A pilot study to identify the extent of small cetacean bycatch in Indonesia using fisher interview and stranding data as proxies

Updated report to the International Whaling Commission

Putu Liza Mustika[1], Februanty S. Purnomo[2], and Simon Northridge[3]

1, 2 Whale Stranding Indonesia
3 School of Biology, University of St. Andrews, United Kingdom

Contact: putuliza@gmail.com

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A pilot study to identify the extent of small cetacean bycatch in Indonesia using fisher interview and stranding data as proxies

Abstract[1]

This study examines the extent of artisanal fishery bycatch of cetaceans at two locations in Indonesia. The study locations were at Paloh (West Kalimantan) and at Adonara (East Nusa Tenggara); each site represents different gear types and different cetacean species. We used three methods: semi-structured interviews of fishermen; examination of stranding data and direct observations. The work was preceded by a workshop to identify signs of fishing gear interaction on cetacean stranding cases in Bali in November 2013, followed by direct observations and interviews from late February to early May 2014.

Paloh and Adonara interviewees were seasoned fishers who had been fishing for at least 15 years. Generally speaking however, the respondents were still relatively young, about 40 years old, with limited formal education. Adonara fishers have significantly more family members depending on them with less alternative income source compared to Paloh.

Finless porpoises (*Neophocaena phocaenoides* - Vulnerable) and Indo-Pacific humpback dolphins (*Sousa chinensis* – Near Threatened) are often accidentally caught in Paloh (West Kalimantan), whereas spinner dolphins (*Stenella longirostris*) and bottlenose dolphins (*Tursiops sp.*) are most often accidentally caught in Adonara. Based on interview result, most cetacean bycatch incidents had occurred in 2013 (34 events for combined sites). All incidental entanglements in Paloh was caused by gillnets. A total of 75% of bycatch in Adonara was caused by purse seines. Most dolphins were dead when found in the net.

The greater number of family dependants and fewer alternative income prospects in Adonara are more significant factors in bycatch mitigation for this region compared to Paloh. However, the conservation threats from Paloh should not be played down because the bycatch species there are listed as either Vulnerable or Near Threatened.

Our sample is too restricted to understand the larger context of artisanal cetacean bycatch in Indonesia where there were over 280,600 gillnet units and over 73,400 seine units in 2011. However, this study has unearthed some important information on the nature and scale of artisanal fishery bycatch of cetaceans in two different regions in Indonesia, including trans-boundary fishery issues between Paloh and Sarawak (Malaysia). The two cetacean bycatch observations made in Paloh indicate fishers' willingness to cooperate to find solutions.

The bycatch lectures and necropsy session during the marine mammal stranding workshop in November 2013 and the photographs from a stranded specimen in East Kalimantan show that stranding data can help indicate the extent of bycatch in the

[1] This document is the revised version of the one previously uploaded. Please use this document for references

country, although such data and the strandings infrastructure are still insufficient to build a comprehensive picture. We suggest that future marine mammal stranding training workshops also include the bycatch components, including the issue of how to release live specimens from entanglement.

Recommended research directions include cetacean artisanal bycatch research within Indonesia and also with other countries such as Malaysia and an expansion of aims to incorporate bycatch research among commercial fishing vessels.

Studi awal untuk identifikasi cakupan tangkapan samping paus dan lumba-lumba di Indonesia dengan menggunakan hasil wawancara dengan nelayan dan data kejadian terdampar

Abstrak[2]

Dokumen ini mengkaji tangkapan samping mamalia laut dalam perikanan tradisional di Indonesia. Studi ini dilakukan di Paloh (Kalimantan Barat) dan Adonara (Nusa Tenggara Timur); setiap lokasi mewakili alat tangkap yang berbeda dan spesies mamalia laut yang berbeda pula. Studi ini menggunakan tiga metode: wawancara semi terstruktur dengan nelayan; pemeriksaan kejadian terdampar dan pengamatan langsung. Kegiatan ini didahului oleh pelatihan untuk mengidentifikasi tanda-tanda interaksi alat tangkap pada kasus mamalia laut terdampar pada bulan November 2013 di Bali, yang diikuti dengan pengamatan langsung dan wawancara pada bulan Februari sampai dengan Maret 2014.

Para nelayan yang diwawancara di Paloh dan Adonara adalah nelayan berpengalaman yang sudah melaut selama setidaknya 15 tahun. Namun, secara umum para nelayan ini masih relatif muda, berumur sekitar 40 tahun, dengan pendidikan formal yang terbatas. Nelayan Adonara memiliki jauh lebih banyak anggota keluarga yang harus ditanggung dengan sumber pendapatan alternatif yang lebih sedikit dibandingkan dengan nelayan Paloh.

Lumba-lumba tanpa sirip (finless porpoise, *Neophocaena phocaenoides*- status IUCN rentan) dan Lumba-lumba bungkuk Indo-Pasifik (Indo-Pacific humpback dolphin, *Sousa chinensis* – status IUCN hampir terancam) adalah jenis yang paling sering tertangkap secara tidak sengaja di Paloh (Kalimantan Barat). Lumba-lumba spinner (spinner dolphins, *Stenella longirostris*) dan lumba-lumba hidung botol (bottlenose dolphins, *Tursiops sp*.) adalah yang paling sering tertangkap secara tidak sengaja di Adonara. Berdasarkan hasil wawancara, kejadian tangkapan samping yang paling banyak terjadi pada tahun 2013 (34 kejadian, gabungan dari kedua lokasi). Semua kejadian terjerat tidak disengaja di Paloh diakibatkan oleh jaring insang. Sebanyak 75% dari total tangkapan samping di Adonara diakibatkan oleh pukat cincin. Semua lumba-lumba yang ditemukan dalam jaring sudah dalam keadaan mati.

Besarnya jumlah anggota keluarga yang harus ditanggung dan sedikitnya kesempatan mendapatkan pendapatan alternatif di Adonara merupakan faktor yang cukup signifikan untuk melakukan pencegahan tangkapan samping di daerah ini dibandingkan dengan Paloh. Meskipun demikian, ancaman konservasi dari Paloh tidak boleh dikesampingkan karena semua jenis hasil tangkapan samping merupakan jenis yang masuk dalam kategori rentan dan hampir terancam.

Jumlah sampel dalam kajian ini terlalu sedikit untuk memahami gambar besar tangkapan samping mamalia laut secara tradisional di Indonesia yang memiliki lebih dari 280,600 unit jaring insang dan lebih dari 73,400 unit pukat cincin pada tahun 2011.

[2] Dokumen ini merupakan revisi dari versi terdahulu. Mohon gunakan versi ini untuk referensi.

Meskipun demikian, studi ini menghasilkan beberapa informasi penting tentang kondisi dan skala tangkapan samping mamalia laut pada perikanan tradisional di dua wilayah yang berbeda di Indonesia, termasuk masalah perikanan lintas batas antara Paloh dan Sarawak (Malaysia). Dari dua pengamatan langsung terhadap hasil tangkapan samping mamalia laut di Paloh, terdapat indikasi bahwa nelayan mau bekerja sama untuk mendapatkan solusi masalah tersebut.

Sesi materi tangkapan samping dan bedah bangkai hewan (necropsy) selama pelatihan penanganan mamalia laut terdampar pada bulan November 2013 dan foto dari sampel kejadian terdampar di Kalimatan Timur menunjukkan bahwa data kejadian terdampar dapat membantu identifikasi tingkat tangkapan samping di Indonesia. Sekalipun demikian, data dan sarana penanganan kejadian terdampar masih tidak memadai untuk memperoleh pemahaman yang lebih menyeluruh. Kami menyarankan agar pelatihan penanganan mamalia laut terdampar di masa depan mengikutsertakan komponen tangkapan samping, termasuk cara membebaskan hewan yang masih hidup dari jeratan jarring atau alat tangkap lainnya.

Penelitian lanjutan yang kami rekomendasikan adalah: penelitian tangkapan samping mamalia laut secara tradisional di Indonesia dan juga dengan negara lain seperti Malaysia, serta penelitian tangkapan samping pada armada perikanan komersil.

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1. Introduction

Bycatch is defined as 'animals that become hooked, trapped, or entangled in fishing gear deployed with the intention of catching something else' (Reeves et al. 2013, p. 73). Bycatch is considered as one of the most important threats to global cetacean populations (Reeves et al. 2013; Reeves et al. 2005; Read et al. 2006). However, the extent of cetacean bycatch and cetacean mortality due to fishing gear entanglement in Indonesia remains insufficiently understood. Two cetacean bycatch datasets are available for Indonesia to date: 1) the 1995-2012 records of cetacean stranding cases collected by Kreb *et al* from RASI Foundation in East Kalimantan (Kreb et al. 2013) and 2) 2005-2008 records of fisher interviews and on-board observers by WWF Indonesia in several long-line fishing grounds in and around the Archipelago. The Kreb data suggests that gillnet entanglement was responsible for 66% of known mortality causes of stranded cetaceans in East Kalimantan. The WWF data shows a low number of cetacean bycatch due to long-line operations (Zainudin 2009). The latter data does not necessarily imply the low occurrence of cetacean bycatch in the Archipelago; particularly because data collection was focused on long-liners instead of gillnet fishing vessels.

Indonesia, a tropical archipelago with over 80,000 km of coastline, is home to approximately 35 species of cetacean (whales and dolphins) and one species of sirenian (the dugong)(Kreb et al. 2013). The number of marine fishing boats in this country in 2011 was 581,845 units, with an annual average increase of 2.3% since 2001 (Ministry of Marine Affairs and Fisheries 2011). By 2011, the country had over 398,700 long-line units, over 280,600 gillnet units and over 73,400 seine units. Considering these data, the low number of recorded cetacean bycatches in the country is most likely an underestimate.

Two main methods of collecting bycatch information are usually employed worldwide: interviews and on-board observer schemes (Moore et al. 2010). On-board observer schemes can be expensive particularly for developing countries; trust-building during on-board observer programs can also be challenging, though rewarding if achieved. Interviews with fishers are regarded as an effective and low-cost method of bycatch data collection, as long as the method is standardised and collected with consistency (Moore et al. 2010). Kreb (research conducted from 1995 onwards) and Whitty (research conducted in 2010-2012) have independently used semi-structured interviews with fishers to understand the extent of artisanal cetacean bycatch in East Kalimantan. Another relatively low-cost method for bycatch appraisal is the use of data from cetacean stranding events. For instance, in addition to the aforementioned data collated by Kreb et al, bycatch was also responsible for at least 61% of 415 dead stranded cetaceans in the UK from 1990 to 2006 and between 5-30% of stranded marine mammals in Spain from 1996 to 1999 (Lopez et al. 2002; Leeney et al. 2008).

This project received a grant from the International Whaling Commission to determine the extent of cetacean bycatch in several priority fishing sites in Indonesia that overlap with cetacean habitats. In general, there are three categories of bycatch: 1) bycatch occurring during fishing and recorded at hauling, 2) bycatch occurring when gear has been lost or abandoned (often referred to as 'ghost fishing') and 3) 'cryptic' bycatch, where animals become entangled in fishing gear and "swim away injured, sometimes

with gear still attached, and die even though they are not 'caught' or accounted for in bycatch statistics" (Reeves et al. 2013, p. 74). We used the first category of bycatch (occurring during normal fishing) in this report. Through a workshop conducted as a part of this project, we also set up a framework to identify ghost fishing bycatch and cryptic bycatch in the country. Due to budget constraints and the lower likelihood of gaining trust from fishers of commercial fishing ports in a relatively short amount of time, we decided to limit the target of this pilot project to bycatch occurring during fishing by small scale fishing vessels only (≤ 30 gross tonnage in Indonesia).

The project is relevant to the IWC priorities identified in Resolution 1997-4 (Cetacean Bycatch Reporting and Bycatch Reduction), Resolution 1997-8 (Small Cetaceans) and the 2012 update of Resolution 1990 (on the population biology and exploitation of the porpoises, *Phocoenidae*) where the sub-committee recommended inter alia the assessment of porpoise bycatch levels. The 1990/2012 Resolution is specifically applicable to bycatch of *Neophocaena phocaenoides* (IUCN Red List ver 3.1 Vulnerable) in Paloh, West Kalimantan (see Section 4.v of the Resolution).

This project contributes to the identification of priority cetacean bycatch sites in Indonesia and is also relevant to bycatch reduction initiatives by the Ministry of Marine Affairs and Fisheries (MMAF) and the Coral Triangle Initiatives. This project is also relevant to the MMAF-initiated national stranding network which underlines the importance of human resource capacity building in handling live and dead stranding events and improves policy work to address anthropogenic causes of stranding events.

1.1. Specific objectives

This project aims for the following objectives:

1) An understanding of the extent of artisanal cetacean bycatch occurring in priority fishing sites in Indonesia
2) To train local human resources to identify evidence of bycatch in cetacean stranding events
3) Providing recommendation to reduce bycatch in priority sites identified in Objective 1

2. Scientific methodology and approach

2.1 Methodology

Three methods were employed for this proposal: 1) Interviews with fishers 2) examination of cetacean stranding data; and 3) workshop to identify signs of fishing gear interaction on cetacean stranding cases. However, method #2 (examination of stranding data) has not yielded much information during the course of the study. Hence, we augmented method #2 with narratives of some cetacean bycatch events occurring during the course of the study. Brief descriptions of the methodology and approach are as follows:

1) Interviews and questionnaires

This method aims to obtain information on fishing effort, cetacean bycatch rate (expressed in number of individual cetaceans taken per unit of fishing effort) and type of fishing gears that generally causes bycatch (*sensu* Moore et al. 2010). Due to financial adjustment and logistical challenges, we reduced the number of provinces to conduct the interview and questionnaire sites from four to two provinces: East Nusa Tenggara and West Kalimantan. West Kalimantan (particularly Paloh District at Sambas Regency) was chosen to represent the riverine and coastal species in western Indonesia, particularly *Neophocaena phocaenoides, Sousa chinensis* and *Orcaella brevirostris*. Paloh's location as the frontier district adjacent to Sabah (Malaysia) also opens the possibility of transboundary projects in the future. A hotspot for cetacean abundance (Kahn 2003), East Nusa Tenggara was chosen for the reported occurrence of marine mammal bycatch in the region. East Nusa Tenggara has narrow continental shelves and deep waters, thus oceanic cetacean species are more frequently sighted here.

