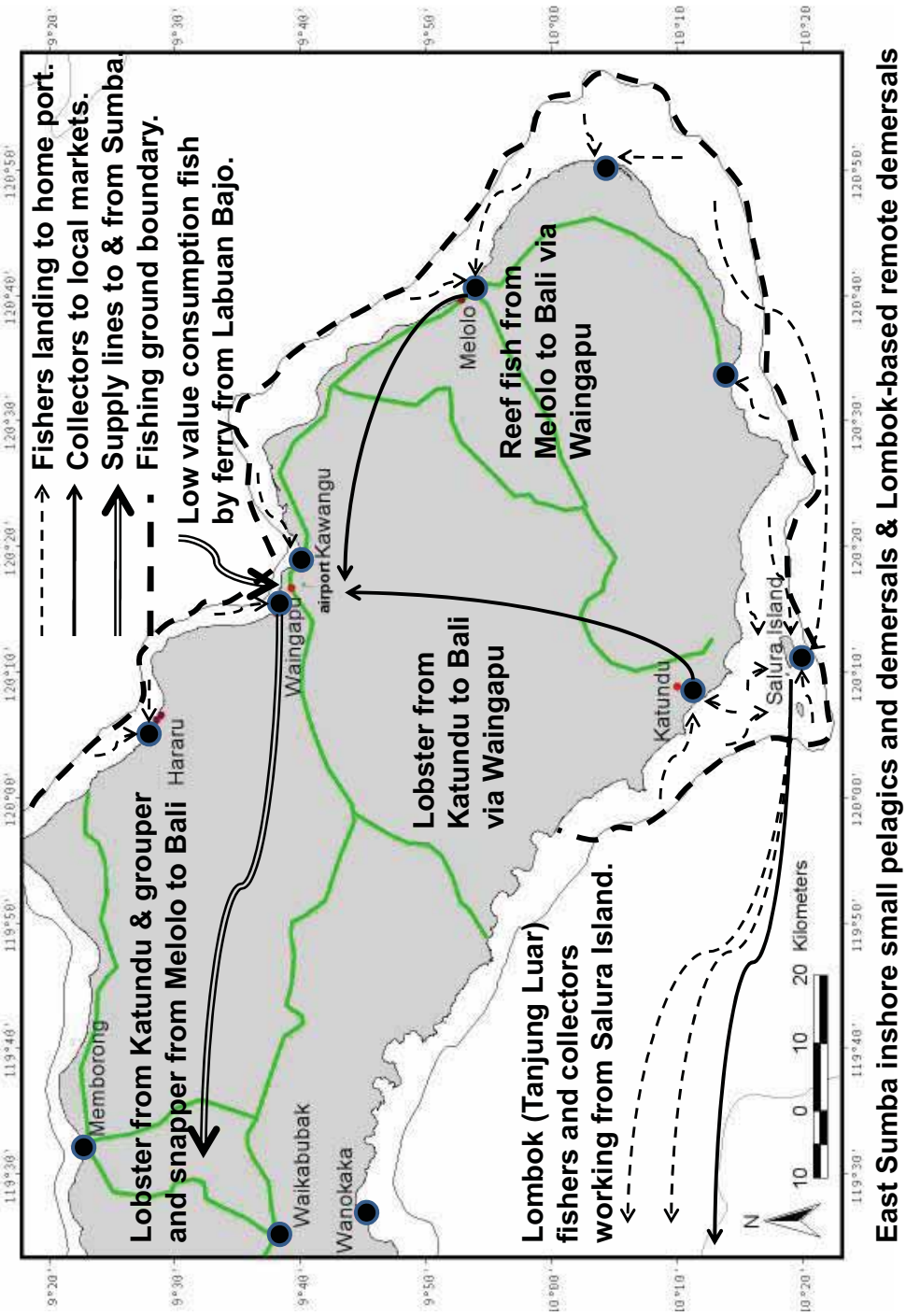
Fishers landing to home port.
Collectors to local markets.
Supply lines to & from Sumba.
Fishing ground boundary.
Low value consumption fish by ferry from Labuan Bajo.
Lobster from Katundu & grouper and snapper from Melolo to Bali
Lobster from Katundu to Bali via Waingapu
Reef fish from Melolo to Bali via Waingapu
Lombok (Tanjung Luar) fishers and collectors working from Salura Island.
Memborong
Hararu
Waikabubak
Wanokaka
Waingapu
airport
Kawangu
Melolo
Katundu
Salura Island
Kilometers
N
East Sumba inshore small pelagics and demersals & Lombok-based remote demersals

