

Report of the Second Workshop on The Biology and Conservation of Small Cetaceans and Dugongs of South-East Asia

Edited by

W. F. Perrin, R. R. Reeves, M. L. L. Dolar, T. A. Jefferson,
H. Marsh, J. Y. Wang and J. Estacion



REPORT OF THE SECOND WORKSHOP ON THE BIOLOGY AND CONSERVATION OF SMALL CETACEANS AND DUGONGS OF SOUTHEAST ASIA

Silliman University, Dumaguete City, Philippines

24-26 July, 2002

Edited by

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Workshop sponsored by Convention on Migratory Species of Wild Animals; additional support provided by Ocean Park Conservation Foundation, WWF-US and WWF-Philippines.

Published by the UNEP/CMS Secretariat

Report of the Second Workshop on the Biology and Conservation of
Small Cetaceans and Dugongs of South-East Asia
UNEP/CMS Secretariat, Bonn, Germany, 161 pages

CMS Technical Series Publication No. 9

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Cover illustration: digital artwork by Jose T. Badelles from a photograph by Jose Ma. Lorenzo Tan

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UNEP / CMS Secretariat
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Martin-Luther-King Str. 8
53175 Bonn, Germany
Fon (+49 228) 815 24 01/02
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ISBN: 3-937429-01-8

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FOREWORD

Marine mammals in South East Asia (cetaceans and dugongs) are exposed to a number of threats. By-catch and non-targeted catch in both legal and illegal or unregulated commercial and artisanal fisheries are the main reasons for dwindling populations of cetaceans and dugongs.

The Convention on Migratory Species looks back on a long-standing commitment in conserving these marine mammals in South East Asia. The first International Conference on Marine Mammals of South East Asia held in Dumaguete, in the Philippines in 1995, marked a starting point for CMS' activities in the region. CMS has initiated surveys aiming at improving knowledge on migratory behaviour and distribution, including among local scientists. By sponsoring that first conference UNEP emphasized the scope of its Marine Mammals Action Plan that covers dugongs and cetaceans in South East Asia. The conference revealed that by-catch of cetaceans and dugongs in fisheries was more serious than supposed. Even in areas where by-catch rates turned out to be low they reflected that populations may have already been seriously depleted. Raising of awareness of conservation threats among the public, fishery, local stakeholders and political decision makers was considered to be indispensable for mitigating those threats.

At the Second International Conference on Marine Mammals of South East Asia (SEAMAM II) and an associated workshop, both sponsored by CMS, the Ocean Park Conservation Foundation, the Silliman University Marine Laboratory, WWF-US and WWF Philippines, scientists discussed the various concerns and research needs of South East Asian countries. The participants took stock of cetacean and dugong populations, although good information on stock structure and abundance of populations and distribution is still rare, as is information on fishing effort and by-catch rates. These information gaps make the assessment of the impact of by-catches difficult.

This publication includes current national reviews of status, research, by-catch, conservation and legislation for eleven South East Asian countries and Australia. It summarizes the present status of dugong conservation and points out the needs for additional research. The draft action plan that was developed at SEAMAM II lists the various phases of raising awareness of by-catch as well as assessment and mitigation. CMS' commitment is reflected in its role as coordinator in South East Asia aiming to set up a network of regional cooperation. The Convention promotes the exchange of research data to better reduce threats to cetaceans and dugongs.

Noting the outcome of this conference, the Conference of the Parties recommended at its Seventh Meeting 2002 the establishment of an instrument of cooperation for the conservation of these species. CMS has already successfully completed a survey of marine mammals in the Gulf of Tonkin as well as of dolphin populations in the Timor and Arafura Seas in Australia and Indonesia. The Convention's experience in developing regional agreements such as the IOSEA MoU will contribute to a successful implementation of conservation activities in South East Asia. Signatories to this agreement are also range states to cetaceans and dugongs.

I would like to thank the contributing editors for this report of the Second Workshop on the Biology and Conservation of Small Cetaceans and Dugongs in South East Asia. This CMS Technical Series publication further documents the Convention's contribution in conserving the species. I hope that CMS, in close collaboration with responsible government agencies, NGOs and the international scientific community will play a central role towards the conservation of these marine mammals.


Robert Hepworth
CMS Executive Secretary

INTRODUCTION

This document is the report of the Second Workshop on the Biology and Conservation of Small Cetaceans and Dugongs of Southeast Asia, held in the Philippines at Silliman University in Dumaguete City, Negros Oriental, 24-26 July, 2002. The first workshop was held in 1995, also at Silliman University; it was sponsored by the United Nations Environment Programme (Perrin et al. 1996). The second workshop was sponsored by the Convention on Migratory Species of Wild Animals (CMS), also known as the Bonn Convention. Additional support for participants was provided by the Ocean Park Conservation Foundation in Hong Kong, WWF-US,

and WWF-Philippines. Content and participation were organized by the Southwest Fisheries Science Center of U.S. NOAA Fisheries and the consulting firm Tropical Marine Research. Travel and local arrangements were organized by the Marine Laboratory of Silliman University (SUML). Scientists and conservationists were present from Australia, Cambodia, Canada, China (Mainland, Taiwan and Hong Kong), Indonesia, Malaysia, Philippines, Thailand, U.S. and Vietnam. A list of participants is given in Appendix 1.

1. PRELIMINARIES

Perrin convened and chaired the meeting. The terms of reference were reviewed:

- (1) Update the 1995 review of general biology of marine small cetaceans and dugongs in SE Asia, including distribution and ecology and with emphasis on by-catch.
- (2) Update the 1995 review of existing conservation measures and legislation at a regional and national level.
- (3) Identify remaining significant gaps in scientific knowledge and assess the threats that must be met to ensure effective conservation.
- (4) Develop recommendations and priorities for research and conservation action at the regional and national levels to address the problem of by-catch in fisheries, and consider a draft regional action plan.

- (5) Consider the potential for development of formal regional cooperation, including review of a draft CMS regional agreement.

The geographic area considered included the waters of most of the nations usually thought of as comprising Southeast Asia (Brunei, Cambodia, East Timor, Indonesia, Laos, Malaysia, Philippines, Singapore, Thailand and Vietnam), the marine waters of China from the Yangtze River south (including Taiwan, Hong Kong and Macao), and the northern waters of Australia from Torres Strait west to Broome in Western Australia (approximately 122° E longitude). It was recognized that the boundaries of this area are arbitrary (as would be the boundaries of any area) but that it nonetheless has some faunistic and biogeographic coherence. For example, inclusion of Myanmar would be questionable because its coast is entirely in the Indian Ocean. Similarly, inclusion of Papua New Guinea would bring in a coastline entirely in the Pacific. The goal in defining the study area was to limit the review to a manageable size.

The cetacean species reviewed included all of the marine odontocetes with exception of the sperm whale (*Physeter macrocephalus*), including those with both marine and freshwater populations/distribution. Common and scientific names are given in Appendix 2. The strictly freshwater baiji of the Yangzi River was not reviewed.

The draft agenda was adopted (Appendix 3). It was agreed that the cetacean species reviews (item 2.2) and the review of dugong conservation and research (item 3) would be carried out by subgroups in concurrent sessions. Reeves, Dolar, Jefferson, Marsh and Wang agreed to act as rapporteurs. A list of documents submitted to the workshop is given in Appendix 4. Also available were the abstracts of papers presented in the two-day symposium that preceded the workshop, and

a collection of relevant references provided by SUML and the participants.

Stokes drew the group's attention to the Seoul Ocean Declaration issued by the first APEC Ocean-related Ministerial Meeting in Seoul in April 2002. The meeting was intended to set the future direction for ocean conservation and management in the Asia-Pacific region. It was noted that fully a third of SE Asia's coral reefs have already been lost. The Seoul Ocean Declaration acknowledges the importance of the ocean environment for food security, economic prosperity, and social and environmental well-being, and calls on nations of the region to address the continuing alarming trends on an urgent basis. The workshop participants expressed strong endorsement of the thrust of the declaration.

2. UPDATE OF 1995 REVIEWS

2.1 National Reviews of Status, Research, By-catch, Conservation and Legislation

2.1.1 Australia

For the purposes of the workshop, Australian waters in SE Asia were defined to extend from Northwest Cape in the west (21° 47'S, 114° 09'E) to the tip of Cape York Peninsula in the east (10° 47'S, 142° 30' E) excluding Torres Strait. The area comprises three Australian state jurisdictions: Western Australia, Northern Territory and Queensland.

Marsh provided an update since the 1995 workshop on species and their distribution, population and habitat status, by-catch and folk attitudes toward marine mammals (Doc. 16). Additional

information was provided by Stokes and Dengate (Doc. 13).

Species and distribution

Sixteen species of small cetaceans and the dugong are known to occur in Australian waters of SE Asia (Appendix 2). The most recent genetic studies indicate that coastal bottlenose dolphins from southeastern Australia are *T. aduncus* (Möller and Beheregaray 2001), like those of West Australia (Connors *et al.* 2000). There are no genetically confirmed records of *T. truncatus* from Australia.

Population status

The IUCN lists the dugong as threatened (Vulnerable) at a global scale. Under the Action Plan for Australian Cetaceans (Bannister *et al.* 1996), the Irrawaddy dolphin, Indo-Pacific humpback dolphin and spinner dolphin are listed as Insufficiently Known. It is not known whether

the population of any species of marine mammals in the Australian waters of SE Asia is increasing, decreasing or stable.

Habitat status

The tropical SE Asian Australian coastline is remote and largely uninhabited. Although the marine habitat is predominately intact, coastal development and trawling in the region may have significant, localized impacts, especially through trawl damage to benthos, dredging, noise, heavy metal pollution and boat traffic associated with resorts. In addition to the habitat loss caused by human activities, seagrasses in the area are subject to large-scale dieback associated with extreme weather events, such as tropical cyclones.

Directed catches

Direct killing of any cetacean species in Australian waters is prohibited under the Environment Protection and Biodiversity Conservation Act of 1999 (EPBC) and state/territory laws. The EPBC Act prohibition also applies to all Australian nationals and Australian-registered vessels outside the Australian Exclusive Economic Zone (EEZ). There is no evidence of direct killing of cetaceans in Australian waters in SE Asia, and catching wild marine mammals for display is prohibited.

Aboriginal and Torres Strait Islander peoples, who are recognized as Native Title right holders, are permitted to hunt dugongs. The legal situation is less clear for indigenous people who are not Native Title holders. In Australian waters of SE Asia dugong hunting occurs mainly in the vicinity of isolated communities between Cape York and Broome (Marsh *et al.* 2002). There are no quantitative data on the catches of dugongs in most communities.

By-catches

Incidental capture of marine mammals occurs in some of the Commonwealth and state fisheries

operating in the SE Asian waters of Australia (Table 1). There is concern for the unknown but potentially high take of marine mammals in 'ghost' nets fishing adrift in Australian waters in SE Asia (pers. comm. to Stokes from J. Miller, Queensland Parks and Wildlife Service).

Legal status and present management arrangements

Several bodies of legislation are relevant:

(1) Commonwealth (National) Legislation.

Since the 1995 SEAMAM workshop, the *National Parks and Wildlife Conservation Act 1975*, *Whale Protection Act 1980*, *Endangered Species Protection Act 1992*, and the *Wildlife Protection (Regulation of Export and Imports) Act 1982* have been repealed by the EPBC Act. Australia's national jurisdiction over marine mammals applies within the EEZ. The *Great Barrier Reef Marine Park Act 1975* also protects marine mammals in that marine park. State/territory laws apply to three nautical miles offshore.

The EPBC Act establishes the Australian Whale Sanctuary, in Commonwealth waters, within which it is an offence for a person to kill, injure, take, trade, keep, move or interfere with a whale or other cetaceans. Significant penalties apply to breaches of these provisions. Further, the whale and other cetacean protection provisions also apply to Australian nationals and Australian-registered vessels operating outside of the Australian Whale Sanctuary on the high seas.

The EPBC Act also provides for the protection of critical habitat, the identification of key threatening processes and the preparation of recovery plans, threat abatement plans, the issuing of conservation orders and wildlife conservation plans. A national recovery plan for the blue whale was completed in 2001.

Table 1. Major commercial Commonwealth and state fisheries found in the Australian waters of Southeast Asia (Doc. 16)

Marine Domain	Management	Fishery
Northern	Commonwealth	Northern Prawn Fishery ¹
		Western Tuna and billfish ¹
	Commonwealth/State	Gulf of Carpentaria net Fishery ²
	State	Shark Fishery ³
		Timor Reef Fishery ³
		Spanish Mackerel ³
		Finfish trawl Fishery ³
		Barramundi and Threadfin Salmon ³
North Western	Commonwealth/State	Northern West Slope Trawl ¹
		North Coast Shark Fishery ⁴
	State	WA Prawn Fishery ⁴
		Northern Demersal Scalefish Fishery ⁴
		Pilbara Demersal Finfish Fisheries ⁴
		Kimberley Gill net and Barramundi ⁴
		Spanish Mackerel ⁴

¹AFMA (2002), ²DPI (2002), ³DBIRD (2002), ⁴DFWA (2002)

Location	No. Fishing Licenses	Main Fishing Method
Extends from the low water mark to the outer edge of the AFZ, in the area between Cape York in QLD and Cape Londonderry in WA.	86 licences / 115 boats	Otter Trawl
Extends from Cape York off QLD to 34°S off the west coast of Western Australia, seaward of the 200m isobath.	52 Longline, 5 purse seine, 67 minor line, 21 pole line licences / 79 boats	Pelagic longline; purse seine; and minor line (hand line, rod and reel, troll, and polling).
Extends from the low water mark up to 25 nautical miles offshore or more, in the area between Bamaga Cape York and the Northern Territory border.	5 boats (for waters between 7–25nm) 90 boats (for waters between 9–7nm)	Gill net
Northern Territory Coast	?	Gill net, longline
Northern Territory Coast	?	Lines and traps
Northern Territory Coast	?	Lines
Northern Territory Coast	?	Demersal fish trawl
Northern Territory Coast	?	Gill net
Extends from the 200 misobath to the edge of the AFZ, in the area between North West Cape to 127°E off the north coast of WA	11 licences / 11 boats	Demersal fish trawl
Extends from North West Cape to NT border.	13 boats	Gillnet, longline, dropline
Waters below the high water mark including Exmouth Gulf, Onslow, Nickol Bay, Broome, and Kimberley	13 boats Exmouth 31 boats Onslow 14 boats Nickol Bay 5 boats Broome 134 boats Kimberley	Otter Trawl
Extends from the low water mark to the outer edge of the AFZ, in the area off the north coast of WA east of longitude 120°E	11 licences / 7 boats	Mainly fish traps, and to a lesser extent handline or dropline
Extends from the 30m isobath to 200m isobath, in the area lying approximately between latitude 21°S and longitude 120°E	11 licences / 7 trawlers, 5 trap boats	Mainly Trawling, and to a lesser extent line and traps
Extends from the low water mark to 3 nm off the coast, in the area between the WA/Nt border and Eight Mile Beach, south of Broome (19°S)	7 licences	Gillnet
Extends from Geraldton in WA, north to the NT border	82 boats	Trolling

(2) State Legislation.

In state waters of Western Australia marine mammals are protected under the *Wildlife Conservation Act 1950*. Interactions between humans and marine mammals in state waters that may injure, disturb, molest or otherwise interfere with, or result in the taking of marine mammals are regulated by the *Wildlife Conservation (Close Season for Marine Mammals) Notice 1998* issued under the *Wildlife Conservation Act 1950*. In the Northern Territory, marine mammals are protected under the *Northern Territory Parks and Wildlife Conservation Act 2000*. In Queensland the *Nature Conservation Act 1992* protects all marine mammals in Queensland waters.

(3) International Agreements.

Australia is party to international conventions relating to the conservation of marine mammals including: International Convention for the Regulation of Whaling, 1946; World Heritage Convention 1972; Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973; Convention on the Conservation of Migratory Species of Wild Animals, 1979; the Convention on the Conservation of Antarctic Marine Living Resources, 1980; the United Nations Convention on the Law of the Sea, 1982; and the Convention on Biological Diversity, 1992.

(4) Fisheries Legislation.

In 2000 the Australian Government launched the Commonwealth Policy on Fisheries By-catch. The development of this by-catch policy demonstrates a commitment to ensure that fisheries are ecologically sustainable through by-catch reduction, improved protection for threatened species, and minimizing adverse impacts of fishing on the marine environment.

Under the Policy on Fisheries By-catch, national (Commonwealth)-managed fisheries are required to have By-catch Action Plans in place. The actions

identified in the action plans have legal authority by being included in permit conditions or making them part of a statutory fishing right under the *Fisheries Management Act 1991*. To date ten by-catch action plans have been completed. However, the provisions of the *Fisheries Management Act 1991* do not apply to fisheries managed by the relevant states/territory.

In addition to the By-catch Action Plans, all Australian fisheries with an export component must be assessed for their sustainability according to prescribed *Guidelines for Assessing the Sustainability of Fisheries* (www.ea.gov.au/coasts/fisheries/assessment/guidelines.html). During the assessment phase fisheries are to be assessed to ensure that the fishery is conducted in a manner that ensures that populations of by-caught species or protected species are maintained. Management responses are specified during the assessment phase, including that measures are in place to avoid capture and mortality of by-catch species. There are also requirements for by-catch action plans under state/territory laws, seasonal closures, gear restrictions and fisher education regarding endangered species.

(5) Regional Marine Planning.

Under *Australia's Oceans Policy* (the first policy of its kind in the world) areas of Australia are undergoing regional marine planning, which is the primary mechanism for implementing an integrated ecosystem-based approach to management. Regional Marine Plans integrate across economic, environmental and social and cultural objectives. The Plans provide a focus for coordination between existing and developing ocean uses and the range of sectoral and administrative agencies with responsibilities for marine systems. The first plan, conducted in the southeastern Australia, commenced in April 2000. The second area for Regional Marine Planning has been identified, the northern area

(including the Gulf of Carpentaria and Torres Strait).

Folk attitudes and interactions with marine mammals

The wider community of Australians place high intrinsic value on marine mammals but generally has a low level of accurate knowledge of the status of marine mammal populations. There are many non-consumptive uses of marine mammals including whale and dolphin watching tourism and interactions with wild dolphins at locations such as Monkey Mia, in Western Australia. Public opinion has been effective in encouraging the development of formal codes, guidelines and regulations (Bannister *et al.* 1996), including whale watching regulations under the national Environment Protection and Biodiversity Regulations 2002.

Capture of marine mammals for live display is no longer permitted in Australia. Although they are not hunted, cetaceans have high spiritual value for many Indigenous Australians (Bannister *et al.* 1996). They are often associated with sacred sites, "Dreaming Tracks", "customary marine states", traditional and contemporary songs, stories, dance and art. Although they are less well known than cetaceans, dugongs have been used as a "flagship species" for several high profile campaigns against resort developments. Dugongs have very high value as traditional food for most coastal Indigenous Australian, and dugong hunting is an expression of Aboriginal identity and manhood (Doc. 16). Marsh noted that coastal Indigenous Australian also see the dugong as a "flagship species" for marine conservation and are very concerned about the impacts of the wider community on dugongs, especially habitat loss and gill netting.

Description of existing research programs

Marine mammal research in Australia is conducted mainly in waters outside the SE Asian region, in areas along the urban coast of Western Australia, Queensland, New South Wales, Victoria and South Australia (Marsh and Dinesen in press). Most of the research in the SE Asian region of Australia has consisted of occasional large-scale aerial surveys for dugongs. Since 1996, aerial surveys for dugongs and other large marine vertebrates have been carried out in Western Australia by the Department of Conservation and Land Management in the Ningaloo Reef Exmouth Gulf Region (Preen *et al.* 1997), along the Pilbara coast to the mouth of the De Grey, and along the Western Australian coastline on a yearly basis by the Centre for Whale Research (Jenner *et al.* 2001). Woodside Energy Ltd has funded aerial surveys to determine the distribution and relative abundance of marine megafauna, especially whale sharks and humpback whales off Ningaloo Reef and North West Cape in Western Australia, with the aim of minimizing the adverse effects of their offshore oil and gas exploration and production activities (Jenner *et al.* 2001; Wilson and Konslow 2001). The inshore waters of the Gulf of Carpentaria in Queensland were surveyed for dugongs and other marine mammals by Marsh *et al.* (1998).

Needs for additional research

Parra and Marsh (Doc. 16) noted that information on the ecology and conservation biology of most of the marine mammals in Australian waters of Southeast Asia is practically non-existent and identified three areas of research as the highest priority for marine mammal research:

- (1) Data from carcasses and live stranded individuals to provide information on distribution, life history, taxonomy and genetic relationships, diet and pathology.

(2) Identification of key habitats.

(3) By-catch.

In addition, it was recommended during the discussion that studies should be carried out on the behavior of humpback and bottlenose dolphins in response to pingers (acoustic alarms to warn marine mammals away from entangling fishing gear) and on the acoustic range of pingers (McPherson *et al.* 1999). Such work has already been conducted for wild dugongs, which did not exhibit a behavioral response to the pingers (pers. comm. to Marsh by Amanda Hodgson, 2002).

Present and potential whale and dolphin watching operations

Currently there are no marine mammal watching operations in Australian waters of SE Asia. Due to the remote and largely uninhabited nature of this area the potential for development of such an industry is low. However, there is potential for tourist activities centered in Ningaloo Reef Marine Park and Exmouth Gulf, Western Australia, to expand further north in tourist destinations such as Broome and Darwin.

2.1.2 Brunei

No new information was available to the workshop.

2.1.3 Cambodia

Beasley provided an update based on Doc. 34

Species and distribution

Ten species are known from Cambodia (Appendix 2). These are summarized separately for the Mekong River and the coast of Cambodia:

Mekong River

Based on dedicated surveys during 2001 and previous surveys conducted by Baird in 1997, the Mekong River Irrawaddy dolphin population

appears to be very small, with seasonal variation in distribution. During the dry season, the entire Mekong River population may be confined to the river section from Kratie to the Laos/Cambodia border (Beasley and Phay Somany 2002, Baird 1997). During the wet season, the population is known to range widely throughout the river system—south to at least Phnom Penh (Beasley 2002) and up major river systems, such as the Sekong and Sesan Rivers (Baird and Mounsouphom 1994, 1997; Beasley and Phay Somany 2002). Based on interviews conducted by Baird (1994, 1999) there were only a few reports of very small numbers of dolphins from near Siam Reap on Tonle Sap Great Lake in the mid-1990s (pers. comm. from Nao Thuok, Director General, Department of Fisheries). Based on these interviews and through experience gained during bird surveys conducted by dedicated Wildlife Conservation Society researchers based at Tonle Sap Great Lake (Goes and Hong 2002), the dolphin apparently no longer occurs in significant numbers (if at all) in the lake.

Coastal marine mammals

No information on coastal species in Cambodian waters was available at the 1995 workshop. Beasley reported that based on research during 2001, Ten marine mammal species have been recorded from Cambodian marine waters.

(1) Finless porpoise: Eight sightings during 2001. Sighted in Kompong Som Bay and coastal waters along Koh Kong Province. Previously sighted near Thai/Cambodian border by Nelson (1999).

(2) Irrawaddy dolphin: Most frequently sighted cetacean in recent surveys of Cambodian coastal waters. Important areas appear to be coastal waters of Koh Kong Province, Kompong Som Bay and Ream National Park. Twenty sightings during

2001. Previously sighted near Thai/Cambodian border by Nelson (1999).

(3) Indo-Pacific humpback dolphin: Four sightings during 2001. Sighted around Koh Kong Island, along Koh Kong Province coastline and northern Kompong Som Bay. Based on sightings and interview surveys during 2001, population appears localized in specific areas of Cambodian coastal waters.

(4) Bottlenose dolphins (*Tursiops aduncus* /*truncatus*): Based on boat surveys during 2001, bottlenose dolphins appear to primarily inhabit the offshore waters between Koh Rong/ Koh Rong Sam Laem Islands and Koh Tang/ Koh Prins archipelagos. During boat surveys in 2001, all *Tursiops* sp. lumped into one category, "bottlenose dolphins". Although two species of bottlenose dolphins have now been recognized (Wang *et al.* 1999, 2000a, 2000b; Rice 1998), only the Indo-Pacific bottlenose dolphin has been confirmed to occur in Cambodian waters. Further at-sea observations and collection of specimen material required to confirm species occurring in Cambodian waters.

(5) Pantropical spotted dolphin: Four sightings in 2001. Occurs around offshore islands of Koh Tang and Koh Polou Wai. Sighted once in association with dwarf spinner dolphins.

(6) Spinner dolphin, dwarf form (*Stenella longirostris roseiventris*): Three sightings during 2001. Sighted around offshore islands of Koh Tang, Koh Prins and Koh Polou Wai.

(7) Long-beaked common dolphin, Indian Ocean form (*Delphinus capensis tropicalis*): One sighting west of Koh Polou Wai (45 m water depth). Extremely long beaks, characteristic of *tropicalis* type (Rice 1998; Perrin 2002; Jefferson and Van Waerebeek 2002).

(8) False killer whale: One sighting during 2001. Large group sighted 5 km west of Koh Rong Sam Laem Island (26 m water depth).

(9) Short-finned pilot whale: One specimen found injured (died three days later) in coastal waters of Kep Province, February 2001.

(10) Dugong: Known to occur in Cambodia through retrieval of by-caught specimens during 2001 and interviews with local people. No dugongs yet observed during boat-based surveys. Based on interview surveys, a small remnant population is thought to exist, possibly ranging between Phu Quoc Island in Vietnam and the Kampot and Kep waters of Cambodia. Previously recorded from Koh Kong Province in early 1990's (Nelson 1999), however recent interview surveys indicate that dugongs no longer occur in this area.

Population status

Mekong River

The population appears to be small and restricted in distribution during the dry season. Four dedicated surveys were conducted over the entire stretch of river from Kratie to the Laos/ Cambodia border (a total of 914 km and 82.4 hours of survey effort). The survey in May, at the height of the dry season, resulted in a direct count of 67 dolphins (range 56-88) (the highest of all four surveys). The total populations may number no more than 100 individuals. This is in agreement with results obtained by Baird (1999) in 1997 in independent surveys. He noted that the majority of the population probably spends most of its time in the Cambodian parts of the Mekong Basin. Future surveys will attempt to estimate the proportion of dolphins missed during surveys, in order to provide a measure of precision and more accurately estimate abundance (Beasley and Phay Somany 2002).

Coastal species

The most frequently sighted cetacean is the Irrawaddy dolphin. Nothing is known of the status of coastal cetacean populations. The reported presence of dugongs is encouraging—although the dugong may be Cambodia's most threatened marine mammal.

Habitat status

Mekong River

During the early 1970s, war and political upheaval resulted indirectly in the preservation of the majority of fish stocks and the natural Mekong River environment. However, stabilization of the country and economic development are now resulting in increased pressure on freshwater resources, with evident threats, such as dynamite fishing and over-fishing. Planned hydro-electric dams and waterway development threatens the entire lower Mekong River Basin (southern Laos, Cambodia and Vietnam). A Chinese plan to develop a shipping channel by blasting the lower Mekong rapids (southern Laos) would severely affect fish stocks and disrupt the dolphin's dry season habitat and deep-water pool refuges (Roberts 2001). In the dry low-water season, the dolphins are generally found in deep-water pools (15-20 m deep); increased siltation due to deforestation and development projects is a threat to this critical habitat.

Coastal waters

As with the Mekong River environment, years of war and political upheaval resulted in decreased fishing effort on coastal resources. However, there are now again significant pressures on the coastal ecosystem. Poverty and lack of infrastructure ensure that local people do not fish far from their homes. They also often engage in destructive fishing practices. Threats include dynamite fishing, trawl and push-net fishing, which are particularly destructive to dugong foraging habitat in seagrass areas. There is also increasing pressure from

neighboring countries (Thailand and Vietnam), whose fishermen are able to fish apparently unregulated in Cambodian waters using large modern trawls and vessels.

Directed catches

Mekong River

The *Cham* people of Cambodia and Vietnam formerly hunted dolphins (Baird and Mounsophom 1994). There is no known direct catch of Irrawaddy dolphins in the Mekong River in Cambodia at present. During the Khmer Rouge regime, dolphins were reportedly killed for their oil (Perrin *et al.* 1996). Based on information obtained through interviews, they were also shot occasionally for target practice by the Vietnamese after the war. However, these activities have now stopped.

Coastal species

Beasley reported that immigrants from inland provinces, who confuse dolphins with fish, are known to have deliberately killed at least seven Irrawaddy dolphins in 2002. No other directed catches are known. The first known live-capture of dolphins in Cambodian waters occurred in 1994 (Perrin *et al.* 1996), when eight Irrawaddy dolphins were captured and sent to Safari World in Thailand. In January 2002, at least eight Irrawaddy and 12 Indo-Pacific humpback dolphins were captured by local Cambodians for display at Koh Kong International Resort, a casino on the Thailand/Cambodia border. Such catches could lead to extirpation of local populations of these species.

Dugongs caught accidentally in fishing gear (such as surrounding nets and gillnets) are killed due to their high monetary value. Tusks, teeth and bones are used for traditional medicine and aphrodisiac purposes (with one tusk worth up to US\$100) and the meat is sold for human consumption.

By-catches

Mekong River

By-catch in gillnets is currently the most significant threat to the survival of the Irrawaddy dolphins in the Mekong River. During the dry season, the dolphins are concentrated in deep-water habitat that also support many economically valuable fishes. During 2001, three carcasses were found of dolphins that had died as a result of by-catch in gillnets. Dynamite fishing is also known to kill dolphins accidentally; it may also injure dolphins and make them more susceptible to entanglement in gillnets.

Coastal species

By-catch is known to occur in a variety of net types for both cetaceans and dugongs. The numbers caught each year are unknown. Dolphins are often released if they are found alive in nets, due to the local belief that it is bad luck to catch them. However, by-caught dugongs are retained and killed (Beasley *et al.* 2001).

Legal status and present management arrangements

Although there are no regulations directed at the conservation or management of marine mammals, a new Fisheries Law is being drafted that includes specific regulations pertaining to marine mammals. In addition, the Department of Fisheries has expressed an interest in developing a draft Royal Decree for the protection of Irrawaddy dolphins in the Mekong River.

Folk attitudes and interactions with marine mammals

Local Cambodian people hold cetaceans in very high regard. Local folklore stresses the dolphin's relationship to humans (Baird 1999). Dolphins are not directly exploited and it is believed to be very bad luck if a dolphin is killed accidentally. This high cultural regard does not extend to dugongs. It is regarded as very good luck if a dugong is found

dead or alive in fishing gear, due to its high monetary and traditional value. This probably explains why the dugong may be the most highly threatened marine mammal in Cambodian waters.