We chose two fishing villages in each province for the interview and questionnaire sites. These villages were chosen for the following criteria: being close to important cetacean habitats, having the majority of local fishers using gillnets and other fishing gears associated with cetacean bycatch (such as purse seines, set nets and hook and lines) and also having safe access for data collectors. An initial stage of categorizing landing sites or fishing towns was conducted based on official statistics and available cetacean habitat data. Chosen landing site description was collected during data collection to estimate the number of fishing boats per village and a general impression of each sampled fishing port or village (Moore et al. 2010).

Paloh District in Sambas Regency is chosen as the area for the interview in West Kalimantan. Paloh is approximately 120 km west of Kuching (Sarawak, Malaysia). In early 2013, WWF Indonesia identified five separate bycatch events of finless porpoises *Neophocaena phocaenoides* in Paloh, one with clear markings of entanglement (Suprapti 2013, *pers comm*). Four finless porpoises died while one was released alive. No bycatch assessment or population estimation of finless porpoises has been conducted in West Kalimantan.

Key informant interviews (Bunce & Pomeroy 2003) was conducted prior to the design and distribution of fisher questionnaires (15-19 February 2014). This method was qualitative in nature and relies more on data saturation than the predetermined number of samples (Marshall 1996; Sandelowski 1995). Questionnaires were designed based on the information received during key informant interviews. We targeted 50 fishers per site (Paloh and Adonara) for the post key informant interviews. A permit was obtained from Dr Tony Ruchimat, the Director of Capture Fisheries of the Ministry of Marine Affairs and Fisheries for this project. Prior-informed consent was asked in writing or verbally from respondents before each interview.

During interviews and questionnaires, fishers were asked about, among others, their fishing efforts and whether and when they have cetacean bycatch. Fishers were also asked whether they have encountered stranded cetaceans (and other marine animals) and whether the stranded animals were entangled in fishing gears (more on this, also see Appendix X on the final questionnaire version). Interviews in Paloh were conducted

over seven days from 21 February to 6 March 2013, while interviews in Adonara were conducted over 11 days from 16 April to 3 May 2013.

In order to be able to place any potential mitigation measures in some economic and social context, social and economic data were also collected at each site to better understand the significance of fishing activities to the respondents in each site.

2) ***Examination of stranding specimens and observations of bycatch events***

We planned to examine available photographs of live and dead stranded cetacean specimens that might indicate possible bycatch in order to understand the extent of bycatch in a particular region (sensu Lopez et al. 2002). However, we had almost no Code 2 stranding events (animals in good condition) that were immediately available to us during the course of the study. The only photographs available on this account came from East Kalimantan, which will be discussed in Section 4.1.

To complement this section, we have included direct observations of cetacean bycatch events occurring in Paloh and/or Adonara during the course of the study. We refer to "direct observation" as those witnessed or heard first-hand by our field assistants, for it was unlikely that we would witness such events ourselves. Genetic materials of stranded or accidentally caught cetaceans will be collected during data collection and processed at the Udayana University Genetic Lab in Denpasar Bali as part of the national protocol decreed by the Indonesian government through the National Stranding Network.

3) Workshop to identify signs of fishing gear interaction on cetacean stranding cases

A two-days' workshop was used to train data collectors and vets on how to identify evidence of entanglement in live and dead stranded cetaceans, both by in-situ examination and necropsy (external and internal). The workshop also included a session on how to guide interviewed fishers to identify fishing gear wounds and scars on the animals. The workshop was conducted in Bali in late November 2013, targeting 20 Indonesians (10 Bali residents and 10 non-Bali residents). A detailed report of the workshop is attached.

2.2 The study sites

Figure 1 The locations for the small cetacean bycatch survey in Indonesia

Paloh (Regency of Sambas, West Kalimantan Province)

Paloh (1,148.84 sqkm) is a district located in the Regency of Sambas, West Kalimantan Province. The District of Paloh is one of several frontier districts in Indonesia. Paloh is located just below the State of Sarawak in Malaysia, at the "tail" of the Island of Kalimantan (Figure 1). In 2012, a total of 24,136 people resided in the District of Paloh with an equal proportion of male and female (12,016 male and 12,120 female). The population density of Paloh District is 21 people per km^2 with 0.49% growth rate (**www.sambaskab.bps.go.id)**. The capital town of Paloh is also called 'Paloh'.

The Paloh District has eight villages: the villages of Kalimantan, Malek, Matang Danau, Mentibar, Nibung, Sebubus, Tanah hitam, and Temajuk (**www.sambaskab.bps.go.id)**. Three villages were included as the sample in the bycatch research (Sebubus , Tanah Hitam and Temajuk) due to the presence of main fishing ports in those villages. Sebubus and Tanah Hitam are located next to each other, within a 10 minute drive from the town of Paloh. Temajuk is the frontier village of the Paloh District, located just next to the Sarawak-West Kalimantan border. It is a 6 hour drive from the town of Paloh to Temajuk, passing through several rivers that mark the landscape of West Kalimantan.

The population for Tanah Hitam in 2012 was 3,111 (1,522 male and 1,589 female). The population for the village of Sebubus in 2012 was 7,026 (3,511 male and 3,515 female). The population for the village of Temajuk in 2012 was 1,820 (892 male and 968 female). (**www.sambaskab.bps.go.id,, www.kalbarkemenkumham.go.id)**. Temajuk has 20 artisanal fishers while the combined number of artisanal fishers in Tanah Hitam and Sebubus is 50.

All Paloh fishers are day fishers. Profit sharing among Paloh fishers in one fishing boat is as follows: For boats owned by another person (called "juragan" or "the owner"), two scenarios are applicable: 1) 50% for the boat owner and 50% for captain and the crew; 2) 70%-75% for the boat owners and 25%-30% for the boat crew and captain. For

boats owned by the captain himself75% of profits accrue to the captain and 25% to the crew.

Adonara (Regency of East Flores, East Nusa Tenggara Province)

In this document, "Adonara" refers to two districts in the Regency of East Flores (East Nusa Tenggara Province). The two districts are East Adonara District (91.06 sq. km) and West Adonara District (79.71 sq. km). Two villages were sampled for the Regency of East Flores; one in East Adonara (the Lamahala Jaya village) and one in West Adonara (the Duwanur village)(www.florestimurkab.bps.go.id).

The village official records state that 5,757 people resided in Lamahala Jaya in 2013 (2,758 males and 2,999 females), including a total of 327 fishing households. A total of 1,100 people (600 females and 500 males) resided in Duwanur in 2014. Based on our personal observation, Lamahala Jaya has 65 units of active purse seine boats, each manned by 10-13 crew members. Duwanur has 3 active purse seine boats (each manned by 10-13 crew members) and 30 active drift net boats (each manned by one fisher).

a) Gillnets at Sebubus village (Paloh)

b) Purse seines at Lamahala Jaya (Adonara)

Figure 2 Two different fishing gears used at Paloh (West Kalimantan) and Adonara (East Nusa Tenggara)

3. Result: Fisher interviews

In total, our research assistants conducted 50 interviews for Paloh and 57 interviews for Adonara. Due to the small sample, we are reluctant to generalise the results and only provide descriptive statistics in this report. The general fishing operation description and the interview results are as follows.

3.1 General fishing operation

Description of Paloh fishing gear:

The Paloh fishers reported three types of gillnets (pukat) commonly used: "Pukat Bawal" (pomfret gillnets), "Pukat halus" (fine gillnets), and "pukat udang" (shrimp nets). Two names corresponds with the names of their main catch: pomfret fish (*Bramidae*) and shrimps. We perceived the last two gillnets (fine gillnet and shrimp net) as very similar in appearance.

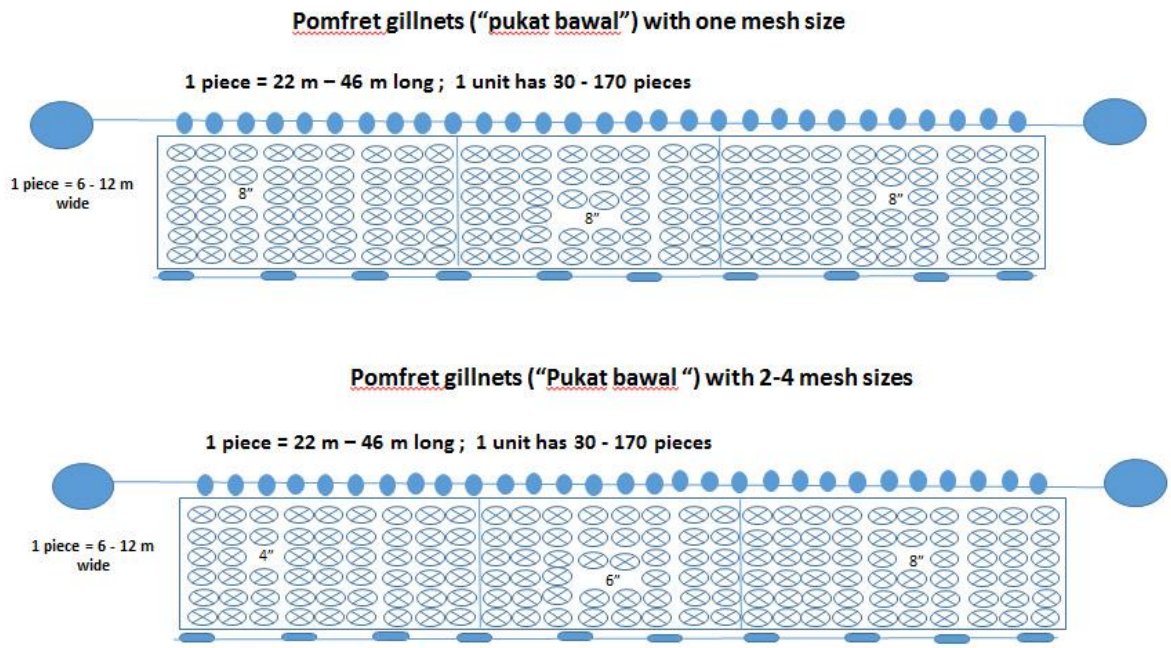


Figure 3 Two types of pomfret gillnet arrangements for Paloh.
Above: pomfret gillnets with one mesh size (in this case, 8" or ~200mm). Below: pomfret gillnets with 2-4 mesh sizes. At times, one mesh size has different widths when it sets together, e.g. 4" (100mm) is 6 m wide, 6" (150mm) is 7 m wide and 8" (200mm) is 8 m wide. Sketch by Februanty Purnomo.

Pomfret gillnets usually have a mesh size of 6-8 inches (150-200mm[3]) and are made from monofilament nylon. Although a fleet of pomfret gillnets usually has one mesh size

[3] All mesh sizes are given as stretched or full mesh measurements.

(of 4,6,7 or 8 inches; ca 100,150,180, or 200mm), some strings may be made up of mixed mesh sizes, typically 4,6 and 8 inches. . Several net panels ("utas") make up one particular mesh size. Thus, one fleet of pomfret gillnet can be up to several km in length. A fleet of pomfret gillnet with several mesh sizes is usually used to catch several species of fish.

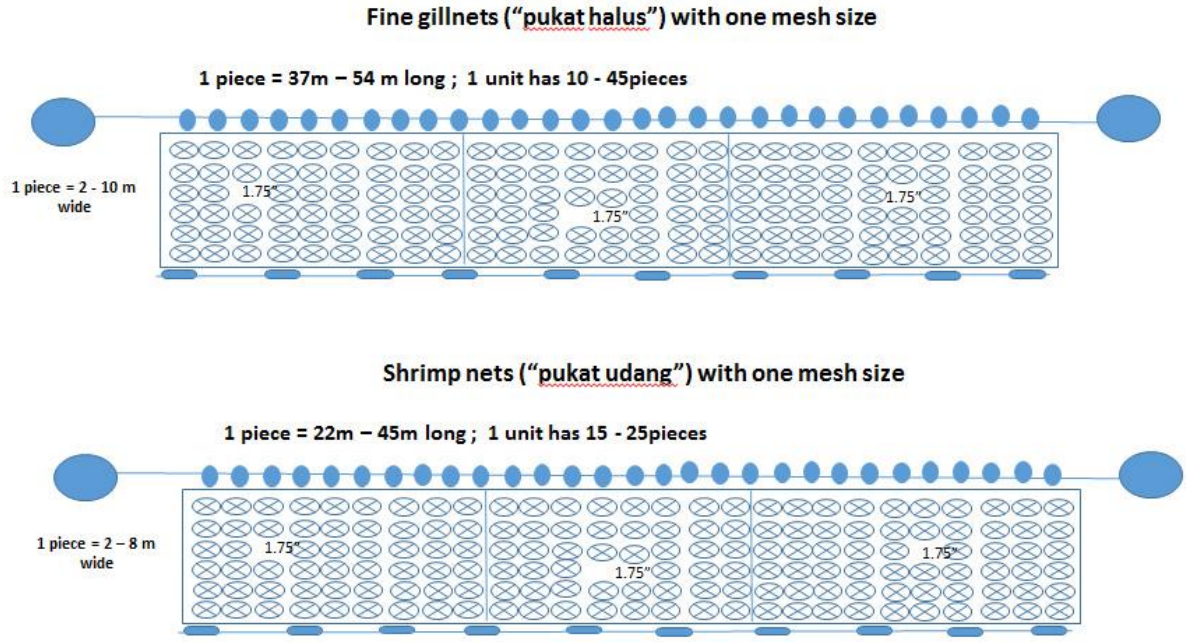


Figure 4 Fine gillnets (above) and shrimp nets (below) with one mesh size. Sketch by Februanty Purnomo

Shrimp/fine gill nets were also made of monofilament nylon twine, but the mesh used is of smaller sizes, ranging from 1.5" to 4" (40-100mm). Shrimp/fine gillnet construction is similar to that of pomfret gillnet. Two types of gillnet arrangements commonly found in Paloh are sketched in Figure 3 and Figure 4.