Figure 3.36

Figure 3.37: Output from Google Earth (center at 9°50′36.47″S and 119°57′56″E, "Eye altitude" at 224 km). The yellow polygons show the areas where resolution was too low to discern individual fishing vessels.

Table 3.1: Results of Google Earth survey of concentrations of fishing boats along the coast of Sumba. See Figure 3.37 for a map with the numbered points listed below.

Nmbr	Location	Date	Boats	Latitude	Longitude
74	Memboro	8/1/2004	20	9°23'27.32"S	119°13'16.00"T
75	Bukutan	2/12/2010	50-60	9°36'25.62"S	118°59'12.49"T
76	Praikalogu	2/15/2010	13	9°45'48.51"S	119°24'55.45"T
77	Teluk Waingapu	11/22/2010	5	9°37'43.22"S	120°25'36.97"T
78	Teluk Waingapu	8/23/2009	30-40	9°38'23.25"S	120°15'22.56"T

Chapter 4

Opportunities for development of sustainable supply lines

Even though Sumba features some fishing villages with dispersed, small-scale fisheries, Sumba lacks a "fishing culture". Despite considerable support from provincial and district *Dinas Kelautan dan Perikanan*, the fishing industry never really developed, and availability of infrastructure (ice, cold storage) is low. Sumba has been one of the least-developed islands of Indonesia, and up till recently it had poor connections with other islands—This may explain why a fishing communities like the ones found in nearby Flores, Sumbawa, and Lombok, never developed in Sumba. It appears that fishers from other islands degraded fish stocks of the waters surrounding Sumba, taking their catch to fishing hubs elsewhere. Today, most fish consumption in Sumba is covered by fish imported from Sape (Sumbawa) and Labuan Bajo (Flores), and export of capture fisheries products from Sumba are negligible.

The absence of a well-developed local fishery sector in combination with apparent degradation of local fish stocks means that opportunities for development of sustainable supply lines are poor. The fishery sector of Sumba is best served by controlling access of fishers from other islands, and putting measures in place to recover nearshore fish stocks. Such measures may include a network of marine reserves in coastal waters (especially around coral reefs and mangroves), in combination with a regulatory framework that allows for controlled development of a local fishery.

Most landing sites that the survey team visited are quiet compared to other islands in Indonesia, and therefore hygienic conditions are somewhat better. Hygienic conditions at the fish market of Waikelo, however, are very poor. Fish ends up in dirty harbour water or on the ground, where free-roaming chickens may cause infections such as *Salmonella*. As small-scale fisheries supply export markets, which impose strict food safety standards,

this is a matter of economic concern. Contaminated fish from small-scale operations may get mixed with high-quality fish, and therefore finding ways to improve hygienic conditions in small-scale fisheries is important for the export sector as a whole. It is only a matter of time before domestic markets will demand better compliance with food safety standards. Some ways to improve hygenic conditions include creating more efficient or fewer linkages in small-scale supply chains, removing chickens and other livestock from landing sites, ensuring access to ice made from clean water, and conducting awareness campaings for fishers and small-scale traders on fish handling practices.

Bibliography

Garcia, S. M., A. Zerbi, C. Aliaume, T. Do Chi, and G. Lasserre (2003). The ecosystem approach to fisheries. issues, terminology, principles, institutional foundations, implementation and outlook. Technical report, FAO Fisheries Technical Paper. No. 443. Rome, FAO. 71 p.