Description of existing research programs

In January 2001, the Wildlife Conservation Society and James Cook University (Queensland, Australia), in collaboration with the Cambodian Department of Fisheries, initiated a research project on both riverine and coastal Cambodian marine mammals. The research project consists of field surveys, education and awareness programs and capacity building (Doc. 34).

Needs for additional research

Additional needed research includes work on abundance, distribution and critical habitats for both Irrawaddy dolphins in the Mekong and coastal marine mammals. Close cooperation with local government departments (such as the Cambodian Department of Fisheries) and local fishing communities will be essential. Building public awareness of cetaceans and their status in both coastal and riverine communities is also needed.

Present and potential whale and dolphin watching operations

Mekong River

One dolphin watching operation presently focuses on Irrawaddy dolphins in the Cambodian sector of the Mekong. The operation is located at Kampi pool near Kratie. Up to three small "longtail" boats take tourists out to view the dolphins for US\$3-5 an hour. The boats normally approach a dolphin group using the motor and then stop the motor for the remainder of the viewing, paddling if necessary to obtain closer views. There is also a land-based viewing site at the same location.

Coastal species

There are currently no dolphin watching operations in coastal waters of Cambodia. However, given the close proximity of the coast to Phnom Penh, and the reliable occurrence in particular areas of coastal and offshore species, dolphin watching tourism has potential.

2.1.4 China

Twenty-one species of small marine cetaceans and the dugong have been reported from Chinese waters of SE Asia (Appendix 2). Separate accounts are given here for the Mainland, Hong Kong, Macao, and Taiwan.

Mainland

Species and distribution

All twenty-one small marine cetacean species known from China have been reported from Mainland waters: 16 from the South China Sea, 20 from the East China Sea, 6 from the Yellow Sea, 3 from the Bohai Sea, and 4 from the Yangtze River (one resident and 3 vagrant) (Table 2). The distribution of the dugong in Chinese waters is now believed to be restricted to a very small population along the coast of Guangxi Zhuang Autonomous Region and the west coast of Hainan Island, especially in the region of Hepu County in Guangxi Zhuang Autonomous Region.

Population status

The humpback dolphin and the coastal finless porpoise (*N. p. phocaenoides*) are particularly susceptible to the effects of human activities in coastal waters. One of the Indo-Pacific humpback dolphin populations is centered around the mouth of the Pearl River (Zhujiang River). The estimate of the total population size in the Pearl River estuary is about 1,000 dolphins (Jefferson 2000). The population in Xiamen waters was roughly estimated to be about 60 animals (Liu and Huang 2000). The sizes of the Indo-Pacific

humpback dolphin populations in other areas, including that in the Beibu Gulf off Guangxi Autonomous Region, remain unknown.

From July to September 1994, a line-transect sampling survey of the common bottlenose dolphin in the area between 25° and 30° N, west of 125°E in the East China Sea yielded a minimum estimated density of 0.14 individuals/km² (Yang *et al.* 1997). Estimated density of the Indo-Pacific bottlenose dolphin in Xiamen-Dongshan waters of the Taiwan Strait based on line transect surveys in June 1998 was 0.0436 ± 0.0286 individuals/km² (Yang *et al.* 2000). Nothing is known about the status of most of the cetacean species or the dugong in Mainland waters.

Habitat status

In the course of economic development in China, rapid industrialization and urbanization have occurred along the coast. The habitat has been degraded as a result of extensive development (Zhou 2002). Pollution-assessment data indicate declines in water quality in Bohai Bay, Laizhou Bay, the northern Yellow Sea, Jiaozhou Bay, off the Jiangsu coast, Hangzhou Bay, the Yangtze River estuary, the Zhoushan Fishing Ground and the Pearl River estuary. The main pollutants in Chinese coastal waters include inorganic nitrogen, inorganic phosphorous and oil. More than 80% of the pollutants are of terrestrial origin. Large amounts of waste material and wastewater are discharged into the sea along the coast. This is a major threat to the seagrass beds in tropical and sub-tropical waters on which the dugongs feeds.

Water pollution is a major factor in the decline of fishery resources in China's coastal waters (Zhou 2002). The Bohai Sea was once a major fishing ground. Now, no fishing season exists there because of pollution and overfishing. Likewise, during the 1970s, Dalian Bay in the Yellow Sea yielded 15,000 kg of sea cucumber

(*Protankura bidentata*), more than 100,000 kg of scallops (*Chlamys farreri*) and more than 100,000 kg of kelp (*Laminaria japonica*) per year. Both the sea cucumber and the scallop, however, have disappeared, and kelp cultivation ceased in the 1980s due to heavy pollution. One hundred and seventy species of animals were recorded in the northwestern part of Jiaozhou Bay in the 1970s, but only 17 were found in 1989 (Miao and Guan 1996). The Yangzi estuary was a traditional icefish ground that during the 1960s yielded more than 300 metric tons of icefish (*Salanx* sp.) per year. When industrial effluent from sewer outfalls began entering the estuary in 1971, yields declined to such an extent that the fishery disappeared in the 1980s. The volume of wastewater discharged through the Yangtze estuary into the East China Sea is greater than two billion metric tons per year, a major threat to the Zhoushan Fishing Ground, the largest fishing ground in China. In the East China Sea, a portion of the Xiamen coast has become a "dead zone" free of all macro-organisms. The amount of industrial and domestic wastewater discharged into the South China Sea through the Pearl River estuary is about 3.7 billion metric tons per year, killing a great number of fish, shrimp and crabs. Fish resources in the Pearl River estuary have been almost eliminated due to water pollution and overexploitation. Although there is insufficient information to quantitatively assess population trends, the decline in fishery resources has probably caused similar drastic declines in cetacean abundance.

Although concentrations of Cd and Hg in tissues of finless porpoises from the East China Sea and Yellow Sea were low (Zhou *et al.* 1993), levels of BHCs in the blubber of finless porpoises were higher than in highly contaminated small cetaceans from Japan and California.

Directed catches

As noted in 1995, shore-based whaling occurred historically in Liaoning and off the southern tip of Taiwan (Banana Bay and South Bay). These operations are known to have taken baleen whales and occasionally small cetaceans, including beaked and killer whales.

By-catches

Fisheries pressure is tremendous. There are more than 3,500,000 gillnets in use in China (Zhou and Wang 1994), as well as unknown numbers of other types of fishing gear known to cause mortality of cetaceans and the dugong (e.g. purse seines, trawl nets, long-lines, rolling hooks, set traps, and trammel nets).

The dugong plus eight species of small marine cetaceans are known to have been captured in coastal fisheries throughout China (Table 3). The finless porpoise has the highest by-catch rate. Based on the data presented in Table 3, the number of the finless porpoise (Yangzi finless porpoise excluded) taken is 79.2 % of the total, the percentages for the other species are 4.8 % for Indo-Pacific bottlenose dolphin, 4.2 % for striped dolphin, 3.7 % for long-beaked common dolphin, 2.8 % for common bottlenose dolphin, 2.0 % for pantropical spotted dolphin, 1.7 % for false killer whale, and 0.8 % for Indo-Pacific humpback dolphin and Risso's dolphin. However, the very low by-catch rate for the Indo-Pacific humpback dolphin may not reflect the real situation. Since it is listed as Grade I in the List of Wildlife Under National Key Protection, fishermen usually throw it back into the sea when it is caught to avoid prosecution. The fishing gears responsible for incidental catches in Chinese coastal waters are predominantly trawl nets, gillnets and stow nets.

A survey of incidental catches of small cetaceans in coastal waters was conducted in 1994 and 1995 in Shandong, Zhejiang, Fujian, Guangdong, Hainan

and Guangxi Provinces (Yang *et al.* 1999). The total incidental catches of cetaceans in 1994 in the five provinces were estimated using the following formula: $N = R \times G$, where N = number of small cetaceans taken, R = incidental catch rate per fishing effort, and G = total fishing effort. Based on the data obtained by questionnaire surveys in 1994, the annual incidental catch in the five provinces were estimated at about $3,045 \pm 2,100$. Of these, finless porpoise were about $2,132 \pm 1,484$.

Two survey members were on board fishing vessels for 24 days to serve as observers during another survey in 1998 (Yang *et al.* 2000). No dolphins were caught by the vessels when observers were aboard, but two spotted dolphins were caught by a vessel operating nearby in the same time period.

The Workshop participants emphasized the unreliability of questionnaire data for quantitatively assessing by-catch and encouraged the collection of more direct data by onboard observers.

Legal status and present management arrangement

The Chinese government at various levels has enacted a series of laws and provisions to protect wildlife including cetaceans. The Indo-Pacific humpback dolphin is listed as Grade I and all other cetaceans as Grade II in the List of Wildlife Under National Key Protection. The capture, killing, selling, or buying of the national key protected animals, including cetaceans, is strictly prohibited. Most of the provinces along the coast and the Yangzi River have issued either their own laws or regulations for the implementation of the national laws and regulations. Marsh *et al.* (2002) concluded that sufficient legal protection for dugong conservation currently exists in China and that the problem lies in implementing the legislation

In Xiamen, Fujian Province, a natural reserve has been designated for the Indo-Pacific humpback dolphin. However, the laws and regulations dealing with wildlife have not been strictly enforced in some areas, the conservation efforts are inadequate in terms of personnel levels and funds, and the endangered species and populations still suffer from habitat degradation.

Folk attitudes and interactions with humans

Cetaceans are not considered a food item in China. By-catches are frequently used for livestock feed in some areas. The small cetaceans captured are usually abandoned or sold at a low price at sea. Usually the by-catches are not brought back to the fishing port. However, in the case of the dugong there is considerable incentive to retain by-catches because of the value of various body parts especially the tusks and tears in Chinese medicine.

Description of existing research program

The Ministry of Agriculture Action has drafted action plans for conservation of the Indo-Pacific humpback dolphin. Research projects supported by the National Natural Science Foundation of China include investigating the population structure of the finless porpoise.

Several projects supported by the Ocean Park Conservation Foundation (OPCF) have been completed in recent years. These include investigations of marine mammal/fishery interactions in coastal waters and of the conservation status of the dugong in the Beibu Gulf. A Chinese-language field guide to marine mammals of China funded by FAO and OPCF was published in 2001 (Zhou *et al.* 2001). The participants in a new OPCF Project (initial establishment of southern China marine mammal stranding network, to be directed by Zhou) will distribute the guide to the local groups forming the network.

Needs for additional research

In the view of Chinese marine mammalogists, research and other work needing to be continued and enhanced include

(1) Studies on conservation genetics of threatened or endangered species and populations.

(2) Monitoring of incidental catches of marine mammals and the effects of pollution on coastal and riverine species.

(3) Surveys to assess marine mammal abundance in coastal and oceanic waters.

(4) Establishment of a marine mammal stranding network along the coast.

Table 2. Occurrence of small marine cetaceans in Mainland Chinese waters.

Legend: YTR = Yangzi River (marine species); BHS = Bohai Sea; YLS = Yellow Sea. ECS = East China Sea; SCS = South China Sea. C = confirmed; U = unconfirmed. O = occasionally.

	YTR	BHS	YLS	ECS	SCS
1 <i>Kogia breviceps</i>				C	C
2 <i>Kogia sima</i>				C	
3 <i>Ziphius cavirostris</i>				C	C
4 <i>Mesoplodon ginkgodens</i>			C	C	
5 <i>Mesoplodon densirostris</i>				C	
6 <i>Steno bredanensis</i>				C	C
7 <i>Sousa chinensis</i>	O			C	C
8 <i>Tursiops truncatus</i>	O		C	C	C
9 <i>Tursiops aduncus</i>				C	C
10 <i>Stenella attenuata</i>				C	C
11 <i>Stenella longirostris</i>				C	C
12 <i>Stenella coeruleoalba</i>				C	C
13 <i>Delphinus capensis</i>				C	C
14 <i>Lagenodelphis hosei</i>				C	C
15 <i>Grampus griseus</i>			C	C	C
16 <i>Peponocephala electra</i>				C	C
17 <i>Feresa attenuata</i>				C	
18 <i>Pseudorca crassidens</i>	O	C	C	C	C
19 <i>Orcinus orca</i>		C	C	C	
20 <i>Globicephala macrorhynchus</i>					C
21 <i>Neophocaena phocaenoides</i>	C	C	C	C	C
Number of species	5	3	6	20	16

Table 3. Records of by-catches of small marine cetaceans in Chinese waters

Species	Date	Locality	Catch	Fishing gear	Reference
<i>S. chinensis</i>	1975/01/08	Hong Kong	1	Gillnet	Parsons <i>et al</i> , 1995
	1996/05/31	Hong Kong	1	Trawl net, net cuts on head and appendages	Jefferson, 2000
	1997/05/31	Hong Kong	1	Trawl net, net cuts on head and appendages	Jefferson, 2000
<i>T. truncatus</i>	1979/12/17	South Yellow Sea	4	Trawl or purse net	Zhou <i>et al</i> , 1982
	1986/07	Jiangsu	1	Trawl net	Doc. 9
	1979/03/01	East China Sea	1	Trawl or purse net	Doc. 9
	1984/11	Zhejiang	4	Trawl or purse net	Doc. 9
	1981/08	Xiamen, Fujian	4	Trawl net	Doc. 9
	1998/10/13	Xiamen, Fujian	4	Purse net	Yang <i>et al</i> , 2000
	1987/04/26	Dongshan, Fujian	6	Purse net	Doc. 9
	1998/08/06-22	Dongshan, Fujian	2	Trawl net	Yang <i>et al</i> , 2000
<i>S. attenuata</i>	1987	Beihai, Guangxi	1	Net	Doc. 9
	1987/02/26	Dongshan, Fujian	4	Net	Doc. 9
	1998/05/29	Dongshan, Fujian	2	Purse net	Yang <i>et al</i> , 2000
<i>S. coeruleoalba</i>	1998/08/02	Dongshan, Fujian	1	Trawl net	Yang <i>et al</i> , 2000
	1999	Pingtang, Fujian	7	Net	Doc. 9
	1998/10/27	Dongshan, Fujian	8	Gillnet	Yang <i>et al</i> , 2000
<i>D. capensis</i>	1979	Jiangsu	1	Trawl or purse net	Doc. 9
	1979/03/01	Ningbo, Zhejiang	1	Trawl or purse net	Doc. 9
	1986/05/20	Zhejiang	3	Trawl net	Doc. 9
	2000/04/07	Wenling, Zhejiang	1	Net cuts on body	Doc. 9
	1981/08	Xiamen, Fujian	2	Trawl net	Doc. 9
	1983/11/05	Mouth of Pearl River	1	Trawl or purse net	Doc. 9
	1976-1987	Beibu Gulf	4	Trawl or purse net	Doc. 9
<i>G. griseus</i>	1998/10	Jinxian, Liaoning	1	<i>Dazhe</i> net	Zhao, 2000
	1996/06/08	Putian, Fujian	1	Net	Li, 1997
	1998/11/25	Dongshan, Fujian	1	Gillnet	Yang <i>et al</i> , 2000
<i>P. crassidens</i>		Jinxian, Liaoning		<i>Dazhe</i> net	Mu, Personal communication
	1979/12/17	South Yellow Sea	4	Trawl or purse net	Zhou <i>et al</i> , 1982
	1984/05/17	Lüsi, Jiangsu	1	Drift gillnet	Doc. 9
	1984/06	Lüsi, Jiangsu	1	Net	Doc. 9
<i>N. phocaenoides</i>		Jinxian, Liaoning		<i>Dazhe</i> net	Mu, Personal communication
	1960/06	Panshan, Liaoning	58	One fixed pound net	Wang, 1979
	1990/06-10	Xincheng, Liaoning	9	Drifting trammel net	Zhou and Wang, 1994
	1959/06	Wudi, Shandong	44	One fixed pound net	Wang, 1979
	1983-1990	Jiangsu	74	Fixed and drift nets	Zhou and Wang, 1994
	1991-1992	Lüsi, Jiangsu	35	Stow net	Doc. 9
	1999	Zhoushan, Zhejiang	3	Net	Doc. 9
	1999	Pingtang, Fujian	16	Gillnet	Doc. 9
	1987-1990	Dongshan, Fujian	38	Drifting trammel net	Zhou and Wang, 1994
	1998/10/04	Dongshan, Fujian	2	Gillnet	Yang <i>et al</i> , 2000
	1982/11/26	Hong Kong	1	Gillnet	Parsons <i>et al</i> , 1995
	1984/01/05	Hong Kong	1	Gillnet	Parson <i>et al</i> , 1995

Hong Kong

Hung presented a review of cetacean research and a summary of the status of small cetaceans in Hong Kong waters (Doc. 15). Additional information on abundance of Indo-Pacific humpback dolphins was presented by Jefferson, on fishery by-catch by Torey (Doc. 7), and on conservation measures adopted by the Hong Kong government by Lun (Doc. 18, 21).

The British dependent territory of Hong Kong became a Special Administrative Region (SAR) within the People's Republic of China in 1997. However, Hong Kong retains a high degree of autonomy, and the political boundary continues to impede cooperative research.

Species and distribution

Since a sighting and stranding report program was initiated by the Hong Kong government in 1973, 11 species of small cetaceans have been recorded either alive or stranded in Hong Kong waters: Indo-Pacific humpback, common bottlenose, Risso's, Fraser's, pantropical spotted, striped, spinner, long-beaked common dolphins, false killer and pygmy sperm whales, and finless porpoises. However, most of them are transients or individuals that have washed ashore from offshore waters, and only the Indo-Pacific humpback dolphin and finless porpoise are year-round residents.

Humpback dolphins occur in the western waters of Hong Kong (i.e. north, west and south of Lantau Island) but do not occur in the eastern waters, where finless porpoises are relatively common. The dolphins have a strong preference for the Pearl River estuarine habitat, and of the western areas, North Lantau is the major area of dolphin distribution in Hong Kong waters (Jefferson 2000). Humpback dolphins also occur immediately west and southwest of Hong Kong

waters throughout the whole Pearl River Estuary of mainland China. In contrast, finless porpoises are found primarily in the southern and eastern waters of the territory including the survey areas of South Lantau, Lamma, Po Toi, Ninepins, Sai Kung and Mirs Bay (Jefferson *et al.* 2002a). In particular, the area along the southwestern coast of Lamma Island appears to be an area of concentration in winter and spring months. Porpoises also occur in the Aizhou area, directly south of Hong Kong in Chinese waters.

Population status

The most up-to-date abundance estimate of humpback dolphins in Hong Kong ranges from 45 in spring to 152 in summer, based on line-transect analysis of boat survey data (Jefferson 2002b). Including the survey areas in the Pearl River Estuary, the minimum population size from line-transect estimates is 1,383 animals, while mark-recapture analysis of photo-identification data indicates a population of at least 753 dolphins (Jefferson 2002b). Jefferson suggested that trends in indices of abundance indicated that the population declined from 1995 to 1998 but may have increased since then. Other members of the group noted that the apparent changes could be due to other factors, such as movement of dolphins in and out of the study area, which comprises only part of the range of the population. Over 260 individual humpback dolphins have been identified in Hong Kong waters and the Pearl River Estuary, and new individuals are still being added to the photo-ID catalog.

A preliminary peak abundance estimate for finless porpoise in Hong Kong waters is 152 animals in the spring, while the low estimate was 55 in the autumn (Jefferson *et al.* 2002a). The combined abundance estimate including all survey areas in Hong Kong and the Aizhou area (directly south of Hong Kong waters) resulted in an estimate of 217 porpoises in spring and summer, which

can be viewed as the minimum population size (Jefferson *et al.* 2002a).

From 1995 to 2001, the stranding rate of humpback dolphins was fairly consistent, with 6 to 11 strandings per year. There were 8 to 15 strandings of finless porpoises per year during the same period.

Habitat status

In Hong Kong waters, dolphins and porpoises are under great pressure from human activities. The marine habitat is deteriorating due to coastal development, pollution from sewage and water treatment plants, dredging for marine fill and shipping, and intensive fishing. The waters where humpback dolphins commonly occur have been affected by numerous human activities, including the construction of a new airport at Chek Lap Kok, which destroyed a large amount of coastal habitat. In association with the new airport development, underwater contaminated-mud pits were located near the airport for dumping of toxic wastes. In the same area, there are three major outfalls for discharging untreated sewage. The recent reclamation project at Penny's Bay, the future Disneyland site, has resulted in further habitat loss for the dolphins and porpoises. Seabed dredging and disposal related to these and other coastal developments could worsen the problem of water pollution, which in turn may threaten dolphins and porpoises.

Sewage from the domestic and industrial sectors and insecticides from farms drain into the sea with little or no treatment. High levels of environmental contaminants including heavy metals (e.g. mercury and cadmium), organochlorines (e.g. DDTs, PCBs and HCHs) and organotin (TBTs), have been found in the blubber, liver and kidney of stranded dolphins and porpoises from Hong Kong (Parsons and Chan 1998; Minh *et al.* 1999; Parsons 1999; Jefferson 2000; Jefferson *et al.* 2002b). Although

the health implications of these environmental contaminants are not fully understood, the high levels of pollutants could pose serious health problems for local cetaceans, particularly in combination with other anthropogenic threat factors (Jefferson 2000; Parsons and Jefferson 2000).

Vessel collision is another significant cause of death for local cetaceans. Hong Kong is one of the world's busiest ports. The Urmston Road shipping channel is situated in the area of highest density of humpback dolphins, and a major fast-ferry lane between Hong Kong and Macao also runs through important finless porpoise habitat just south of Lantau Island. Dolphins and porpoises may be hit by high-speed vessels and become seriously injured or killed (Jefferson 2000; Parsons and Jefferson 2000; Jefferson *et al.* 2002b). A few identified individual dolphins have permanent injury marks on their bodies and fins caused by propellers, and several stranded dolphins and porpoises have borne wounds consistent with blunt traumatic injury, probably caused by boat collisions.

Overfishing in Hong Kong and the adjacent waters may lead to depletion of food resources for local cetaceans, although there is no evidence of this at present. In addition, underwater noises generated by marine traffic and development projects such as piling work can affect the ability of dolphins and porpoises to locate their food and communicate. Sometimes it can even cause injury or death.

Directed catches

Direct killing or deliberate capture of humpback dolphins and finless porpoises have not been reported in Hong Kong and nearby waters. Fishermen in Hong Kong generally regard dolphins and porpoises as sacred creatures of the sea and do not willfully harm or disturb them.

By-catches

Fishery by-catch seems to be a significant cause of death for local dolphins and porpoises (Jefferson 2000; Torey 2000; Jefferson *et al.* 2002b). Results from necropsies suggested that a total of 11 finless porpoises and 5 humpback dolphins were caught or possibly caught incidentally from 1996 to early 2002. There are also indications that the incidence of net entanglement for finless porpoises may have increased in recent years (Jefferson *et al.* 2002b). These animals have been found with net markings around their flukes and flippers, apparently caused by entanglement in gill nets and trawl nets. As some humpback dolphins tend to feed behind fishing boats, they may occasionally become entangled in fishing nets. Although finless porpoises have not been observed feeding behind fishing boats in Hong Kong water, fishermen reported that they do associate with fishing boats in offshore waters.

Monitoring by-catch by trawl boats is feasible since 70% of the overall catch is landed in Hong Kong ports (making placement of observers logistically possible) and the vessels are large enough to accommodate observers. Monitoring gillnet by-catch, however, may be more difficult since boats land their catches in many areas. Gillnet boats are small and it is not feasible to put observers onboard. Two suggestions were made by Workshop participants for monitoring by-catch in gillnets: a) the use of patrol boats and b) monitoring from shore, similar to the method used in California.

Legal status and present management arrangements

Several laws and ordinances of the Hong Kong government protect local cetaceans. The "Wild Animals Protection Ordinance" provides full protection to all dolphins, porpoises and whales in Hong Kong, and no person is allowed to hunt or willfully disturb them. The "Animals

and Plant (Protection of Endangered Species) Ordinance" strictly regulates the import, export and possession of cetaceans.

The Hong Kong government also implements a marine park system under the "Marine Parks Ordinance". One such marine park, called the "Sha Chau and Lung Kwu Chau Marine Park" (also known informally as "the dolphin sanctuary"), was established in 1996 under the ordinance, specifically to protect local humpback dolphins. The marine park covers a sea area of 1,200 hectares, including some of the important habitat of humpback dolphins in Hong Kong. Within the protected area, boat speed is limited to less than 10 knots. Bottom trawling is not allowed within the marine park, while other fishing activities are strictly regulated in order to provide a suitable habitat for the dolphins. Another marine park is scheduled to be established in 2002, which will include important habitat for both humpback dolphins and finless porpoises south of Lantau Island.

It was recommended during the discussion that park regulations should be better enforced to protect cetaceans, although the difficulty of enforcing regulations with respect to fishermen from mainland China was acknowledged. In addition, it was suggested that developments on the coast of mainland China that have the potential to affect the marine parks and cetaceans be plotted and the likely impacts assessed.

The "Environmental Impact Assessment Ordinance" provides further protection for local cetaceans and their habitats. All coastal development projects are required to identify the potential impacts, and to recommend mitigation measures to minimize such impacts on marine life, including dolphins and porpoises.

Workshop participants recommended that establishment of a protected area between mainland China and Hong Kong be considered and that collaborative efforts between the mainland and Hong Kong be augmented. The Ocean Park Conservation Foundation could play an important role in educating the public to support conservation efforts. A stranding network involving individuals and institutions from both the mainland and Hong Kong would be a potential mechanism for collaboration.

Folk attitudes and interactions with marine mammals

The Hong Kong public is increasingly aware of and interested in the plight of local dolphins and porpoises, largely as a result of exposure through the news media and educational materials produced by the Hong Kong government and local NGOs (e.g. Ocean Park Conservation Foundation). People have a high interest in dolphins and porpoises, and many have participated in educational seminars and dolphin watching trips in the last several years. The efficiency of the stranding program has been greatly enhanced in recent years through prompt reports by the Hong Kong public.

Description of existing research programs

The Hong Kong government funded several studies on the status and biology of humpback dolphins in Hong Kong waters starting in 1993, and again in 1995. In 1998, additional funding from the government was allocated for a 2.5-year study on the population biology of finless porpoises. The Hong Kong government and local NGOs continue to fund long-term monitoring of the local populations of humpback dolphins and finless porpoises. A doctoral study is currently underway to investigate the habitat-use patterns of local dolphins and porpoises. Studies on fishery by-catch and the possible impact of dolphin-watching activities on local cetaceans are also being conducted.

Needs for additional research

Systematic line-transect studies should be continued throughout the Pearl River Estuary and surrounding waters over the long term, with a view to monitoring trends in abundance for the entire dolphin and porpoise populations. There is also a need to obtain reliable data on levels of organochlorines and heavy metals from both of these populations. This could begin with a small-scale trial program of biopsy sampling of skin and blubber from known (photo-identified) individual dolphins. The movements of finless porpoises in Hong Kong and Mainland Chinese waters are poorly known, and a tagging and tracking project should be pursued in the near future. There has been little research on acoustic behavior and noise disturbance for either humpback dolphins or finless porpoises, and such work should be encouraged. Studies of by-catch should be carried out and should include fishing methods other than trawling. The Agriculture and Fisheries Department plans to implement a by-catch assessment program. It is important that assessment of by-catch and fishing activities be undertaken in collaboration with Mainland China, as boats from China fish in Hong Kong waters, even close to marine parks.

Present and potential whale and dolphin watching operations

More than five commercial dolphin watching operators offer regular trips from Hong Kong to see humpback dolphins, and the sighting rate is high year round in inshore waters. A voluntary code-of-conduct for dolphin watching has been outlined by the Hong Kong government, and the information is disseminated to tour operators and the public through training workshops and educational pamphlets.

Macao

In 1999, the Portuguese dependent territory of Macao became a Special Administrative Region (SAR) within the People's Republic of China. Macao has no territorial waters; its waters are under the jurisdiction of the mainland PRC. Hung noted that there have been some strandings of humpback dolphins on Macao shores.

Taiwan

Species and distribution

Changes to the list of cetaceans occurring in Taiwanese waters since the list in the 1995 workshop report include: 1) deletion of the dugong due to a lack of evidence of its existence in Taiwan waters, and 2) addition of striped, dwarf spinner (*Stenella longirostris roseiventris*) and Indo-Pacific humpback dolphins and melon-headed, Blaineville's beaked and tropical bottlenose whale (also known as Longman's beaked whale).

In 1999/2000, the taxonomic status of two sympatric forms of bottlenose dolphins in Chinese waters was clarified by Wang *et al.* (1999, 2000a, 2000b). Consistent genetic (mtDNA), external morphological and osteological differences between the two forms strongly support the existence of two species of bottlenose dolphins in Chinese waters, the common bottlenose dolphin (*Tursiops truncatus*) and the Indo-Pacific bottlenose dolphin (*T. aduncus*).

Population status

Field surveys of small cetaceans in Taiwan's southwestern waters were conducted by T. G. Chen's group in 1994-1999 and in northeastern and southeastern waters by L. S. Chou's group in 1997-2000. Huang (1996) reported the abundance estimates for common bottlenose dolphins (N=672) and Risso's dolphins (N=153) in southwestern waters. However, these estimates were not based on systematic line-transect methodology and are

of unknown accuracy and precision. Further, the geographical limits of the populations with regard to the surveyed area are not known. In addition, it is not clear whether some of the bottlenose dolphins might have been *T. aduncus*. These factors make the estimates of questionable reliability and usefulness. Y.-A. Chen (2001) reported the population estimates for Risso's dolphin (N=218, CV=29%), spinner dolphin (N=1490, CV=253%), pantropical spotted dolphin (N=1280, CV=38%), and common bottlenose dolphin (N=193, CV=53%) from the same surveys. The same problems of unknown population boundaries relative to the survey area and questions of species identity apply to these estimates. Estimates for southeastern waters will be made in the near future based on data collected during 1997-1999.

A small group of *T. aduncus* was observed in Nan Wan and adjacent waters of southern Taiwan. Because many of the photo-identified individuals were observed together over three consecutive summers, these dolphins likely represent a functional or family group. A preliminary estimate of abundance was only about 24 individuals in the study area of about 85 km² (Doc. 6, 8).