The boat size for pomfret gillnet (also operating drift gillnets at times) is relative small. Our observations recorded boats as being 5 – 15 m long and 1.5 - 3.5 m wide with 5.5 - 40 HP outboard? engines. Gautama et al. (2013) reported that the gear is set three times per trip per boat with the net depth of 2 – 15 meters (an average of 7.4 meter depth).

Shrimp net boat size is 5-7 m length and 1.5 -1.7 m width (2 GT boat). The fishing operation is one day per trip (morning-night) with maximum gear setting twice a day. The fine gillnet boat size is 5-12 m long and 1-3 m wide, with a 2-5 GT engine. A fishing day operation lasts from 1-4 days with a mode of one fishing day per trip. The gears are set twice per day at the most.

Description of Adonara fishing gear

Several fishing gears used in the East and West Adonara Districts of East Flores are described below.

Purse seine ("pukat cincin")

In 2008, boats operating purse seines were usually of 15-16 meters long and 2-3.5 meters wide with two engines of 16 and 24 HPs (WWF Indonesia 2008). The specification in 2014 is different: the boat length is 12-23 m, the boat width is 2-5 m, and the inboard engine powers are usually 24 and 300 HPs. Purse seines in Adonara use multifilament polyamide (PA). The number of net panels used varies but usually there are 3-4 panels horizontally and 19-27 panels vertically (WWF Indonesia 2008). The fishers used three mesh sizes (from top to bottom): 0.75", 1" and 1.5" (approx. 20, 25 and 40mm). A purse seine boat is manned by 7-9 crew members, operating for 20-24 working days a month. The soak time from setting the nets to hauling them is approximately 1-2 hours. During one fishing day (morning until night), the purse seines were set 3-8 times. A day of work on a purse seine boat may result in at least one ton of Indian Scad (*Decapterus russelli*, "ikan layang"), little tunny/false albacore (*Euthynnus allecteratus*, "ikan tongkol"), or skipjack tuna (*Katsuwonus pelamis*, "ikan cakalang").

Monthly profit is shared in two equal parts: 50% for the boat owner, while the remaining 50% is divided between crew members according to the captain's decision, taking into account the crew's skills, the number of household dependents, and whether he has been hard working or not (WWF Indonesia 2008).

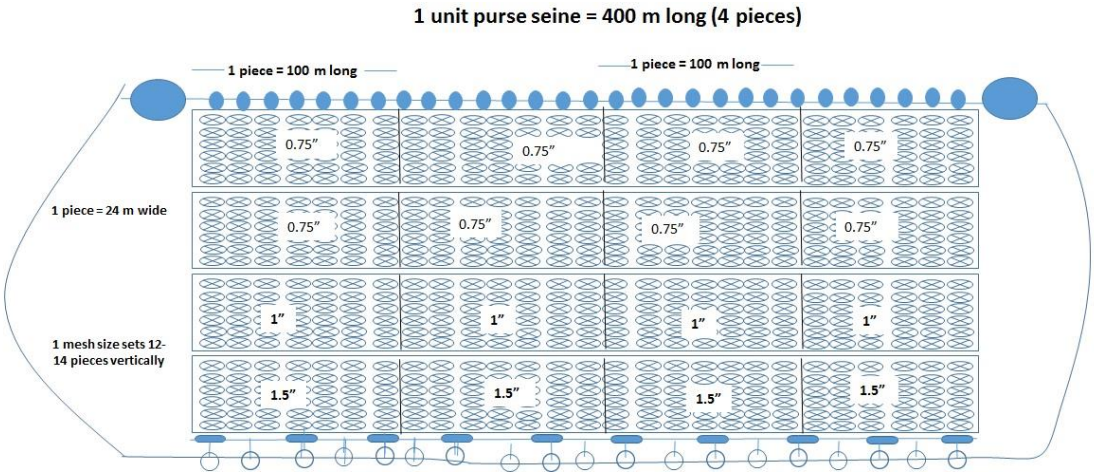


Figure 5 The sketch of a typical purse seine setting for Adonara (sketch by Februanty Purnomo)

Drift net ("pukat hanyut")

Drift nets, made of monofilament nylon with 2.5" (ca 65mm) mesh size, are usually loaded into 24 HP outboard-engine boats. A drift net boat is usually manned by 2-5 fishers. The cost-deducted net profit is divided into two equal parts: 50% for the boat owner, 50% for the captain and his crew.

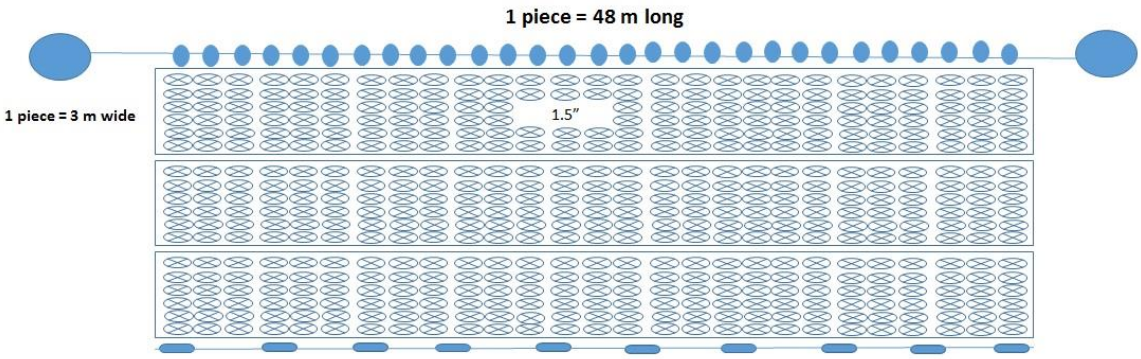


Figure 6 The sketch of a "pukat senar" (monofilament gillnet) functioning as a driftnet in Adonara (sketch by Februanty Purnomo)

Hook and line fishing ("pancing")

Several terms are applicable to the way these fishers use hook and lines: "tonda" (where the fisher tows the line with the boat, usually following dolphins to arrive at a school of fish); "rintas" (where the long line is deployed at a certain depth, see Figure 7); and "pancing" (where the line is held by hand). Each method targets different species. The tonda is the tuna and albacore-specialist. Rintas is the eel-specialist. Pancing catches mostly red snappers, catfish, and scads. According to WWF Indonesia (2008), the fishers use plastic/artificial baits and live baits, particularly goldstripe sardinella (*Sardinella gibbosa*, "ikan tembang") and smaller Indian scads (*Decapterus russelli*). The fishers use the 700 or the 800 tackle size with hook sizes 7, 10, or 12. Every fisher brings his own cooler and ice bags to keep the fish fresh.

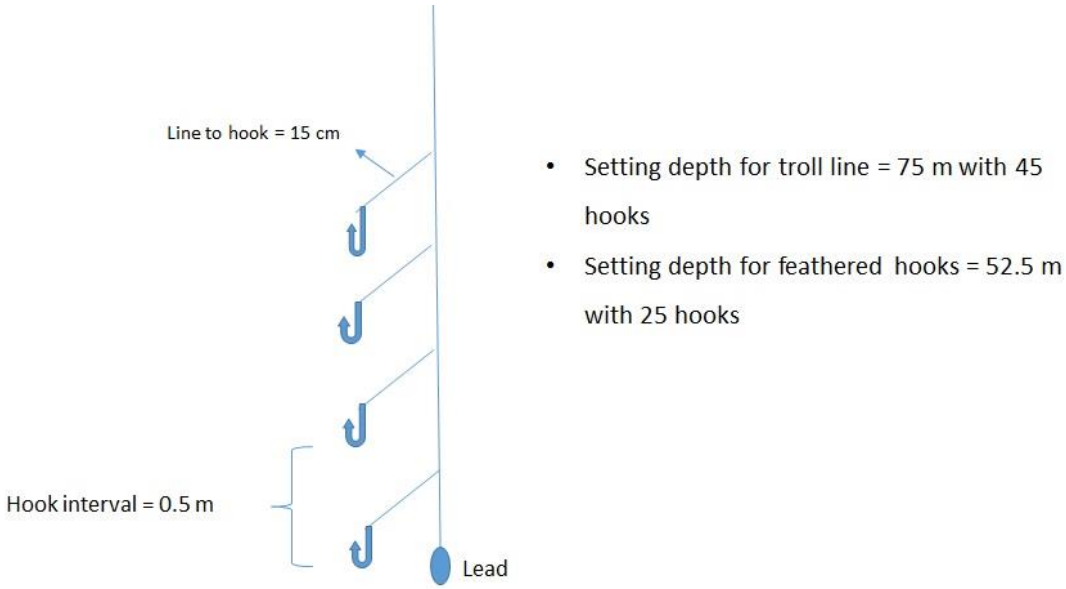


Figure 7 The sketch of a "rintas" long line setting in Adonara (sketch by Februanty Purnomo)

3.2 Interviews with fishermen

Interview results from the two locations are presented below.

Demography and economic dependence

In total, we interviewed 50 fishers from Paloh and 57 fishers from Adonara. Table 1 describes the demography of Paloh and Adonara fishers. On average, the respondents were about 40 years old when they were interviewed this year. The Adonara fishers had been fishing significantly longer than the Paloh fishers. Most of the fishers had a low formal education level, although comparatively speaking, more Adonara fishers had finished high school compared to Paloh fishers (Pearson Chi Square p=.018). The Adonara fishers had significantly more family members depending on them compared to Paloh. More fishers in Paloh had other income source compared to Adonara fishers.

Fishing operation

The majority of fishers in both locations owned their own boats and/or gears (77.6% of Paloh and 68.5% for Adonara, with no significant difference between the two sites Pearson Chi Square p =.303)). All Paloh fishers had the freedom to choose where to fish, as opposed to only 58.2% Adonara fishers who had such freedom. The discrepancy is because most Paloh fishers we interviewed have their own boats and thus have the freedom to choose their fishing ground of the day. Paloh fishers who operate other people's boats also have their freedom to choose the fishing ground because the boat owners in Paloh gave them the freedom to do so. On the contrary, Adonara fishers we interviewed were either boat owner, boat captains who are also owners, boat captains who operate other people's boats, or boat crew. Boat captains who do not own their boats can still freely decide the fishing ground location, as long as the boat owners are kept informed. However, as it transpired, many of our interviewed fishers were boat crew members who would need to consult either the captains or boat owners on the subject. This result also suggests that the two sites have no particular taboo fishing restrictions, perceived 'ownership' of fishing grounds by another party or potential gear conflict with other types of boats.

Table 1 The demography of interviewed fishers in Paloh and Adonara (p values refer to the difference between the two sites)

No	Variables	Paloh		Adonara		P-value
	Independent t-test	**mean**	**valid n**	**mean**	**valid n**	
1	Age of fishers (yo)	42.27	49	42.63	57	0.837
2	How many years have been fishing***	15.76	45	22.25	57	0.002
3	Household dependents***	4.88	50	6.09	57	0.005
		Paloh		**Adonara**		
	Pearson Chi Square	**n**	**% (column)**	**n**	**% (column)**	**p-value**
4	The presence of other income***					
	Yes	27	55.10%	12	24.00%	0.002
	No	22	44.90%	38	76.00%	
		49		50		
5	Education level**					0.018
	Elementary School (year 1-6)	32	64.00%	34	59.65%	
	Secondary School (year 7-9)	10	20.00%	11	19.30%	
	High School (year 10-12)	3	6.00%	12	21.05%	
	Did not finish Elementary School	5	10.00%	0	0.00%	
		50		57		
6	Was the father also a fisher?***					0.000
	Yes	23	46.00%	45	78.95%	
	No	27	54.00%	12	21.05%	
		50		57		

**significant at 5% level
***significant at 1% level
Shadowed areas show columns with significant difference according to Pearson Chi Square

Cost per trip of Paloh fishers were higher than Adonara fishers (IDR 554,800 vs IDR 377,000, or USD 55 vs USD 37) but not at a significant level (independent t-test p=.314). The boats in Paloh have larger petrol capacity than the boats in Adonara (median Paloh 20 liters vs median Adonara 5 liters, median test p=.037, also see (Figure 8). Although generally speaking, the trip length in Paloh is one day, some fishers are fishing for several days days per trip. In contrast, Adonara fishers are mostly daily fishers (Figure 9).