Pikitch, E. K., C. Santora, E. A. Babcock, A. Bakun, R. Bonfil, D. O. Conover, P. Dayton, P. Doukakis, D. Fluharty, B. Heneman, E. D. Houde, J. Link, P. A. Livingston, M. Mangel, M. K. McAllister, J. Pope, and K. J. Sainsbury (2004). Ecosystem-based fishery management. *Science 305*, 346–347.

Spalding, M., H. Fox, N. Davidson, Z. Ferdana, M. Finlayson, B. Halpern, M. Jorge, A. Lombana, S. Lourie, K. Martin, E. McManus, J. Molnar, K. Newman, C. Recchia, and J. Robertson (2007). Marine ecoregions of the world: A bioregionalization of coastal and shelf areas. *BioScience 57*, 573–583.

Appendices

Appendix A

Local resource persons and data gathering events

The survey team conducted following interviews and observations (in chronological order; unless indicated otherwise interviews were conducted by the complete team):

1. Pero, Monday April 16: Visit and interview with c. five fishers.
2. Katewel, Monday April 16: Visit and interview with c. 10 fishers on Katewel beach.
3. Katewel, Monday April 16: Visit and interview with fisher specializing in flying fish.
4. Waikelo, Tuesday April 17: Visit and interviews with various bystanders.
5. Waitabula, Tuesday April 17: Visit to fish market, and interviews with various fish vendors.
6. Memborong, Tuesday April 17: Visit to the village harbour, and interviews with various fishers (including Bpk. Ramadhan Bugi).
7. Waingapu, Kampung Bugis, Tuesday April 17: Visit to Kampung Bugis, Waingapu, and interviews with a purse seine captain and two traders (facilitated by Ibu Ijen and Pak Frits of DKP Sumba Timur). Interviews with Pak Imam, a purse sein owner, Pak Sidiq, a surface gillnet fisher, and Pak Ahmad Karim, a bottom handline fisher.
8. Waingapu, Kampung Bugis, Wednesday April 18: Visit to two small landing sites to witness landings.

9. Malolo, Wednesday April 18: Visit to TPI, interview with fishers and head of community surveillance group (POKMASWAS), Pak Amos Riwu (facilitated by Ibu Ijen and Pak Frits of DKP Sumba Timur).

10. Malolo, Wednesday April 18: Interview by phone with local trader aji Yeni Iriawan.

11. Kawangu, Wednesday April 18: Visit to landing site, interview with six fishers (facilitated by Ibu Ijen and Pak Frits of DKP Sumba Timur).

12. Hararu, Wednesday April 18: Visit to landing site, interview with fishers, including Bpk. Jaro Leo (facilitated by Ibu Ijen and Pak Frits of DKP Sumba Timur).

13. Waingapu, ferry terminal, Wednesday April 18: Visit to a small landing site, and interviews with fishers (facilitated by Ibu Ijen and Pak Frits of DKP Sumba Timur).

14. Wanokaka, Thursday April 19: Visit to village and landing site, interviews with various fishers.

15. Waikabubak, Thursday April 19: Passing through Waikabubak various times, no interviews.

Appendix B

Contact details

- Boby Karlo, BRIMOB, 085253020101 (joined field visits on April 16).
- Albertus Kambe ("Abe"), driver, 085239811512 (joined during the entire field trip).
- Frits Benyamin Uki, official of DKP Sumba Timur, mobile 082113534713.
- Ibu Ijen, official of DKP Sumba Timur, mobile 082145926211.
- Aji Yeni Iriawan, fish trader in Malolo, mobile 085239351085.
- Pak Imam, purse seine boat owner, Kampung Bugis, Waingapu, mobile 082132533423.

Appendix C

List of Indonesian, English, and scientific fish names

The following list is indicative only, since Indonesian names for fish species vary widely between islands and fishing communities.