Habitat status

Coastal development of the west coast of Taiwan continues at a rapid pace. All major rivers draining into the Taiwan Strait are controlled upstream by dams and reservoirs. There is still no sewage treatment before discharge. Little monitoring of water quality and seafood contamination occurs. While analyses of tissues from pelagic cetaceans off Taiwan have shown that neither chlorine nor heavy metal accumulations are very high relative to other countries in the world (Chen 1998, Shih 2001, 2002, Chen *et al.* 2002), concentrations in coastal animals are unknown, and factors of age and sex in relation to

bioaccumulation have not yet been examined for the pelagic species.

Fish stocks off the west coast are seriously depleted, and fishing vessels from Mainland China are adding to the fishing pressure there. Illegal fishing methods (e.g. with explosives, electricity and toxins) are reportedly still employed, but this has not been confirmed. The Penghu County government banned the use of trammel nets in 1999 and has supported programs to remove fishing nets discarded or entangled on rocks and coral in the Penghu area. This type of fishing gear is still used widely in the coastal waters of western Taiwan.

Along the east coast of Taiwan, the main problems for the oceanic species are entanglement in drift gillnets (see below) and illegal harpooning (see below). Over-fishing of prey species may be a problem for the coastal cetacean species that forage on the narrow continental shelf.

Directed catches

Harpooning of small cetaceans continues illegally. One kill of two Risso's dolphins by Nanfang Ao (northeast coast) fishermen and three instances of illegal frozen storage of cetacean meat have resulted in prosecutions during the last two years. However, the defendants were acquitted in the latter cases. Wang reported a rough estimate of 600 cetaceans per year taken by harpoon in local waters and landed at Nanfang Ao in 1993-1995. The harpooned dolphins were mainly pantropical spotted dolphins (~70%), common bottlenose dolphins (~15%), spinner dolphins (~7%) and Fraser's dolphins (~3%).

Wang also reported that comparable numbers of harpooned cetaceans have been observed at the Tungkang fishing port (located in southwestern Taiwan) but that the data are awaiting analysis. Given that numerous distant-water tuna longliners are based at this fishing port, the

origins of the cetaceans are unknown. Because many of these vessels fish in or just outside Philippine waters, some of the animals may have come from there.

Cetaceans are now landed covertly and in pieces, usually in bags. Several recent confiscations of large amounts of cetacean parts suggest that there may still be substantial illegal harpooning of cetaceans.

The main outlets for cetacean products are in Yunlin and Chiayi counties with a small local market at Nanfang Ao. Before the price of cetacean meat increased (due to scarcity as a result of legal protection of cetaceans), it was used as a beef or pork substitute in the dried-meat market (e.g., jerky). Presently much of the cetacean meat is likely consumed fresh.

By-catches

These are described separately for coastal and far-seas fisheries:

Coastal fisheries

Wang reported on incidental catches at the fishing ports of Nanfang Ao, Hualien, Shihti and Chengkung along the east coast, based on surveys of carcasses at these ports of landing between the end of 1993 and mid-1995. At Nanfang Ao, about 30% of landed cetaceans [$n = 69$] were judged to be incidental catches (note: "incidental" catches refer to animals that were not clearly harpooned; incidental and directed takes with nets are not distinguishable at present). Although it was not possible to associate most carcasses with particular fishing vessels, Wang determined that ~30% of the incidental catch had been taken by pelagic longlines, ~22% by large purse seines, and the rest (~48%) by gear of uncertain type. From these data, a catch rate of 2.9 cetaceans per day was estimated for Nanfang Ao and assuming that fisheries that caught cetaceans operated

about 300 days per year, Wang estimated that roughly 275 animals are killed incidentally and landed at Nanfang Ao each year (note: because most fishermen discard by-caught cetaceans to avoid prosecution for possession, the number of carcasses landed at Nanfang Ao is necessarily less than the number of cetaceans actually killed). The main species were common bottlenose (~40%), pantropical spotted (~35%) and rough-toothed (~15%) dolphins. At Shihti harbour, based on two months of data, Wang found at least 19 cetaceans landed: 10 pantropical, six Risso's and one Fraser's dolphin, one short-finned pilot whale and one pygmy sperm whale. Based on this information, he estimated the annual cetacean by-catch by driftnets at this port to be 475 to 570 (9.5 cetaceans per month*10 months*5 vessels). During an interview with one Chengkung driftnetter in 2000, Wang was told that 16 or 17 cetaceans had been killed incidentally by this man's drift-net vessel in 20 days of fishing over a 1.5 month period. Assuming that this fisherman was representative of others at Chenkung, Wang estimated, the incidental catch rate to be 10.7 cetaceans per month per boat (fairly similar to the catch rate estimated for Shihti harbour). Using the rates determined for Shih-ti harbour (9.5 cetaceans per vessel per month) and Cheng-kung (10.7 per month), Wang estimated the annual catch at Hualien harbour to be 950 to 2,130 cetaceans, assuming a 10-12 month driftnet fishing period and 10-20 driftnet vessels operating from this harbour. In Chengkung harbour, there is a fleet of about 200-300 large mesh, drifting gillnet vessels. The extrapolated annual cetacean by-catch would then be 25,680 to 38,520 ($10.7 \times 12 \text{ month} \times 200\text{-}300 \text{ vessels}$). Wang reported his own earlier "guesstimate" of 5,000 to 10,000 cetaceans per year for the entire east coast to two Chengkung fishermen. These two fishermen insisted the actual number was higher. Species that have been recorded as by-catch at Chengkung harbour include Risso's, pantropical and Fraser's

dolphins and short-finned, pygmy sperm, Cuvier's beaked and Blaineville's beaked whales.

By combining the estimated incidental catches from these four harbors of the east coast (Nanfang Ao, Hualien, Shihti and Chengkung), Wang estimated the total number of cetaceans incidentally killed annually by fisheries to be between 27,000 and 41,000 in the eastern waters of Taiwan (details of the driftnet fisheries and calculations were presented in Doc. 6).

Wang emphasized and the group agreed that while these various estimates must be regarded as highly provisional because of the many assumptions involved and the relatively small sample sizes for the observations, they are indicative of large-scale mortality and suggest that there should be some urgency in collecting and analyzing further data on catch and by-catch in eastern Taiwanese coastal waters.

In the Taiwan Strait (western Taiwan), fishermen who use drifting gillnets, sink gillnets and trammel nets are plentiful. The number of cetaceans killed each year seems to be less than in eastern waters. However, the impact of fisheries on the cetaceans of the west coast may be greater due to already severely reduced numbers of these coastal species. The species that have been recorded killed incidentally by fisheries in the Taiwan Strait include bottlenose dolphins (both species) and finless porpoises. Wang also reported that a few fisheries may also catch cetaceans incidentally in southern waters. Nothing is known about cetaceans and their interactions with fisheries in northern Taiwan, where large numbers of vessels operate.

Chou reported the results of a questionnaire survey of fishermen from the (Penghu Islands (n=146) and a portion of the east coast (Hualien and Taitung counties; n=95) during 1999-2001. The proportion

of fishermen who had experienced by-catch was very high for the driftnet fisheries (60% in the Penghu Islands, and 71% in eastern waters). It was also surprisingly high for the longline fishery (55%) in eastern waters. Annual incidental catch rates were estimated from these questionnaire data at 0.4 cetaceans per boat for the Penghu Islands (n= 50 questionnaires; 3.7 cetaceans per boat for 12 driftnet fishing boats for 15 months) and 5.1 cetaceans per boat (n= 21 questionnaires in 2001) in the eastern waters. The number of actively operating boats was 150 for the Penghu Islands and 50 to 100 in eastern waters (although the numbers registered were 363 and 571 boats, respectively). Based on the estimated number of operating fishing boats, the number of cetaceans killed incidentally each year can be estimated as 57 by the Penghu Islands' boats and 185 to 2900 by the boats from Hualien and Taitung counties, eastern Taiwan. The cetaceans by-caught by the Penghu fishermen included bottlenose dolphins (both species), finless porpoises, and long-beaked common (with the former two being most common). The by-caught cetaceans in eastern waters include at least nine species: Risso's, pantropical spotted, Fraser's, common bottlenose, spinner and rough-toothed dolphins and pygmy sperm, dwarf sperm and long-finned pilot whales (the first three species being most common).

Distant-water fisheries

Wang reported that fishing vessels based in Tungkung Harbour (many operating in the EEZs of other countries), especially longliners, could be taking significant by-catch. Some of these boats are known to fish illegally in Philippine waters for bluefin and other species of tuna, so some of the cetaceans observed at the Tungkung fishmarket may have originated there. Recent information (post-workshop, supplied by Wang) also suggests that Taiwanese far-seas tuna purse-seine vessels are killing large numbers of cetaceans in some of the foreign fishing grounds. The activities

of the far-seas fleet need to be investigated thoroughly.

The Fishery Administration, Council of Agriculture has sponsored a far-seas by-catch study led by Chou since 1997 on a small scale. Many questionnaires were distributed to Taiwanese purse-seine vessels operating in the waters of Micronesia and Guam. Only one boat returned a completed questionnaire. According to this vessel's report, seven cetaceans (two large ones, five small ones) were killed accidentally during the operation from June 1999 to July 2000. Professional observers were not sent on board until 2000. The first one was on board a tuna purse-seine vessel in Micronesia for 45 days (19 Aug – 8 Oct 2000) and did not record any by-catch. The second was sent out on a tuna long-line boat in the Indian Ocean for 64 days (Aug-Oct), and no by-catch was recorded. Currently 9 observers have been trained and assigned to various boats. Their reports are expected in the near future.

Legal status and present management arrangements

Except for bottlenose dolphins, which were listed in the third category, all cetaceans were listed in the highest two categories in the list of protected wildlife under the Wildlife Conservation Law in 1990. The Wildlife Conservation Law was amended in 1994, and the status of bottlenose dolphins was upgraded. Under this level of protection, the capture, sale, possession or consumption of cetaceans, in whole or in part, is strictly prohibited. This law falls under the jurisdiction of the Council of Agriculture.

The continuing exploitation and traffic in cetaceans suggests that enforcement of the Wildlife Conservation Law is inadequate for these animals. The three most recent arrests for possession of cetacean parts for sale resulted in acquittals. Furthermore, a permit for the

live capture of several Indo-Pacific bottlenose dolphins was issued by the Council of Agriculture to the National Museum of Marine Biology and Aquarium in 2001 (this permit was not exercised due to later concerns by the permittee about the uncertain conservation status of this species in Taiwanese waters).

Other than the Wildlife Conservation Law, there are presently no formal management arrangements or plans for cetaceans in Taiwanese waters.

Folk attitudes and interactions with marine mammals

Due to many cetacean watch tours, public educational programs conducted by non-governmental organizations, popular articles, books and frequent media reports, public awareness of cetaceans has increased greatly. This awareness has led to the reporting of many stranded cetaceans both dead and alive.

The Taiwan Cetacean Society has grown in size since 1995 (now with more than 100 members) and several additional non-governmental organizations involved in cetacean conservation have been established. A national stranding network (Taiwan Cetacean Stranding Network) was established in November 1996 with support from the Council of Agriculture, and a Cetacean Committee within the Society of Wildlife & Nature was established in January 1997. The Kuroshio Ocean Education Foundation and Taiwan Cetacean Society were founded in 1998. The *FormosaCetus* Research and Conservation Group was established in 2001 to provide an independent perspective on cetacean conservation in Taiwan based on credible scientific research. Also in 2001, the Marine Education Foundation of the National Museum of Marine Biology and Aquarium was founded.

Although public attitudes towards cetaceans have changed greatly, there are still people who hunt,

sell and consume cetacean meat. The main markets are in Yunlin and Chiayi counties, with smaller local markets at fishing ports where cetaceans are still landed (e.g., Nanfang Ao). Cetacean meat is believed to have medicinal properties for postpartum women.

Description of existing research programs

Since 1995, many works have either been formally published in journals, presented in symposia, or appeared as theses or governmental reports. The subjects include species checklists and results of surveys (Chou *et al.* 1995b, Yang *et al.* 1999, Yeh 2001, Y.-A. Chen 2001, Chou 2002, Wang *et al.* 1995, 2001a, 2001b), taxonomy of bottlenose dolphins (Wang 1999; Wang *et al.* 1999, 2000a, 2000b), life history of pantropical spotted dolphins (Chu 1996), acoustics (Wu 1995, Yu 2002), physical habitat analysis (Chen 2001, Yeh 2001), phylogeny (Lin 1997), comparative morphology (Lin *et al.* 1998, J.-P. Wang *et al.* 1998, 1999; Chen *et al.* 1999, Kuo *et al.* 2002), diet analysis (Chou *et al.* 1995a), chemical and heavy metal accumulations (Chen 1998, Shih 2001, Chen 2002, Chen *et al.* 2002), whale watching impacts (Yo 2000, Kou 2002), economy and management of whale watching (Tseng 1999, Chu 1999, Chu 2002), fishery interactions (Chi 2001), parasitology (T.-M. Wu 1996, M.-T. Wu 1997), veterinary medicine (Yang 2000; T.-D. Chiu 2001; Chou 2000, 2001) and fishery deterrence gear (Lai 2002, Chen 2001). Workshop participants noted that many of these research results have appeared in theses or internal reports and stressed the importance of ensuring that they are published in the peer-reviewed literature.

Response to strandings was initiated in 1994 by Chou's group and taken over by the Taiwan Cetacean Society in 2000. Currently, only the TCS and the National Museum of Marine Biology and Aquarium are authorized to deal with strandings, although other agencies and groups assist with the work. Biological samples from stranded animals

are supplied to scholars and organizations for various research purposes. The rehabilitation of live-stranded cetaceans started in 1997. Two dolphins (a male Risso's dolphin and a male rough-toothed dolphin) were released in 2000 and 2002, respectively.

Wang reported that *FormosaCetus* Research and Conservation Group has been studying a small group of Indo-Pacific bottlenose dolphins in southern Taiwan since 2000. This is a long-term project with the aim of obtaining basic biological information on the species in the region. Also, *FormosaCetus*, in collaboration with S.K.Y. Hung of the Hong Kong Cetacean Research Project, conducted the first cetacean survey of the coastal waters of western Taiwan in June 2002. This survey confirmed that the Indo-Pacific humpback dolphin is a major component of western Taiwan's cetacean fauna—not a vagrant or an unusual inhabitant. Further studies of the cetaceans of western Taiwan are planned for 2003. Genetic analyses of Taiwan's bottlenose dolphins are being conducted by J.Y. Wang and L. Moller (Yale University). The prevalence of morbillivirus in stranded cetaceans is being investigated in collaboration with J.-Y. Liao, veterinarian at the National Museum of Marine Biology and Aquarium. Most of the funding for this group's work is obtained from sources outside Taiwan—e.g., Ocean Park Conservation Foundation in Hong Kong.

The main depository for skeleton specimens is the National Museum of Natural Sciences – NMNS (Taichung – with several hundred specimens of most species confirmed from Taiwan). Other institutions with collections include: National Taiwan Ocean University – NTOU (Keelung); Wang's laboratory at the National Cheng-Kung University – NCKU (Taiwan); Chou's laboratory at the Department of Zoology, National Taiwan University – NTU (Taipei); and the National

Museum of Marine Biology and Aquarium – NMMA (Pingtung County). There are also display specimens at numerous institutions throughout Taiwan (e.g., Kenting National Park; Ocean World, Taipei). A list of all specimens is being collated by Y.-J. Chen, Collections Manager of the NMNS.

Needs for additional research

Rescuing stranded cetaceans and investigating the impact of eco-tourism have been the main foci of cetacean conservation in Taiwan until recently. Although programs of research to assess populations and address by-catch have begun, funding has been inadequate. Information about the population structure, population size, and levels of mortality caused by fisheries is of the highest priority for cetacean conservation in Taiwan. Clearly those species that are especially prone to fatal interactions with fisheries should be given greatest attention. In addition, more work is needed to obtain basic biological information (e.g., distribution, reproductive biology, home range, movement patterns, etc.) for all species. As part of understanding the level of mortality caused by fisheries, an updated inventory of all fisheries, the gear types used and the methods of operation is needed. Although there is concern about the potential disturbance caused by the rapidly expanding whale watching industry in Taiwan, this is clearly a low priority compared to the impact of cetacean mortality caused by fisheries

Present and potential whale and dolphin watching operations

Following shipboard-surveys conducted by Chou along the coast of Hualien County (central eastern Taiwan) in 1996 and others in 1997 (Yang *et al.* 1999), whale watching started at Shihtsai port in 1997. The number of whale watching boats increased from one in 1997 to 33 in 2001 along the entire coast, with 90% operating in eastern coastal waters. Chou reported that the number of

tourists reached 200,000 in 2001. There are four major areas for whale watching along the east coast of Taiwan. One to 14 whale watching boats run cruises from these areas.

Although all cetacean watching tours originate along the east coast, there is a harbor cruise in Taichung Harbour (central western Taiwan) that is promoted as a dolphin watching tour. However, the course taken by the tour boat does give tourists a high probability of seeing dolphins.

Cetacean watching tours in other regions of Taiwan may also be feasible. However, surveys are required to evaluate their potential.

2.1.5 East Timor

No information was available to the workshop.

2.1.6 Indonesia

Species and distribution

Indonesian waters have an exceptional cetacean diversity. A recent and extensive review of cetaceans positively identified in Indonesian waters lists 20 species of small cetaceans, provides information on their distribution and notes the occurrence of the striped dolphin as still unconfirmed (Appendix 2; Rudolph *et al.* 1997).

A comprehensive review of the status of the dugong in Indonesian waters indicates that there is little information on its distribution, abundance, movements, feeding ecology, or reproduction in the region (Marsh *et al.* 2002).

Population status

There is no information on the population status of Indonesia's marine mammals except for the Irrawaddy dolphins of the Mahakam River, also called *pesut*. This population has been declining rapidly rate and is currently estimated to number less than 50 animals, possibly only 35 – 42

(Kreb 2002). The earliest estimates in 1978 by the Directorate of Forest Protection and Natural Conservation were 125-150 animals for the same population. In 1993 the population was estimated to consist of only 68 individuals (Priyono 1993). Although these numbers cannot be use for a rigorous trend analysis, the extremely small size of this apparently isolated population were regarded as sufficient cause for the IUCN to list it as "critically endangered" in 2000.

Marsh *et al.* (2002) describe dugongs as rare or depleted throughout their original range in the Indonesian archipelago, with a rough population estimate of perhaps 1,000 animals in 1994. In Indonesia, declines in dugong abundance and distribution, including extirpation of local populations, are likely to continue and may even accelerate (see habitat status).

Habitat status

Indonesia's marine mammal habitats include major rivers and mangroves as well as coastal, reef and open-ocean environments. These diverse habitats are often in close proximity to one another because of Indonesia's narrow continental shelf, abundant oceanic islands and extreme depth gradients (Kahn 2001).

Indonesia has undergone extensive political reform since 1997 and currently pursues a policy of decentralization and regional autonomy. In many Indonesian provinces there has been an increase in the rates of extraction of natural resources including rampant and uncontrolled logging, large- and small-scale mineral mining, expanded coastal developments and industrialization, and increased mariculture, together with ever-growing coastal and pelagic fisheries. Hence, it is likely that in addition to the Irrawaddy dolphins (such as the population of the Mahakam River), other species and populations of coastal cetaceans and the dugong face similar and equally severe

threats. Many marine mammal populations that inhabit Indonesia's estuaries and coastal waters may be in decline. For Indonesia's oceanic cetacean species, fishery by-catch has probably caused significant reductions in abundance, especially for small cetaceans but possibly also

for large cetaceans such as sperm whales and blue whales in the eastern provinces.

An overview of environmental impacts of relevance to Indonesia's marine mammals is given in Table 4.

Table 4. Overview of environmental impacts of relevance to Indonesia's marine mammals
(from www.apex-environmental.com/IOCPImpacts.html, which includes more detailed descriptions of impacts).

Impacts	Habitats affected		
	Riverine	Coastal	Oceanic
Habitat destruction – Forest logging	■	■	—
Habitat destruction – Coastal development	■	■	—
Chemical pollution – Industrial and urban wastes, terrestrial run-off	■	■	■
Chemical pollution – The discharge of mining wastes at sea. The disposal of toxins via a procedure termed submarine tailings placement (STP) is of special relevance to Indonesian marine life.	—	■	■
Acoustic pollution – Destructive fishing practices such as reef bombing. This illegal fishing method can have regional impacts, especially in the vicinity of sensitive marine areas for cetaceans such as preferred feeding and breeding areas as well as migration passages.	—	■	■
Acoustic pollution – Seismic surveying for oil and gas by offshore industries.	—	■	■
Acoustic pollution – Military and scientific experiments	—	■	■
Gill netting in sensitive marine areas for cetaceans.	■	■	■
Traditional hunting, especially in the waters of the East Flores islands.	—	—	■
Discarded plastics and fishing gear.	■	■	■
By-catch in local and regional fisheries.	■	■	■

Directed catches

Directed catches of several species are known to occur in the whaling villages of Lamalera on

Lembata and to a lesser extent Lamakera on Solor (Barnes 1996, Kahn 2002c). The extent and impact of directed takes of cetaceans and

dugongs by artisanal and commercial coastal and pelagic fisheries in Indonesian waters are largely unknown — as they are for other cetacean-fishery interactions. However, it is important to note that Indonesia has the largest shark fishery in the world and catches more sharks than Malaysia, Philippines and Thailand combined (see review by Kahn and Fauzi 2001). In addition, Indonesia's fisheries are conducted by tens of 1000s of multi-species, multi-gear vessels, and the retention of by-caught or deliberately captured small cetaceans for consumption and/or bait in long-line operations is thought to be widespread.

Limited interviews at sea indicate that artisanal fishermen and small-scale long-line vessels (i.e., <400 hooks/set) in eastern Indonesia regularly use harpoons to catch small cetaceans (Kahn 2002c). Dolphins are harpooned opportunistically, mostly during bow-riding activities by the animals or during active pursuit by the long-line vessels, especially when long-line bait supplies for fisheries targeting pelagic sharks and other elasmobranchs are low. The size of the directed catches by large-scale long-line fishing operations (e.g. >400 hooks/set) and the large pelagic driftnet fleet are unknown.

Small cetaceans are taken deliberately in Indonesia in "tiger nets". Also called "experimental nets", these are large-mesh nets set in migratory corridors or island passages that specifically target large migratory marine life (Kahn 2002b). Tiger nets are sophisticated structures, often kept in place with a permanent buoyed frame that may span hundreds of meters. Once in place, the nets can result in immensely high catch rates of large marine life (e.g. Lembeh Strait, North Sulawesi – see also below). Specific characteristics of tiger nets that make their use qualify as a destructive fishing practice (DFP) include:

- 1) They are strategically positioned to catch extremely high numbers of large migratory and/or vulnerable marine species.
- 2) Populations can be over-exploited in very short time spans (1-2 migratory seasons) yet take decades to recover, if they recover at all.
- 3) Local fishing practices have major and regional ecological and socio-economic impacts (see below).

Catch data are available for two sets of a Taiwanese tiger net in the pelagic migratory channel at Tangkoko, Manado area, NE Sulawesi. The tiger net was positioned at the entrance of Lembeh Strait, a narrow corridor at the eastern tip of north Sulawesi. The net was in place from March 1996 - February 1997. All marine life killed in this net was processed locally in Bitung, mostly as pet food for export. Because of this net's particular design and position, the catch included a high species diversity and abundance of large marine life: 1,424 manta rays (exact species composition unknown), 18 whale sharks, 312 other, unidentified sharks, 577 pilot whales (may include other globicephalines), four baleen whales (reportedly minke but likely Bryde's whales), 326 dolphins of unknown species, 789 marlin (species unknown), 84 unidentified turtles (species unknown) and nine dugongs. Sightings of the more heavily impacted species have been minimal after the removal of the net (as reported by the marine tourism industry in Lembeh and Bunaken National Park, NSWSA unpublished data). Indications are that previously common species in the area, such as manta rays and pilot whales, had not recovered as of 2002.

Unsubstantiated reports mention that permits have been issued to the same Taiwanese company responsible for the Lembeh Strait tiger nets for at least 10 other identical 'experimental fish traps' in remote areas of the Moluccas. It is possible that

these nets are currently in operation and resulting in high landings of large migratory marine life.

Despite numerous reports indicating widespread over-exploitation of marine resources in Indonesia, the nation's fishing effort is considered by policy makers to be below that to obtain maximum sustainable yields (MSY). As a result, Indonesia's national fisheries policies continue to strive towards increasing fishing licenses and achieving higher overall catches, rather than towards management to achieve sustainability, including restricted or closed areas, improved catch handling and other measures to add value to the catch.

Live-captures

Indonesia has three dolphinariums, Jaya Ancol Oceanarium and Sea World, both located in Jakarta, and Dolphin Lodge on Batam Island near Singapore. Jaya Ancol Oceanarium opened in 1974 and has held six species: Irrawaddy, Indo-Pacific bottlenose and spinner dolphins, false killer whales, finless porpoises and dugongs (Appendix 8). These were all captured in Indonesian waters and included seven Irrawaddy dolphins from the critically endangered Mahakam River population. At present, only Indo-Pacific bottlenose dolphins remain at the facility. Dolphin Lodge opened in 2001 with 24 Indo-Pacific bottlenose dolphins from Indonesian waters. Beasley reported that there are indications that survivorship is poor. Live-captures in Indonesian waters for export to recently established oceanaria in other SE Asian countries (including China and Thailand) has also occurred. The extent of this trade is unknown.

By-catches

By-catch is considered the major threat to all marine mammals in Indonesian waters, and especially to small cetaceans and the dugong. The level of marine cetacean by-catch is likely to have increased significantly due to the greatly expanded national and foreign fishing fleets in Indonesian waters—

both long-range longliners and driftnetters. No by-catch monitoring system is operational, and fisheries data on sharks and marine mammal species are particularly poor.

Legal status and present management arrangements

All land and water natural resources are controlled by the state, in accordance with Article 33(3) of the 1945 Constitution. The state (the central government) thus has responsibility for protecting species. The National House of Representatives—Dewan Perwakilan Rakyat (DPR)—has enacted several laws (*undang-undang*) that relate, either specifically or generally, to the protection of marine mammals. Taken together, these laws (1) confirm state authority and responsibility for management of living marine resources, including marine mammals, and their habitats; and (2) establish a loose and amorphous legal framework through which living marine resources, including marine mammals, are to be protected and conserved for their intrinsic value and for benefit of Indonesians, present and future; and (3) can provide specific protections for certain marine mammals that are listed as endangered or threatened.

Several national laws include references to the fact that marine mammals are protected throughout Indonesian waters. Nevertheless, the legal status of cetaceans and the dugong in Indonesian waters is unclear. Existing legislation is inadequate in several respects, not least of which is that it lacks implementation and enforcement mechanisms. Laws relating to marine mammals are vague, with few specific requirements. Terms such as 'protection' are not well defined, and the protected status does not address the traditional (sperm) whaling activities in Lamalera, Lembata and the continued directed takes of small cetaceans in eastern Indonesia and elsewhere, nor does it recognize the numerous environmental threats faced by cetaceans and dugongs in Indonesia's

waters or recognize important international conventions and specific management needs for endangered and vulnerable marine mammal species and populations. In addition, laws relating to marine mammals are confused by secondary fisheries laws, some of which classify marine mammals as fish and seek to promote and regulate fish harvest. In some regions the protected status of cetaceans and dugongs is unknown or ignored. Habitat destruction and directed catches of small cetaceans especially are widespread.

To address these issues, a recent discussion paper has been produced at the request of the Ministry of Marine Affairs and Fisheries to outline the possible establishment of a marine mammal 'no-take zone'. This marine mammal sanctuary, referred to a "Protected Marine Mammal Fisheries Area" would extend throughout Indonesia's national waters and economic exclusion zone (EEZ). It would prohibit commercial and scientific takes of marine mammals and strengthen specific fisheries regulations that benefit to marine mammals (Kahn 2002a). Importantly it would a) integrate the existing laws within a unified marine mammal conservation strategy, b) identify and address the current gaps in legislation and legal prescriptions, c) provide a clear management tool for the strategy's implementation on the ground, and d) incorporate both major environmental threats and international treaties relevant to (migratory) marine mammal management.

Both the Ministry of Forestry and Ministry of Fisheries and Marine Affairs have initiated programs to improve marine mammal management and conservation at both national and site-specific levels. A national strategy for the conservation of migratory marine life was completed in 2001 and includes descriptions of marine mammals and management recommendations (DKP/IPB 2001).

Marine mammal conservation and management issues are increasingly being considered in protected areas such as Bunaken Marine Park and Komodo National Park. In the latter, extensions to the Park's boundaries and additional buffer zones have been adopted by the management authorities and will be incorporated into a 25-year management plan, in order to protect sensitive marine areas, such as migration corridors, for cetaceans (Pet and Yeager, 2000). Needed conservation actions have been identified for the critically endangered *pesut* population of the Mahakam River in East Kalimantan (Doc. 12). Strong and continued government commitment to implementation is urgently needed to avoid extirpation of this population in the near future.

The effective implementation of these government and non-government marine mammal conservation initiatives will greatly improve the status of Indonesia's marine mammals.

Folk attitudes

No new information was available. Cetaceans are generally perceived as competitors for fish. However, in a country as vast and ethnically diverse as Indonesia, folk attitudes to marine mammals are likely to be different for each province, coastal district and community. In some parts of Indonesia such as West Timor and North Sulawesi dugongs are protected because they are thought to bring luck. In contrast in other areas "sea gypsies" catch dugongs because of their magical powers. These kills are generally opportunistic (see Marsh *et al.* 2002 for details).

Descriptions of existing research programs

Prior to 1997, only a limited number of scientific studies had been conducted on marine mammals in Indonesian waters. Ecological aspects such as species-specific habitat preferences in Indonesia were (and still are) largely unknown.

Surveys of the critically endangered Irrawaddy dolphin population of the Mahakam River in East Kalimantan are ongoing (Doc. 12; Krebs 2002). The focus is to obtain data on the distribution, abundance and ecology of this declining population and to develop a conservation program for Indonesia's sole freshwater dolphin population. Krebs (2002) estimated total abundance in the Mahakam during 1999–2000 at only 35–42 dolphins.

In recent years, visual and acoustic cetacean surveys and ecological studies on oceanic cetaceans have been periodically conducted in eastern Indonesian waters. Research areas since 1997 have included North Sulawesi and the Sangihe-Talaud Archipelago 1997 (Kahn 1999, Kahn 2001), as well as Komodo National Park since 1999 (Kahn *et al.* 2000, Pet and Yeager 2000, Kahn and Pet 2001) and the eastern Flores to western Alor region, including the islands of Adonara, Solor, Lembata, Pantar and Alor since 2001 (Kahn 2002c). For each area, surveys have been conducted at least annually and often seasonally during inter-monsoon periods. The surveys focus on the following cetacean management and conservation priorities for marine mammals in eastern Indonesia:

- 1) Identify which species are present in the research area and adjacent waters and provide data on relative abundance, seasonality, habitat use, migratory passages of regional importance, tourism potential and environmental impacts.
- 2) Integrate survey outcomes with other marine conservation actions such as the establishment of additional Marine Protected Areas.
- 3) Initiate ecology-focused research on priority species using photographic, genetic and telemetric techniques.