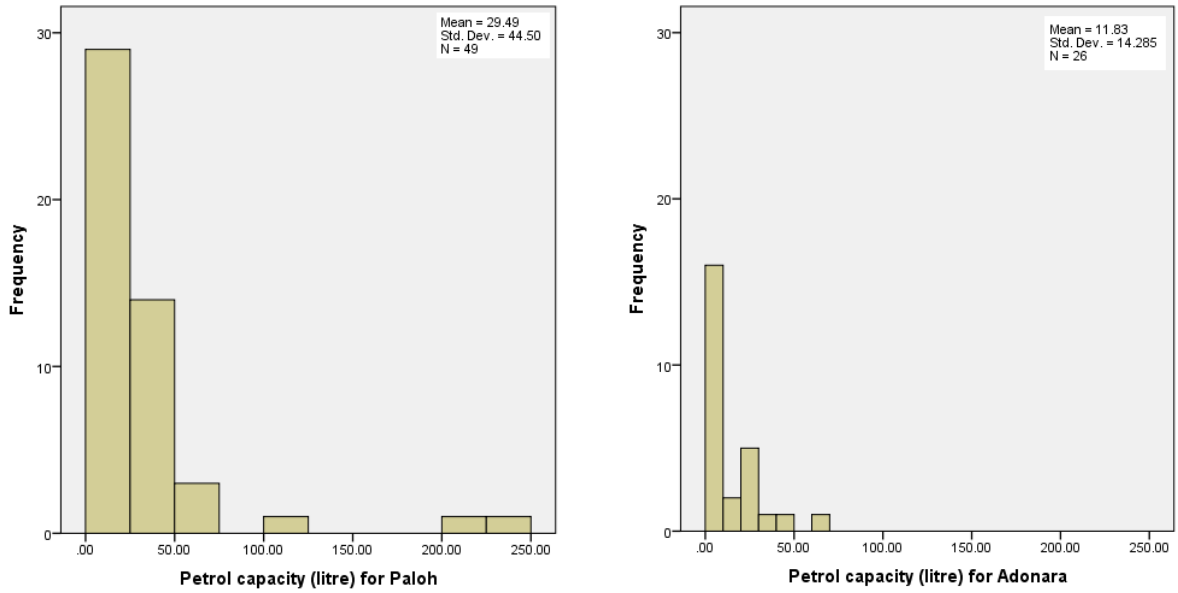


Figure 8 Petrol capacity (litre) in Paloh and Adonara

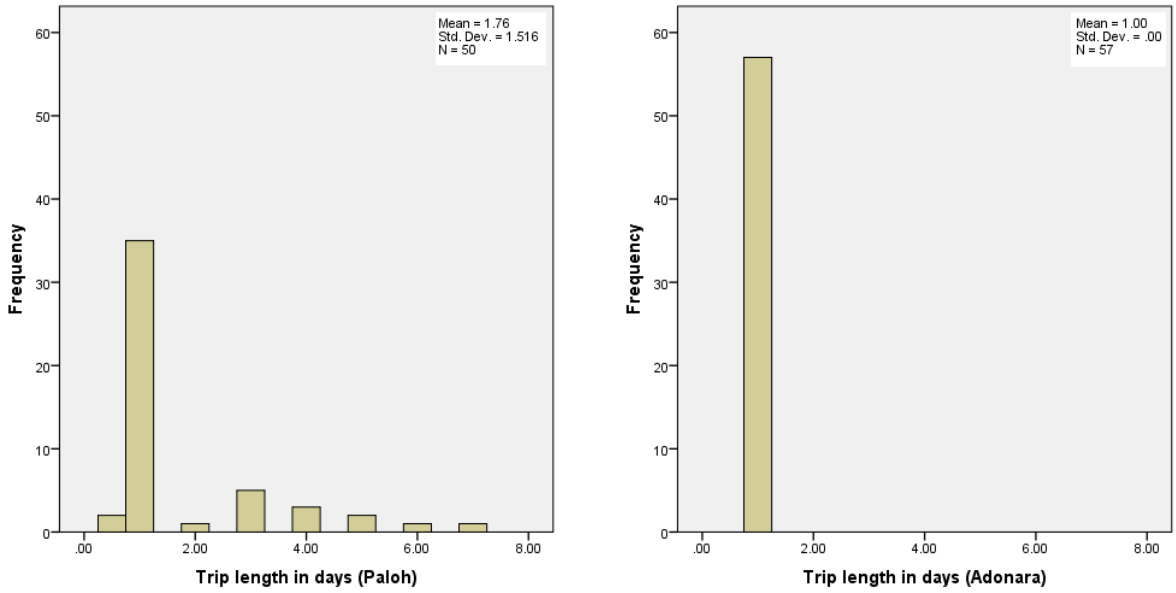


Figure 9 The number of days per fishing trips in Paloh and Adonara

On average, Paloh and Adonara fishers owned only one type of gears (**Table 2**). Paloh fishers owned significantly more fishing gear units than Adonara fishers. The most common fishing gears used by Paloh fishers are pomfret gillnet (42%), followed by fine/shrimp net (28%, **Table 2**). **Table 2** also shows the most common fishing gears in Adonara (70.2% purse seine and 17.6% gillnets). In terms of soak time per gear, data from both sites show that gillnet soak time varies more than purse seine soak time (Figure 10).

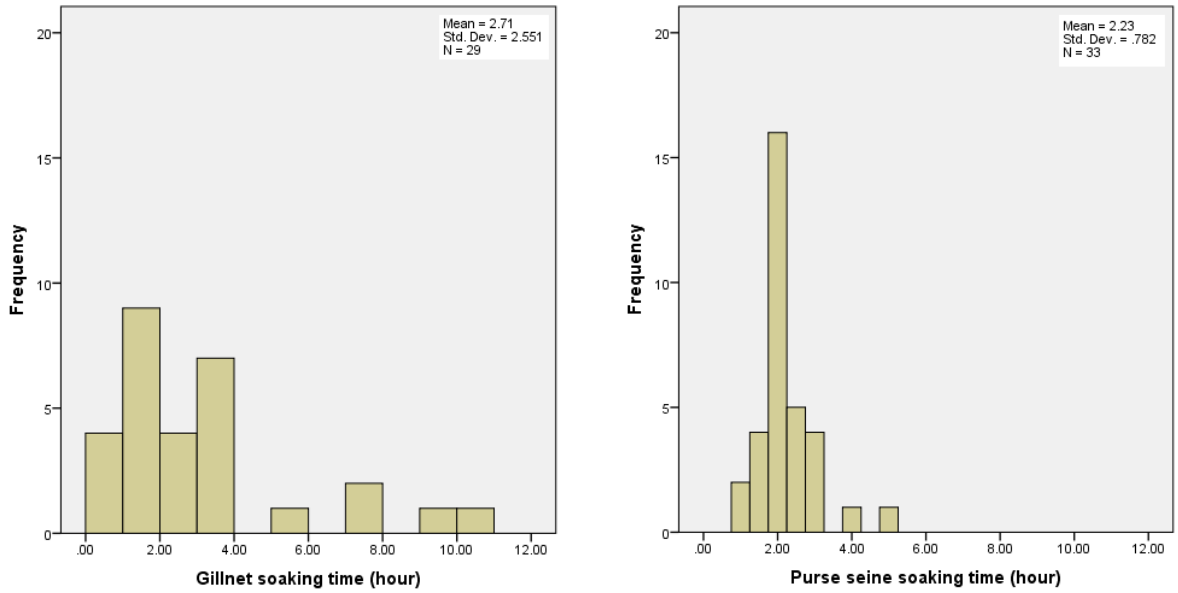


Figure 10 Soak time (hours) for gillnets and purse seines

Table 2 Fishing gear types in Paloh and Adonara

	Variable	Paloh		Adonara		Pearson Chi Square
		n	%	n	%	p-value
1	**Number of type of fishing gears owned**					0.393
	only 1 type	43	86.00%	52	91.23%	
	more than 1 type	7	14.00%	5	8.77%	
	Total	50		57		
2	**Fishing gears owned*** **					0.000
	fish pot/trap (bubu)	3	6.00%	0	0.00%	
	hand line (pancing)	2	4.00%	0	0.00%	
	troll line (pancing tonda)	0	0.00%	1	1.75%	
	pomfret gillnet (pukat bawal)	21	42.00%	0	0.00%	
	pomfret gillnet & hand line	1	2.00%	1	1.75%	
	pomfret gillnet & fine gillnet	4	8.00%	0	0.00%	
	purse seine	0	0.00%	40	70.18%	
	gillnet (pukat senar)	0	0.00%	10	17.54%	
	gillnet & hand line	2	4.00%	1	1.75%	
	fine/shrimp net (pukat halus/udang)	14	28.00%	0	0.00%	
	drift gillnet (pukat tangsi)	1	2.00%	2	3.51%	
	trammel net	2	4.00%	2	3.51%	
	total	50		57		

***significant at 1% level
Shadowed areas show columns with significant difference according to Pearson Chi Square

a) Pomfret fish, one of the fishing targets in Paloh

b) The Paloh boats at Sebubus port

c) Dried fish catch of the day in Paloh

d) Paloh gillnet

e) Fisher interview in Paloh

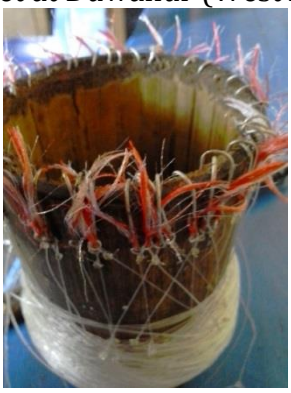
f) Fish traps in Temajuk

Figure 11 The fisheries life in Paloh

Houses at Adonara

Fishing net at Duwanur (West Adonara)

Interview at Adonara



Fishing bait for hand line and troll line

Figure 12 The fisheries life in Adonara

Small cetacean bycatch

Almost all fishers in Adonara reported seeing dolphins around their nets often (95.7% of n=46). No such information was available for Paloh. Reportedly, Paloh fishers have caught significantly fewer dolphins than Adonara fishers; 2.6 vs 1.2 dolphins per fisher over the course of their lives as fishers (independent t-test p=0.013, also see Figure **13**).

Figure 13 depicts small cetacean bycatch events as reported by fishers during the interviews. The number of dolphins accidentally caught per fisher in Paloh is much less varied compared to that in Adonara. The number of cetacean bycatch events per person per year, assuming a career of 15.76 years in Paloh and 22.25 years in Adonara, was reportedly 0.074 in Paloh and 0.113 in Adonara.

Most dolphins were dead when found in the net (80% for Paloh, 61.7% for Adonara) with no significant difference between the two sites (Pearson Chi Square p=.483). Gillnets were responsible for all 10 bycatch events reported in Paloh, catching mostly finless porpoises (*Neophocaena phocaenoides*, IUCN Red List ver 3.1 Vulnerable, Table 3). Purse seines were responsible for more than 75% of bycatch events in Adonara,

catching mainly spinner dolphins (*Stenella longirostris*, IUCN Red List ver 3.1 Data Deficient,
Table 4).

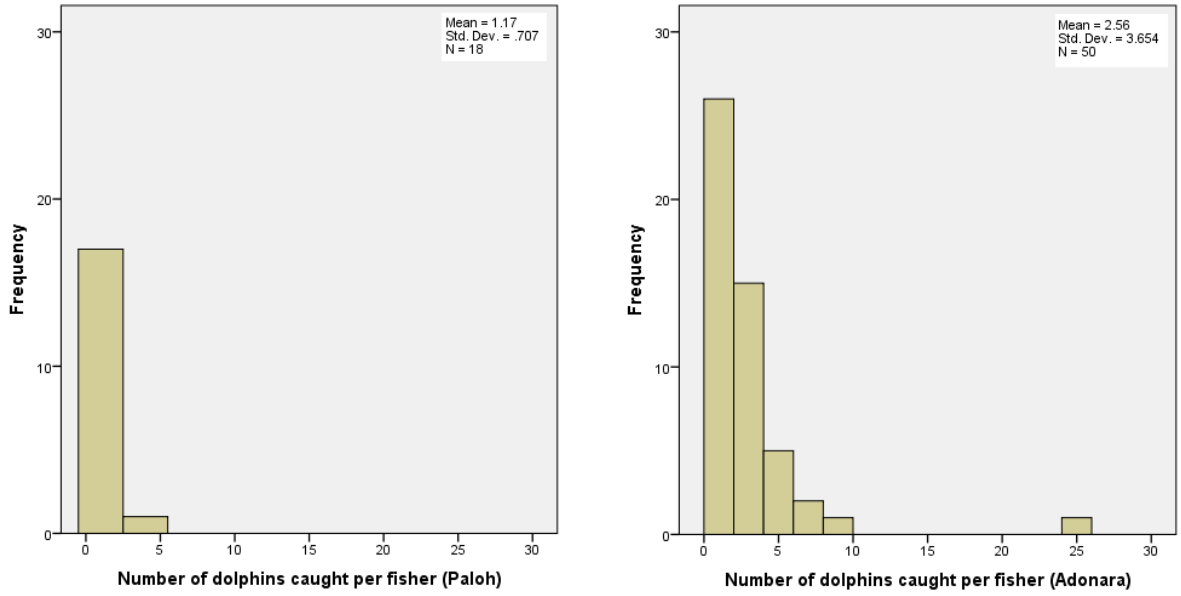


Figure 13 Number of dolphins caught per fisher in Paloh and Adonara

Table 3 Bycatch events per fishing gears in Paloh

Species/taxa	**gillnet**	**long line**	**purse seine**	**gillnet & long line**
dolphins	1	0	0	0
finless porpoise (*Neophocaena phocaenoides*)	11	0	0	0
Indo Pacific humpback dolphin (*Sousa chinensis*)	1	0	0	0
Bottlenose dolphins (*Tursiops sp.*)	0	0	0	0
Spinner dolphins (*Stenella longirostris*)	0	0	0	0
Irrawaddy dolphins (*Orcaella brevirostris*)	1	0	0	0
Bottlenose and spinners	0	0	0	0
Sea turtles and sharks	0	0	0	0
Cetacean and non-cetacean	4	0	0	0
Total	**18**	**0**	**0**	**0**

Table 4 Bycatch events per fishing gears in Adonara

Species/taxa	gillnet	long line	purse seine	gillnet & long line
dolphins	2	0	4	1
finless porpoise (*Neophocaena phocaenoides*)	0	0	0	0
Indo Pacific humpback dolphin (*Sousa chinensis*)	0	0	0	0
Bottlenose dolphins (*Tursiops sp.*)	1	0	0	0
Spinner dolphins (*Stenella longirostris*)	1	0	21	0
Irrawaddy dolphins (*Orcaella brevirostris*)	0	0	0	0
Bottlenose and spinners	2	0	6	0
Sea turtles and sharks	0	0	0	0
Cetacean and non-cetacean	3	1	3	0
Total	**9**	**1**	**34**	**1**

Figure 14 depicts the last time the fishers report having accidentally caught dolphins. Combined, most reports clump around year 2013 (34 events for combined sites). This suggests either that bycatches may be more frequent in actuality than is indicated in Figure 13 or that bycatch rates have been increasing. The most likely explanation is that people forget bycatch events and are most likely to remember only the most recent ones and therefore underestimate the true total number animals encountered in their nets over the years. WWF Indonesia confirmed five bycatch events of finless porpoises *Neophocaena sp*. in Paloh in 2013, which was approximately the same number of cases we found from our interviews (6). No comparative data on bycatch from Adonara was available, but the number of reported 'most recent' bycatch events from the interviews in Adonara (28 in 2013 and 13 in early 2014 among 52 respondents) suggests that bycatch rates per person per year are much higher than the 0.113 (or one animal every 8.8 years) reported.

When asked what they did with the accidentally caught dolphins, 28.6% of Paloh fishers said that they gave the dolphins to someone else (n=7) compared to only 1.8% Adonara fishers who said they did so (n=55). About 71% of the Paloh fishers released the dolphins dead (n=7) or alive compared to only 23.6% of the Adonara fishers who said they did so (n=55).