Indonesian	English and scientific names
anggoli	goldband snapper *Pristipomoides multidens*
bagong	ruby snapper *Etelis carbunculus*
bawal tongkat	long-spined snapper *Argyrops spinifer*
cakalang	skipjack tuna *Katsuwonus pelamis*
cumi	squid and cuttlefish (Loligo, Sepia)
cunding	paddletail *Lutjanus gibbus*
guntur	green jobfish *Aprion virescens*
hamadai	Japanese name for various snappers, sometimes also used by Indonesian traders who export to Japan.
jarang gigi	red bass *Lutjanus bohar* (*L. bohar* is also referred to as "kakap merah")
julung-julung	various species of the families Belonidae (needlefishes, including longtoms and garfish) and Hemiramphidae (halfbeaks)
kaci-kaci	sweetlip emperor *Plectorhynchus pictus*, grass emperor *Lethrinus laticaudis*
kakap	emperors and snappers
kakap merah	red snappers (various species)
kakap putih	barramundi *Lates calcarifer*, but also various snappers and emperors of any colour but red
kampo	Maori seaperch *Lutjanus rivulatus*
kampo merah	emperor red snapper *Lutjanus sebae*

continued on next page

Indonesian	English and scientific names
kembung	Indian mackerel *Rastrelliger kanagurta*
ketambak	spangled emperor *Lethrinus nebulosus*
kerapu bulan	yellow-edged lyretail *Variola louti* and white-edged lyretail *V. albimarginata*
kerapu otang	potato cod *Epinephelus tukula*
kerapu sunuk	squaretail coralgrouper *Plectropomus areolatus*, and various other *Plectropomus* species, including *P. leopardus*, *P. maculatus*, and *P. laevis*
kerapu tutul	estuary cod *Epinephelus coioides* and various other brown grouper species including *E. maculatus E. merra*, and *E. quoyanus*
kurisi	threadfin *Nemipterus* spp
kurisi bali, kurisi perak	various *Pristipomoides* species, (including *P. typus* and *P. filamentosus*) and toothed jobfish *Aphareus furca*
layang	scads *Decapterus spp.*
layaran	sailfish *Istiophorus platypterus*
layur	cutlass fishes Trichiuridae (mostly hairtails *Trichiurus* spp, but also *Lepidopus caudatus* and *Lepturacanthus savala*)
lemadang	dolphin fish, mahi-mahi *Coryphaena hippurus*
lemuru	various herring and sardine species, including *Sardinella lemuru* and *Sardinella longiceps*, but not *Sardinella fimbriata*
nunuk	crimson seaperch *Lutjanus erythropterus*
sunu	various grouper species of the genus *Plectropomus*
sunu halus	leopard coralgrouper *Plectropomus leopardus*
sunu kasar	spotted coralgrouper *Plectropomus maculatus*
tembang	fringescale sardinella *Sardinella fimbriata* or goldstripe sardinella *Sardinella gibbosa*
tenggiri	usually narrow-banded Spanish mackerel *Scomberomorus commersoni*, but also various other *Scomberomorus* species as well as wahoo *Acanthocybium solandri*
teri	anchovy *Stolephorus* spp
tongkol	Eastern little tuna *Euthynnus affinis*, bonito *Sarda orientalis*, frigate tuna *Auxis thazard*, and bullet tuna *Auxis rochei*; sometimes the larger two species (*E. affinis* and *S. orientalis*) are known as *tongkol besar*, whereas the other two go by *tongkol kecil*.
tongkol gigi (Sumba)	bonito *Sarda orientalis*
tuna mata besar	bigeye tuna *Thunnus obesus*

continued on next page

Indonesian	English and scientific names
tuna sirip kuning, madidihang	yellowfin tuna *Thunnus albacares*