- 4) Involve government, industry and community stakeholders in marine mammal monitoring and outreach programs.

Indonesia is located in an equatorial region where natural inter-oceanic exchange of marine flora and fauna occurs. Cetacean movements between the tropical Pacific and Indian Oceans can occur through the passages between the Lesser Sunda Islands (Nusa Tenggara) which span over 900 km between the Sunda and Sahul shelves. The routes of whales entering or leaving the Indian Ocean from or to the Pacific Ocean lie exclusively in Indonesian seas. The ecological significance of these passages remains poorly understood, yet their importance as migration corridors has been established (PHPA 1984, Kahn and Pet 2001, Kahn 2002b).

Cetaceans that use these passages for local or long-range movements are vulnerable to directed catches, habitat destruction, subsurface noise disturbances (e.g., reef bombing), entanglement in fishing gear, marine pollution and overfishing of marine resources (Hofman 1995; Fair and Becker 2000). Most, if not all, of these phenomena occur in the waters of Indonesia and would affect both resident populations and transient populations. On-going research is intended to assess the role of eastern Indonesia's island passages as migratory corridors and improve the management of large migratory marine animals.

Kahn reported that additional research is being conducted on spinner dolphins along north coast of Bali.

Results of completed research in east Kalimantan, Sulawesi and Nusa Tenggara have been disseminated to various stakeholders, ranging from local fishermen and coastal communities to the central government in Jakarta, where marine mammals are increasingly considered as a national

marine conservation priority. Progress has been made on capacity building and making educational materials available, including brochures on species, cetacean ecology, fisheries interactions, marine mammal stranding and rescues.

Needs for additional research

Research is needed on the distribution, abundance and ecology of all marine mammal species found in Indonesian waters. Identification of habitat requirements of endangered and vulnerable species and assessment of threats to such habitats is most important.

Indonesia's level of marine resource exploitation is high and human pressures on marine mammal populations are intense. Thus, cetacean and dugong research in Indonesia tends to be conservation-driven and focus on outcomes that assist the development and implementation of threat mitigation and conservation strategies. Because of the lack of knowledge for most populations, a habitat focus is often most effective in providing guidance toward short-term conservation goals, while at the same time allowing research on species to address ecological questions relevant to long-term management.

For the Irrawaddy dolphins in the Mahakam River, continued population monitoring and threat mitigation are crucial. Proposed mechanisms for conservation include alternative employment for gillnet fishermen and improved enforcement against destructive fishing practices and illegal logging (Doc. 12). Expanded survey effort is needed, including statistical testing of models used to estimate dolphin abundance. Toxicological and genetic analyses of tissues obtained from stranded or incidentally killed dolphins, and investigations into habitat destruction.

Continued photographic identifications, additional telemetry research, toxicological and genetic

analysis of sampled and harpooned cetaceans (for local consumption) are needed (Kahn and Pet 2001, Kahn *et al.* 2001). Additional capacity building and collaboration with National Parks staff and environmental NGOs are paramount for long-term continuation of survey activities and successful implementation of management measures.

An assessment of marine mammal by-catch in commercial fisheries operating within Indonesia's EEZ is urgently needed. Targeted catches of cetaceans and depredation on fish catches by cetaceans need to be investigated and quantified. Realistic mitigation measures should be considered as soon as a problem has been identified, and trial solutions may be implemented during the initial fishery assessment. A precautionary approach should be applied to those fishing practices that have been implicated in extremely high cetacean by-catch levels in other SE Asia countries.

Research is also urgently needed on the extent and locations of live-capture operations and the potential effects of these on local populations.

Present and potential whale and dolphin watching operations

Whale and dolphin watching in Indonesia is a relatively new industry and has grown rapidly in the last five years. Most activities are based on Bali (Fig. 1). On the island's rugged south coast, dolphin-watch tours focus on spinner dolphins in open waters 5-15 km south of Uluwatu. On the relatively sheltered north coast of the island, tours focus on pantropical spotted dolphins and, to a lesser extent, spinner dolphins. These activities are largely unregulated and more operators are active each year.

Aggressive boat handling and crowding increasingly result in harassment of the

dolphins. Wild dolphins are also being fed by the tour operators, presumably to encourage the animals to approach the boats and to tame them for close-up interactions with tourists. This is reportedly a substantial problem in Lovina on Bali's north coast. On most of Bali's dolphin tours, interpretative and educational materials are lacking.

Codes of conduct for responsible cetacean watching have been developed by APEX Environmental, based on international guidelines from the Whale and Dolphin Conservation Society. These have been endorsed by several government agencies and non-governmental organizations. However, these codes are not legally binding and thus are not enforceable.

The main species involved in Bali are the spinner dolphin, pantropical spotted dolphin, short-finned pilot whale, sperm whale, fin whale, and Bryde's whale. In eastern Indonesia, multi-day "whale watching expeditions" which began in 2001 concentrate on several species of oceanic dolphins as well as Bryde's whales, sperm whales and occasionally blue whales (Hoyt 2000; Kahn 2002a).

Cetacean watching potential in other regions has increased due to the various research and survey results and greater awareness. However, this may not be an appropriate tourism activity without strict controls and enforcement in place first (Kahn *et al.* 2000). Additional legislation and strong government commitment to implementation and enforcement are needed prior to further promotion and development of cetacean watching activities in Indonesian waters.

2.1.7 Laos

Beasley provided an update based in part on Doc. 34. Additional information was provided by Ian Baird after the workshop.

Species known distribution

Only the Irrawaddy dolphin (called *pa kha*) occurs in the land-locked Lao PDR. Its presence is confined to below Khone Falls, situated 5 km upstream from the Laos/Cambodia border in the southernmost part of the country. During the dry season it is confined to a deep-water pool called *Veun Nyang* in Lao and *Chhoeuteal* in Khmer. The dolphins that inhabit the Mekong River waters of Laos are part of the same population as those in the Cambodian and upper Vietnamese portions of the river. Based on interview surveys and collections of skeletal material, dolphins also occur during the wet season in the Sekong Basin in Laos, as far north as Kaleum District, Sekong Province (Baird and Mounsouphom 1997). During the wet season, the "Laotian" group of dolphins likely moves south into Cambodian portions of the Mekong River as well as up small tributaries along the Laos/Cambodia border.

Population status

Veun Nyang Pool on the Laos/Cambodia border is the most well-studied dolphin habitat in the Mekong River. Research began in 1991 (Baird and Mounsouphom 1994, 1997; Baird *et al.* 1994; Stacey 1996; Borsani 1999; Stacey and Hvenegaard 2002). Baird reported (in Perrin *et al.* 1996) that approximately 30 dolphins were found in this area in the mid 1990s. On the basis of a visual and acoustic survey, Borsani (1999) estimated that there were 8-10 dolphins present in the pool during March and April 1998. Surveys in 2001 observed only 5-9 dolphins during each of the four times that the pool was visited (Beasley and Phay Somany 2002). This apparent decline in abundance may reflect either negative effects of

dolphin watching tourism or an actual decline in the overall population in the Mekong River. Beasley reported that local fishermen from Hang Khone Village also believe that fewer than 10 dolphins remain in the area. Due to a lack of research on the Cambodian Mekong River, animal movements are unknown and it is uncertain whether the population has declined substantially. However, based on interviews and collection of carcasses (Baird 1994), it is likely that a decline has occurred. Significant factors have been entanglement in large-mesh gillnets and use of explosives (intensive until 2001) in fishing. It is unclear what impact dolphin watching is having on the animals, but it has been observed that they avoid boats (Stacey 1996).

Habitat status

The habitat status for the Laos/Cambodia border section of the Mekong River is similar to that outlined in the national review for Cambodia.

Directed takes

There are no known recent directed takes of dolphins in Laos. Directed takes were recorded historically in the Mekong and Sekong Rivers, including at Veun Nyang Pool (Perrin *et al.* 1996).

By-catches

By-catches have been recorded previously from Veun Nyang Pool on the Laos/Cambodia border (Perrin *et al.* 1996). Between December 1990 and September 1998, a total of 27 dolphins were recorded to have died in the Mekong River near the border through direct observation of carcasses, multiple reliable reports from villagers of carcasses, and photographs or collection of skeletal material (Baird and Mounsouphom 1994, 1997; Baird 1999). In addition, one carcass was recovered during 2001, apparently the result of by-catch in a gillnet (Beasley and Phay Somany 2002). In April 2002, a juvenile dolphin died of injuries possibly incurred by the propeller of a boat (pers.

comm. from Mr. Keo, Veun Kham Village, May 2002). By-catch is the most significant current threat to the survival of the Irrawaddy dolphin population in the Mekong River.

Legal status and present management arrangements

In Laos, dolphins are fully protected by Decree 118/MCC; the hunting, capturing and trading of animals is illegal. Violators can be fined 50-000-500,000 kip (approx US\$65 – 650) and imprisoned for three months to one year (Baird and Mounsouphom 1997, Perrin *et al.* 1996).

Between 1993 and 1997 the Lao Community Fisheries and Dolphin Protection Project (under the direction of the Agriculture and Forestry Division of Champasak Province) was instrumental in raising the awareness and knowledge of local people towards the conservation of Irrawaddy dolphins (Perrin *et al.* 1996). This project was followed up by the Environmental Protection and Community Development portion of the Siphandone Wetland Project in 1997 – 1999. However, Baird reported this program has ended.

The transboundary nature of the group of dolphins along the border with Cambodia has made management difficult.

Folk attitudes and interactions with marine mammals

Laotian people generally strongly revere the dolphins that inhabit the Mekong River and have well-known folklore and beliefs concerning them. Local people will generally try to release alive any dolphin accidentally caught in fishing gear. It is taboo to bring dolphin bones into Laotian villages near Veun Nyang (Baird and Mounsouphom 1994, 1997).

Description of existing research program

The dolphin research and conservation program sponsored by Wildlife Conservation Society and

James Cook University (Queensland, Australia) in Cambodia includes projects on the dolphins in Veun Nyang Pool on the border with Laos. There currently is no other cetacean research occurring in southern Laos.

Needs for additional research

The needs for additional research are as follows:

1) Continued training of Laotian Department of Fisheries officials (at both national and local levels) and university students, preferably as a joint exercise with similar persons from Cambodia, should be a priority. This will ensure the continuation of research and conservation programs, irrespective of assistance from outside countries.

2) Increased cooperation among Laotian, Cambodian and Vietnamese researchers and/or authorities is needed to ensure that conservation actions are coordinated over the entire range in the Mekong River system.

Present and potential whale and dolphin watching operations

Present dolphin watching operations focus on the animals in Veun Nyang Pool. The first was established in the early 1990s in Laos with some support from the Lao Community Fisheries and Development Project. There are a number of small "long-tail" boats involved from both sides of the border, although dolphin-based tourism is more developed on the Laos side. There are currently voluntary guidelines on the number of people that can travel in the boats, as well as general agreement to not disturb the dolphins. However, the operations have increased rapidly in size, and there is a need for more formal regulations.

Although dolphin-based tourism was initially based only in Hang Khone Village on the south side of Khone Island, the inhabitants of Khone Tai Village have now set up their own operations and there has been conflict between the two villages concerning respective shares of the tourist trade.

2.1.8 Malaysia

Species and distribution

Examination of the published and unpublished literature indicates that 17 species of small cetaceans and the dugong have been confirmed either as resident or transient within Malaysian territorial and EEZ waters (Table 5; Appendix 2). There is also evidence to suggest that a further five species of small cetaceans stray or pass through Malaysian waters at least occasionally: pygmy killer and ginkgo-toothed beaked whales and pantropical spotted and rough-toothed dolphins. Confirmed records of these four species exist for neighboring countries—Thailand, Myanmar, Vietnam, Indonesia, and the Philippines (Jaaman 2001).

In East Malaysia, dugongs have been recorded from Tanjung (cape) Datu, Lawas, and Limbang in Sarawak (Bank 1931; Jaaman *et al.* 2000a; Jaaman *et al.* 2001b), Labuan Island and from various locations in Sabah (Jaaman 2000b; Jaaman *et al.* 1999, 2000b). Distinct populations may occur in Kudat, Kota Kinabalu and Brunei Bay in Sabah. In Peninsular Malaysia, it has been suggested that a small population of dugongs resides in the southeastern waters of Johore and Singapore (Mansor *et al.* 2000).

Reports by Beasley and Jefferson (1997), Jaaman (2000b), Jaaman *et al.* (2000a,b), Anyi and Jaaman (2002) and Jaaman *et al.* (2000a,b; 2001b) indicate that a number of small cetaceans inhabit Sabah and Sarawak inshore waters, especially in bays and estuaries along the coast. The most common species reported are the Irrawaddy dolphin, bottlenose dolphin (*T. truncatus* and/or *T. aduncus*), Indo-Pacific humpback dolphin and finless porpoise. Surveys conducted by the Universiti Malaysia Sabah have confirmed the occurrence of Irrawaddy dolphins in Batang (river) Rajang, Batang Saribas, Tanjung Manis, Muara (estuary)

Tebas and Tanjung Po in Sarawak (Jaaman *et al.* 2000a, 2001b) and the bay of Sandakan, Labuk (Jaaman *et al.* 2000b) and Cowei in Sabah (Anyi and Jaaman in press). In addition, small numbers of bottlenose dolphins and Indo-Pacific humpback dolphins are known to be present in Cowei Bay, Sabah and within Talang-Satang National Park, Sarawak. Recent reports by Nadarajah (2000) and Jaaman *et al.* (2001a) have confirmed, through

sighting and stranding records, the common occurrence of inshore cetaceans in Peninsular Malaysia, particularly around Langkawi Island and in some other marine parks.

Table 5. Currently known distribution of small cetaceans and the dugong in Malaysian waters

Species	Peninsular Malaysia	Sabah	Sarawak	Remarks
1 <i>Delphinus sp.</i>	x			
2 <i>Dugong dugon</i>	x	x	x	
3 <i>Globicephala zacrorhynchus</i>	x	x		
4 <i>Grampus griseus</i>			x	
5 <i>Kogia breviceps</i>			x	
6 <i>Lagenodelphis hosei</i>		x	x	
7 <i>Neophocaena phocaenoides</i>	x	x	x	
8 <i>Orcaella brevirostris</i>	x	x	x	
9 <i>Orcinus orca</i>		x	x	Layang-Layang Atoll
10 <i>Peponocephala electra</i>	x	x	x	Also at Layang-Layang Atoll
11 <i>Pseudorca crassidens</i>		x	x	
12 <i>Sousa chinensis</i>	x	x	x	
13 <i>Stenella attenuata</i>		x	x	Also at Layang-Layang Atoll
14 <i>Stenella longirostris</i>	x	x	x	Also at Layang-Layang Atoll
15 <i>Tursiops aduncus</i>	x	x	x	
16 <i>Tursiops truncatus</i>		x	x	Also at Layang-Layang Atoll
17 <i>Ziphius cavirostris</i>		x		

Population status

There are no estimates of marine mammal populations and little is known about their current status in Malaysia. According to Jaaman and Anyi (2002a), the dugong population in the coastal waters of Sabah is resident and probably makes local movements only. The population may be shared in the north with the Island of Palawan and in the east with Southern Sulu (Philippines) and Kalimantan, Indonesia. They concluded that the population consists of only 200 animals or less, occurring in low densities and constantly facing anthropogenic threats.

Habitat status

There has been little assessment of marine mammals, their habitats and problems relating to their environment in Malaysia (Jaaman *et al.* 2001a). In Peninsular Malaysia, areas of already high human population and intensive coastal development, such as the south coast of Johore, Kelang and Penang, suffer direct impacts from sedimentation and pollution. Untreated waste disposal and other human activities have severely degraded important habitats (e.g., seagrass beds, coral reefs, and mangroves) on which many marine organisms depend directly or indirectly. In

the last ten years, many rain forests along and upstream of main rivers and bays in Sabah and Sarawak have been logged and transformed into cultivation lands, such as large-scale palm oil plantations (Jaaman 2000b; Jaaman *et al.* 2000a, b). Effluents from these areas are polluted as a result of excessive use of insecticides and fertilizers; they also contain many drifting logs and other debris, especially during the rainy season (November – February) Jaaman (2002). In some areas that are left cleared, the rain deposits sediment into the rivers and bays and increases the turbidity of the water, thereby decreasing water quality. The development of Sandakan and Tawau in Sabah, and of Tanjung Manis and Muara Tebas in Sarawak, into some of the most industrialized regions in East Malaysia may affect the natural habitat of Irrawaddy dolphins. Furthermore, a causeway across the Santubong River completely cuts its flows to the ocean, and a barrage in Pending limits the flows of the Sarawak River to the ocean (through Muara Tebas). Such impediments interrupt the natural movements of estuarine cetaceans into and out of the Kuching River system. Although little documentation exists regarding fish stocks throughout Malaysia, they are believed to be declining due to cumulative effects of pollution, poor recruitment, and overfishing. Many inshore fishermen and local villagers interviewed in Sabah and Sarawak have expressed concern over the poor quality of water and lack of fish in traditional fishing areas (Jaaman 2000b; Jaaman *et al.* 2000a, b).

Directed catches

Except for one record of dugong hunting at Kampung (village) Pendas Laut, Johore in the 1970's (Mansor *et al.* 2000), no direct exploitation of marine mammals is known to occur in Peninsular Malaysia. In Sabah, dugongs have been hunted traditionally (Jaaman 2000b). The local *Bajau Laut* community has long regarded the dugong

as a traditional food item (Jaaman and Anyi 2002b). The animals are hunted using specially made harpoons and usually with the help of indigenous medicine men called *pawang*. Besides family consumption, dugong meat is sold to other villagers in secrecy. A kilogram of dugong meat is reported to fetch between RM5 and RM10 (US\$2.63), and a whole dugong can be sold for up to RM400 (US\$105). Several dugong parts, such as the teardrops and tusks, are also highly sought after for their traditionally held medicinal value. In Sarawak, dugongs were hunted in the Limbang, Lawas, and probably Sematan areas by locals before the 1980s (Jaaman *et al.* 2000a). Dolphins, on the other hand, are reportedly hunted for food only by the *Bajau Pelauh* (immigrant *Bajau Laut*) in Semporna, Sabah (Jaaman and Anyi 2002b). The two main dolphin species that are hunted are the *bung saelo* (bottlenose dolphin, species unknown) and *bung saeso* (probably spinner dolphin). A two-inch cube of dolphin meat costs about RM2 (US\$0.53). According to Jaaman (2000b), most fishermen and local villagers interviewed in Sabah admitted that the numbers of dugongs and dolphins have declined significantly over the years and almost all catches nowadays are accidental, although some fishermen probably continue to go after dugongs opportunistically.

By-catches

Gillnets, which include set, drift and trammel nets, are widely used by traditional fishermen in shallow coastal waters of Malaysia. Incidental catches of dugongs and small cetaceans, particularly Irrawaddy dolphins and finless porpoises, are known to occur regularly in gillnets and *kelong* (fish traps), and to a lesser extent in trawls (Jaaman 2000b; Jaaman *et al.* 2000a, b; Jaaman *et al.* 2001a). According to Jaaman (2002), a considerable number of cases have been reported annually since 1996. Usually the caught animals have died. In the case of dugongs on the east coast of Sabah, they have been slaughtered for

local consumption. In many parts of Malaysia, live-caught dolphins are usually released back to sea.

Most of the fishermen and other local people interviewed at coastal villages in Sabah and Sarawak reported accidental catches of marine mammals in gillnets (setnets and trammel nets) (Jaaman *et al.* 2000a; Jaaman 2002). Preliminary results suggested that, on average, at least one marine mammal (dugong, Irrawaddy dolphin or finless porpoise) is caught per year per village surveyed. However, the number of reported catches has always been considered to be many fewer than the actual number (Jaaman 2002).

Some *Melanau* and *Melayu* fishermen in Sarawak bring accidentally caught dolphins and finless porpoises to shore for family consumption (Jaaman *et al.* 2000a). Some fishermen in Kuching have reported selling dolphin meat for RM2 to RM6 per kilogram, in secrecy, to local buyers.

Other causes of marine mammal mortality are the use of dynamite to catch fish in Sabah and intense navigation in coastal waters (Jaaman 2000a). Although enforcement efforts to curb dynamite fishing and the selling of materials to produce dynamite have increased significantly in recent years, this destructive fishing technique is still rampant, mostly practiced by illegal immigrants in less patrolled areas.

The increasing popularity of leisure motorboats and the heavy use of harbors also threaten dugongs and inshore cetaceans. Dugongs and dolphins have been observed in the harbors at Tawau, Sandakan, Kota Kinabalu, Labuan, Tg. Manis, Muara Tebas, Pasir Gudang, Kelang and Penang. In addition to the risk of collision, intense navigation is likely to affect dugong behavior, forcing them to leave busy areas or modifying their feeding habits. There is evidence that some

stranded dugongs may have been victims of boat propeller strikes in Kota Kinabalu (Jaaman 2000a) and Pasir Gudang (Mansor *et al.* 2000).

Legal status and present management arrangements

All marine mammals are protected in Malaysian waters, and Federal laws apply within the 200nm EEZ. Federal legislation concerning marine mammals includes the Wildlife Protection Act 1972 and Fisheries Act 1985 (Part VI - Aquatic Mammals in Malaysian EEZ), together with Fisheries Regulations 1999 (Control of Endangered Species of Fish). Related State laws reflect the federal legislation and include specific regulations for management of wildlife within State jurisdiction (Sarawak Wild Life Protection Ordinance 1998 and Sabah Wildlife Conservation Enactment 1997).

In general, these laws and regulations prohibit any person from fishing, catching, disturbing, harassing, taking, killing, possessing, selling, buying, transporting, consuming, exporting or importing any marine mammal that is found in Malaysia. In addition to the police and armed forces that have the authority to enforce all laws and regulations in Malaysia, the departments listed below are given the main responsibility to manage and conserve all marine mammals in Malaysia.

- 1) Department of Fisheries Malaysia (in rivers and territorial waters of Peninsular Malaysia and Federal Territory of Labuan, and the whole EEZ).
- 2) Sarawak Forest Department (in rivers and territorial waters of Sarawak).
- 3) Department of Wildlife Sabah (in rivers and territorial waters of Sabah).

In collaboration with Universiti Malaysia Sabah (UMS), the responsible departments have been

proactive in engaging more staff and upgrading their skills to facilitate their work on marine mammals, particularly in Sabah and Sarawak. Several efforts have been made to establish MPAs that will include the protection of animals and their habitat (seagrass and mangrove areas), namely the proposed North Borneo Marine Park in Kudat, Sabah and Lawas Mangrove National Park in Sarawak. Small populations of dugongs and inshore cetaceans are known to occur within these areas.

There is also an effort to raise public awareness on conservation of marine mammals. The main target group is the people living in rural areas.

Folk attitudes and interactions with marine mammals

In East Malaysia, the dugong is locally known as *duyung*, which means mermaid. Many older folks believe that the animal originated from human beings (Jaaman and Anyi 2002b). Sometimes, it is also known as *babi laut* (sea pig) or *lembu laut* (sea cow). The majority of the *Bajau Laut* in Sabah reported that landed dugongs are primarily slaughtered for their meat. Historically, cooked or grilled dugong meat was a necessity for their important celebrations, such as weddings. Besides the economic importance of dugong meat, older people in Sabah and in Limbang Division, Sarawak, commonly believe that certain parts of the dugong can be used for other purposes. The “teardrops” reportedly may be used as a love potion to win a woman’s heart. The tusks and bones have been used by traditional medicine men to treat asthma, high fever, internal pain, and eyesight deficiency, and as amulets to guard fruit orchards and other crops against wild boars.

Many fishermen believe that dolphins are baby whales or fish. Some *Bugis* fishermen in Tawau believe that dolphins originated from a human who was cursed because of trying to steal Prophet

Sulaiman’s ring. Some Malay and *Melanau* fishermen in Kuching believe that it is a bad omen when a “white dolphin” (Indo-Pacific humpback dolphin) is found at sea while fishing. They think that when a white dolphin leaps out of water, it portends rain and thunderstorms. “*Masap*” refers to times when dolphins swim around their boats and frighten them. On 29 April 1999, three *Bajau Pelauh* (sea nomads) were arrested by the police in Semporna, Sabah for killing 12 spinner dolphins that were to be served as a delicacy in a wedding party and used as dowry for the bride. They were sentenced to 12 months in prison. Some *Bajau Pelauh* village headmen confirmed that it is part of their old tradition for an adult to go out and hunt a dugong, dolphin, or a whale, at least once to demonstrate his manhood.

Nevertheless, many other fishermen in Sabah and Sarawak believe that dolphins are friends of man and should not be harmed in any way. Many local villagers along the main estuaries believe that there could be crocodiles in the water if they have not seen Irrawaddy dolphins entering rivers for quite some time.

Description of existing research programs

In 1996, the Borneo Marine Research Unit (now a full-fledged Institute) of Universiti Malaysia Sabah (UMS) took steps to initiate marine mammal research in Malaysia, culminating in development of the Marine Mammals and Whale Shark Research and Conservation Programme with the objective of conducting applied studies as well as creating public awareness of endangered animals in the country. Research has focused on the population status of dugongs and inshore cetaceans and their interactions with humans, particularly in East Malaysian waters.

The program is currently supported by two IRPA (Intensify Research Priority Areas) grants from the Ministry of Science, Technology and Environment

Malaysia. The projects are entitled “An integrated study of marine mammals and whale sharks in the Malaysian EEZ waters” and “Dugong, seagrass and fisheries integrated project in East Malaysia.” Both projects will continue at least until the end of 2003.

In addition, various government agencies, NGOs and the private sector contributing to research on and conservation of marine mammals. Most are members of the Malaysian Marine Mammals and Whale Shark Working Group. Among members are UMS, Universiti Putra Malaysia, Universiti Malaysia Sarawak, Department of Wildlife Sabah, Department of Fisheries Sabah, Sabah Parks, Sarawak Forest Department, Department of Fisheries Malaysia, WWF Malaysia and Borneo Divers. Research will start soon in the Santubong and Bako (Kuching River System), Beladin and Pusa (Batang Saribas) and Tanjung Manis (Batang Rajang) regions in Sarawak and Cowei Bay in Tawau, Sabah to assess the resident populations of Irrawaddy dolphins.

Recently, the Department of Fisheries Malaysia in collaboration with the Working Group, has agreed in principle to develop a National Stranding Network on Marine Mammals and Whale Sharks with the objective of monitoring and responding to strandings and by-catch as well as increasing public awareness of the endangered animals in the country.

Need for additional research

The long-term objectives of the Marine Mammals and Whale Shark Research and Conservation Programme of UMS are to gain comprehensive knowledge of the species composition, distribution and abundance of marine mammals and whale shark in Malaysia, to identify areas that are important habitats for biodiversity, and to highlight threats affecting populations of endangered animals.

In-depth study of the Irrawaddy dolphins in the bay and estuarine areas of Sabah and Sarawak should be a high priority.

Efforts to estimate the magnitude of by-catch of dugongs and inshore cetaceans in artisanal fisheries need to be extended to cover the whole country, and more serious efforts should be made to educate the public, particularly the coastal residents of Sabah and Sarawak. This is particularly important because only about half of the fishermen interviewed in these areas were aware that marine mammals are protected by law and should not be harmed (Jaaman and Anyi 2002b).

Present and potential whale and dolphin watching operations

At present, there is one marine mammal watching enterprise in Malaysia, operating out of Kuching, Sarawak. In addition, dive operators usually take their guests to watch the animals whenever they encounter them during diving trips. In the Santubong and Bako (Kuching River System), Beladin and Pusa (Batang Saribas) and Tanjung Manis (Batang Rajang) regions in Sarawak and Cowei Bay in Tawau, Sabah, where Irrawaddy dolphins are known to occur, there is potential for establishment of “reserve areas” where regulated dolphin watching activities would be feasible. Any such developments should be for the purpose of improving understanding and awareness of endangered species and their environment.

2.1.9 Philippines

Species and distribution

To date 17 species of small cetaceans and the dugong have been confirmed to occur in the Philippines (Appendix 2). In 1995, 16 species of small cetaceans were reported for the Philippines during the Workshop on the Biology and Conservation of Small Cetaceans and Dugongs

of SE Asia. Two species have since been removed from the list due to the lack of any recent (within ten years) confirmatory records, in spite of efforts made to survey possible habitats and to resolve possible misidentifications. Animals initially thought to be finless porpoises in Malampaya Sound turned out to be Irrawaddy dolphins. A stranded Irrawaddy dolphin from the Turtle Islands (as reported by Reeves *et al.* 1997) was also misidentified as a finless porpoise. Although sightings of pygmy sperm whales have been reported, there have never been any confirmatory specimens or photographs. The species added since 1995 include Indo-Pacific humpback dolphin, Cuvier's beaked whale, and Irrawaddy dolphin.

In 1995, 10% of Philippine waters had been surveyed for cetaceans (Doc. 1). As of this report, surveys have been conducted in an estimated 40% of Philippine waters. (Dolar *et al.* 1997; Tan 1995; Dolar 1999a, b; Doc. 25).

Marsh *et al.* (2002) provides a summary of current knowledge of dugong distribution in the Philippines. Overall, the population is sparse and scattered. Palawan Island is considered the dugong's stronghold but a substantial population also exist in parts of southern Mindanao.

Other institutions in addition to those listed in 1995 which house or collect cetacean bones are Aquinas University in Rawis, Legazpi City (which has the skull and a few vertebrae of a sperm whale stranded in Manito, Albay) and the Endangered Species Cemetery of the National Integrated Fisheries Research Training and Development Center (NIFRTDC) in Bonuan-Binloc, Dagupan City, Pangasinan, where carcasses of three spinner dolphins, a Risso's dolphin and an unidentified whale are buried.