Table 5 describes the anatomical primary points of entanglement of small cetaceans in fishing gears. Many fishers reported more than one bycatch incident in their careers, with more than one fishing gear. For such information, we cannot ascertain which body part was attributed to what fishing gear, and whether that entanglement caused death

to the animals. However, from the first two rows, entanglement by the rostrum mostly involved purse seine operations, whereas entanglement by the fluke mostly involved gillnet operations. Three dolphins were also found inside the purse seine (not entangled) alive.

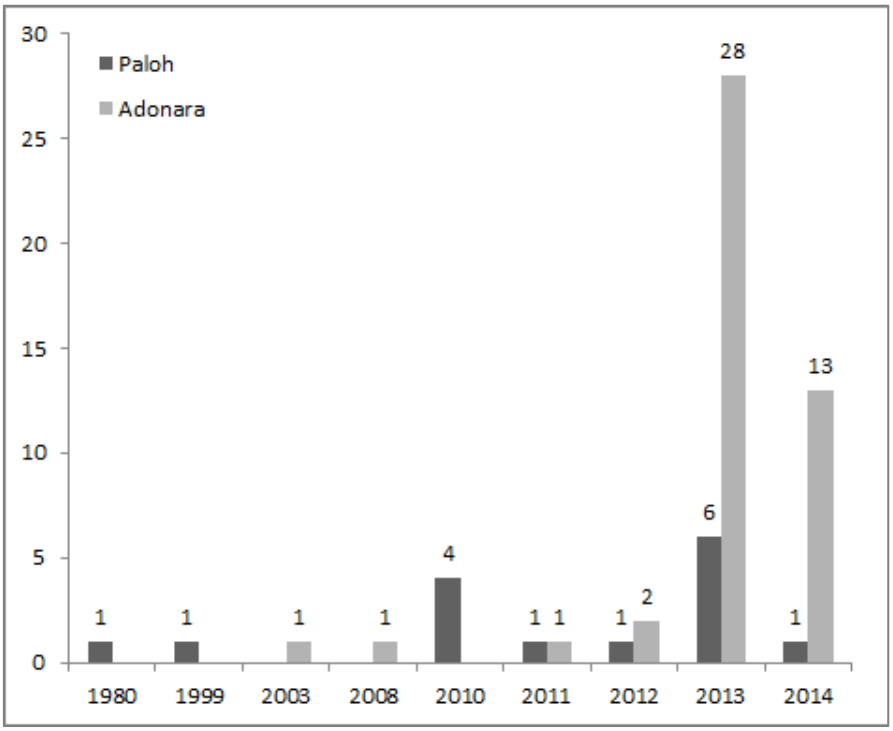


Figure 14 The last time the fishers accidentally caught dolphins

Table 5 Point of entanglement of small cetaceans in fishing gears in Paloh and Adonara

Primary point of entanglement	Dead or alive	gillnet	longline	purse seine	gillnet & longline
Fluke	Dead	5	0	0	0
	Alive	2	0	0	0
	Some dead, some alive	0	0	0	0
Rostrum	Dead	0	0	3	0
	Alive	1	1	3	0
	Some dead, some alive	0	0	0	0
Two or more or all body parts	Dead	4	0	18	1
	Alive	1	0	5	0
	Some dead, some alive	1	0	2	0
Not entangled (but found inside the net)	Dead	0	0	0	0
	Alive	1	0	3	0
	Some dead, some alive	0	0	0	0

When asked about possible bycatch solutions, fishers made the following suggestions:

- Scaring dolphins away before setting their gears by:
  - Throwing stones at the dolphins;
  - Making loud noises with cutlery and other gears on board;
- Government involvement on the issue;
- Cutting the entangled gear entangled animals;
- Using lights the way sea turtle bycatch is being mitigated at the moment;
- Using more sophisticated tools to scare the dolphins away or to avoid bycatch and
- More enforcement for bycatch events.

Other problems and suggestions from fishers

Fishers from other regions in Indonesia also operate at Paloh and Adonara. About the same percentage of fishers from both sites admitted that the presence of outside fishers was a problem. When asked whether outside fishers operated in their fishing grounds, 62% of Paloh fishers (n=50) confirmed this happened occasionally, and a further 22%

of the fishers admitted some problems with outside fishers. Although only 30% Adonara fishers (n=55) stated that they had non-native fishers operating in their fishing grounds, a further 26.3% of them stated some problems with outside fishers. The general problems with outside fishers are, among others, their larger fleets and more sophisticated fishing gears (including better lighting at night time). The outside fishers also shoot their trawls within the vicinity of artisanal boats.

3.3 Discussions

Paloh and Adonara fishers are seasoned fishers who had been fishing for at least 15 years on average. Generally speaking however, the respondents were still relatively young, about 40 years old, with low formal educational qualifications. The fact that Adonara fishers have significantly more family members depending on them with less alternative income source compared to Paloh means that implementing mitigation measures may be more difficult if any restraint in fishing success is required.

The fishers in Paloh often accidentally caught finless porpoises (*Neophocaena phocaenoides*), Indo-Pacific humpback dolphins (*Sousa chinensis*, sea turtles and sharks. The fishers in Adonara often accidentally caught spinner dolphins (*Stenella longirostris*), bottlenose dolphins (*Tursiops sp*, sea turtles and sharks. Paloh seems to have more sea turtle and shark bycatch compared to cetacean bycatch, which was corroborated by WWF Indonesia. During a two-month WWF survey in Paloh in 2013, the proportion of sea turtle and shark bycatch compared to the overall bycatch record in Paloh were 44.4% and 37%, respectively (Ernawati 2013). Adonara fishers seemed to have more cetacean bycatch than non-cetacean bycatch. However, we must also consider that the non-cetacean bycatch in Adonara was under-reported; possibly because our enumerators did not explicitly ask for numbers of other non-target species on this site.

Gillnets and purse seines are the two gears responsible for incidental entanglement in Paloh and Adonara, respectively. Most dolphins were dead when found in the nets. Most of the 'most recent' cetacean bycatch incidents were reported to have occurred since 2012 (i.e. 48 events reported in 2013/14 for both sites 41 (for Adonara alone). This suggests that if the year of bycatch is remembered correctly and is the most recent event, a fisher in Adonara may take an animal on average every 2.26 years (0.44 animals per year) while a fisher in Paloh only every 10.13 years (0.099 animals per year).

All cetacean bycatch events in Paloh were caused by gillnets, which confirms the general observations of artisanal bycatch (Read et al. 2006; Moore et al. 2010; Reeves et al. 2013). The fact that 75% of bycatch events in Adonara were purse seine-related adds to the limited understanding of purse seine-induced cetacean bycatch. At least in Asia, Sabah (Malaysia) has been documented to operate purse seines that accidentally caught marine mammals, specifically the cetaceans (Moore et al. 2010; Lewison et al. 2011). More research is needed to understand the extent of bycatch events caused by this type of gear which has received relatively little attention in this respect.

The general responses we received from our respondents were favourable. They did not perceive our research as intrusive, probably because we put emphasize on finding ways

to mitigate cetacean bycatch issues in their area. The fishers stated that, if applicable, better methods for cetacean bycatch mitigation would be appreciated. The fishers also indicated problems with outside fishers; particularly due to their larger fleets and more sophisticated fishing gears (including better lighting at night time), as well as because the outside fishers shoot their trawls within the vicinity of artisanal boats. The fishers who expressed these concerns were mostly from Paloh. This information indicates a possible trans-boundary fisheries management issue, although the "outside" fishers might also came from other parts of Indonesia.

Our sample size is too small to understand the larger context of artisanal cetacean bycatch in Indonesia which had over 398,700 long-line units (vessels), over 280,600 gillnet units and over 73,400 seine units in 2011 (Ministry of Marine Affairs and Fisheries 2011). However, this study adds to the two independent artisanal cetacean bycatch studies in Indonesia (Danielle Kreb and Tara S. Whitty had independently conducted their artisanal cetacean bycatch studies in East Kalimantan prior to this study). This study responds to the IWC Resolution 1997-4 (Cetacean Bycatch Reporting and Bycatch Reduction), Resolution 1997-8 (Small Cetaceans) and the 2012 update of Resolution 1990 (on the population biology and exploitation of the porpoises, *Phocoenidae*) which recommend the assessment of porpoise bycatch levels.

The trans-boundary fisheries issues between Paloh and Sarawak (Malaysia) opens a possible regional bycatch research between Indonesia and Malaysia. Linked to the ongoing Coral Triangle Initiative, this research fits well into the Regional Plan of Action for Threatened Species (specifically marine mammals), particularly on the "incidental catch or by-catch and mitigation mechanisms" of marine mammals (CTI-CFF 2009, p. 24).

Recommended research directions include cetacean artisanal bycatch research in more villages in Paloh and Sarawak for trans-boundary research. In-country research in other villages in Indonesia is also recommended. Sumba (an island within a one day ferry trip southwestward from Adonara) is a potential candidate, as we received anecdotal information on cetacean bycatch on that island during this study. The examination on the extent of cetacean bycatch on large-scale/commercial fleets should be considered, particularly for vessels operating around West Kalimantan and East Nusa Tenggara.

Quantifying cetacean bycatch on its own of course, makes little sense unless there is also some estimate of abundance of the animals being taken, or at least density in the area where the bycatch is studied. Further work is needed to quantify the abundance and distribution of the species impacted by bycatch as reported in this study.

4. Result: Analysis of stranding specimens and observation of bycatch events

4.1 Analyses of stranding specimens

Below are the photographs of a "Pesut Mahakam" (Irrawaddy dolphin, *Orcaella brevirostris*) stranded at Muara Muntai on 10 October 2012. The photographs show indentations on the peduncle and across the girth. RASI Foundation records the occurrence of bycatch and stranding events in East Kalimantan. Gillnets are the suspect for most bycatch events.

Although no measurements of the twine diameter or the circumferential extent of the lesions were made, it is clear that a relatively thick twine or twines were involved and possibly a fairly large mesh size – as evidenced by the fact that the circumscribing lesions on this animal are located around the pectoral fins and not just around the rostrum.

Figure 15 The "Pesut Mahakam" (Irrawaddy dolphin, *Orcaella brevirostris*) stranded at Muara Muntai on 10 October 2012 (photos by I.Y. Noor).
From upper left clockwise: the indentations on the peduncle, the indentation across the girth, and the whole specimen. Courtesy of Danielle Kreb, RASI Foundation.

4.2 Observation of bycatch events

The followings are two cetacean bycatch observations made during the course of the study.

First bycatch: Paloh, 17 February 2014, *Sousa chinensis*

Putu Liza Mustika and Februanty Purnomo received the news on a dolphin bycatch during the reconnaissance trip to Paloh on 17 February 2014. Along with WWF Indonesia staff Dwi Suprapti, DVM, we visited the bycatch site in Guntung, about 20 min drive south from the WWF Paloh basecamp. Upon arrival, the team found out that the dolphin had been cleanly dissected by the locals for personal consumption, leaving only about 30x30x30 chunk of meat in whitish skin on the ground. One of the fishers produced his Blackberry and showed us the picture of the dolphin. As suspected from the white skin, it was a *Sousa chinensis* (Indo Pacific humpback dolphin).

We asked permission to collect samples, it was granted. We collected a piece of blubber for toxicology, a piece of skin for genetic analyses and a piece of meat for good measure. Then we walked to the beach to check the boat and gillnet specs. We found that approximately 4 sq. m of the 2.5" gillnet was gone as the result of the entanglement. The fisher, 40 years old Miraldi, said it was the first time he caught this species, although he often saw it milling around the shallow waters of his village. From the dolphin's position on the boat, we concluded that the *Sousa* was about 2.5 m long. We also found an almost complete set of the *Sousa's* internal organs abandoned, floating on the surface of an adjacent small river.

Upon fishing the organs out of the water, we realised it lacked the heart and liver. It had the lungs, stomachs and intestines though (and later we found out: also the kidneys and spleen). We also found another item: the floating fetus, still wrapped in its amniotic sac.
We started the necropsy at around 8pm last night. We started with the gross examination of the lungs, including measurement. We then proceeded to the trachea and the three stomachs. We skipped the intestines because it was already green and it surely would smell bloody awful. We found fish thorns in the pyloric and fore stomachs; that dolphin had been eating before it was by-caught, but not sure the time interval between her finished eating and being caught. I'd say she had finished digesting the meal before being caught. We also found froth/foam inside the airway and lungs. However, because we found the internal organs already floating on the river, we're not certain that the froth was post-mortem or ante-mortem. Before and after the necropsy, we consulted with our colleague Nimal Fernando, DVM of Ocean Park Hong Kong on the necropsy process and its interpretation.

After finishing with the kidneys (which looked healthy with pronounced granules), we proceed to the fetus. We felt the fetus before Suprapti cut the amniotic sac; the fetus seemed to have developed into a complete individual. After Suprapti cut the amniotic sac, we found that the fetus was indeed ready to be born in a few days. Everything was complete, externally. The total length from snout to fluke is 75 cm, about ¾ of the usual newborn length of a *Sousa chinensis* (approx. 1m). The teeth have not developed yet. It was a male.

We secured the baby inside a freezer specifically purchased to store this specimen in the WWF office in Pontianak (the capital city of West Kalimantan). From the mother, we have secured the blubber, skin sample, and also samples of lungs, kidneys, spleen, trachea, and stomach. The samples are now stored in Bali, Indonesia.

Figure 16 *Sousa chinensis* necropsy.
From top left, clockwise: the boat and gillnet involved in the entanglement; the internal organs of the *Sousa chinensis*; the fish thorns and otoliths inside the fore stomach; and the unborn baby found inside the amniotic sac

Second bycatch: Paloh, Saturday 19 April 2014, *Sousa chinensis*

This observation was made by Fahrul Armalinsyah, a WWF Indonesia observer overboard Pendi's boat that night. Fahrul was on a sea turtle conservation mission; collecting data on the use of LED light on gillnets to reduce the sea turtle bycatch in Paloh. The report was translated and slightly adopted from the WWF Indonesia report.
On 19 April 2014 almost midnight, a *Sousa chinensis* (Indo Pacific humpback dolphin) was accidentally caught by in a fisher's gillnet. When Mr Pendi (the fisher) hauled the animal, it was already dead but still fresh, entangled in the net. It is suspected that the dolphin died because it was entangled for too long in the gillnet. In recollection, Pendi admitted that he heard the noise of a dolphin swimming around the boat when he was setting the gillnet at around 17:09 local time. When he hauled the gillnet at 23:25, he found the dolphin, 185 cm length and approximately 80 kg weight. The WWF report stated that the animal was possibly a female, but upon examining the photograph, we

consider it to be a male. The accidental catch happened at the Blacan River in Paloh (GPS N 01.97734º dan E 109.35161º).