Appendix D

Acronyms

Acronym	Description
ABF	Air Blast Freezer
AOI	Area Of Interest, technical term that is often used in spatial planning to indicate the entire area that the planner is interested in
BPS	*Badan Pusat Statistik*
CBM	Community-based management
CPUE	Catch-Per-Unit-Effort
CTSP	Coral Triangle Support Program [Coral Triangle Initiative], the name of the ADB- and USAID-funded project that supports the Coral Triangle Initiative. Starting October 2011, the Indonesian part of CTSP has been known as MPAG.
CV	Commanditaire Venootschap, an Indonesian company structure
DISHIDROS	*Dinas Hidro-Oseanografi*, the agency within the Indonesian Navy responsible for publication of nautical charts
DKP	*Dinah Kelautan dan Perikanan*, district- or province-level fisheries service (Indonesia)
EAFM	Ecosystem Approach to Fisheries Management (FAO)
EBFM	Ecosystem-Based Fisheries Management
EEZ	Exclusive Economic Zone
EU	European Union
FAD	Fish Aggregation Device
FAO	Food and Agricultural Organization of the United Nations
GIS	Geographic Information System
GOI	Government of Indonesia

continued on next page

Acronym	Description
GPS	Global Positioning System, a satellite-based system for finding coordinates of a position anywhere on Earth.
GT	Gross Tonnage, a measure of size for boats
HP	Horse Power, an outdated but still commonly used measure of engine power (in Indonesia sometimes "PK")
IDR	Indonesian Rupiah, 1 US$ is about IDR 9,000 (2011)
ICZM	Integrated Coastal Zone Management, an approach towards multi-sectoral management of coasts
IMACS	Indonesia Marine and Climate Support project, a technical assistance project supported by USAID/Indonesia
IPB	*Institut Pertanian Bogor*, Bogor Agricultural University
IOTC	Indian Ocean Tuna Commission, a regional fisheries management organization
KKP	*Kementrian Kelautan dan Perikanan*, Ministry of Marine Affairs and Fisheries (Indonesia).
LSSFI	Lesser Sundas Sustainable Fisheries Initiative, a fisheries program run by Bali Seafood International
MB	*Mitra Bahari*, Sea Partership, a collaboration among Indonesia universities working on fisheries, coastal zone management planning, etc.
MCS	Monitoring, Control, and Surveillance
MEOW	Marine Ecoregions of the World, a bio-geographic regionalization by Spalding et al. (2007)
MMAF	Ministry of Marine Affairs and Fisheries (Indonesia)
MoU	Memorandum of Understanding
MPA	Marine Protected Area
MPAG	Marine Protected Area Governance project, supported by USAID/Indonesia and implemented by various NGOs
MRP	Marine Resource Program (USAID)
MSC	Marine Stewardship Council
MSY	Maximum Sustainable Yield, the maximum total catch that can be sustained indefinitively. Typically, MSY models assume that each level of fishing effort results in an equilibrium catch. Stocks are under-exploited if effort is lower than the effort at MSY, and stocks are over-exploited if effort is higher than the effort at MSY.
NGO	Non-Governmental Organization
NOAA	National Oceanographic and Atmospheric Administration [USA]
PERDA	*Peraturan Daerah*, province- or district-level law or regulation
PK	see HP

continued on next page

Acronym	Description
PNCI	People and Nature Consulting International, a Bali-based consulting company
PPP	*Pelabuhan Perikanan Pantai* or Coastal Fishing Harbour (Indonesia)
PPP	Public-Private Partnership
PRA	Participatory Resource Assessment
PSM	Port State Measures (FAO)
PT	*Perseroan Terbatas* (limited liability company, similar to Ltd.), an Indonesian company structure
PUMP	*Pengembangan Usaha Mina Perdesaan*, an Indonosian development program (Village Fishery Enterprise Development program)
RFMO	Regional Fisheries Management Organization, such as IOTC and WCPFC
RRA	Rapid Rural Appraisal
RRI	Rapid Resource Inventory (a survey method)
TAC	Total Allowable Catch
TPI	*Tempat Pelelengan Ikan*, Fish Landing Site (Indonesia)
TURF	Territorial Use Rights in Fisheries
UD	*Usaha Dagang*, and Indonesian company structure (sole proprietorship)
WCPFC	Western and Central Pacific Fisheries Commission, an RFMO
WPP	*Wilayah Pengelolaan Perikanan* or Fishery Management Area (Indonesia).