Population status

Abundance estimates of cetaceans have been made for only a few areas in the Philippines: the eastern and southern Sulu Sea, Tañon Strait, and Malampaya Sound. Species with abundance estimates include the spinner, pantropical spotted, Fraser's, common bottlenose and Risso's dolphins; short-finned pilot whale; melon-headed whale and dwarf sperm whale (Dolar *et al.* 1997; Dolar 1999a)

Of all the cetaceans found in the Philippines, the Irrawaddy dolphin is considered to be the most endangered. The population in Malampaya Sound is the only known population of the species in the country. An estimated 77 individuals (CV=27%) occur in a limited area of the inner Sound of around 133.7 km² (Doc. 14). The impact of dolphin mortality attributed to by-catch is extremely high (del Valle and Aquino 2002; Doc. 14; Doc. 29) and poses an immediate threat to the population's survival. It is strongly recommended that the population be listed as Critically Endangered in the IUCN Red List, that FAO 208 be amended to include this dolphin population, and that concrete action be taken to ensure that the species survives in the Philippines. There are ongoing efforts for further research and conservation management of the population and its habitat. An integrated conservation and development project is currently being implemented by WWF-Philippines in collaboration with stakeholders in the area.

There is no estimate of dugong abundance in the Philippines, and the status of the species is unknown. However, the distribution is considered greatly reduced as almost all islands have recorded sightings. Dugongs are now believed to be locally extinct in many areas (Marsh *et al.* 2002)

Habitat status

Most marine mammal habitats in the Philippines overlap with areas of increasing fishing

operations. The animals are therefore susceptible to by-catch in both commercial and artisanal fishing. The degradation of marine habitats is a continuing problem as reported earlier. Coastal areas are dumping grounds for industrial and agricultural run-off. This situation is worsened by the growing human population in the coastal zone, which leads to increased dumping and discharge of domestic waste—e.g. in Tañon Strait, which is bordered by an intensive agro-industrial area. Tañon Strait, considered an important habitat for at least nine species of dolphins and whales, was declared a Protected Seascape in 1998 under the Presidential Proclamation 1234. It, however, is still threatened by a number of factors such as the overexploitation of fishery stocks, conversion of coastal habitats (e.g., mangroves), and the disturbance from inter-island travel.

In Northern Luzon, illegal fishing methods (dynamite and cyanide fishing) are rampant in the Babuyan Islands and coastal areas of Cagayan province. Non-selective fishing gear and Taiwanese fishing within the waters of northern Luzon are evident (Doc. 33). The Babuyan group of islands, possibly the southernmost breeding area of humpback whales in the western North Pacific, records 11 cetacean species including the humpback and sperm whales, the most cetacean-diverse are surveyed to date (Doc.33; Acebes 2001; Acebes *et al.* 2000; Yaptinchay 1999). It is being recommended as a humpback whale sanctuary.

Malampaya Sound was declared a protected landscape and seascape in July 2000. Although a management board has been created, the general management plan for the area has not yet been implemented. The increasing fishing activities are beginning to take their toll on the productivity of the area. Pesticides and fertilizers used in surrounding agricultural lands may become concentrated in the inner Sound. It should be further noted that, based on an ecological study

conducted in 2001, sedimentation is apparently not yet a problem in the area. In contrast, the most important threats to the dugong habitat in Palawan are siltation and sedimentation from deforestation.

Directed catches

Both historically and currently, at least 29 fishing villages have been reported to hunt cetaceans (Doc. 28 and below). In the southern parts of the Philippines, a group of indigenous people known as *badjaos* are known to consume dolphins as part of their traditional diet. A diminishing number of small-scale directed hunts still occur in a few fishing villages. The meat of cetaceans (mainly dolphins) was formerly used chiefly as bait to catch sharks and chambered nautilus, *Nautilus pompilius* (Dolar *et al.* 1994, Dolar *et al.* 1997). A taste for dolphin meat eventually developed among the local people and the fishermen now catch dolphins for local human consumption (Dolar 1999c).

In the 1995 Workshop Report (Perrin *et al.* 1996), five sites were listed as having directed catches of small cetaceans: San Francisco, Negros Oriental (=200–300 per fishing season); Selinog Island in Dapitan, Mindanao; Pamilacan Island in Bacayon, Bohol (in conjunction with a hunt for pygmy Bryde's whales, *Balaenoptera edeni*); Catarman in Camiguin Island, Mindanao; and Limasawa, southern Leyte (Dolar and Wood 1993; Dolar *et al.* 1994; Alava 1995. Except in San Francisco, dolphin catches were considered low. The directed fishery in San Francisco has been stopped due to FAO 185-1 (Dolar, 1999c). Gaudioano reported that of the rest, only the Selinog fishery is active at present.

Surveys around the Sulu Sea from 1996-1998 revealed at least 11 more sites which directly take cetaceans: Brooke's point (Palawan); Bulalacao Is (Coron, in the Calamian Group of islands);

San Francisco (Negros Oriental); Lintub in Basay (Negros Occidental); San Jose in Panay; Dalipi and Culasi in Antique (Panay); Selinog Island (Misamis Occidental); Mapun Booan and Kinapusan Islands (Tawi-tawi) (Dolar 1999b, c; Dolar *et al.* 1997; Alava and Dolar 1995; Dolar *et al.* 1994). Dolphins were taken in Lintub, Basay using purse seines for the live-aquarium trade, instigated by a foreign vessel; at the other sites dynamite, gillnets or driftnets were used with harpoons to take the animals (Dolar, 1999c).

At least ten additional fishing villages have now been reported to have directed takes: Region I (Brgy Poblacion 1 in Pagudpud , Ilocos Norte), Region II (Brgy Tangatan in Sta Ana; Brgy Centro 9 and Sitio La Union, Brgy Macanya in Aparri), Region IX (Brgy Silaway in General Santos) and Region X (Misamis Oriental: Brgys Poblacion and San Jose in Talisayan, Brgys Poblacion and North Poblacion in Medina; and Brgy Punta-puti in Camiguin Island, northern Mindanao) (Doc. 28, 29). Hunting gears used include harpoon (in Ilocos Norte), gaff hook (in San Jose, Misamis Oriental), lasso (in Silaway, Aparri), and/or spear or speargun. Alava reported that direct taking of dolphins reportedly happens when fish catch is minimal or nonexistent, to recoup fishing expenses.

Additional towns where directed takes of dolphins have been reported include Baleno in Masbate, Barangay Wawa in Nasugbu, Batangas and in the island of Sibuyan. Dynamite is used in Masbate, while spear guns are used in Batangas and Sibuyan. In Baleno, grilled dolphin meat on barbecue sticks was found being sold in the public market during a fiesta for PhP40.00/kilo (US\$0.80).

Species taken include the common bottlenose, Fraser's, spinner, pantropical spotted, and Risso's dolphins and the Blainville's beaked, melon-headed,

short-finned pilot, and dwarf sperm whales (Alava 1999; Alava and Dolar 1995; Dolar 1999a, b, c; Dolar *et al.* 1997; Alava 1995; Dolar *et al.*, 1994; Dolar and Wood 1993; Aragones 1995; Leatherwood *et al.* 1992). Torres reported that there is anecdotal information about a directed take of an unknown dolphin species in Region IV (Laguna), sold at the Alaminos Public Market in April 2002.

In two separate interviews in the southern Luzon area, a preference for specific dolphin species has been expressed. The fishermen say that the longer the snout of the dolphin, the more tender the meat. In Sibuyan, animals described as larger animals with spots but without a beak (possibly Risso's dolphins) are not caught because of this perception.

Shark fisheries are reportedly expanding, primarily because of the shark fin trade, and this has increased the pressure to take cetaceans to use as bait for large pelagic sharks (Doc. 28, 29). Alava reported that according to partial returns of the Rapid Assessment Project from WWF/BFAR-NSAP, at least 13 fishing villages use cetaceans as shark bait. This study does not, however, provide estimates of the number of dolphins taken for use as bait in various fisheries. Dolar *et al.* (1994) estimated that 117 dolphins were killed for bait in a shark fishery conducted from a single village.

Small cetaceans are caught deliberately for shark bait in the following coastal municipalities of Cagayan province: Aparri, Claveria, Sta Ana and Gonzaga (Doc. 28, 33). There is concern about the killing of cetaceans for the benefit of shark fisheries. The directed catch of dugongs has been documented throughout its range in the Philippines. Despite their protected status dugongs are opportunistically hunted today. There are no estimates of such takes but they have been reported from Zambales, the Bicol region, Isabela, Quezon,

Palawan and the Sulu Archipelago in 1995 (Perrin *et al.* 1996).

By-catches

For small cetaceans and the dugong, entanglement in fishing gear is the predominant threat. Cetaceans and dugongs are by-caught in many kinds of fishing gear in both commercial and municipal fisheries, such as baby ringnet, bagnet, beach seine, set gillnet, bottom longline, castnet, crabtrap, drift gillnet (*pamo*, *palaran*), drift longline, drivenet, fish corral, flying fish net, stationary liftnet, two-boat lift net, purse-seine, shark net, and troll line; they also die as a result of illegal fishing practices such as blast fishing (Doc. 14, 19, 28, 29; Alava 1995, 1999; Alava and Dolar 1995; Dolar 1999a, b, c; Dolar *et al.* 1997; Calvelo 1995; Dolar 1990, 1994; Dolar *et al.* 1994; Aragonés 1995; Dolar and Wood 1993; Alava *et al.* 1993; Dolar 1990; Leatherwood *et al.* 1992).

There are no total estimates of by-catch in all these fisheries. An initial assessment of incidental takes from purse seining and driftnet operations in three villages in 1991-92 estimated about 600 dolphins killed; and an estimate for commercial and municipal purse seiners in 1990 operating in the eastern Sulu Sea was between 2,000-3,000 dolphins (Dolar 1994). By-catch data from commercial tuna purse seining generated by Earth Island Institute (EII) from 1992-1996 are still to be processed. It was noted, however, that EII's on-board monitoring program discouraged incidental kills and thus reported numbers may be lower than during normal fishing operations (Doc. 17, and reported by Concepcion).

Earth Island Institute (EII) has been involved in cetacean conservation in the Philippines since 1992. Currently, they issue certificates for dolphin-free tuna involving 11 canneries and focus on the prevention of dolphin by-catch in large purse-seine operations in the Philippines.

Most by-catches recorded have been in driftnets and ringnets (Dolar 1999c). Driftnet by-catch was reported in Malabuan, Siaton (Negros Oriental), Bauang and Sto. Tomas (La Union), Jagna (Bohol), Limasawa (southern Leyte) (Dolar *et al.* 1994; Dolar and Wood 1993; Alava *et al.* 1993). According to Alava, driftnet fisheries have been reported in many additional areas in the country including fishing villages in Caramoan and Pasacao (Camarines Sur), Catarman (Camiguin province), Gingoog City, Magsaysay, Medina (Misamis Oriental), Surigao City (Surigao del Norte).

Preliminary results of WWF/BFAR-NSAP's rapid assessments (RAP) in 11 regions showed prevalence of cetacean by-catch fisheries in at least 67% of 105 fishing villages visited (Doc. 28, 29). With the burgeoning shark fishery, by-caught species, as well as strandings, are opportunistically targeted for use as bait. Presence of fishing gears directed at large pelagic sharks (e.g., long line) is taken as an indicator of presence of cetacean fisheries in an area. An off-shoot of the cetacean by-catch research by WWF Philippines is the assessment of the status of cetacean-elasmobranch fisheries interactions in priority sites.

By-caught species identified include bottlenose, Risso's, spinner, pantropical spotted, Fraser's, and Irrawaddy dolphins (Dolar 1999c; Doc. 28). When by-caught alive the dolphins were more often released, while dead ones are consumed as food.

Despite its prevalence, the cetacean by-catch problem is as yet unquantified because of the relative absence of standardized documentation and of accurate data collection on fishing fleet operational dynamics. This is further complicated by the small scale and dispersed nature of most of the fisheries. It is difficult to make a statistical inference on how many cetaceans and dugongs are targeted and/or taken accidentally by the marine capture fishery sector annually (Doc. 29).

Legal status and present management arrangements

Republic Act 8550 was enacted by congress to update fishery management and development in the country. It is also known as the Fisheries Act of 1998 (Doc. 26). By virtue of this law, the mandate for cetacean management and conservation was accorded to the Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR). The mandate and jurisdiction on cetacean conservation were explicitly defined with the issuance of Fisheries Administrative Order (FAO) 208, listing rare, threatened and endangered fishery species. The Order classified the 20 species of cetaceans recorded in the Philippines as endangered species. This law updates FAO 185 of 1992, which was limited to species in the family Dephinidae, and FAO 185-1 of 1997, an amendment to include all cetaceans. However, the Irrawaddy dolphin, found only in Malampaya Sound and probably the most critically endangered species among all the cetaceans found in the Philippines, was not listed in FAO 208. As a corollary to the Fisheries Act, the Wildlife Conservation Policy was updated through the Wildlife Act of 2001 (Doc. 26). Consistent with the Fisheries Act of 1998 this law specifically stipulates that marine mammal species except the dugong shall be under the jurisdiction of the Department of Agriculture's Bureau of Fisheries and Aquatic Resources. The dugong is under the jurisdiction of the Department of Environment and Natural Resources. Another feature of this policy is the acknowledgement of Palawan's Strategic Environmental Plan for Palawan, whereby responsibility for wildlife resources in Palawan, whether aquatic or terrestrial, was devolved to the Palawan Council for Sustainable Development (PCSD) (Doc. 26). The three designated management authorities, DENR, DA-BFAR and PCSD, are presently in the process of updating the list for critical, endangered, vulnerable and threatened species as well as developing an

Order implementing rules and regulations for the Wildlife Act.

Prior to enactment of the Fisheries Act of 1998, the Inter-agency Task Force on Marine Mammal Conservation (IATFMMC) was created by the DENR, through Special Order 1636, to undertake survey and assessment of marine mammal resources in the Philippines. Aside from its mandate to conduct assessments, the Task Force, composed of the DENR, BFAR, Department of Tourism, UPMSI, SUML, WWF-Philippines, and Bookmark Inc., identified the need for a national marine mammal conservation program. To achieve this, the first symposium workshop on marine mammals in the Philippines was convened in April of 1994.

The national conservation plan has four major components: Survey and Research; Habitat and Resource Management; Policy; and Public Information, Education, and Capacity Building. The following activities have been initiated or completed under the plan (Doc. 26):

1) Survey and Research: surveys conducted in the following areas: Malampaya Sound, Honda Bay, Babuyan Channel, Balayan Bay, Sogod Bay, Ragay Gulf, San Bernardino Strait, Masbate Pass, Burias Pass, Ticao Pass, Lingayan Gulf, Sulu Sea (including Sabah, Malaysia).

2) Habitat and Resource Management: Pamilacan Island Whale Watching Village Project, incorporation of whale/dolphin watching as a priority activity in the Ecotourism Plan of the Philippines, establishment of stranding and rescue network in six general areas around the Philippines (Palawan, Negros, Batangas, Cagayan-Babuyan Channel, Northern Mindanao; Bohol).

3) Policy: Common position against a proposed captive cetacean breeding and dolphinarium facility in 1995; inputs and advocacy for the

passage of national policies concerning marine mammal conservation; Fisheries Act of 1998; Wildlife Act of 2001.

4) Public information and education and capacity building: Joint Philippine-Sabah, Malaysia Training Workshop on Cetacean Research and Survey in 1996; publication of proceedings of the 1st Symposium Workshop on Marine Mammal Conservation; assistance with publication of "A Field Guide to Whales and Dolphins in the Philippines" spearheaded by Bookmark Inc.; publication of a Marine Mammal Stranding Response Manual; production of information materials on marine mammal species (posters and postcards).

With enactment of the Fisheries Act of 1998, the DENR lost its mandate to convene and spearhead the Task Force.

A specialist workshop on dugongs was held in 1998. Research to provide the scientific basis for dugong conservation is carried out by three agencies: DENR, WWF and the University of the Philippines.

With the institutionalization of the Integrated Protected Areas System in 1992, protected areas are considered an effective tool to manage wildlife species including marine mammals. In 1998, Tañon Strait, a significant cetacean habitat, was declared as Tañon Strait Protected Seascape (TSPS) by virtue of Presidential Proclamation 1234. So far this is the only protected area (PA) that has been established explicitly for the management and protection of cetaceans. Because of existing intensive agro-industrial operations in the area, the PA was classified under the seascapes category. However, management of the area never was implemented. The area that was designated a PA was very extensive, covering 41 municipalities. A Tañon Strait Commission

was established in lieu of a Management Board. Realizing the unmanageable scale of the PA, the Commission was de-established by the President under an Executive Order in June of 2002 (S. Greene, pers. comm.) (Doc. 26). There is an ongoing effort by the Negros Oriental chapter of the Vice Mayors League of the Philippines to de-establish the Protected Seascape itself.

In other areas, however, the establishment of PAs has facilitated the protection of marine mammals, notably in Malampaya, Palawan and the Northern Sierra Madre Natural Park. These PAs were established through the support of a European-Union-funded National Integrated Protected Areas System Project and the Conservation of Priority Protected Areas Project, respectively. These projects were designed to protect biologically important areas. In the case of Malampaya, it was declared as a Land and Seascape for its rich fishery resources. The declaration of the area under the NIPAP accorded some form of protection for the Irrawaddy dolphins through its Protected Areas Management Board when it was established in 2000. With the implementation of the Malampaya Research and Conservation Project by WWF-Philippines, the Irrawaddy dolphin was accorded special attention in the management of the protected area. For the Northern Sierra Madre National Park, an initial marine mammal assessment was conducted prior to its PA establishment as part of its management planning process.

Taytay and Roxas Bays in north-eastern Palawan are being established as PAs for dugongs. Several other key dugongs habitats have the potential to be protected through national parks and national marine reserves.

Finally, with the devolution of governance to local government units under the Local Government Code of 1991, management of municipal waters

within 15 kilometers from the shore was turned over to local governments. Such autonomy encourages municipalities to implement conservation-linked development activities such as eco-tourism, e.g. in the case of Bais City, where since 1997 a dolphin watching activity has been operating.

Over the last five years the policy framework and institutional arrangements for marine mammal conservation have been clearly defined. The main issue of conservation in the Philippines is implementation. The laws are hardly enforced. Given the extent of work that needs to be done in the field of marine mammal conservation, a multi-agency approach is recommended as exemplified by the IATFMMC.

Folk attitudes and interaction with marine mammals

In Gingoog Bay (Misamis Oriental), Legazpi City, and Bacacay (Albay), dolphins are taken primarily because they damage fishing gear and compete for fish catch. The dolphins killed for this reason are eaten. Interviews have revealed that fishermen in some other areas also regard cetaceans as pests. These fishermen, when given the opportunity, poke dolphins with long poles, or throw rocks at them to drive them away. Some artisanal fishermen wait for the dolphins to finish feeding then proceed with their fishing after the animals leave. It is also a belief by fishers of Cagayan that sightings of whales/dolphins are indications of good or, alternatively, bad weather.

In every town visited, all dolphin catches and the sale of dolphin meat is accomplished surreptitiously. The same is true for dugongs. All the fishermen interviewed knew that these activities were illegal. The continued direct catches of marine mammals and traffic in meat from these and by-caught animals in the Philippines are not a reflection of ignorance, or a lack of knowledge of

existing laws; rather, they reflect a knowing lack of compliance and poor enforcement.

Description of existing research programs

WWF-Philippines has been closely involved in cetacean and dugong research in the Philippines since 1995. Five major projects on cetaceans have been implemented at local and national levels.

1) Cetacean Research and Conservation Project

– Objectives are to further increase the level of awareness and concern regarding cetaceans and elasmobranchs on the national and local levels; to enhance the capability of local groups on cetacean and elasmobranch identification, biology, ecology, and conservation as well as on field data collection techniques; to assess the status of cetacean by-catch, elasmobranch catches and use of cetaceans as shark bait in collaboration with the Sulu-Sulawesi Marine Ecoregion Action Program and develop a mitigation program based on this assessment; to assess and monitor the status of cetaceans in selected sites in Philippines; to further build partnerships with groups that can be activated at the ground level on marine mammal conservation; to develop a marine mammal rescue fund that will enable the various established rescue teams to conduct their rescue operations; and to enhance the capability of project staff to implement the project.

2) Humpback Whale Research and Conservation Project

– Objectives are to determine the minimum abundance, distribution and migratory origins of humpback whales in the Babuyan islands; to develop and implement an Information, Education and Communication (IEC) program on marine mammals for the coastal communities of Calayan, Claveria, Sta. Ana and Aparri; and to recommend steps in the protection of the humpback whales through an Initial Conservation Plan.

3) *Malampaya Sound Research and Conservation Project* – This is a study on population status of Irrawaddy dolphins, ecology, and by-catch. The project aims to sustainably manage the rich biodiversity and fisheries resources in ecologically important areas in the Philippines such as Malampaya Sound and to effectively manage and protect the Irrawaddy dolphin population in the Sound.

4) *Stranding program* – WWF-Philippines and local partners are establishing The Philippine National Marine Mammal Stranding Network which is currently composed of rescue teams from the provinces of Cagayan, Batangas, Palawan, Bohol, Negros Oriental and Misamis Oriental, monitoring a total of 39 known cetacean sites throughout the Philippine archipelago. The network consists of 212 individuals trained to provide the proper response and data collection for stranded marine mammals. Data and samples collected from strandings are currently housed at WWF-Philippines.

5) *Cetacean By-catch Fisheries Assessment Project* – Recent and current research, particularly on cetacean-fisheries interactions, was initiated in 2001 through the WWF cetacean by-catch fisheries assessment project. This project is to develop a long-term program for regular and sustained monitoring of cetacean by-catch in fisheries at priority sites. The ultimate goal is to identify problem species and fisheries for focused intervention and management planning, and specifically to implement pilot programs to reduce by-catch. Major activities of the project were: conduct of a site-prioritization workshop followed by validation through rapid assessment programs (RAPs) at selected sites; capacity-building through training of collaborators (e.g., BFAR-NSAP regional project leaders and/or assistants) on cetacean identification and cetacean fisheries data collection using the RAP; database

and information management using GIS mapping and database programming; and development of initial by-catch reduction programs at heavily impacted sites (Doc. 29).

Site-based research and monitoring program were identified for selected sites, particularly WWF projects sites in the Philippines (e.g., Malampaya Sound and Babuyan Islands) and in other priority sites for cetacean-fisheries interaction research and conservation management (e.g., Tañon Strait, Leyte Gulf, Gingoog-Butuan Bay and Moro Gulf).

WWF-Philippines is currently working in Tañon Strait (under the Tañon Strait Initiative Project) towards increasing stakeholders' participation and capacity on marine conservation as well as promoting collaborative management of TSPS by both the public and private sectors. The three primary goals of the project are community and constituency building, marine biodiversity conservation, and policy advocacy.

A joint research project that resulted directly from the 1995 small cetacean and dugong workshop was the preliminary investigation of marine mammal distribution, abundance, and interactions with humans in the southern Sulu Sea conducted in 1996. The project was funded by CMS, WWF-Philippines, Ocean Park Conservation Foundation and Southwest Fisheries Science Center and provided an important stimulus to marine mammal work in Malaysia and facilitated cooperation among researchers in the Philippines and Malaysia.

Silliman University, in collaboration with the U.S. Southwest Fisheries Science Center, Scripps Institution of Oceanography, DENR, Haribon Foundation, U.S. National Science Foundation, International Foundation for Science (Sweden), Earth Island Institute, Whale and Dolphin Conservation Society (WDCS-UK), CMS and WWF-

US, has actively participated in cetacean research since 1989. This has included surveys to study species composition, distribution, abundance, movements and marine mammal-fisheries interactions; feeding biology; physiology and stock identification. Areas covered were the Sulu Sea, Tañon Strait, Bohol Sea, Panay Gulf, Sogod Bay and Malampaya Sound. However, since 1999, Silliman has had no active research program. Its current involvement in the Bohol Marine Triangle Project should allow renewed involvement with cetacean research. Two graduate student projects are about to commence: a) species composition, movements and site fidelity of cetaceans in the Bohol Sea, and b) study of movements and site fidelity of cetaceans in Tañon Strait.

The University of the Philippines' Institute of Biological Sciences has been conducting surveys throughout the country since 1997 with the objectives of determining the status and distribution of marine mammals within Philippine waters, identifying important areas that support populations of dugongs and other marine mammals ("hot spots"), documenting and identifying marine mammal and fishery interactions, and identifying sources of anthropogenic impacts on marine mammals.

The Bureau of Fisheries and Aquatic Resources's Marine Fisheries Research and Development Division is proposing to address the cetacean by-catch issue through several of its national programs, including a) a national stock assessment program, b) observations on catches in Philippine commercial fisheries, c) stranding research and documentation program for cetaceans and elasmobranchs, d) genetic characterization of regulated aquatic species in the Philippines, and e) a joint Philippines-Indonesia marine mammal distribution and abundance survey in the Sulawesi Sea (to be funded by CMS).

Needs for additional research

The needed continued research as prescribed by the Task Force in 1994 is to be further undertaken as part of the national marine mammal program. The following areas for research were identified: inventory of marine mammal areas and distribution, fishery interaction, and extent of habitat degradation. Given these general areas for research, listed below are the recommended specific studies that still need to be undertaken:

- 1) Population modeling of Irrawaddy dolphins; habitat use and range; study of fishery interactions (by-catch) and gear modification in Malampaya Sound.
- 2) Research on Taiwanese-directed catch or by-catch in Babuyan islands, northern Luzon (through interviews or actual observation).
- 3) Species identification and stock identity of bottlenose dolphins in Malampaya Sound, Palawan and Babuyan islands.
- 4) Abundance of Fraser's dolphins in Babuyan Islands, Bohol and Leyte.
- 5) Research on areas of "pamo" fisheries for large pelagics.
- 6) Further investigation of spinner dolphin population in Balayan Bay, Batangas.
- 7) Stock identity of Risso's dolphins in Palawan, Bohol and Sulu sea through photo-identification.
- 8) Photo-identification of killer whales in Davao or Aliguey area.
- 9) Photo-identification of short-finned pilot whales in known areas of occurrence in the country.

- 10) Surveys of other sites in the Philippines that may harbor Irrawaddy dolphins.
- 11) Strategic survey of new sites for identification of species, threatened populations and habitats, and important conservation sites.
- 12) Sustained monitoring of areas that are known to have cetacean takes.
- 13) Socio-economic studies of fisheries with significant cetacean by-catch, and possible development of alternative livelihoods and whale watching.
- 14) Levels and effects of pollutants on populations.
- 15) Expansion of stranding networks to support research objectives and conservation goals.
- 16) Association of rough-toothed dolphins in Babuyan Islands with Taiwanese long-line fishery.
- 17) Genetic study of the Irrawaddy dolphin population in Malampaya Sound.
- 18) Broadscale surveys throughout the Philippines to obtain information on the pattern of distribution and abundance of dugongs as a basis for sites at which to develop community based conservation and management strategies.

Present and potential whale and dolphin watching operations

The best-organized whale/dolphin watching operations in the Philippines are located in Tañon Strait. Currently, tours are available at Bais, Manjuyod, and Dumaguete on Negros. The exceptional cetacean diversity of Tañon, coupled with a relatively long season, i.e., April to late October, easy access and good hotels, have added to the popularity of the area. The

Bohol Sea cetacean populations are highlighted by a Pamilacan-based organization called the Pamilacan Island Dolphin and Whale Watching Organization (PIDWWO). Although the Bohol Sea also offers visitors the possibility of observing large cetaceans, such as sperm and Bryde's whales, it is more exposed to wind than Tañon and has a shorter season; i.e., April to June. Tours were reportedly also conducted in Cagayan de Oro, Misamis Oriental under the Department of Tourism (Region X) and the Mindanao Marine Wildlife Watch (MMWW), a government-led organization composed of LGUs in the provinces of Misamis Oriental and Camiguin, local and national NGO's and academia.

Among the surveyed sites, Balayan Bay in Batangas, Lagonoy Gulf in Albay, Honda Bay in Palawan, Camiguin Island off northern Mindanao and the Babuyan Islands off northern Luzon possess many characteristics required for development as whale/dolphin watching destinations. Malampaya Sound's Irrawaddy dolphins certainly have ecotourism potential. However, the extremely small size of the population precludes the advisability of boat-based trips. Dolphin watching on the sound should be confined to land-based observation. Dolphin watching is also being considered as a potential alternate or complementary tourism activity to an already established whale shark interaction tourism in Donsol, Sorsogon.

The Department of Tourism has expressed interest in establishing a network of whale/dolphin watching sites throughout the Philippines.

2.1.10 Singapore

Jefferson reported that a directed research program on marine mammals in Singapore's coastal waters (Singapore Wild Marine Mammal Survey - SWiMMS) was started by the National University of Singapore in 1996. However,

the project was suspended in 1999 due to lack of funds. The program collected several new cetacean records from divers and others and confirmed the presence of five species: bottlenose (species not determined), Indo-Pacific humpback and Irrawaddy dolphins, false killer whale and finless porpoise. In addition, several strandings of dugongs were investigated and samples collected from specimens washed ashore from the Johore River, just east of Singapore.

2.1.11 Thailand

The cetacean research program in Thailand has been carried out at Phuket Marine Biological Center (PMBC), Department of Fisheries since 1991. The program was initiated by two Danish cetologists, Michael Andersen & Carl C. Kinze, under the project "The Small Cetaceans in the Gulf of Thailand and the Andaman Sea (SCIGTAS)." Training and workshops on cetacean biology have been conducted for Thai and SE Asian participants. Interviews of fishermen and coastal villagers have been conducted to obtain tentative records of occurrence of cetaceans. In addition, information has been recorded on fishing gear, by-catches, fishing effort, etc. A stranding network has been established by cooperation with local Department of Forest (DOF) offices and villages. Awareness campaigns have been launched aimed at students and local villagers via direct contact and media such as posters, fact sheets, radio and television. The stranded specimens, from both dead and live strandings, have supported studies as diverse as genetics and variation in external morphology. Efforts have been made to rescue live-stranded animals. Aerial and boat-based surveys have been conducted to study distribution and abundance of cetaceans and dugongs.

Species and distribution

Nineteen species of small cetaceans and the dugong have been recorded from Thailand (Appendix 2). Recently, more than 300 records of stranded

cetaceans and dugongs have been registered at the Marine Endangered Species Unit (MESU), Phuket Marine Biological Center (PMBC). Knowledge on distribution is limited. Several resident coastal cetaceans have been recorded, such as Indo-Pacific bottlenose dolphin and finless porpoise in Phang Nga Bay, Indo-Pacific humpback dolphin in Trang Province, and Irrawaddy dolphin in Songkhla Lake and Tarutao Island. Dugongs have been observed in seagrass beds in several coastal provinces.