Pendi considered the *Sousa chinensis* entanglement as a rare event; it was the first time he caught the *Sousa* during his tens of year career as a fisher. When he did catch a dolphin, he caught the "dark blue" ones instead (suspected finless porpoise). Pendi planned to bring the dolphin home. But the day after (he was staying overnight on his boat), he decided to throw the dolphin overboard because he didn't have enough space to keep it, and also because the dolphin started to decompose. All photos below are by Fahrul Armalinsyah, WWF Indonesia.

Figure 17 Photos of the *Sousa chinensis* entanglement in Paloh, 19 April 2014

5. Result: the marine mammal stranding workshop

The full report of the 1st national Indonesian marine mammal stranding workshop (25-28 November 2013) is available at the Appendix. Through this workshop, the participants understood the importance of a better understanding of bycatch in Indonesia and Asia in general. Although the workshop mainly discussed the management of stranded marine mammals in general, the issue of bycatch has received a good coverage through the bycatch lecture (the introduction to cetacean bycatch and the pathological and forensic aspects of bycatch), the national marine mammal threat discussion (see the section above), and the necropsy demo session (Figure 18). The participants were informed on how to recognise indications of bycatch on a stranding specimen. The Indonesian participants mapped some possible marine mammal bycatch areas and found 16 areas susceptible to bycatch in the country. Some overseas participants also asked about possible intervention techniques for chronic entanglement on marine mammals, particularly large whales. We suggest that future stranding trainings in Indonesia should include bycatch issues in the lectures and discussions. Whenever possible, a practical demo on how to release marine mammals from entanglement should be included in the future, using props and available fishing gears.

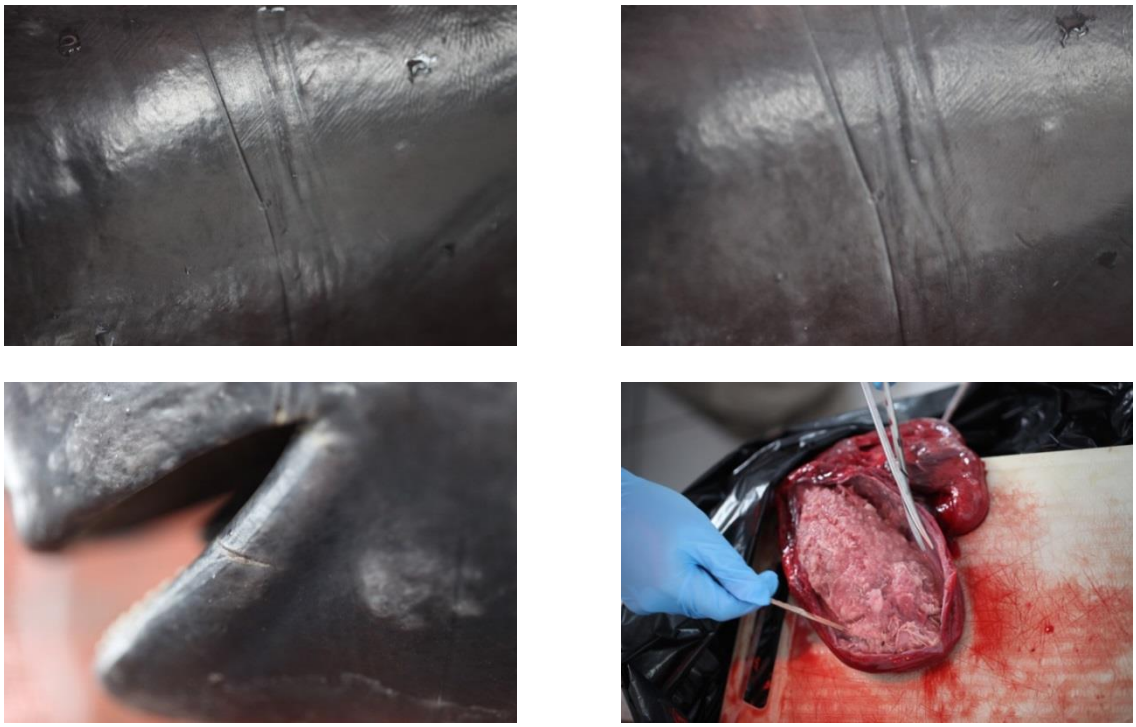


Figure 18 The necropsied finless porpoise (*Neophocaena phocaenoides*) in November 2013 (accidentally captured on 13 October 2013).
From upper left, clockwise: the fishing knot; another fishing knot on the porpoise's skin; the stomach content showing undigested fish; and the injuries on the porpoise's mouth. All photos by Simon Northridge.

6. General conclusions

Paloh and Adonara fishers are seasoned fishers who had been fishing for at least 15 years. The respondents were still relatively young, about 40 years old, with low education. Adonara fishers have significantly more family members depending on them with less alternative income source compared to Paloh.

Finless porpoise (*Neophocaena phocaenoides* – Vulnerable) and the Indo-Pacific humpback dolphin (*Sousa chinensis* – Near Threatened) are often accidentally caught in Paloh (West Kalimantan), whereas spinner dolphin (*Stenella longirostris*) and bottlenose dolphin (*Tursiops sp.*) are often accidentally caught in Adonara. Based on interview results, most recently reported cetacean bycatch incidents occurred within the most recent year to 18 months (48 events for combined sites). All incidental entanglements in Paloh was caused by gillnets. A total of 75% of bycatch in Adonara was caused by purse seines. Most dolphins were dead when found in the net.

The number of dependants and less alternative income in Adonara weigh more factors in bycatch mitigation for this region compared to Paloh. However, the threats from Paloh should not be played down because the main bycatch species at Paloh are listed as either Vulnerable or Near Threatened.

Our sample size is too small so far to understand the larger context of artisanal cetacean bycatch in Indonesia which has over 280,600 gillnet units and over 73,400 seine units in 2011. However, this study has unearthed some important information on the propensity of cetacean artisanal bycatch in two different regions in Indonesia, including the trans-boundary fisheries issues between Paloh and Sarawak (Malaysia). The two cetacean bycatch observations made in Paloh indicate fishers' willingness to cooperate to find solutions. The bycatch lectures and necropsy session during the marine mammal stranding workshop in November 2013 and the photographs from a stranded specimen in East Kalimantan show that stranding data can help to elucidate bycatch in the country, although such data are still insufficient to build a more comprehensive picture. We suggest that future marine mammal stranding training workshops should also include bycatch components, including how to release live specimens from entanglement. Recommended research directions include cetacean artisanal bycatch research within Indonesia and also with other countries such as Malaysia and expansion to bycatch research into the commercial fishing sector.

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APPENDICES

Cetacean by-catch interview questions

Interview date:		Enumerator name:	
Interview location:	Village:	District:	Regency:

Why are we doing this? (please read it to the fisher before interview)

"We understand that there has been increasing reports of by-catch, particularly the dolphins, in your area. We would like to know your opinions about it, whether you'd like to reduce the number of by-catch, and if you do, how do we achieve it? In addition, we also want to know what other problems you have with your fishing industry, and what kind of assistance is needed."

Questions:

I. DEMOGRAPHY

1. Full name:	
Date of birth:	
Origin:	
If not from here, since when residing here:	
2. Latest education:	
3. How long have you been in the industry?	
4. Was your father a fisher?	

II. ECONOMIC DEPENDENCE

5. How many people in your household you have to support?	
6. Do you have any other occupation? (you yourself, other than being a fisher)	
7. In your family, are there any other people working to support the income? If yes, who? If yes, what are they working on?	
8. Do you have your own boat and gears (yes/no)? If YES, do you use it yourself? Or do others use your gears? Continue to #9. If NO, do you use other people's boat? Do you become a crew of another boat? Continue to #10.	
9. Do you still need to pay for your boat/gear? If yes, how much? To whom do you have your debt above?	
10. Can you independently decide when or where you want to fish? Yes or No. If yes, go to #12.	
11. If no, do you need someone else's permission to do that? Boat owner? Trader? Cukong	
12. Can you tell me of any cultural taboo that restricts you going out to fish in general?	

III. FISHING GEAR

13. What's the spec of your boat (length and width), how many HP is your engine, what's your petrol capacity?	
14. What's your operational cost per trip? How many liters needed for one trip?	
15. What gear do you use? (if gillnet, go to 16a; if others, go to 16b)	

a. Gillnet (please sketch the gear)

Info	Type of fishing net		
	Net.....	**Net....**	**Net....**
What's your mesh size? Mention all sizes.			
How many piece per gear? Length per piece (m/piece)? Width per piece? Depth per piece?			
Total length per unit? How many units?			
How long do you fish? (day, hour, or how long is one trip)			
How many settings per trip			
Dipping time (morning/afternoon/evening/night)			
Hauling time (morning/afternoon/evening/night)			
Season/month			
Target species			
Fishing region (see map, or mention beach/cape name)			

b. Other fishing gear, please draw

Info	Other fishing gear			
	1.	**2.**	3.	4.
Gear size				
How long do you fish? (day, hour, or how long is one trip)				
When do you go out to fish? (morning, around noon, afternoon, evening)				
How many settings per trip				
Dipping time (morning/afternoon/evening/night)				
Hauling time (morning/afternoon/evening/night)				
Gear depth per piece?				
Target species				
Fishing region (see map, or mention beach/cape name)				
Season/month				

IV. FISH CATCH

16. About your fish catch since you became a fisher, which target species has increasing catch? Which target species has declining catch? In general, do you have more or less catch rate? Or is it the same?	
17. What's the price of your most expensive catch? (e.g.: white caranx for Paloh) What's the price of your cheapest catch? Give per kg or per unit.	
18. What is your average catch (in kg) for the most expensive and the cheapest targets?	
19. What animals do you find in the river, estuarine, and at sea? (Use *flash card*: crocodile, shark, sperm whale, baleen whale, dolphins, finless porpoise, sea turtle, dugong). Which ones do you see the most? Do you still see many of them, or seldom see them?	
20. For dolphins, where and when do you see them at the river? At sea?	

V. CETACEAN BYCATCH

21. What animals have been caught in your gear, which are actually not your target species? (use *flash card*).	
22. If you have accidentally caught a dolphin before, when and where did you accidentally catch it? Live or dead? How many? **Note: if they never by-caught dolphins, ask them who (as they know it) had by-caught dolphins before, with what gear, when and where. Then continue to Q27.**	
23. For dolphins, with what gear were they usually caught?	
24. How big was the dolphin(s)? (weigh and length)	
25. If the dolphin was caught by gillnet, how was it caught? Did it hit the mesh part of the net and spin? Did it just hit the outer part of the net? Did it rip the net then got entangled? What parts of its body was entangled in the net? (fluke, dorsal fin, pectoral fins, head, snout/mouth, the whole body?) Continue to #27	
26. If caught by long line, which part of the body was caught? (snout, dorsal fin, pectoral fins, body or fluke)	
27. How often are the dolphins caught in your gear? (e.g., once a week? Twice a week? 3-4 times every fortnight?)	
28. Does he see animals around the net often?	
29. Usually, where did you accidentally catch the dolphin?	

30. On what season/month do you accidentally catch the dolphin? In the morning, afternoon or evening?	
31. When was the last time you accidentally caught this animal? What gear did you use? How big was the damage? How much money did you have to spend to fix it? How long to fix it?	
32. What do you think the dolphins were doing when they were caught?	
33. If you accidentally catch a dolphin, what do you do with it?	
34. Do you have a problem with sharks, dolphins, turtles etc interacting with you while fishing? E.g., do they often 'steal' your fish?	
35. Would you like to solve this dolphin bycatch issue? If yes, do you have any suggestions to reduce/solve this dolphin bycatch issue?	

VI. OTHER ISSUES

36. Do you have any issues with your livelihood as a fisher? If yes, what are they?	
37. Do you have any issues with large trawlers, fishers from other regions or overseas fishers? Please elaborate.	

Thank you.

Report of the 1st National Indonesian Marine Mammal Stranding Workshop for the International Whaling Commission

Sanur, Bali, Indonesia, 25-28 November 2013

By Putu Liza Mustika (putuliza@gmail.com, putu.liza@my.jcu.edu.au)
Whale Stranding Indonesia

In consultation with Nimal Fernando (Ocean Park Hong Kong, nimal.fernando@oceanpark.com.hk) and Februanty Purnomo (Whale Stranding Indonesia, gyanti.purnomo@gmail.com)

Summary

The 1st National Indonesian Marine Mammal Stranding Workshop was conducted in Bali from 25 to 28 November 2013 to: 1) increase the capacity of Indonesian and Asian 1st responders in the handling of live stranded marine mammals; 2) increase the understanding of the science behind marine mammal stranding events; 3) provide skills on how to determine the cause of death of marine mammals through necropsy; and 4) strengthen and widen the Indonesian and Asian stranding networks, including capacity building and public awareness strategies.

This workshop was endorsed by the Ministry of Marine Affairs and Fisheries of Indonesia; sponsored by Ocean Park Hong Kong, Ocean Park Conservation Foundation Hong Kong, International Whaling Commission, and WWF Indonesia; coordinated by Dr Putu Liza Mustika from Whale Stranding Indonesia and Dr Nimal Fernando from Ocean Park, Hong Kong; and supported by the Indonesian Biodiversity Research Center, the Indonesian Veterinary Medical Association and the University of St Andrews Scotland. Mr Agus Dermawan as the Director of the Area and Species Conservation of the Ministry of Marine Affairs and Fisheries officially opened the event on the evening of 25 November 2013.