Population status

An attempt has been made to investigate abundance of dugongs and coastal cetaceans. From the information obtained there may be one small group of Irrawaddy dolphins in fresh water of the Mekong River, in the northeastern part of Thailand next to Laos, although this may be an old and potentially unreliable record and remains unconfirmed. Another group inhabits Songkhla Lake, Songkhla Province in southern Thailand. This group is thought to number no more than 50 and declining rapidly due to by-catch in gillnets (Beasley *et al.* 2002b). Intensive survey is needed in to estimate the population size and seasonal distribution patterns of these dolphins.

Preliminary surveys have been carried out both in coastal and off shore waters in the Andaman Sea (Adulyanukosol *et al.* 2000; Chantrapornsyl and Kittiwattanawong 2001). Few cetaceans were recorded during the surveys. Three resident groups of dolphins were observed: south of Khai Island, Phang-nga Province (15-20 bottlenose dolphins); south of Maithon Island, Phuket (10-15 bottlenose dolphins); and northwest of Racha Island, Phuket (5-6 spinner or spotted dolphins).

Habitat status

Habitat has been degraded by urbanization. Several coastal areas have been developed for tourism,

aquaculture and manufacturing. There is growing concern about the production of large amounts of waste. The development of shrimp farms in some areas is difficult to control and leads to impacts on coastal habitats. It may cause serious problems for Irrawaddy dolphins, especially in Songkhla Lake due to the very shallow water and the flushing by the sea.

Illegal fishing with trawls and pushnets within 3,000 meters of shore is a major problem (see below). It destroys the feeding and breeding grounds of many coastal species. However, the impacts on the environment of cetaceans has not yet been studied.

Directed catches

Directed catches of cetaceans and dugong are prohibited under regulations of the Department of Fisheries (Protection and Conservation of Wild Animals Law, 1992). However, captures of humpback and Irrawaddy dolphins for Thai aquaria began in the mid-1980s and apparently have continued in recent years. The effects of these on the potentially small populations are unknown. It has been recommended by PMBC that the government monitor the captures and holding conditions; the participants endorsed this recommendation.

By-catches

Coastal cetaceans and dugongs are vulnerable to by-catch in artisanal fishing gear. The population of Irrawaddy dolphins in Songkhla Lake has been seriously depleted as a result of by-catch in gillnets and set nets. Finless porpoises occasionally are found entangled in coastal gillnets. Little information on incidental catches of cetaceans and dugong is obtained, due to lack of cooperation by fishermen.

Legal status and present management arrangement

The first act to protect the dugong and other endangered species was the Fisheries Act of 1974. This act also prohibits trawlers and push-net boats from operating within 3,000 meters of shore, in order to secure the breeding grounds of marine life. However, enforcement of this provision has proven difficult. Violators can be punished only when they are directly observed to be engaged in illegal operations. Thailand adhered to the Convention on International Trade in Endangered Species (CITES) in 1983. Some of the species of cetaceans occurring in Thailand are in CITES Appendix I. The Protection and Conservation of Wild Animals Law of 1992 consists of 1) Act No. 16 —prohibition of hunting or catching protected animals, 2) Act No. 19—prohibition of possessing protected animals or their carcasses, and 3) Act No. 20—prohibition of trade in protected animals

Folk attitudes and interaction with marine mammals

Thais traditionally do not eat cetaceans. Most Thai fishermen consider dolphins to be friends. A folk story claims that a dolphin saved a fisherman from drowning. Some villagers use the presence of dolphins to predict the weather, i.e. when they see dolphins swimming to a river mouth, they expect a storm to come soon. The presence of dolphins is believed to be an indication of high abundance of fish in the area.

Most Thai people believe that giant or wondrous animals have special powers, and they have great respect for such animals. When they find a dead stranded animal they often attempt to collect the bones, especially teeth and the lower jaw, for making potions. This creates a problem for scientific specimen collection; the important parts of many specimens are removed by local people before researchers arrive on the scene.

Recently, the campaign to conserve dolphins and whales has been extended widely to the public. Laws and regulations for protecting cetaceans have been publicized, including the fact that catch and consumption of cetacean meat are prohibited. Those by-caught animals that are reported to a Provincial Fisheries Officer are eventually transported to the cetacean project at the Phuket Marine Biological Center.

Description of existing research program

Only a few institutes conduct marine mammal research in Thailand:

1) *The Marine Endangered Species Unit, Phuket Marine Biological Center.* The research activities are to document the species present in Thailand, to promote cetacean awareness by the public, to identify fisheries that take marine mammals, and to investigate areas and identify vulnerable species in order to implement management policies. Boat surveys have been conducted in some specific areas. An international training course on marine mammal research techniques was provided for researchers and Government officers. Age determination and examination of stomach contents of dugong were carried out. An attempt was made to establish a stranding network and a health-care center for marine animals in the Center. More than 200 stranded whales and dolphins and at least 120 dugongs were collected and the skeletons deposited in the collection.

2) *Sea Turtle Conservation Station, Man-nai Island, Rayong Province.* Only very limited research projects on marine mammals have been carried due to lack of manpower and budget support.

3) *Bangsan Institute of Marine Science, Burapha University, Chonburi Province.* Only stranded specimens have been collected.

4) *Lam Pam Fisheries Station, Phattalung Province.* In association with the Forestry Department, this fisheries station since 2000 has provided logistical support for research on the Irrawaddy dolphins inhabiting Songkhla Lake. The project has included boat surveys, interviews of local fishermen, collection of stranded and by-caught dolphins, and public education and awareness programs targeting school children and local communities.

A number of additional institutions now house collections of marine mammals in Thailand:

- 1) (NHCU) Natural History Museum, Chulalongkorn University, Bangkok
- 2) (KUMF) Kasetsart University Museum, Faculty of Fisheries, KU, Bangkok
- 3) (NICA) National Institute of Coastal Aquaculture, Songkhla
- 4) (PMBC) Phuket Marine Biological Center, Phuket
- 5) (NHM) National History Museum, Bangkok
- 6) (EMDEC) Eastern Marine Fisheries Development Center, Rayong
- 7) (OFD) Oceanic Fisheries Division, Samutprakan
- 8) (CNP) Chaomai National Park, Trang
- 9) (SNHM) Songkhla National History Museum, Songkhla

In addition, there are marine mammal specimens in many Buddhist Temples situated near the coastline. Also, local fishery stations and some

private individuals may collect dolphin skeletons as curiosities for people to come and admire.

Needs for additional research

An immediate need is to conduct research on and survey the Irrawaddy dolphins in Songkhla Lake. Surveys of marine mammals are needed in both the Gulf of Thailand and the Andaman Sea. There is a need for improved skills in species identification. Also needed are studies of biology and behavior of the identified populations, monitoring of by-catch in fisheries, genetic population studies, and studies of the impact of habitat degradation. There is also a need to improve the current stranding network and increase conservation awareness among the general public. For example, there was one report of live stranding of more than ten animals, but only two of them were returned to the sea.

Present and potential whale and dolphin watching operations

Dolphin watching for bottlenose dolphins at Khai and Maithon Islands, Phuket, has been discussed but not yet established. There is potential for dolphin watching tours at Songkhla Lake. The northern part of the lake holds large water bird populations, offering the possibility of combined nature tours.

2.1.12 Vietnam

Bui, Dao and Braulik summarized information available in Doc. 3 and Doc. 4. Additional information was provided by Smith and Hines and came from the references cited below.

Species and distribution

Cetaceans that can be added to the species list included in the 1995 report include Fraser's and striped dolphins. Indo-Pacific humpback dolphins are regularly observed in the Nam Trieu River mouth near Haiphong, have been seen in Bin Cang Bay near Nha Trang and based on an

unconfirmed sighting and many reports from fishermen, likely occur in the Ma River mouth south of Haiphong (Smith *et al.* 1995, 1997). Smith and Braulik reported seeing what were possibly dwarf spinner dolphins in Halong Bay. However, most of the specimens recorded in whale temples in South-Central Vietnam were of the larger *S. l. longirostris* (Smith *et al.* 1995, 1997). A single Irrawaddy dolphin was caught in a fishing net in the Tien tributary near the Cambodian border on 2 March 2002. This was the first confirmed record from this region of the Vietnamese Mekong.

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Dugongs are currently known from north of Halong Bay near the Chinese border, and a single skull is housed at the Haiphong Institute of Oceanography. Five skulls are also deposited at five different whale temples in the Nha Trang area of South-Central Vietnam (Smith *et al.* 1995, 1997). In 1997, three dugongs were caught accidentally by fishermen in the Con Dao Islands in southern Vietnam (two were released alive), and National Park officials estimated that there were 8-12 individuals near the Islands. Hines reported that at least six dugong skulls were observed at one dugong hunter's home in Phu Quoc Island.

Population status

There are no abundance estimates for any species in Vietnamese waters. However, sighting surveys during March, April, and October 1995, October 1999, and April 2000 (Smith *et al.* 1995, 1997; Smith and Braulik, unpublished data) in various areas along the coast of Vietnam resulted in extremely low encounter rates. Also, no Irrawaddy dolphins were sighted within their historical range during a survey in April 1996 of the entire length of the

Mekong River downstream of the Cambodian border, covering both Tien and Hau distributaries (Smith *et al.* 1997).

Habitat status

Dynamite and cyanide fishing occur frequently and appear to be increasing. Smith and Braulik reported that pushnet fishermen were observed using dynamite on many occasions inside Halong Bay (a UNESCO World Heritage Site) during surveys in October 1999 and April 2000. Both dynamite and cyanide fishing are illegal in Vietnam but enforcement is virtually non-existent. Overfishing from trawlers, gillnetters, and longliners appears to be a serious problem and may be affecting the availability of prey for cetaceans.

There has been a serious decline in the extent and quality of sea grass beds in many places. The reasons for the decline have not been studied but are probably related to destructive fishing practices and increasing sedimentation.

Directed catches

Directed catches of cetaceans are rare in Vietnam due to the animals' venerated status among fishermen. However, Smith *et al.* (1995, 1997) reported that dolphin meat is occasionally sold in the fish market on Cat Ba Island, and a newspaper article entitled 'killing of a dolphin in Halong Tourist Area' stated that a dolphin weighing 300kg was shot and brought to the beach by a hunter who stated that the animal could be sold for the equivalent of approximately US\$20. Dugongs are hunted, at least from Phu Quoc Island near the Cambodian border.

By-catches

No information is available on cetacean by-catch levels. During an at-sea survey in April 2000 a partial carcass of a finless porpoise was found floating next to a gill net. The cut was extremely clean, suggesting that the animal may have

been cut after its tail had become entangled in a gillnet. Interviews with fishermen indicated that gillnets kill cetaceans more often than other fishing techniques but that by-catch rates were low, perhaps due to the low density of cetaceans in Vietnamese waters.

Braulik reported that animals by-caught in north-central Vietnam were often sold in the market. Hines added that dolphins have been reported caught in nets and that flukes were cut off to prevent the nets from being destroyed.

Legal status and present management arrangements

Cetaceans are currently protected by a decree of the national assembly but this is not generally enforced. During the last three years the Vietnamese government has been drafting a new law that will give authorities greater power to enforce fishery regulations. This law is expected to be approved by the national assembly in the near future. Under this law dugongs are considered the same as cetaceans. The government also approved a national biodiversity action plan in 1995 that includes improved provisions for the establishment of marine protected areas. The Con Dao National Park was established in 1985. It includes the Con Dao Islands and the surrounding 14,000 ha of ocean. The park provides protection for a range of endangered species, including the dugong.

Folk attitudes and interactions with marine mammals

Vietnamese fishermen venerate cetaceans because they believe the animals will aid them when they are in distress at sea and help them catch more fish. Along the coast of south and central Vietnam fishermen build whale temples where they deposit whale and dolphin bones for worship. In the Mekong Delta, the villagers of Thoi Thuan hold a 'whale festival.' During the festival, the entire

village goes to sea in fishing boats to search for whales for the purpose of offering them prayers (Smith *et al.* 1997). In the northern part of Vietnam, dolphins and whales are not venerated as they are in the south; whale temples are rare, and cetaceans by-caught or stranded are usually buried in the sand.

Description of existing research programs

There are currently no dedicated research programs for marine mammals in Vietnam. WWF recently conducted an exploratory survey of dugongs in Phu Quoc and the Con Dao Islands and plans to continue research on dugongs in Vietnam. CMS and the IUCN SSC Cetacean Specialist Group also conducted, in collaboration with the Research Institute of Marine Products, Haiphong Institute of Oceanography, and Nha Trang Institute of Oceanography, a training course on cetacean research techniques and surveys in the Gulf of Tonkin during 1999 and 2000.

Needs for additional research

Assessments of direct and incidental catches should be integrated as part of fisheries monitoring activities. This will require training programs for fisheries officers and the establishment of standardized techniques. A dedicated research program is needed to investigate the status of humpback dolphins in the Nam Trieu River mouth. In addition, a comprehensive inventory and morphometrics study on skeletal materials stored at whale temples could yield valuable information on species occurrence and the population structure of cetaceans in SE Asia.

Present and potential whale and dolphin watching operations

The low density of cetaceans in most Vietnamese waters, with the possible exception of humpback dolphins in the Nam Trieu River mouth, make the potential for dolphin and whale watching poor.

2.2 Small Cetacean Species Reviews

The following update from the 1995 report was compiled from the available documents and verbal reports by the participants. The strictly freshwater Yangzi river dolphin, *Lipotes vexillifer*, was not substantively reviewed at this meeting, as it is distributed outside the study area considered.

Data available at the workshop on relative abundance of small cetaceans in surveys were compiled and discussed (Appendix 5). The most commonly encountered species in oceanic surveys in the Sulu Sea was the spinner dolphin, while Risso's dolphin predominated off Taiwan and the rough-toothed dolphin in the Babuyan Islands off the northern Philippines. In coastal surveys, which by and large were less extensive and had smaller total numbers of sightings, the most common species was variously the humpback dolphin, finless porpoise, Irrawaddy dolphin and Indo-Pacific bottlenose dolphin.

2.2.1 *Neophocaena phocaenoides*

Distribution

The global distribution of the finless porpoise appears to be highly fragmented. The 1995 workshop report stated that the species occurred in the Philippines. The records from northwestern Palawan that served as the basis for that statement, however, have since been found to be in error. Thus, the finless porpoise is not confirmed to occur in the Philippines, although it does occur along some of the islands of northeastern Borneo (Doc. 10), very close to Philippine territorial waters. The species has now been confirmed from Cambodian waters (Doc. 34).

Population/stock structure

A recent study of geographic variation in skull morphology (Jefferson 2002a) indicated that there are at least three geographical forms of finless

porpoises in tropical waters of SE Asia. The southern and northern South China Seas (SCS) animals appear to belong to different stocks, based on the much smaller size of the southern form, and finless porpoises in the Indian Ocean appear to belong to a third tropical population, based on their much shorter depth of the pterygoid notch (Jefferson 2002a). All three tropical forms have a wide dorsal ridge (*phocaenoides*-type). In addition, there are at least two populations of narrow-ridge finless porpoises (*asiaeorientalis*-type) in more temperate waters north of the Taiwan Strait. Chantrapornsyl reported that genetic studies suggest differences between finless porpoises in the Gulf of Thailand and those in the Andaman Sea.

Population status

The population in Hong Kong and adjacent areas of China's Guangdong Province numbers at least 217 porpoises (Jefferson *et al.* 2002a). This is the only abundance estimate available for tropical SE Asia, although there are estimates for populations farther north, in the Yangzi River and in Japanese waters.

Habitat status

While degradation of the species' habitat in Hong Kong waters continues, Jefferson and Lun reported that the Hong Kong Government had initiated measures aimed at ensuring the species' long-term survival in the region. This includes monitoring of the population, establishment of marine parks in critical habitat areas, and mitigation measures for development projects that are deemed to be potentially harmful to the species. The Taiwan Strait is badly degraded, but the effects on finless porpoises in the area have not been studied (Doc. 6). Highly industrialized areas such as Hong Kong, Taiwan, and Singapore are subjected to large discharges of toxic substances and human sewage, thereby degrading the habitat of this species (Reeves *et al.* 1997).

Directed catches

Other than occasional live-captures for aquaria and for research institutes, no directed captures of this species are known to have occurred in the region in recent years.

By-catches

Based on stranded specimens with net markings on their bodies, net entanglement appears to be the principal human-related cause of death for finless porpoises in Hong Kong (Jefferson *et al.* 2002b). By-catch in Hong Kong occurs in at least gillnet and trawl net fisheries. Torey (Doc. 7) identified 14 cases of definite or possible fishery by-catches of finless porpoises in Hong Kong between 1982 and 2002. However, the total by-catch has not yet been assessed. Torey reported that a planned onboard fishery observer program may provide better data in the near future. There are records of by-catches in gillnets in northern Vietnam (Doc. 3,4) and in several regions in Taiwan (reported by Chou). Zhou (Doc. 9) documented a potentially serious problem of by-catch of finless porpoises, involving many different types of fishing gear, in Chinese waters. Some of the porpoises taken as by-catch may be used to feed livestock in mainland China. In Taiwan, by-catch occurs in a number of different types of fisheries (driftnets, set gillnets, purse seines, fixed net traps, and possibly trawls) (Doc. 6). By-catches of finless porpoises have also been documented in Malaysian gillnets, fish traps, and trawls (Doc. 10).

Needs for additional research

The major need is for research on global systematics and population structure based on molecular genetics, to complement the recent studies based on morphology (see Jefferson 2002a). Ecological work, including population assessment in unstudied portions of the species' range (essentially almost all of SE Asia), is badly needed. The potentially serious problem of by-

catch in fisheries should be addressed urgently, through research, monitoring, and management.

2.2.2 *Steno bredanensis*

Distribution

No new information.

Population/stock structure

No new information.

Population status

No new information.

Habitat status

No new information.

Directed catches

Specimens thought to have been harpooned have been found in Taiwan fishing ports (Doc. 6). The specimen from the Philippines mentioned in the 1995 workshop report may have been taken in a purse seine. Stocks in SE Asia may be affected by the infrequent drive-fishery catches in Japanese waters.

By-catches

By-catch occurs on longlines and in drift gillnets in Taiwanese waters (Doc. 6). This species has a tendency to be associated with logs and other floating objects, and it may therefore be predisposed to capture in longline and purse seine fisheries. In the Babuyan Islands, Philippines, some by-catch may occur on longlines. Two stranded specimens from Vietnam had evidence of gillnet markings, and were probably by-caught (Doc. 4).

Needs for additional research

No directed research on this species has been conducted anywhere in SE Asia. Such studies would be beneficial, especially in areas of high fishing effort in deep water. Opportunistic biopsy

sampling should be attempted in areas where this species is seen on a regular basis, such as the Babuyan Islands. There is a need for assessment of the effects of by-catch in longline fisheries, especially for waters between the Philippines and Taiwan. In light of the paucity of specimen material for the region, samples (skulls and genetic tissues) should be collected whenever possible.

2.2.3 *Sousa chinensis*

Distribution

The distribution of the Indo-Pacific humpback dolphin is fragmented in many areas. Wang and Hung reported that the distribution in Chinese waters has recently been shown to extend to the west coast of the main island of Taiwan. Verifiable records from the coast of China suggest that eight or nine populations of humpback dolphins may exist from the Vietnam border to the mouth of the Yangzi River, mostly centered around the mouths of large rivers (Jefferson 2000b). Humpback dolphins appear to be common in the Hon Tre River area (Doc. 3). Dolar reported an unconfirmed stranding in the Turtle Islands area of the Philippines. [Editors' note: the specimen has now been confirmed to be an Indo-Pacific humpback dolphin]. The species has now been confirmed from Cambodian waters (Doc. 34).

Population/stock structure

The taxonomy of the genus *Sousa* remains confused in spite of considerable recent research (IWC in press). Although West African humpback dolphins (*Sousa teuszii*) clearly constitute a separate species, the taxonomy of animals in the Indo-Pacific must await the completion of ongoing studies using molecular genetic and morphometric techniques. Some preliminary evidence suggests that eastern (*chinensis*-type) and western Indian Ocean (*plumbea*-type) forms may be distinct (Jefferson 2000c). At this point, though, it is prudent to provisionally recognize only one

species in the Indo-Pacific (*S. chinensis*). A new species, *Sousa huangi*, described from China (P.-L. Wang 1999) is thought to be based on a juvenile specimen of *S. chinensis*.

Population status

The statement in the 1995 workshop report that the Hong Kong population of humpback dolphins numbered only about 84 individuals was inaccurate. Jefferson reported that extensive vessel-based survey work has shown that the Hong Kong and Pearl River Estuary population is much larger than previously believed, numbering at least 1,383 animals. Despite the many threats still facing this population, Jefferson (2000b) believes it to still be viable. About 60-80 animals occur in the Xiamen area (Doc. 9).

Habitat status

Habitat degradation is rampant in many areas of the species' range, including well-studied regions such as Hong Kong and Xiamen, P.R. China. Plans to conserve the dolphin populations are in place for both of these areas. In Hong Kong, these include long-term research and monitoring of the population, the creation of marine reserves for protection of the species, development of a conservation plan, and the requirement of mitigation measures for marine construction and development activities (Doc. 18,21). The flow of all major rivers of the west coast of Taiwan have been greatly reduced by the construction of dams and reservoirs, the banks have been altered by flood-control measures, and the estuaries are badly degraded. Estuaries along the west coast of Taiwan are badly degraded, as are several areas along the mainland Chinese coast (Doc. 9). In addition, fishing activities are often more intense in the productive estuarine areas typically inhabited by humpback dolphins than elsewhere.

Directed catches

No directed fisheries for this species are known, apart from the fact that 12 humpback dolphins were recently live-captured for display at a casino in Cambodia (Doc. 34). Data on the number of animals live-captured in the Gulf of Thailand were not available to this meeting. Workshop participants considered that although the number taken since the start of live-capture operations in the Gulf of Thailand is not known accurately, it may have been great enough to affect the wild source population(s). In 1960-1962, 36 humpback dolphins were deliberately killed by netting in Xiamen, P.R. China, in an attempt to reduce fishing interference and to test the feasibility of using their skin as a source of leather (Wang 1965).

By-catches

By-catches have been documented in almost every area where this species has been studied in the region. They most often involve set gillnet, driftnet and trawl fisheries. Wang reported that some live animals recently observed off Taiwan had large scars on their caudal peduncles that were consistent with injuries caused by net fisheries. Although there are records of by-catch in mainland China, the lack of more extensive data on by-catch there may be due, at least in part, to the species' protected status (Grade 1), which makes fishermen reluctant to disclose incidental catches (Doc. 9). One stranding on Taiwan's Chinmen Island may have been the result of capture in a fish trap. Torey (Doc. 7) summarized six cases of certain or possible net entanglement in Hong Kong waters between 1975 and 2000. She also reported that an on-board fishery observer program was about to begin in Hong Kong, and therefore better data may be available in the near future. Humpback dolphins are taken in inshore gillnets along the northern coast of Australia (Doc. 16).

Needs for additional research

There is a need to study local coastal populations of this species wherever it occurs in SE Asia. Boat surveys are urgently needed. The populations must be assessed, and effective conservation plans must be implemented, before the populations decline to critical levels. To date, such assessment and conservation has taken place only in Hong Kong, and to a lesser extent in Xiamen. Catches to stock oceanaria should be accurately monitored and reported. Estimates of incidental mortality and abundance are particularly needed off the west coast of Taiwan, in the Gulf of Tonkin northern Vietnam, and in the Gulf of Thailand. The ecological overlap with fisheries should also be investigated, especially in the Gulf of Thailand.

2.2.4 *Grampus griseus*

Distribution

Wang and Chou reported that Risso's dolphin is the most commonly encountered species off Hualien on the southeastern coast of Taiwan. It is also fairly common in the Bohol and Tañon Straits, Philippines, according to Dolar.

Population/stock structure

No new information.

Population status

Chou reported that some photo-identification work had been conducted in Taiwan waters, and that about 300 individual Risso's dolphins had been identified, thus providing a minimum estimate of population size (Kou 2002a). Dolar (1999a) produced an abundance estimate for the Sulu Sea of 941 (CV=40%). There are also minimum abundance estimates for southwestern Taiwan of 153 dolphins (CV=77%) (Huang 1996), and northeastern Taiwan of 218 individuals (CV=29%) (Chen 2001).

Habitat status

No new information.

Directed catches

Wang reported that Risso's dolphins are harpooned in Japan and Taiwan. There are also directed takes off Palawan, Philippines, and off Lamalera and Solor, Indonesia (Rudolph and Smeenk 2002). Stocks in SE Asia may be affected by catches in Japanese waters.

By-catches

There are recent records of by-catch in gillnets and other types of nets in China (Doc. 9), and in large-mesh drift gillnets in Taiwan (Doc. 6). By-catches also occur in purse seines and driftnets in the Philippines (Doc. 19, 28).

Needs for additional research

Population studies, based on photo-identification, should be pursued for this species, which is well-suited to this research technique. Some assessment of the effects of by-catch in large-mesh driftnet fisheries is also needed, particularly for deep coastal areas off Taiwan and other regions where Risso's dolphins and driftnet fisheries co-occur.

2.2.5 *Tursiops truncatus*

Distribution

There are no confirmed records of common bottlenose dolphins in the SE Asian portion of Australian waters—all known bottlenose dolphins records there are of *T. aduncus*. However, Marsh cautioned that the cetaceans in this area are poorly studied. The Sulu Sea driftnet catches in the Philippines have been confirmed to be *T. truncatus*, based on genetics. Wang stated that common bottlenose dolphins occur in both coastal and deepwater, offshore areas off Taiwan. The only report of common bottlenose dolphins in Malaysia is from the Spratley Islands (Doc. 10).

Population/stock structure

No new information.

Population status

Common bottlenose dolphins occur in the East China Sea at an estimated density of 0.14 individuals/km² (Doc. 9). A minimum abundance estimate for southwestern Taiwan is 672 dolphins (CV=44%), although this may be a combination of *T. truncatus* and *T. aduncus* (Huang 1996). A preliminary abundance estimate for northeastern Taiwan is 193 individuals (CV=53%) (Chen 2001).

Habitat status

Habitat in the Taiwan Strait is seriously degraded. These animals are found entirely inside the 800-m depth contour in Philippine waters, according to Dolar.

Directed catches

This species is commonly taken with harpoons in Taiwan (Doc. 6). Many *Tursiops* sp. (some may have been *T. aduncus*) have been live-captured in recent years for oceanaria in China. Bottlenose dolphins apparently are hunted for food by immigrants in Sabah (Doc. 10).

By-catches

There are some by-catches in trawls and purse seines in Chinese waters (Doc. 9), as well as in drift gillnets, bottom set gillnets, trammel nets, purse seines, and longlines in Taiwan (Doc. 6). Bottlenose dolphins are taken in driftnets at the Penghu Islands; however, Wang noted that it is uncertain which species of *Tursiops* is involved (likely both). There is a stranding record of a probable by-caught specimen in Hong Kong (Doc. 7). Incidental catches are also known from driftnets and purse seines in the Philippines (Doc. 19, 28).

Needs for additional research

More genetic studies are needed to determine which of the two species of *Tursiops* are involved

in sightings and catches throughout different areas of SE Asia. Workshop participants noted the difficulties in distinguishing between the two species in the field and urged that identifications be considered tentative in the absence of specimens, genetic samples or other voucher material. Investigations of by-catch, especially in Indonesia, the Philippines, and Taiwan, are also needed for this species.

2.2.6 *Tursiops aduncus*

Distribution

The Indo-Pacific bottlenose dolphin appears to have a fragmented distribution. It occurs in Shark Bay (Western Australia), Hervey Bay (eastern Australia), and other tropical areas of northern Australia. There are no confirmed records of *T. aduncus* anywhere in the Philippines, although the possibility of their occurrence has not been ruled out. Chantrapornsyl reported that all known bottlenose dolphins from the Gulf of Thailand are of the *aduncus* species, and bottlenose dolphins recently observed in Cambodian waters (Doc. 34) will probably prove to be this species. In Taiwan, *T. aduncus* appear to occur in shallow-water (continental-shelf) areas, especially where rocky reefs are present, such as at Nan Wan at the southern tip of the island and the Penghu Islands (Doc. 8).

Population/stock structure

There is good reason to believe that the southern Taiwan group is a functional or family unit that is isolated from others for at least part of the year (Doc. 8).

Population status

A density estimate is available for the western Taiwan Strait, between Xiamen and Dongshan (0.044 individuals/km²), but the overall population size is not known (Doc. 9). The southern Taiwan population appears be very small, possibly only

24 animals, and it has only been observed in one small portion of a bay (Doc. 8).

Habitat status

Vessel traffic and associated noise appears to affect the behavior and movements of the small group of animals at Nan Wan, at the southern tip of Taiwan and the coral reef ecosystem of this bay is greatly damaged (Doc. 8). The Taiwan Strait is highly degraded by activities on the shores of both mainland China and Taiwan.

Directed catches

Numerous bottlenose dolphins have been taken for Indonesia aquaria since the late 1970s, and recently animals have been exported to China (Appendix 8). Beasley and Jefferson reported that six Indo-Pacific bottlenose dolphins had been captured for Hong Kong's Ocean Park in Indonesian waters in 1997. Recently, three probable Indo-Pacific bottlenose dolphins were captured near the Thai/Myanmar border for a swim-with-the-dolphins program at a casino in Myanmar, according to Smith.

By-catches

Some animals are taken in drift gillnets, bottom set gillnets, trammel nets, and possibly trawl nets in Taiwanese waters (Doc. 6). By-catches in purse seines and trawl nets are also known from mainland Chinese waters (Doc. 9). The levels and impacts of fisheries by-catch in this region are unknown.

Needs for additional research

Further molecular genetic studies should be conducted to investigate population structure. By-catch in fisheries should be monitored and assessed, especially in the Gulf of Thailand and the Taiwan Strait. Groups of *Tursiops* observed in the wild should be photographed and biopsy-sampled, when and where feasible, to determine whether they are *T. aduncus* or *T. truncatus*. Focused

studies including following the animals and photo-ID may be needed to confirm species identity. Live-captures should be monitored and their impacts on local populations assessed.

2.2.7 *Stenella attenuata*

Distribution

Since the 1995 meeting, the pantropical spotted dolphin has been confirmed to occur in Malaysian waters (Doc. 10) and in Cambodian waters (Doc. 34).

Population/stock structure

No new information.

Population status

There are estimates of abundance for Tañon Strait (46 individuals, CV=43%; Dolar 1999a), the eastern Sulu Sea (17,143, CV=29%; Dolar 1999a), the southern Sulu Sea (3445, CV=32%; Dolar *et al.* 1997), and the northeastern coast of Taiwan (1280, CV=38%; Chen 2001).