The first day of the workshop covers key identifying features of the species most likely to occur in Indonesian and adjacent waters, stranding networks , the basic biology needed to make initial assessments of stranded cetaceans and onshore and in water training for 1st responders, covering several common live-stranded cetacean scenarios. Main mentors were Dr Lindsay Porter (University of St Andrews) & Mr Grant Abel (Ocean Park Hong Kong).

The following two days had a series of lectures covering topics including cetacean anatomy, triage, acoustic trauma, by-catch, acoustics & acoustic pathology, toxicology and cetacean necropsy procedures. Key speakers included Dr Nimal Fernando (Ocean Park Hong Kong) for triage, medicine, acoustic pathology, bycatch pathology, general pathology and necropsy, Dr Simon Northridge (University of St Andrews) for by-catch issues, Dr Pat Fair (National Oceanic and Atmospheric

Administration - NOAA) for toxicology, Dr Kathy Larson (Ocean Park, Hong Kong) Cetacean Anatomy and Cetacean Disease and Dr Matthias Hoffman-Khunt for acoustics. A wet lab demonstrating general cetacean necropsy procedures and the extraction and preservation of ear bones for the investigation of potential acoustic trauma was conducted on the last day by Dr Nimal Fernando.

The workshop involved 60+ participants from seven countries (30 from Indonesia; the rest were from Malaysia, the Philippines, Myanmar, Cambodia, China, Sri Lanka) and international speakers from Hong Kong, the USA, UK, and Singapore. Evaluation questionnaires were distributed at the end of the workshop. Of the 39 filled in questionnaires, 37 of them gave grading to the workshop. A total of 21 people (56.8%) said it was "good"; 12 people (32.4%) said it was "very good". The workshop was considered successful, leading to the plan to conduct regular biennial national workshops in the future.

General comments on the execution of workshop schedule

The followings are Mustika's commentaries on the execution of workshop schedule based on her direct involvement and participant comments. In essence, participants and organisers agree that the workshop should have been done in four days, instead of three days. Or, since funding was an issue, some lectures might have to be cut to accommodate more discussion time. Ideally for the next round, this workshop should be designed for four full days, instead of three days and an extra opening night. See Appendix 1 for the workshop schedule. See Table 1 for evaluation form and participant comments, respectively.

First responder section

The first day of the workshop was dedicated for first responder workshop and training, both led by Mr Grant Abel (Ocean Park Hong Kong) and Dr Lindsay Porter (University of St. Andrews). We had too many lectures on the half-day session, which resulted in the omission of species identification lecture. In hindsight, future first responder workshop should dedicate less time for some lectures (in this case, the reduced time for 'partnership between government and NGO in marine mammal stranding in HK' and less time for stranding scenario sub-workshop). However, it should be noted that, time permitted, a stranding scenario sub-workshop where participants were divided into several groups to discuss several scenarios is an excellent idea worth repeating. It does beg for a shorter time, although it would mean that not all groups would be able to present their discussion results.

Marine mammal identification session is a very important lecture which should be made priority in the next workshop. This input is also based on two specific comments on this topic from the participants (as written on their evaluation form).

'Triage and First Response' lecture should have been allocated to the First Responder Day (1st day) to enable participants to understand the underlying medical reasons for first responder practices (including things to do and to avoid). One participant specifically wrote this comment on the evaluation form, while two more participants verbally informed Mustika about this matter.

Last but not least, we had too many participants joining the first responder training. We had more than 50 participants on the pool and on the beach, which was too large for the trainers to handle. Thirty is the number recommended for future first responder trainings. If we have more than 30 participants, then two options are available: 1) some participants become passive observers, or 2) some are only involved in parts of the hands-on practice, instead of in all practical sessions.

Despite all the comments above, the majority of participants felt that the first responder section was most beneficial for them (23 of 39, or 59%). This result is likely to be influenced by the fact that most participants were field practitioners instead of veterinarians.

Veterinary section

The veterinary section covered the 2nd and 3rd day of the workshop. Cetacean anatomy was delivered by Dr Kathy Larson – Ocean Park HK; four participants considered the anatomy lecture as one of the most useful for them. As previously has been pointed out, 'Triage and First Response' (by Dr Nimal Fernando) was considered very useful that it should have been delivered in the first day during the First Responder workshop.

The 'Cetacean Rehabilitation Medicine' (Dr Fernando) was considered very useful to some participants (mostly Chinese participants who have access to similar technologies as what Ocean Park Hong Kong has), but not to many participants who have no access to such technologies. It is suggested to reduce the time of this lecture for next workshops in Indonesia due to its little relevance. However, the essence of the lecture should be kept, adjusting to the situation in a developing country. This adjustment can be achieved through, e.g., inventory of health equipment available in Indonesia and other countries involved in the training, and slightly revise the lecture in accordance with available equipment.

'Diseases of Cetacean' (Dr Kathy Larson) placed an important understanding on why personnel safety is very important in stranding management. Some participants, particularly field practitioners, would find this topic too detailed for them, but I think this lecture should be retained for next workshops.

The bycatch session was well-received by the participants, possibly because many of them are involved in fisheries-related conservation programs. The combination of bycatch theories (including how to identify fishing net marks on an animal's skin – delivered by Dr Simon Northridge of the University of St Andrews) and bycatch pathology (delivered by Dr Fernando) was conducted seamlessly to give the audience a better understanding on how to investigate possible bycatch fingerprints in stranding cases. Some participants were asking about chronic entanglement (i.e., cases where animals are found moving around the waters with entangled fishing gears) and how to release the animals from such entanglement. Two participants specifically considered bycatch and bycatch pathology as one of the most useful topics for him/her in the evaluation forms.

Dr Patricia Fair delivered two toxicology lectures: 'Introduction to Toxicology' on Day Two and 'Marine Mammals and Toxicology' on Day Three. Although toxicology is an important topic for stranding management, in hindsight the first lecture could have been reduced to 45 minutes instead of an hour to allow participants more time to absorb the theories. The second lecture was considered more practical

for field practitioner. However, it should still be kept under an hour to avoid fatigue. A participant specifically mentioned the need of another toxicology training for him/her.

Acoustic was an interesting topic for many participants, particularly those coming from countries or regions where seismic activities are often conducted (such as Indonesia and the Philippines). Dr Matthias Hoffman-Khunt (University of National Singapore) explained the theories behind underwater acoustic and why excessive noise could be lethal to cetaceans. Dr Fernando then delivered the acoustic pathology lecture that explained the veterinary aspects of acoustic trauma. The two combined lectures were also considered well-executed. A participant specifically considered acoustic pathology as most useful for him/her in the evaluation form.

The wet laboratory work for cytology (Mr Chan San Yuen, Ocean Park) was an interesting break from the lecture. For future workshops, this session could be allocated for the end of Day Two (first day of vet) to reduce fatigue and provide participants some relief from lectures.

The necropsy location was at the Turtle Conservation and Education Center in Serangan Island, about 20 minutes' ride from the venue (Sanur Beach Hotel). Most participants had never witnessed a necropsy before, hence it generated a lot of interest. A turtle pond was dried to accommodate a depressed stage for the vet team (led by Dr Fernando) to conduct the necropsy (see Appendix 2 for photographs). Only veterinarians, lecturers and participants who were willing to join the hands-on demo were allowed inside the pool. Other participants would either stand on the edge of the pool, looking down to the necropsy table, or watch the necropsy process from two live-feed TVs. Necropsy target was a finless porpoise (*Neophocaena phocaenoides*) with total length of 135.5 cm, by-caught by a fisher in Paloh, West Kalimantan. Prior to the dissection, Dr Northridge gave some technical comments on fishing net marks and other external features of bycatch on of the finless porpoise skin. Necropsy was started and led by Dr Fernando who also gave direct commentaries. Jaya Ratha from Conservation International translated the necropsy process for Indonesian speakers. Although we know that the circumstances of death was bycatch, the necropsy process could not find the technical cause of death, primarily due to the fact that storage time had reduced the carcass condition (still Code 2, edging to Code 3 when frozen). However, the vet team did find the stomach to be full of semi-digested fish and no sign of lung drowning; the first sign was diagnostic for by-catch. Participants generally viewed the necropsy demo as favorable. Six participants specifically considered necropsy as one of the most useful topics for him/her in the evaluation forms.

General comments on workshop content

Despite the many suggestions for improvement, the workshop was considered a success by almost 90% participants. Due to the different nature of field conservation and veterinary works, many participants were originally confused as to why the workshop had a large section of veterinary aspects. They eventually understood that the veterinary aspects were delivered to provide them with a larger picture of the stranding phenomenon.

Nonetheless, for future workshops with similar contents (e.g. the 2nd National Stranding Workshop), a clear division of the workshop is suggested. Participants should be clearly informed that the workshop consists of two parts: the First Responder (with hands-on demo) and the Veterinary (with necropsy subject to availability). Participants should be given a clear instruction to indicate whether they are going to attend the First Responder section only, the Veterinary section only, or the two sections. This division is important to avoid any participants questioning their own participation in the workshop due to irrelevant content.

Translation process is another important aspect to the workshop. Due to human resource shortage, Mustika was the main verbal translators for the whole workshop. She was assisted by Jaya Ratha for verbal translation of toxicology, anatomy, disease, cytology wet lab and necropsy sessions. However, two translators were insufficient for a three days workshop. We suggest adding 1-2 extra translators for 2nd National Workshop to reduce fatigue and avoid possible mistakes. Unfortunately, professional translators are not advisable for this type of workshop due to the specific and technical terms translators must master. The deployment of two LCD projectors (instead of just one), beaming up two versions of the presentations (English and Indonesian versions) was very helpful in supporting the translation process. However, since the Powerpoint presentations should be pre-translated into Indonesians, the followings are suggested for future workshop:

1) Speakers to adhere to the agreed deadline for PPT submission to reduce translation burden
2) Speakers to limit the number of their slides to fit into 45 minutes of presentation to allow for translation time. In this case, an hour of presentation should have a maximum of 50 slides instead of 70 or 80 slides to allow for explanation and digestion
3) Speakers to make their slides self-explanatory as possible without cramming it with too many texts. Phrases are to be used in support of pictures, graphs or photographs to aid participants' understanding process. A single picture as the only content in a slide is not recommended, even when accompanied with a single word. In this case, the picture should at least be accompanied with a phrase to aid comprehension

National discussion summary and commentary

Several anthropogenic activities have been linked to stranding events worldwide. The oil and gas industry may cause underwater noise pollution [1-3] and oil spill that may lead to stranding events. Naval low frequency sonar has been linked to some lethal stranding cases in the UK, Canary Islands and Taiwan [4, 5]. Reports suggest that fisheries by-catch (including ghost-fishing) plays an important role in stranding events [6]. A specific by-catch subset requiring closer scrutiny for Indonesia is 'cryptic' by-catch, which is defined as "the animals that become entangled in fishing gear and either swim away injured, sometimes with gear still attached, and die even though they are not 'caught' or accounted for in bycatch statistics" [6, p. 74]. Almost half of cetacean by-catch species (30) are present in Indonesia [7].

Foreign objects (including unused/lost fishing nets, plastics, etc) have been found in dolphin stomachs [8, Danielle Kreb pers comm 2013], raising concern for the detrimental impacts of marine debris to the health of marine mammal populations in Indonesia. Blast fishing may give similar symptoms to the use of air-guns during seismic surveys [see 2], which would cause auditory damage to the cetaceans and increase stranding probability. Destructive fishing practises, such as blast fishing, manifest in specific injury which can be identified through examination by trained personnel.

Boat collision is also a suspected cause of stranding events; fin whales stranding records in Southern California are consistent with boat-strike rates [9]. Currently, Indonesia has no reliable data on boat strike. However, regular frequency of in-country passenger ships (PELNI) passing through cetacean hotspots in eastern Indonesia highlights the importance of future investigation of boat collision with marine mammals in the Archipelago.

Unsustainable coastal and riverine development (including mining industries) may have a significant correlation to stranding events by altering or reducing prey abundance and causing habitat shift. Contaminants released from the development may also result in immune suppression, increased disease susceptibility and increased likelihood of cancers [10-12].

The identification and documentation of such destructive anthropogenic activities are essential to guide and direct appropriate policy to reduce risks to cetaceans. A better understanding of threats to these animals will lead to a better design of conservation policies and actions.

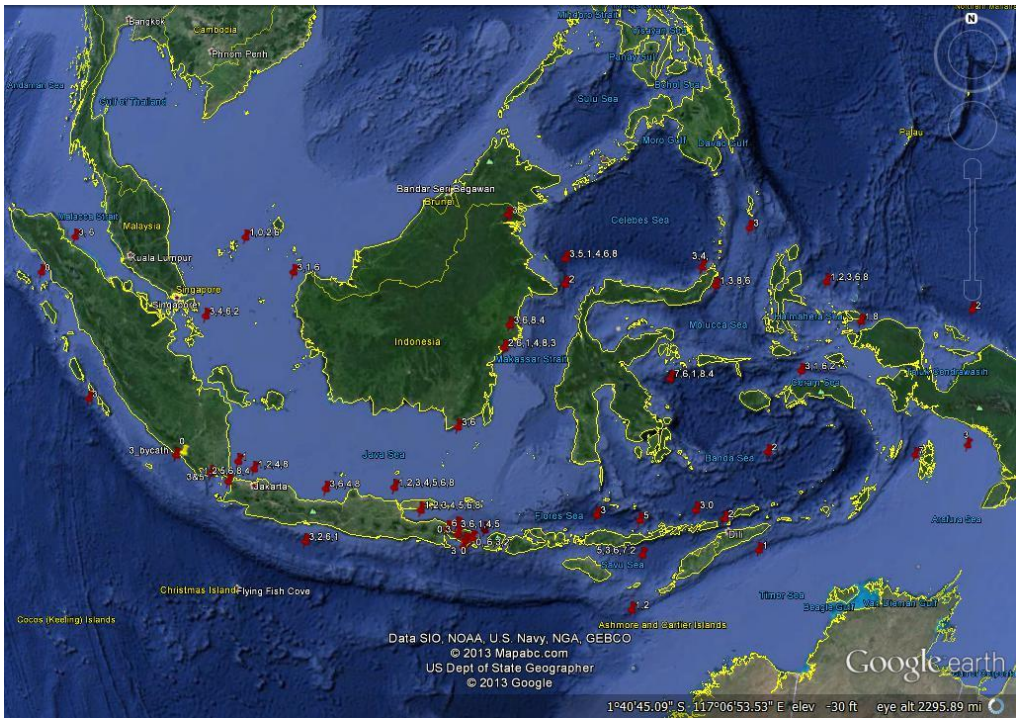

Figure 1 The original map of potential threats to marine mammals in Indonesia. Explanation are given below, with additional threats not necessarily reflected in the original map

The national discussion on marine mammal stranding was conducted in the evening of 27 November with threat mapping as the main agenda (Figure 1). The threat mapping discussion was based on a thematic mapping conducted by Mustika, Abel, Porter, Fernando, and Purnomo back in May 2013. A zero (0) was added for stranding sites without enough information for number assignment. Threat #7 was revised from the original 'whaling (escaped individuals)' to 'direct catch', which involves any targeted catch towards the marine mammals (including for tuna bait).

The followings are the nine threats discussed during the session:

0. Threat unknown
1. Oil and gas industry (seismic and oil slick)
2. Sonar
3. By-catch (including ghost net)
4. Marine debris (including pieces of fishing nets, plastics, and other foreign objects)
5. Blast fishing
6. Boat collision
7. Direct catch
8. Unsustainable coastal & riverine development (including mining)

Nazdan Meuraxa from the Marine and Fisheries Agency Lampung volunteered to be the co-facilitator with Mustika. The participants were asked to place the nine numbers on the general coastlines of Indonesia. The followings are the result, based on an island-coastline combination:

Sumatra

- North east coast of Sumatra (including the Malacca Strait): by-catch (3) and boat collision (6)
- West coast of Sumatra (facing the Indian Ocean): unknown (0), by-catch (3)
- Around the Batam areas: by-catch (3), marine debris (4), boat collision (6), sonar (2)
- Anambas areas: unknown (0), oil and gas industry (1), sonar (2), by-catch (3 – added later by Mustika based on personal observation) and boat collision (6)
- Lampung: by-catch (3), blast fishing (5), direct catch (7)

Kalimantan

- West Kalimantan: oil and gas industry (1), by-catch (3) and boat collision (6)
- East Kalimantan: oil and gas industry (1), sonar (2), by-catch (3), marine debris (4), blast fishing (5), boat collision (6), and unsustainable coastal and riverine development (8)

Java

- The Sunda Strait: sonar (2), marine debris (4), blast fishing (5), boat collision (6), unsustainable coastal and riverine development (8)
- Jakarta: oil and gas industry (1), sonar (2), marine debris (4), blast fishing (5)
- North Central Java: by-catch (3), marine debris (4), blast fishing (5), unsustainable coastal and riverine development (8)
- East Java, including Madura: oil and gas industry (1), sonar (2), by-catch (3), marine debris (4), blast fishing (5), boat collision (6), and unsustainable coastal and riverine development (8)
- South coasts of Java: oil and gas industry (1), sonar (2), by-catch (3), boat collision (6)

Bali:

- North Bali: oil and gas industry (1), by-catch (3), marine debris (4), blast fishing (5), boat collision (6), and unsustainable coastal and riverine development (8)
- South and southeast Bali: unknown (0), sonar (2), by-catch (3)

Lombok:

- unknown (0), by-catch (3), boat collision (6)

Sulawesi:

- North Sulawesi, Manado part: by-catch (3), marine debris (4)
- North Sulawesi, eastern part: oil and gas industry (1), by-catch (3), boat collision (6), and unsustainable coastal and riverine development (8)
- Central Sulawesi: oil and gas industry (1), marine debris (4), boat collision (6), direct catch (7)

East Nusa Tenggara:

- unknown (0), oil and gas industry (1), sonar (2), by-catch (3), blast fishing (5), boat collision (6), direct catch (7)

Maluku:

- Southwest Banda Sea: sonar (2)
- Seram Sea: oil and gas industry (1), sonar (2), by-catch (3), boat collision (6)
- East Halmahera: oil and gas industry (1), sonar (2), by-catch (3), boat collision (6)
- Kei Islands: direct catch (7)

Papua:

- Bird’s Head Seascape: oil and gas industry (1), unsustainable coastal and riverine development (8)
- Northern waters of Papua: sonar (2)
- Kaimana: unsustainable coastal and riverine development (8)

It must be stressed that many of these threats are anecdotal threats only; solid evidence or ground-truthing must be obtained to ensure that those threats indeed exist in respective places. The most frequently mentioned threats were by-catch (18 times), boat collision (15 times), sonar and unsustainable coastal and riverine development (13 times), and oil and gas industry (12 times). Marine debris (9 times) and blast fishing (8 times) were perceived as medium threats, whereas direct catch were mentioned three times. Managers at six places perceived that the marine mammals in their waters might be subjected to at least an unknown threat (hence, 'unknown').

Upon ground-truthing, the revised threat map should be consulted and adjusted for marine mammal conservations in the country, including the Cetacean National Plan of Action (NPOA) to be designed by the Ministry of Marine Affairs and Fisheries in 2014.

Commentaries on by-catch content

Through this workshop, the participants understood the importance of a better understanding of bycatch in Indonesia and Asia in general. Although the workshop mainly discussed the management of stranded marine mammals in general, the issue of bycatch has received a good coverage through the bycatch lecture (the introduction to cetacean bycatch and the pathological and forensic aspects of bycatch), the national marine mammal threat discussion (see the section above), and the necropsy demo session. The participants were informed on how to recognise indications of bycatch on a stranding specimen. The Indonesian participants mapped some possible marine mammal bycatch areas and found 16 areas susceptible to bycatch in the country. Some overseas participants also asked about possible intervention techniques for chronic entanglement on marine mammals, particularly large whales. We suggest that future stranding trainings in Indonesia should include bycatch issues in the lectures and discussions. Whenever possible, a practical demo on how to release marine mammals from entanglement should be included in the future, using props and available fishing gears.

Participant input

Table 1 below summarises participant input from the workshop. The questionnaires were distributed at before lunch time on the last day (28 November 2013), hence we missed some Indonesian participants who had gone home in the morning.

Table 1 Summary of participant input from the workshop (n=39)

Q #	Question phrased	1st Responder		Veterinary		Overall	
		n	%	n	%	n	%
1	Have attended 1st responder training before?						
	n	38		38			
	yes	16	42.1	7	18.4		
	no	22	57.9	31	81.6		
2	Was the content relevant to your job?						
	n	37		37			
	strongly disagree	0	0	1	2.7		
	disagree	0	0	1	2.7		
	fair	3	8.1	4	10.8		
	agree	15	40.5	15	40.5		
	strongly agree	19	51.4	16	43.2		
3	Rewarded by better performing the job later						
	n	37		36			
	strongly disagree	0	0	1	2.8		
	disagree	4	10.8	3	8.3		
	fair	6	16.2	10	27.8		
	agree	19	51.4	13	36.1		
	strongly agree	8	21.6	9	25		
4	Methods used are suitable						
	n	38		38			
	fair	5	13.2	6	15.8		
	agree	19	50	19	50		
	strongly agree	14	36.8	13	34.2		
5	Training aids appropriate						
	n	38		38			
	fair	6	15.8	4	10.5		
	agree	19	50	23	60.5		
	strongly agree	13	34.2	11	28.9		

6	Room setting: room environment						
	n	38		38			
	fair	2	5.3	2	5.3		
	good	21	55.3	23	60.5		
	very good	15	39.5	13	34.2		
6	Room setting: room size						
	n	37		37			
	fair	1	2.7	0	0		
	good	19	51.4	23	62.2		
	very good	17	45.9	14	37.8		
6	Room setting: seating arrangement						
	n	36		36			
	fair	7	19.4	6	16.7		
	good	15	41.7	17	47.2		
	very good	14	38.9	13	36.1		
6	Room setting: lighting						
	n	37		37			
	very poor	1	2.7	0	0		
	poor	1	2.7	1	2.7		
	fair	8	21.6	8	21.6		
	good	15	40.5	17	45.9		
	very good	12	32.4	11	29.7		
6	Room setting: ventilation						
	n	37		37			
	very poor	1	2.7	1	2.7		
	poor	0	0	0	0		
	fair	6	16.2	6	16.2		
	good	17	45.9	17	45.9		
	very good	13	35.1	13	35.1		
7	Speaker performance: Appearance						
	n	36		37			
	fair	5	13.9	3	8.1		
	good	16	44.4	19	51.4		
	very good	15	41.7	15	40.5		
7	Speaker performance: Speech						

	n	35		36			
	poor	0	0	1	2.8		
	fair	8	22.9	10	27.8		
	good	17	48.6	15	41.7		
	very good	10	28.6	10	27.8		
7	Speaker performance: Care trainees						
	n	35		36			
	fair	6	17.1	5	13.9		
	good	19	54.3	21	58.3		
	very good	10	28.6	10	27.8		
7	Speaker performance: Presentation skill						
	n	35		36			
	poor	1	2.9	1	2.8		
	fair	4	11.4	3	8.3		
	good	20	57.1	21	58.3		
	very good	10	28.6	11	30.6		
8	Which part of the workshop most useful	First responder (23/39), veterinarian (15/39), bycatch (2), acoustic (1), necropsy (6)					
9	Other comments to improve the course	More days (4-5 days) or fewer lectures, shorter lecture duration and more discussion, better time management, a better mix of theory and practice, inclusion of Triage lecture in the First Responder Day					
10	Other training course needed	Toxicology, acoustic analysis, direct observation methods, marine mammal rehabilitation/husbandry and health management, more in-depth veterinary training, species identification					
11	Overall grading of workshop						
	n					37	
	poor					1	2.7
	fair					3	8.1
	good					21	56.8
	very good					12	32.4

In general, a total of 21 people (56.8%) said it was “good”; 12 people (32.4%) said it was “very good”. With almost 90% people satisfied with the workshop, it is safe to conclude that the 1st National Indonesian Marine Mammal Stranding Workshop was successful.

Commentary on overseas participation

The involvement of 20 overseas participants from Malaysia, the Philippines, Myanmar, Cambodia, China, and Sri Lanka is viewed as favorable to the workshop process and also to general networking. The need to bilingually translate any questions from overseas participants for local participants' benefit did, naturally, prolong the workshop process. Hence, adherence to the translation process suggestions (see page 4) is important to ensure more effective workshop process in the future. We suggest replicating the involvement of overseas participants for the 2nd National Indonesian Marine Mammal Stranding Workshop in late 2015, with additional countries, e.g., Timor Leste and Vietnam.

Conclusion

With almost 90% people satisfied with the workshop, the 1st National Indonesian Marine Mammal Stranding Workshop was successfully executed. Various aspects still need to be improved for the 2nd national workshop and local-level workshops. The National Stranding Network discussion has mapped potential threats to marine mammals in Indonesia; this map should be considered in designing marine mammal conservations in the country, including the Cetacean National Plan of Action (NPOA) to be designed by the Ministry of Marine Affairs and Fisheries in 2014.

The involvement of overseas participants has been demonstrated as beneficial to national participants, for it encourages regional collaborations instead of just limiting it to within the country. We suggest inviting overseas participants to the 2nd national workshop, particularly for the veterinary workshop section.

We thank all sponsors and supporters, particularly the International Whaling Commission for their generous financial support for this workshop.

Appendix 1. Schedule

25th November 2013 (Day 1: Opening Ceremony and Welcoming Speech)

Time	Topic
19:00	Welcoming Speech
	SEA Marine Mammal Stranding Network
	Banquet Dinner

26th November 2013 (Day 2: First Responder)

Time	Topic
08:30-08:45	Welcome - Summary for Day & Intro of speakers (15 min - incl 10 min for starting late)
08:45-09:15	Partnership between government and NGO in marine mammal stranding-case studies of Hong Kong
09:15 -11:00	Stranding Scenarios - (interactive) - strategy development - incl morning break
11:00 -11:30	Species identification SEA region with focus on indonesia (30 min)
11:30 -12:00	Discussion on afternoon practical responder workshop - Q&A Short P/Point from May workshop - sign up teams
12:00-12:15	Wrap up morning - Q & A
12:30-13:30	Lunch
13:30	Gathering into 4 (5?) teams at poolside
13:45-14:15	Scenario 1: Recovery from shallow water & transport to beach site
14:15-14:45	Scenario 2: First aid at beach site
14:45-15:30	Scenario 3: Return to sea - deep water
15:30-16:15	Scenario 4: Mass stranding - first aid and assessment protocol
16:15-16:45	Scenario 5: Transport injured/incapacitated animals to vehicle for road transport
17:00-17:15	Team Assessment, Q&A, wrap up
17:30	Wash down equipment - Finish

27th November 2013 (Day 3: Veterinary)

Time	Topic
08:00-08:45	Regional Stranding Updates from represented countries
08:45-09:30	Cetacean Anatomy
09:30-10:00	Triage and First Response
10:00-10:15	BREAK
10:15-11:00	Cetacean Rehabilitation Medicine
11:00-11:45	Diseases of Cetacean
12:00-13:00	LUNCH
13:00-14:00	Bycatch and Bycatch Pathology
14:00-15:00	Necropsy of Cetaceans
15:00-15:15	BREAK
15:15-16:15	Toxicology I
16:30-18:00	Indonesian national stranding network

28th November 2013 (Day 4: Veterinary)

Time	Topic
08:00-08:15	Set up for wet lab
08:15-09:15	Wet Lab for cytology
09:30-10:30	Introduction to Acoustics and Acoustic Trauma
10:30-10:45	BREAK
10:45-11:45	Toxicology II
11:45-12:45	LUNCH
12:45-13:30	Transport to necropsy demostration location
13:30-17:00	Post-mortem Procedures and Workshop
17:00-18:00	Worskhop Assessment and Awarding of Certificates
	Banquet Dinner

Appendix 2. Photographs

One of the lectures during the workshop

National Stranding Network discussion

The pool practice

The beach practice

Using a boat to relocate the 'dolphin'

The mass stranding scenario

Some of the participants and mentors/presenters

The cytology wet lab

The necropsy demo