Habitat status

No new information.

Directed catches

This is the most commonly caught species in illegal direct fisheries in Taiwan, according to Wang. Direct catches are also known from the Philippines (Doc. 28).

By-catches

There are many records of by-catch for several countries in the region (e.g., Vietnam, Taiwan, China; Doc. 6, 9, 28). In the Philippines, spotted dolphins are taken in purse seines and driftnets (Doc. 19). In Vietnam, two specimens were found in 2001 with evidence of net entanglement (Doc. 4).

Needs for additional research

Stock identity research is badly needed, especially given the possibility of shared populations between SE Asia and Japan, where there are large-scale directed catches of this species. Some assessment is also needed of the effects of by-catch in large-mesh driftnet fisheries, particularly in deep coastal waters of Taiwan. The illegal harpoon catches in Taiwan should be investigated further.

2.2.8 *Stenella longirostris*

Distribution

The spinner dolphin has been confirmed to occur in Malaysia (Doc. 10). Smith noted that the dwarf subspecies of the spinner dolphin (*S. longirostris roseiventris* - Perrin *et al.* 1999), described from the Gulf of Thailand and the Arafura and Timor Seas, may be present in the Gulf of Tonkin waters of Vietnam, based on a single sighting. Wang reported that dwarf spinners also may be present in shallow waters off the southern and eastern coasts of Taiwan (Wang *et al.* 2001a). These areas, if confirmed as part of the subspecies' distribution, would represent large range extensions. It has now been reported from Cambodian waters (Doc. 34).

Population/stock structure

No new information.

Population status

Dolar (1999a) provided abundance estimates for Tañon Strait (3,214; CV=33%) and the eastern Sulu Sea (29,966; CV=29%). An estimate for the southern Sulu Sea is 3,979 (CV=59%; Dolar *et al.* 1997). Chen (2001) calculated an abundance estimate of 1,490 individuals (CV=25%) for northeastern Taiwan.

Habitat status

The nearshore reef habitat of the dwarf subspecies is highly vulnerable to human impacts in SE Asia. Wang reported that high-speed watercrafts have been observed chasing dwarf spinner dolphins (tentative identification) in southern Taiwan and that the coral reef ecosystem of southern Taiwan has experienced great destruction by human activities.

Directed catches

This is one of the most commonly harpooned species off Taiwan (Doc. 6), and directed catches are also known from the Philippines (Doc. 28). The spinner dolphin is one of several species of dolphins that may be hunted for food by immigrants in Sabah, Malaysia (Doc. 10).

By-catches

By-catches of three spinner dolphins are known from Vietnam, off the Con Dao Islands (Doc. 4). The species is also taken in driftnets in Taiwan (Doc. 6). Perrin noted that there are still no data on the by-catch of dwarf spinner dolphins in the Taiwanese shark gillnet fishery that operates in Indonesian territorial waters. This is the same fishery that previously operated in Australian territorial waters and was ejected because of causing a large by-catch of dolphins there (Doc. 16). By-catch occurs in purse seines, driftnets, and longlines in many areas of the Philippines (Doc. 19).

Needs for additional research

There should be a detailed study of whale-temple specimens to examine the possibility of the presence of the dwarf form in Vietnam. The by-catch in the shark gillnet fishery in Indonesian waters is of serious concern, and should be investigated as a matter of urgency. Whenever possible sightings of the dwarf spinner dolphin are made in Taiwan, effort should be made to collect

data and obtain photographs to help confirm the presence of the subspecies in Taiwan waters.

2.2.9 *Stenella coeruleoalba*

Distribution

The striped dolphin has been added to the known cetacean fauna of Vietnam, Thailand, Taiwan, and the Philippines since 1995 (Doc. 25, 31). However, it is not known to be common anywhere in the region.

Population/stock structure

Perrin noted that SE Asian population(s) may move seasonally into Japanese waters where this species has been heavily exploited in drive fisheries.

Population status

The striped dolphin does not appear to be common in any of the studied nearshore regions of SE Asia. The population exploited in Japan has crashed in recent years (Kasuya 1999), and this may have affected the status of this species in SE Asia.

Habitat status

No new information.

Directed catches

Striped dolphins have been harpooned off Taiwan, but they represent a small proportion of the total catch (Doc. 6). By-catch is also known from mainland China (Doc. 9).

By-catches

In Taiwan, there are records of incidental catch on longlines and in large-mesh drift gillnets (Doc. 6). By-catches in gillnets are also known to occur in Fujian Province, P.R. China (Doc. 9).

Needs for additional research

None identified.

2.2.10 *Delphinus delphis*

Jefferson and Van Waerebeek (2002) investigated records of common dolphins in the Indo-Pacific and found that all verifiable records of the genus for SE Asia were of the long-beaked species (*D. capensis*). Apparently the short-beaked species (*D. delphis*) does not occur in SE Asia. The nearest records are from southern Japan and southern Australia.

However, there has been very little survey effort in deep offshore waters in this region (e.g., eastern coasts of Philippines) and distinguishing this species from *D. capensis* at sea is not trivial.

2.2.11 *Delphinus capensis*

Distribution

The long-beaked common dolphin occurs through the region, in coastal and nearshore waters, and all records from tropical waters of SE Asia appear to be of the exceedingly long-beaked subspecies, *D. capensis tropicalis* (Jefferson and Van Waerebeek 2002). Recent studies indicate that long-beaked common dolphins do not occur offshore or around oceanic islands in the Indo-Pacific (Jefferson and Van Waerebeek 2002). Recent surveys off the Cambodian coast have provided the first records for that country's waters (Doc. 34).

Population/stock structure

Most common dolphins in SE Asia appear to be of the extremely long-beaked form (*D. capensis tropicalis*). However, the standard long-beaked form (*D. c. capensis*) also seems to occur in the more temperate areas, in particular near Taiwan and possibly parts of central and northern China (Jefferson and Van Waerebeek 2002).

Population status

This species appears to be relatively uncommon among long-beaked delphinids in the tropical

waters of SE Asia, and records in this area are few. However, it is much more common in Chinese waters, according to Wang and Jefferson.

Habitat status

The nearshore habitat of this species may be under relatively greater threat than the offshore habitats of more oceanic species.

Directed catches

While directed catches are known from farther west in the species' range in the Indian Ocean, the only known direct takes in SE Asia are the harpoon catches in Taiwan reported by Wang and Yang (Doc. 6).

By-catches

Long-beaked common dolphins are frequently by-caught in fisheries along the coast of China (Doc. 9; Wang 1990). There are also probable records of by-catch in Taiwanese waters (Doc. 6).

Needs for additional research

This species has frequently been misidentified in the past, and many previous reports in the literature are erroneous or unconfirmed. Therefore, new scrutiny of existing records would be appropriate.

2.2.12 *Lagenodelphis hosei*

Distribution

Fraser's dolphin has been added to the known cetacean faunas of Vietnam (Doc. 4) and Thailand (Doc. 31). It strands relatively often in Taiwan, according to Chou. Dolar noted that there are no recent records for Tañon Strait in the Philippines, and the species may be absent from that area.

Population/stock structure

Perrin reported that a recent study (submitted for publication) indicates population-level differences between Japan and the central Philippines.

Population status

There is an abundance estimate for the eastern Sulu Sea (8,697; CV=30%; Dolar 1999a).

Habitat status

No new information.

Directed catches

There are records of captures used for shark bait in the Babuyan Islands, Philippines (Doc. 28). Harpoon catches also occur in Taiwan (Doc. 6).

By-catches

A specimen at the RIMP in northern Vietnam was taken incidentally in a driftnet in a joint Japanese/Vietnamese exploratory fisheries resource investigation (Doc. 4). The animals used as shark bait in the Babuyan Islands may be recorded as either by-catches or direct catches (Doc. 28). Fraser's dolphins are also taken in driftnets in several other areas of the Philippines (Doc. 19; Dolar 1994, 1999a) and in Taiwan (Doc. 6).

Needs for additional research

Distribution and abundance in the Babuyan Islands should be investigated because of the intense fishing effort in that area. Other areas where large-mesh drift gillnet fishing occurs in the Philippines and elsewhere in SE Asia (e.g., eastern coast of Taiwan) should also be investigated.

2.2.13 *Orcaella brevirostris*

Distribution

Irrawaddy dolphins have probably been extirpated or reduced to insignificant numbers in the Tonle Sap (Great Lake) of Cambodia (Doc. 34). In the Mekong River, they occur only as far upstream as Khone Falls just above the Laos/Cambodia border (Doc. 34). Although there was an anecdotal report of their presence in a tributary of the

Mekong in Thailand, this record would represent a significant range extension and its validity need to be confirmed. A small population recently found to inhabit Malampaya Sound, Palawan, is the only known population of the species in the Philippines (Dolar *et al.* 2002; Doc. 14). The species has now been confirmed to occur in Cambodian coastal waters (Doc. 34).

Population/stock structure

There are numerous cranial morphometric differences between Irrawaddy dolphins from Australia (including Papua New Guinea) and those from SE Asia proper (Indonesia to India) (Beasley *et al.* 2002a). The two forms are at least subspecies and may even represent different species. There are two populations in Thailand, one in the open Gulf and the other in Songkhla Lake (Beasley *et al.* 2002a; Doc. 31). Small distinct, fragmented populations occur throughout much of SE Asia. Although many of these populations are thought to be depleted, some of those in Borneo may be relatively robust at present (Doc. 10).

Population status

Population status was summarized by Smith and Jefferson (2002). Irrawaddy dolphins in Songkhla Lake, southern Thailand, appear to have declined in abundance in recent years. While no population estimate is available, seemingly high mortality levels place the continued survival of this population in doubt (Beasley *et al.* 2002b). The freshwater population inhabiting the Mahakam River system of East Kalimantan, Borneo, also appears to be small (possibly as few as 34 dolphins); it is highly threatened (Kreb 2002). Similarly, the population in inner Malampaya Sound, Philippines, is small and clearly threatened by human activities (Dolar *et al.* 2002; Doc. 14). There may be only about 77 dolphins in this population, and the by-catch in *matang quatro* gillnets and other fishing operations is almost certainly unsustainable (Doc. 14). The Mekong River population appears to be

small, possibly numbering no more than about 100 individuals (Doc. 34).

Habitat status

In the lower Mekong River of southern Laos, where some habitat-use studies have been completed, the dolphins are concentrated in a deep-water pool habitat near a tributary confluence and near an adjacent island (Stacey and Hvenegaard 2002). The planned damming of rivers in Cambodia represents a threat to the population in the Mekong River (Doc. 34). A Chinese plan to create a shipping channel in the upper Mekong, involving blasting of the upper Cambodian and southern Lao rapids, would certainly have serious detrimental effects on the Mekong River dolphin population (Doc. 34). Many water development projects degrade important river features for this species, and the effects extend to coastal populations that inhabit estuaries.

Directed catches

Eight oceanic Irrawaddy dolphins were live-captured for display at a casino in Cambodia (Doc. 34). In addition, an unknown number have been taken illegally since the mid 1980s to stock Thai oceanaria and private facilities. Live-captures also may have occurred in the Mahakam River in recent years. Japanese oceanaria have several Irrawaddy dolphins from the Mahakam River (see Appendix 8).

By-catches

By-catches in local fisheries occur virtually everywhere that the species has been studied. At least 27 Irrawaddy dolphins were reported to have been killed accidentally in the Laos/Cambodia border region of the Mekong River between December 1990 and September 1998, some by explosives (Baird and Mounsouphom 1994, 1997; Baird 1999). Additional mortality in gillnets and due to dynamite fishing in the Cambodian Mekong was reported in Doc. 34. The amount of human-

caused mortality is certainly large enough to merit grave concern about survival of the Mekong River population. A specimen was caught in a fishing net in the Tien River in Vietnam in 2002 (Doc. 4). There are by-catches in bottom-set gillnets, and possibly fish corrals, lift nets, and crab-trap gear in Malampaya Sound, Philippines (Doc. 19). By-catches of Irrawaddy dolphins have been documented in Malaysian gillnets, fish traps, and trawls (Doc. 10).

Needs for additional research

Live-captures from the Gulf of Thailand and from other small and isolated populations to stock casinos and oceanaria should be monitored as a matter of priority. Also, boat-based surveys should be conducted to estimate abundance of Irrawaddy dolphins in northern Australian waters and other regions (e.g., Borneo and Cambodia) where relatively robust marine populations likely exist.

2.2.14 *Peponocephala electra*

Distribution

There are new records of melon-headed whales around the Babuyan Islands, Philippines (Doc. 33). They have also been confirmed to occur in Malaysia (Doc. 10). There have been many recent records of this species in Taiwan waters (Wang *et al.* 2001b).

Population/stock structure

No new information.

Population status

No new information.

Habitat status

No new information.

Directed catches

Direct catches were known to occur in the Philippines previously (Dolar 1994), and some illegal hunting may still occur, e.g. in the Babuyan

Islands (Doc. 28). Harpooned specimens have been discovered in Taiwanese fish markets (Doc. 6).

By-catches

This species may be caught in large-mesh drift gillnets in Taiwan (Doc. 6).

Needs for additional research

None identified.

2.2.15 *Feresa attenuata*

Distribution

The pygmy killer whale has been confirmed to occur in Malaysia (Doc. 10).

Population/stock structure

No new information.

Population status

No new information.

Habitat status

No new information.

Directed catches

Harpooned specimens have been discovered at Taiwanese fish markets (Doc. 6).

By-catches

There are possible records of by-catch in large-mesh driftnets in Taiwan (Doc. 6).

Needs for additional research

None identified.

2.2.16 *Pseudorca crassidens*

Distribution

Since the 1995 meeting, false killer whales have been added to the lists of species known to occur in the Philippines (Doc. 25) and Cambodia (Doc. 34). Wang pointed out that false killer whales occur in some coastal waters (e.g., of the Penghu

Islands), as well as oceanic waters. Zhou noted that they enter the lower reaches of certain rivers in China, possibly on an annual basis.

Population/stock structure

No new information.

Population status

No new information.

Habitat status

No new information.

Directed catches

Exploitation of this species in Japan may affect populations that occur seasonally in Taiwan or the Philippines. False killer whales are probably harpooned in Taiwan, due to their interference with longlining operations, but the harpooned animals may not always be landed (Doc. 6).

By-catches

False killer whales are apparently taken in purse seines, gillnets, and trawl nets in Chinese waters (Doc. 9). They are known to take fish off longlines, but there seem to be few records of by-catch in SE Asia. However, Japanese long-line vessels fishing in Australian waters in the 1990s did have some by-catch of false killer whales (Doc. 16). Wang noted that the whales may be either by-caught or deliberately persecuted because of their depredations on the longlines. This species was one of several taken in the Taiwanese shark gillnet fishery in Australian waters in the past (Doc. 16).

Needs for additional research

None identified.

2.2.17 *Orcinus orca*

Distribution

No new information.

Population/stock structure

It is uncertain whether distinct fish-eating and mammal-eating killer whale pods occur in SE Asia, as in northeastern Pacific waters. Ingrid Visser reported during the pre-workshop symposium that killer whales in Papua New Guinea feed on sharks. In Indonesia they feed on ocean sunfish (*Mola mola*), according to Kahn. Kahn also reported that the saddle patch is not very distinct in Indonesian animals and that the eye patch has gray shading between it and the surrounding cape. Coloration patterns may aid in defining population structure in SE Asia.

Population status

No new information.

Habitat status

No new information.

Directed catches

Killer whales used to be taken in the direct fishery for cetaceans at Lamalera, Indonesia, but according to Kahn, the whalers no longer hunt them because of difficulties with landing them. Catches at Lamalera between 1960 and 1994 totaled 24 animals (Rudolph and Smeenk 2002). Killer whale meat has been found among remains of cetaceans that were confiscated in Taiwan (Doc. 6). Wang reported that a killer whale was harpooned in Taiwan in the early 1990s.

By-catches

Japanese long-line vessels fishing in Australian waters in the 1990s caused some by-catch of killer whales (Doc. 16). Killer whales may be caught in large-mesh drift gillnets in Taiwan (Doc. 6).

Needs for additional research

Properly documented identification photographs should be collected opportunistically throughout SE Asia. Some initial effort of this kind has already begun by Kahn (Apex Environmental, Cairns, Australia) and Ingrid Visser (Orca Research Trust, Whangarei, New Zealand).

2.2.18 *Globicephala macrorhynchus*

Distribution

There are now confirmed records of short-finned pilot whales in Cambodia (Doc. 34), Taiwan (Doc. 6; Chen 2001), and Indonesia (Doc. 23).

Population/stock structure

Wang and Dolar reported that animals in Taiwan and the Philippines do not appear to have the post-dorsal fin saddle patch and eye streak, which are useful features in distinguishing the two stocks that have been identified in Japanese waters.

Population status

No new information.

Habitat status

Abundance estimates are available for Tañon Strait (7,690; CV=34%) and the eastern Sulu Sea (31; CV=100%), Philippines (Dolar 1999a).

Directed catches

From 1996-1997, about 577 pilot whales (species identification somewhat questionable—some may have been other species of globicephalines) were taken in “tiger nets” (large-mesh gillnets stretched across narrow straits) in Manado, northern Sulawesi (Doc. 24). Kahn noted that the catch was used locally in pet-food factories. Although the nets in Manado have been removed, there are plans to set more of them in other areas of Indonesia; ten permits are rumored to have been issued for the Mollucas area.

By-catches

There is some by-catch of pilot whales in the large-mesh driftnet fishery in Taiwan; however, the numbers involved are not known (Doc. 6).

Needs for additional research

There is a need to investigate whether further tiger net fisheries are planned. Because of their social organization and occurrence in large aggregations, pilot whales may be particularly vulnerable to intensive capture operations, such as tiger netting. There is also a need to confirm the species composition of the tiger net fisheries, perhaps by examining videos taken by an observer off Manado.

2.2.19 *Mesoplodon* spp.

Distribution

Species known from the area include *M. densirostris* and *M. ginkodens*. It is possible that additional species of *Mesoplodon* will be found in SE Asia in the future. *M. densirostris* has been added to the fauna of Taiwan since 1995 (Doc. 6). Dolar and Perrin noted that the specimen from the Philippines referred to in the 1995 meeting report as *M. ginkodens* (which is stored at the Silliman University Marine Laboratory) has since been confirmed to be *M. densirostris*.

Population/stock structure

No new information.

Population status

No new information.

Habitat status

Kahn noted that for all species of ziphiids, the impacts of deep-sea mining operations using explosives or intense sounds could be severe.

Directed catches

Wang reported that a specimen of *M. densirostris* at the National Museum of Natural Science in Taiwan was probably from a directed take, and that *Mesoplodon* spp. (both *M. ginkgodens* and *M. densirostris*) are occasionally harpooned in Taiwan (Doc. 6).

By-catches

Large numbers of beaked whales (perhaps as many as 100 per year) may be taken in large-mesh driftnets in Taiwan, according to Wang. As many as 100 per year were reported by one driftnetter—the fisherman's identification of carcasses as beaked whales was considered reliable based on his descriptions of the animals' large size, indistinct beak and the purgative properties of the blubber).

Needs for additional research

A habitat approach should be taken in assessing the species diversity and abundance of beaked whales in SE Asia. Also, the potential effects of submarine disposal of mining wastes on the habitat of these animals should be evaluated. Whale-temple specimens in Vietnam represent a promising source of information on ziphiid distribution in that area, and they should be systematically examined and catalogued. Species identifications of specimens at whale temples (and in museums) should be confirmed, most appropriately by molecular genetic techniques (see Dalebout 2002, Dalebout *et al.* 2002).

2.2.20 *Ziphius cavirostris*

Distribution

Cuvier's beaked whale was recently added to the fauna of the Andaman Sea, confirming its occurrence in Thai waters (Doc. 31). It has also been confirmed in Malaysian (Doc. 10; Jaaman *et al.* 2000c) and Philippine waters (Doc. 25). This

species strands frequently in Taiwan (Wang *et al.* 1995).

Population/stock structure

No new information.

Population status

No new information.

Habitat status

In light of recent mass mortality incidents in Greece and the Bahamas, special attention should be paid to the potential acoustic impacts of military activities.

Directed catches

Ziphius may have been harpooned in the past in Taiwan (Doc. 6).

By-catches

There is a record of a Cuvier's beaked whale by-catch in the driftnet fishery in the Philippines and possible records in Taiwan (Doc. 6).

Needs for additional research

Studies focused on likely *Ziphius* habitat in SE Asia should be considered. The possible effects of submarine disposal of mining wastes on these animals should also be evaluated.

2.2.21 *Indopacetus pacificus*

Distribution

In the 1995 workshop report, records of "tropical bottlenose whales" in the Indo-Pacific were listed under *Hyperoodon* sp., due to uncertainty in the taxonomy of these animals at the time. Recent work, however, has shown these animals to be Longman's beaked whales (Pitman *et al.* 1999; Dalebout 2002). Records of the species are known from a band extending from about 10° S to about 40° N in the Indian and Pacific oceans. While there are no confirmed records of the species

from SE Asia, it is known to occur in both the Indian and Pacific Oceans, and three unconfirmed records for SE Asia do exist, for the Philippines, Indonesia (both mentioned in the 1995 report), and Taiwan (Doc. 6, Wang et al. 2001a).

Population/stock structure

No new information.

Population status

No new information.

Habitat status

No new information.

Directed catches

No new information.

By-catches

No new information.

Needs for additional research

Due to the recently clarified taxonomy of the animals known in the past as “tropical bottlenose whales,” records of beaked whales in SE Asia should be re-examined to determine whether any should be referred to *Indopacetus pacificus*. Molecular approaches (see Dalebout 2002) would be needed for species confirmation in at least some cases.

2.2.22 *Kogia breviceps*

Distribution

The pygmy sperm whale is not yet known to occur in the Philippines. All confirmed records there appear to be of *K. sima* (Doc. 25).

Population/stock structure

No new information.

Population status

No new information.

Habitat status

No new information.

Directed catches

There are harpoon catches in Taiwan (Doc. 6).

By-catches

This species is by-caught in large-mesh driftnets off Taiwan (Doc. 6).

Needs for additional research

In light of the Bahamas mass mortality incident and its effects on beaked whales (Balcomb and Claridge 2001), attention should be paid to the potential acoustic impacts of military activities on *Kogia* spp., which are also deep-diving whales.

2.2.23 *Kogia sima*

Distribution

Dwarf sperm whales strand relatively often in Taiwan, according to Chou.

Population/stock structure

No new information.

Population status

No new information.

Habitat status

No new information.

Directed catches

In the past, this species was taken in the direct fishery using harpoons at Pamilacan, Philippines. This fishery is no longer active, according to Dolar. *Kogia* is taken by harpoon off Taiwan (Doc. 6).

By-catches

This species is by-caught in large-mesh driftnets off Taiwan (Doc. 6).

Needs for additional research

Acoustic impacts of military activities should be evaluated.

3. REVIEW OF DUGONG CONSERVATION AND RESEARCH

3.1 Distribution and Abundance

The dugong has a large range which spans the coastal and island waters of at least 37 countries and territories in the Indo-West Pacific from East Africa to Vanuatu between the latitudes of about 26 degrees north and south of the equator (Marsh *et al.* 2002). Within the SE Asian region, substantial populations are known to exist in the coastal waters of tropical Australia. However, throughout the remainder of the region, dugong populations are believed to be fragmented and their numbers low and declining. In some countries of SE Asia such as Cambodia, dugongs are thought to be the most endangered marine mammal because of the high value place on their body parts, especially their tusks and tears. Nonetheless, it is encouraging that dugongs are still present (even if in very low numbers) at the northern limit of their Asian range in Okinawa, Japan. The information on dugong distribution and abundance summarized below is detailed in Marsh *et al.* (2002). Updates were provided by the workshop participants. Japan is included because occurrence in the Ryukyus near Taiwan represents the northern limit of the range of this tropical animal.

3.1.1 Japan

Dugongs are believed to have had a wide distribution within the Nansei Shoto Islands which extend as a 1,150 km arc from Kyushu to Taiwan (China). Extensive aerial surveys of the region in recent years have established that dugongs are now restricted to a small population off the coast of Okinawa Island. The largest number of separate sightings on a single day was of six animals.

3.1.2 China (including Taiwan)

The distribution of the dugong in Chinese waters is now believed to be restricted to a very small population along the coast of Guangxi Zhuang

Autonomous Region and the west coast of Hainan Island, especially in the region of Hepu County in Guangxi Zhuang Autonomous Region. Wang reported that dugongs do not now occur in Taiwanese waters and there are no confirmed records of their past occurrence.

3.1.3 Vietnam

Anecdotal reports and stranding records indicate that dugongs still occur in Vietnamese waters, especially in the region of the Con Dao Islands, Phu Quoc Island and Bai Tu Lon Bay.

3.1.4 Cambodia

Dugongs were previously reported to occur along the entire Cambodian coastline. Anecdotal reports and sightings confirm that a small population still occurs in the SE in the Kampot and Kep region.

3.1.5 Philippines

In the past, dugongs occurred along most of the Philippines coast. Their distribution is now greatly reduced. Anecdotal reports and qualitative surveys indicate that small numbers of animals occur in the following areas: Palawan, Sulu Archipelago, Southern Mindanao, Guimaras Strait and Panay Gulf, Northeastern Luzon, and Northeastern Mindanao.

3.1.6 Indonesia and East Timor

Dugongs are widely distributed in the region, but anecdotal reports and spatially limited qualitative aerial surveys suggest that local abundance is generally low. Islands which support populations of dugongs include Sumatra, Java, Kalimantan, Sulawesi, Bali, Nusa Tenggara timur, Maluku, Papua Barat and Timor (see Marsh *et al.* 2002 for details).

3.1.7 Australia

Dugongs occur all along the tropical coast. Quantitative surveys for dugongs have been conducted over most of the region except between the mouth of the De Grey River in Western Australia and the mouth of the Daley River in the Northern Territory. The most recent population estimates available are as follows: North-West Cape and the De Grey River in Western Australia (population estimate 2,046 + se 376 in 2000; Prince *et al.* 2001), northern coast of Northern Territory (13,800 + se 2,683 in 1984; Bayliss and Freeland 1989), Northern Territory coast of the Gulf of Carpentaria (16,846 + se 3257; Bayliss and Freeland 1989) in 1985, the Queensland coast of the Gulf of Carpentaria (4266 + se 657 in 1997; Marsh *et al.* 1998).

3.1.8 Malaysia, Singapore and Brunei

Dugongs occur in low numbers off the coasts of Peninsular Malaysia and Singapore and East Malaysia and Brunei. Anecdotal reports and aerial surveys indicate that dugongs still occur in: Johore Strait, East Johore, Lankawi (Peninsula Malaysia and Singapore), Brunei Bay, Banggi, Labuan, Kudat, Semporan, Sandakan, Mantanani (East Malaysia and Brunei)

3.1.9 Thailand

As reported by Hines, the Andaman coast of Thailand arguably supports the largest population of dugongs in mainland SE Asian waters with an estimated 200 animals along the entire coast, the largest number of animals being in Trang province. Anecdotal reports suggest that dugongs are still present in low numbers along parts of the Gulf of Thailand coast.

3.2 Population/Stock Identity

Research using mitochondrial DNA suggests stock separation between dugongs occurring in Australian waters and those occurring in the

remainder of the region. Sample sizes are too small to make a definitive statement about stock differentiation between dugong populations from the remaining countries of SE Asia. Within Australian waters, there are two overlapping maternal lineages apparently reflecting the history of sea level change (B. McDonald pers. comm. to Marsh, 2002).

3.3 Population Status

The status of the dugong population is not known for any country in the region, however, numbers are believed to have declined throughout the region with the possible exception of Australian waters (Marsh *et al.* 2002).

3.4 Habitat Status

There is serious concern about anthropogenic impacts on seagrass beds in all countries in the region outside Australia as summarized in Table 6. In the Australian waters of SE Asia, such impacts occur at local scales only as trawling is zoned out of seagrass beds. Extreme weather events such as cyclones and floods can cause the loss of hundreds of square kilometers of seagrass. Recovery typically takes at least several years (for details see Marsh *et al.* 2002). The significance of anthropogenic losses of seagrass must be viewed in the context of natural losses. In Australia, dugong mortality and movements follow large-scale loss of seagrass associated with extreme weather events (Preen and Marsh 1995; Marsh *et al.* 2002). It is likely that similar losses and responses occur in other areas.

3.5 Directed Catches

Some Indigenous peoples in Australia are permitted by law to hunt dugongs as a Native Title right. The legal status of hunting by indigenous Australians who are not Native Title holders is less certain. There are no quantitative records for Indigenous harvest in the region. The total catch is likely to be of the order of several

Table 6. Causes of anthropogenic loss of seagrass in SE Asia.

Cause of anthropogenic loss of seagrass	Countries where this is of concern
Coastal development	Indonesia, Japan, Malaysia, Philippines, Thailand, Vietnam
Agricultural land use	Indonesia, Japan, Malaysia, Philippines, Thailand, Vietnam
Fishing in seagrass areas	Cambodia, Indonesia, Malaysia, Philippines, Thailand, Vietnam

hundred dugongs per year. Dugongs are also killed opportunistically for meat, oil and other products such as tusks and tears in Cambodia, Indonesia, Malaysia, Philippines, and Vietnam.

3.6 By-catches

Marsh *et al.* (2002) indicated that dugongs are caught incidentally in fishing gear throughout their range. Participants in the workshop indicated that dugongs are caught as by-catch in all countries of SE Asia with various gear types as summarized in Table 7. Gill nets are the most ubiquitous and serious source of dugong mortality, catching dugongs as by-catch in all countries. Dugongs caught as by-catch are unlikely to be released alive in the following countries because of the high value of their body parts, especially tusks: Cambodia, Indonesia, Malaysia (some areas),

Philippines (most areas), Thailand (some areas), and Vietnam. For example, a pair of dugong tusks is worth almost half the annual income of a Thai artisanal fisher. The high value of dugong products reduces the range of mitigating factors appropriate to solving the dugong by-catch problem in SE Asia.

3.7 Regional Priorities for Conservation Action and Associated Research

National research priorities and conservation initiatives are detailed in Marsh *et al.* (2002). Workshop participants identified a number of conservation objectives and the research and other actions required to address these objectives as their highest priorities for the region (Table 8).

Table 7. Details of fishing practices that catch dugongs as by-catch in various SE Asian countries.

Gear	Countries where dugongs are caught as by-catch
gill and meshnets	Australia, Cambodia, Indonesia, Japan, Malaysia, Philippines, Thailand, Vietnam
dynamite fishing	China, Indonesia, Cambodia?, Malaysia, Philippines, Vietnam
ghost fishing	Malaysia, Australia?, Cambodia, Indonesia, Philippines
cyanide	Indonesia
bamboo fish trap (kelong)	Indonesia, Malaysia, Thailand
trapnet	Japan
fish corral	Philippines
pushnet	Thailand
trawl	Malaysia

Table 8. Conservation objectives identified by workshop participants as their highest priorities for the dugong in SE Asia, and the research and other actions required to address these objectives.

No priorities were developed for Australia in view of its developed country status. However, the workshop noted with concern the overall lack of research on marine mammals in the Australian waters of SE Asia.

Objectives	Strategies
General Improve understanding of stock identity	Develop cooperative exchange of specimens, DNA and methodology throughout region
Thailand, Cambodia Vietnam Develop and implement series of reserves to protect dugongs in the Gulf of Thailand, Cambodia and Vietnam	<ol style="list-style-type: none"> 1. Hold technical workshop to investigate and plan logistics and develop joint proposal 2. Hold discussions with government in each country 3. Modify proposal if required by governments 4. Seek funding 5. Conduct aerial surveys of the region to 20m depth contour to the 20m contour, potentially coordinated by WWF Indochina 6. Provide management guidelines to government(s) 7. Assist in the development of education and awareness programs
Thailand and Malaysia Upgrade reserves in Trang to Langkawi areas to ensure dugong and seagrass conservation	<ol style="list-style-type: none"> 1. Hold bilateral workshop to considerations required to upgrade reserves 2. Conduct aerial surveys in Langkawi region to identify dugong distribution and relative abundance 3. Advise authorities on requirements to upgrade reserves and results of survey
China Upgrade reserves established for dugongs in Hepu area	<ol style="list-style-type: none"> 1. Conduct aerial survey in Chinese waters—particularly Hepu waters to upgrade information on dugong distribution and relative abundance in Gulf of Tonkin 2. Advise authorities of priorities for upgrading reserves
Philippines Establish MPAs particularly for dugong	<ol style="list-style-type: none"> 1. Identify critical sites e.g. Calauit Island, Busuanga; Green Island Bay, Palawan; Malita, Davao del Sur; Sarangani Bay, Sarangani; Sulu Archipelago; Hinatuan Bay, Surigao del Sur) 2. Educate and involve community in MPA development and implementation 3. Establish protected areas according to nationally established protocols

4. THE PROBLEM OF BY-CATCH IN FISHERIES

4.1 Regional Review

Research in SE Asia since the 1995 workshop have revealed that the by-catch of cetaceans and dugongs in fisheries is even greater than previously supposed, and there is no indication that this problem has been addressed in a meaningful or satisfactory way anywhere in the region. Illegal and unregulated fishing by distant-water commercial fleets is a major problem for SE Asian countries. In particular, encroachment by Taiwanese vessels in offshore EEZ waters of the Philippines was repeatedly noted by workshop participants. Exclusion of such vessels from one country's territorial waters all too often simply displaces the problem. An example is the Taiwanese tuna driftnet fishery in the Arafura Sea. Australia banned this fishery within its EEZ after large by-catches of dolphins had been documented (Harwood et al. 1984). Rather than ending its operations, however, this Taiwanese fishery simply relocated to international waters and is now believed to be operating in Indonesian waters with little or no monitoring or regulation. This example demonstrates the need for a regional approach to by-catch reduction/mitigation.

It was also noted that in some instances, incentive programs by government agencies have been responsible for over-capitalization of fishing fleets, or increasing the amount of fishing with gillnets and other unselective gear. There is a need to end directed government programs and policies that effectively, albeit inadvertently, increase marine mammal by-catch.

A factor to consider in present and future assessments is that low by-catch rates in many areas reflect the fact that cetacean and dugong populations have already been severely reduced by direct and incidental removals. Vietnam provides

one particularly stark example. There, observed densities of marine mammals in coastal waters are very low, fishing intensity is extremely high, and skulls in whale temples bespeak a formerly diverse and abundant local marine mammal fauna (Smith et al. 1997; Doc. 3, 14).

4.2 Useful Approaches and Priorities for Research

4.2.1 Small cetaceans

Only a few existing cetacean by-catch reduction/mitigation efforts in SE Asia were identified:

WWF-Philippines, in collaboration with local government, has initiated a project to develop modifications to crab-fishing gear and/or practices in Malampaya Sound, with the goal of reducing the by-catch of Irrawaddy dolphins, especially in *matang quatro* nets.

Declaration of marine reserves and other types of marine protected areas in Brunei and Malaysia is justified, at least in part, as a way of reducing dugong and cetacean by-catch, although protection of coral reefs and seagrass beds is likely the primary impetus for such initiatives.

The participants were asked to identify and rank what they considered to be useful generic approaches to small cetacean by-catch mitigation. A total of 18 strategies were identified, of which seven were considered important by more than one or two individuals. These seven, in descending rank order, were:

- 1) Targeted community education and awareness programs.
- 2) Improved enforcement initiatives.

- 3) Monitoring and assessment of by-catch and fisheries.
- 4) Gear research.
- 5) Promotion of alternative livelihoods.
- 6) Identification of key areas and closure of fisheries.
- 7) Development of laws and regulations to reduce by-catch.

While it was recognized that by-catch data from interviews are almost always seriously biased downward (Lien *et al.* 1984), the participants acknowledged the difficulty of placing observers on small artisanal fishing vessels, and therefore of obtaining by-catch data for such fisheries any way other than by interviews. However, it was noted that in the United States, some small-boat fisheries have been successfully observed from one or more independent vessels that move around on the fishing ground and monitor the nets from a distance as they are being hauled. Also, in California it has proven feasible to use shore-based observers to obtain unbiased data on by-catch for some nearshore fisheries (Hanan *et al.* 1986).

Data need to be collected in such a way that by-catch rates can be discriminated at least to the species level. Moreover, for by-catch rate estimates to be meaningful in population assessment, it is necessary to have good information on stock structure and abundance. For small populations where sufficient data are available, e.g., the Irrawaddy dolphins in Malampaya Sound, Philippines, it may be possible and useful to calculate a potential biological removal (PBR) level ("mortality limit," as it is called in Europe) and/or to conduct a population viability analysis (PVA). These kinds of calculations can inform

policy makers and resource managers as to the probable consequences of various alternative management strategies.

4.2.2 Dugongs

Workshop participants with dugong experience suggested the strategies listed in Table 9 as having the potential to mitigate dugong by-catch. Participants from each country then identified the three or four measures that they considered most likely to succeed in their country. The results, summarized in Table 9, indicate that community-based education and management was considered the most promising strategy for nine countries, spatial closures in key habitats for seven countries and improved enforcement for seven countries. Given the value of dugong products and the resultant low probability of dugongs being released alive in many countries as outlined above, area closures to high-risk fisheries (i.e., those likely to catch dugongs) are probably the most effective means of reducing dugong by-catch. However, such closures are especially problematical in developing countries where they would be regarded as inimical to food security. In addition, the effective enforcement of closure areas will be prohibitively expensive unless there is widespread community support (hence the need for community education programs).

4.3 Development of Draft Plan of Action

The group discussed various potential approaches to coordinate regional action. It was agreed that the best strategy would be to formulate a plan in two stages, the first phase to concentrate on raising awareness of the issue of by-catch and the second on assessment and mitigation. An initial awareness-raising phase is necessary because in much of SE Asia awareness of the conservation

Table 9. Strategies identified by workshop participants as having the potential to reduce dugong by-catch, ranked by relative potential for each country.

Strategy	Country rankings (1=most important)
Develop community-based education and management programs in fishing communities	(1) Indonesia, Japan, Malaysia, Philippines; (2) Australia, China, Thailand, Vietnam; (4) Cambodia
Identify key dugong habitats and negotiate closure to by-catch fisheries (i.e., fisheries in which dugong by-catch is known or suspected to occur)	(1) Australia, Thailand, Vietnam; (2) Cambodia; (3) China, Malaysia; (4) Indonesia.
Improve enforcement of regulations	(1) China; (2) Indonesia, Malaysia, Philippines; (3) Australia, Cambodia, Thailand.
Monitor by-catch	(2) Japan; (4) Malaysia, Thailand
Develop stricter regulations	(1) Cambodia
Modify gear (e.g., replace gillnets with fish corrals or trap nets)	(3) Indonesia, Japan, Philippines
Sponsor alternative livelihoods for fishermen involved in by-catch fisheries	(3) Vietnam
Reduce effort in by-catch fisheries	
Introduce and enforce rules that require attendance at nets	
Buy out gear known to be destructive of dugongs (e.g., pushnets)	
Introduce incentives to change to less damaging gear	
Emphasize conservation value of seagrass habitats	

threats posed by by-catch is so low on the part of the public, fishery and community stakeholders, and decision makers that immediate initiation of full assessment and mitigation efforts is unlikely to be supported or funded. Education efforts would be coupled in this phase with preliminary surveys of the scope of by-catch in regional fisheries. Recognizing that some nations in the region are farther along in their efforts to address by-catch, e.g., the Philippines, it was stressed that

any regional action plan should not be viewed as supplanting or substituting for existing national efforts and plans, but rather as augmenting and complementing them.

A draft outline of items for inclusion in the first phase of the plan (Doc. 30) was amended and agreed (Table 10).

Table 10. Outline of draft regional action plan on by-catch of small cetaceans and dugongs in SE Asia - Phase 1: Raising awareness.

- I. Background
- II. Objectives
- III. Proposed actions (not necessarily in this order)
 - A. Identify fisheries with small cetacean by-catch.
 - 1. For each nation, identify coordinating national institution.
 - 2. Identify national coordinator and academic/NGO collaborators.
 - 3. Develop catalog of fisheries for each nation (using GIS?)
 - 4. Identify regional coordinating institution and coordinator.
 - 5. Exchange information on fisheries with by-catch, and compile regional catalog of fisheries affecting shared cetacean populations.
 - B. In regional consultation, prioritize fisheries to identify those with likely greatest impacts.
 - C. Conduct regional training courses on:
 - 1. Methods for collecting by-catch data (field people)
 - 2. Methods for assessing impacts of by-catches (analysts)
 - 3. Development of standardized data forms.
 - D. Develop pooled regional databases.
 - E. Develop draft regional action plan for assessment and mitigation of by-catch.
 - F. Establish regional email discussion group/list
 - G. Educate public and stakeholders.
 - 1. Establish information center for fishermen and other stakeholders (interactive website)
 - 2. Develop community-based education programs in fishing communities.
 - 3. Produce popular articles/films
 - 4. Develop information packages for decision makers (legislators, administrators, executives)
 - H. Work toward wider regional membership in CMS.
- IV. List of specific projects/fisheries (based on present information and proposals).
- V. References
- Appendix - List of species
- Appendix - List of potential range states and states with adjacent waters

Time did not permit full development of the draft action plan. A start was made toward casting the agreed action items for Phase 1 in the CMS action-plan format (Appendix 6). It was agreed that the group would continue work on "timeline" and "responsibility" elements of the plan, as well as Phase 2, by correspondence, should the

CMS Scientific Council decide that this would be desirable.

4.4 Terminology

The term “by-catch” is generally understood to mean anything that is caught in addition to the target species of a fishery. It is often used interchangeably with the term “incidental catch,” implying that the catch is accidental, unintended, and not desirable (e.g., “trash fish”). In practice, however, there is considerable ambiguity surrounding these terms. In SE Asia, the distinction between catch and by-catch is often obscured by the fact that fisheries have multiple target species and that almost anything that is caught has value (whether for commercial sale, use as bait, or domestic consumption). Defining by-catch becomes more complicated when the target species is/are present in very low densities (but possibly high value), and when the target shifts to include one or more of the by-caught species. In a number of countries (e.g., Peru, Sri Lanka, and the Philippines), cetaceans were initially taken as a true by-catch (unwanted) in certain fisheries but eventually became intended targets as markets developed for their meat and as communities came to regard them as food resources. Some fishermen in these countries now intentionally set driftnets, for example, in areas where they are likely to take either cetaceans or other valuable species (tuna, billfish, sharks). All are desired and used. Throughout SE Asia, any catch of a dugong by a non-commercial fisherman is likely to be welcomed as a source of good food and cash potential (tusks). Therefore, to regard dugong captures as by-catch can be very misleading.

There was considerable discussion of the problem of terminology, and workshop participants agreed to the following principles in this regard:

By-catch needs to be recognized as part of the catch, and therefore affected stocks should be managed for sustainability regardless of whether they are targets of the fishery or whether they are

utilized. Thenamingoffisheriesisimportant. Those that target a combination of species should be labeled as such, e.g., tuna-and-dolphin fishery, or billfish-shark-and-small cetacean fishery.

By-catch, whether it is discarded or utilized, needs to be documented quantitatively and taken into account as exploitation of the resource.

Simply declaring by-catch as illegal does not solve the by-catch problem. In fact, it is likely to exacerbate the problem by forcing fishermen to conceal information.

Some local, small-scale fisheries may best be described as opportunistic. Another approach to defining classes of catch might be to identify primary, secondary, and unwanted species that are taken in a given fishery. Kahn proposed a system of terminology as follows:

1) *Primary catch* - the commercial target species (in SE Asia often a “wish-list” item, a bonus high-value species).

2) *Secondary catch* - also called by-product, catch that is kept or sold but is not primarily a target species (in SE Asia this is the majority of the catch and secondary catch species may become primary catch due to over-exploited fisheries)

3) *Discarded catch* - species that are returned to the sea either because they have no commercial value, or because regulations do not allow them to be landed and sold (in SE Asia this may be minimal, as most non-commercial species can be consumed locally or used as bait)

4) *Catch interactions with fishing gear* - catch that does not reach the deck of the fishing vessel but is affected by interaction with the fishing gear (including lost fishing gear).

The group agreed that this set of terms has merit but recognized that the term “by-catch” is firmly established in international fishery and conservation circles and therefore must be used *per force*, with appropriate qualifications as outlined above.

The concept of “destructive fishing practices” or DFP may deserve to be broadened beyond its usual meaning, which relates primarily to damage to habitat (e.g., use of explosives, poisoning, bottom trawling). Extremely unselective or intensive fishing (e.g., wall-to-wall driftnets, using high-tech equipment to locate productive sites for “attack” with small-mesh netting) may cause direct harm to the integrity of ecosystems and therefore qualify as destructive. It therefore may be appropriate to incorporate the term “destructive fishing practices” into legislation and management policy.

It is important to differentiate between over-exploited fisheries and destructive fishing practices, as they are not the same. The first is related to fishing capacity and intensity, or too many fishermen chasing after too few fish. The latter is a particular practice that has an unacceptable environmental impact, wherever and whenever it is pursued. With DFP, very few practitioners can cause major

environmental damage and the collapse of fisheries stocks. Hence, DFP are highly unsustainable. For example, by reef-blasting a major grouper spawning aggregation, a few local fishermen can devastate crucial habitats and decimate the marine resources of a much wider geographical region.

The term “indiscriminate” may be a useful alternative to “destructive.”

In SE Asia, fisheries are often characterized as IUU—illegal, undocumented, and unregulated.

Often, DFP are illegal but enforcement is lacking. The recognition of DFP as a term to describe highly unsustainable capture methods is important, as it can mobilize public support against such practices and to portray them as socially unacceptable, within coastal communities and ultimately by the fishermen. This is especially important in vast archipelagic nations such as Indonesia and the Philippines, where the resources for management and enforcement are meager in relation to the extent of the coastline and the overall size of the marine area.

5. REGIONAL COOPERATION

5.1 Information Exchange

Participants agreed on the importance of sharing access to the various resources available within the region for research and conservation – equipment and technology, references, funding, expertise on methods of research and analysis, and other experience. Suggestions on how to achieve such sharing included primarily the use of an e-mail discussion group to enhance communication

among scientists, NGO representatives, and managers concerned with marine mammals in SE Asia. This list has already been established at San Francisco State University and is currently managed by Hines. It is unedited. Hines agreed to send subscription information to all workshop participants by mid-August 2002.

The list was considered to be an opportunity to share local or regional current events, research

and educational opportunities, published material, funding opportunities, reviews of tools and technologies, sightings and strandings information, species identification, and other topics of interest. The participants expressed a special interest in using the e-mail list to explore further the feasibility of cooperative exchange of tools and training in the basics of genetic analysis.

Other suggestions included the establishment of centralized databases on species and habitats and a regional webpage on by-catch in fisheries. The latter is addressed further in section 4.4 above. It was noted that WWF-US has announced its intention to create an international webpage to disseminate information on assessment and mitigation of cetacean by-catch in fisheries.

A regional organization, or society, was also discussed, to include SE Asia, South Asia and East Asia. Several attempts to start such a society have taken place in recent years. Yaptinchay, Smith and Hines agreed to look further into this possibility, including investigating the status of an initiative by Nobuyuki Miyazaki of Japan. It was tentatively agreed to hold a planning/review session at the next Biennial Conference on the Biology of Marine Mammals, to be held in North Carolina in 2003.

Participants reiterated the importance of developing regional and national expertise in techniques for the study and conservation of marine mammals, as emphasized and detailed in the report of the 1995 conference (Perrin et al. 1996). A ten-day training workshop on marine mammal research techniques was conducted in February 2002, with 22 students from throughout SE Asia and South Asia, at the Phuket Marine Biological Center in Phuket, Thailand. The sponsors of the workshop included the Wildlife Conservation Society (WCS) and the Whale and Dolphin Conservation Society (WDACS). The instructors included a number of the participants in this workshop (Smith, Hines,

Chantrapornsyl, and Kittiwatanawong). Pending availability of funds, there are plans to revise and publish a handbook written for the course (Smith et al. 2002). Participants strongly recommended further such training workshops. The range of topics recommended in the report of the 1995 workshop should be expanded to include instruction in veterinary techniques used to determine cause of death, and training in the technologies of global positioning systems (GPS), geographic information systems (GIS) and remote sensing, as relevant.

5.2 Review of Draft CMS Agreement

The group reviewed the draft regional agreement provided in Doc. 2. A number of modifications were discussed and incorporated into a revised draft (Appendix 7). These included expanding the scope to include dugongs, deletion of the wording on driftnets longer than 2.5 km but inclusion of a specific caution on the use of driftnets, deletion of the provision for legalizing the utilization of by-caught animals, recognition of the importance of migratory corridors, and requirement of collaboration with local communities in establishing protected areas. Additional minor changes in wording were made for clarity and completeness. A preamble to the agreement was discussed and added. The participants agreed to call the draft agreement to the attention of the fisheries agencies and other responsible management and regulatory bodies in their respective countries.

5.3 Funding Mechanisms

The group had an informal discussion of possible sources of funding for conservation research on small cetaceans and dugongs in SE Asia. A number of NGOs and private foundations were mentioned.

6. SUMMARY AND CONCLUSIONS

The workshop agreed to the following conclusions and recommendations:

6.1 By-catch

1) By-catch of cetaceans and dugongs in fisheries is a large and growing problem in SE Asia. Unless this problem is addressed in an immediate, aggressive manner, major losses of biodiversity are inevitable. Such losses are more than aesthetic or academic; they eliminate future options for sustainable use, simplify ecosystem structure, and increase the risk of catastrophic declines in marine productivity, with severe implications for food security.

2) A Regional Action Plan to address by-catch of small cetaceans and dugongs in SE Asia is both feasible and desirable. Such a plan should be developed and implemented in a phased manner, beginning with a public awareness and education phase.

3) While valuable information on by-catch has been obtained from rigorous interview/questionnaire studies, accurate assessment of by-catch levels is generally impossible without independent on-board or site-based direct observation at a statistically appropriate scale.

4) To complement data on by-catch, *per se*, it is important to develop accurate quantitative information on characteristics of the fishing industry e.g., fleet size, temporal and spatial allocation of effort by gear type, etc. The table of data provided to the workshop by Australia (Table 1) provides a good model.

5) Some approaches to by-catch mitigation will need to be fishery-specific, e.g., the *matang*

quatro crab nets affecting Irrawaddy dolphins in Malampaya Sound, Philippines.

6.2 Additional Conservation Threats

1) The expansion of live-capture operations directed at vulnerable coastal and riverine small cetaceans may be contributing to the depletion of some local populations. While it is recognized that exposure to cetaceans in captivity may have some long term benefits, such as potentially raising public awareness regarding cetaceans and their conservation, the frequent claims by live-capture proponents that their facilities are engaged in "captive breeding" for conservation are generally unfounded and misleading. (A provisional list of facilities holding small cetaceans or dugongs in SE Asia is given in Appendix 8).

2) "Tiger nets" set in movement passages in Indonesia pose a clear, undeniable threat to populations of cetaceans and other large marine organisms. Such nets are, by their very essence, highly damaging to the environment, and their use should be prohibited.

3) The recent evidence linking military sonar activities to lethal mass strandings of beaked whales gives cause for concern about similar activities in SE Asian waters. Some kind of risk assessment should be undertaken, and appropriate mitigation measures should be identified and implemented.

6.3 Regional Cooperation and Education

1) The 1995 workshop provided a useful stimulus to collaboration and cooperation in SE Asian marine mammal research, and contributions to the 2002 workshop reflect the vast amount of new knowledge that has resulted. Among the

more noteworthy recent developments have been publication of the special volume on Irrawaddy dolphins and finless porpoises edited by Jefferson and Smith (2002) and the training workshop in Thailand in February 2002. Further regional training workshops are strongly encouraged, incorporating, in addition to field survey techniques, instruction related to veterinary and pathology assessment.

2) Based on the successful outcomes of the 1995 and 2002 SE Asia workshops, a similar approach should be initiated in South Asia (India, Bangladesh, Sri Lanka, Myanmar and Pakistan).

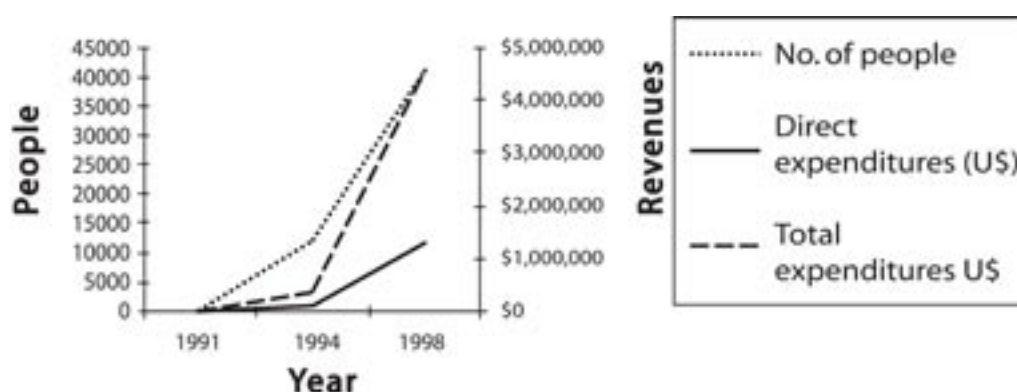
3) The ongoing cooperative studies in the Sulu-Sulawesi Sea, involving scientists from the Philippines, Malaysia, and Indonesia, provide a model for further regional cooperation and collaboration.

7. OTHER BUSINESS

It was agreed that a venue or venues would be sought for publication of the report of this workshop and for the submitted meeting documents and papers presented at the symposium that preceded the workshop. Perrin agreed to investigate the possibility of publication in the CMS technical series. Tan offered the help of Bookmark Inc. in Manila should other possibilities not work out.

The group expressed thanks to Janet Estacion and staff at Silliman University Marine Laboratory for the excellent arrangements and highly efficient support provided for the workshop.

Figure 1. Industry growth of Bali's dolphin watch tours (data from Hoyt 2000).



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APPENDIX 2

Recorded Occurrence of Small Marine Cetaceans and the Dugong in Southeast Asian Waters

AU=Australia **BR**=Brunei **CA**=Cambodia **CH**=China, including Hong Kong, Macau, and Taiwan
ET=East Timor **IN**=Indonesia **LA**=Laos **MA**=Malaysia
PH=Philippines **SI**=Singapore **TH**=Thailand **VI**=Vietnam

Species	AU ¹	BR	CA	CH ²	ET	IN	LA	MA	PH	SI	TH	VI
Finless porpoise, <i>Neophocaena phocaenoides</i>		C	C	C		C		C		C	C	C
Rough-toothed dolphin, <i>Steno bredanensis</i>	C	C		C		C			C		C	C
Indo-Pacific humpback dolphin, <i>Sousa chinensis</i>	C	C	C	C		C		C	C	C	C	C
Risso's dolphin, <i>Grampus griseus</i>	C	C		C		C		C	C			C
Common bottlenose dolphin, <i>Tursiops truncatus</i>		C	U	C		C		C	C	C	C	C
Indo-Pacific bottlenose dolphin, <i>Tursiops aduncus</i>	C	C	C	C		C		C			C	C
Pantropical spotted dolphin, <i>Stenella attenuata</i>	C		C	C		C		C	C		C	C
Spinner dolphin, <i>Stenella longirostris</i>	C	C	C	C		C		C	C		C	C
Striped dolphin, <i>Stenella coeruleoalba</i>	C			C		U			C		C	C
Long-beaked common dolphin, <i>Delphinus capensis</i>	U		C	C		C		C			C	C
Fraser's dolphin, <i>Lagenodelphis hosei</i>	C			C		C		C	C		C	C
Irrawaddy dolphin, <i>Orcaella brevirostris</i>	C	C	C			C	C	C	C	C	C	C
Melon-headed whale, <i>Peponocephala electra</i>	C			C		C		C	C		C	C
Pygmy killer whale, <i>Feresa attenuata</i>				C		C		C	C		C	C
False killer whale, <i>Pseudorca crassidens</i>	C		C	C		C		C	C	C	C	C
Killer whale, <i>Orcinus orca</i>	C			C		C		C	C		C	C
Short-finned pilot whale, <i>Globicephala macrorhynchus</i>	C	C	C	C		C		C	C		C	
Blaineville's beaked whale, <i>Mesoplodon densirostris</i>				C					C		C	
Ginkgo-toothed beaked whale, <i>Mesoplodon ginkgodens</i>				C								
Cuvier's beaked whale, <i>Ziphius cavirostris</i>	C			C		C		C	C		C	U
Tropical bottlenose whale, <i>Indopacetus pacificus</i>				U		U			U			
Pygmy sperm whale, <i>Kogia breviceps</i>				C		C		C			C	C
Dwarf sperm whale, <i>Kogia sima</i>	C			C					C		C	C
Dugong, <i>Dugong dugon</i>	C	C	C	C		C		C	C	C	C	C

¹Includes only northern Australian waters in SE Asia. ²Includes only waters south from Yangzi River.

C = confirmed; U = unconfirmed

APPENDIX 3

Agenda

1. Preliminaries
2. Update of 1995 reviews
 - 2.1 National reviews of status, research, by-catch, conservation and legislation
 - 2.1.1 Australia
 - 2.1.2 Brunei
 - 2.1.3 Cambodia
 - 2.1.4 China (including Hong Kong, Macau and Taiwan)
 - 2.1.5 East Timor
 - 2.1.6 Indonesia
 - 2.1.7 Laos
 - 2.1.8 Malaysia
 - 2.1.9 Philippines
 - 2.1.10 Singapore
 - 2.1.11 Thailand
 - 2.1.12 Vietnam
 - 2.2 Small cetacean species reviews
3. Review of dugong conservation and research
4. The problem of by-catch in fisheries
 - 4.1 Regional review
 - 4.2 Useful approaches and priorities for research
 - 4.3. Development of draft plan of action
 - 4.4 Terminology
5. Regional cooperation
 - 5.1 Information exchange
 - 5.2 Review of draft CMS agreement
 - 5.3 Funding mechanisms
6. Conclusions and recommendations
7. Other business

APPENDIX 4

List of Workshop Documents

- CMS/SEAMAMII/Doc.1* Report of the Workshop on the Biology and Conservation of Small Cetaceans and Dugongs of Southeast Asia [UNEP(W)/EAS WG.1/2].
- Doc. 2* Preliminary draft Agreement on Small Cetaceans of Southeast Asia (ASCOSEA).
- Doc. 3* Note on marine mammal bycatch and coastal dolphins in north-central Vietnam. (Gill Braulik and Bach Van Hanh).
- Doc. 4* A review of the results of the studies on marine mammals in Vietnamese waters. (Bui Dinh Chung and Dao Tan Ho).
- Doc. 5* Conservation of the dugong (*Dugong dugon*) in Thailand. (Ellen Hines and Kanjana Adulyanukosi).
- Doc. 6* Update on the marine mammals in the waters of Taiwan:1995-2002. (John Y. Wang and Shih-Chu Yang).
- Doc. 7* Impacts of fishery bycatch on cetaceans in Hong Kong waters. (Mientje Torey).
- Doc. 8* Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) of Nan Wan and adjacent waters in southern Taiwan. (John Y. Wang and Shih-Chu Yang).
- Doc. 9* Population status and by-catches of cetaceans in Chinese waters. (Zhou Kaiya).
- Doc. 10* Summary of current knowledge of cetaceans and dugongs in Malaysian waters. (Saifullah A. Jaaman, James Bali and Kamarruddin Ibrahim).
- Doc. 11* Identification of dugong (*Dugong dugon*) tissues using isozymes. (Kongkiat Kittiwattanawong, Kanjana Adulyanukoso and Pantarak Na Takuatung).
- Doc. 12* Chapter 4 – IUCN-CSG Action Plan 2002. [Excerpt from in-press action plan, on Irrawaddy dolphins].
- Doc. 13* Australia conservation regime and research activities relating to marine mammal by-catch in fisheries. (Clinton Dengate).
- Doc. 14* Status, ecology and conservation of Irrawaddy dolphins *Orcaella brevirostris* in Malampaya Sound, Palawan, Philippines. (Brian D. Smith, Isabel Beasley, Mariel Buccat, Victor Calderon, Roderick Evina, Joseph Lemmuel de Valle, Angela Cadigal, Emmalyn Tura and Zhuljakim Visitacion).
- Doc. 15* A review of cetacean research in Hong Kong and adjacent waters. (Samuel K. Hung and Thomas A. Jefferson).
- Doc. 16* Status of marine mammals in the Australian waters of Southeast Asia. (Guido J. Parra and Helene Marsh).
- Doc. 17* International Marine Mammal Project, Earth Island Institute. (Trixie Concepcion).
- Doc. 18* Conservation effort to protect the Indo-Pacific humpback dolphins in Hong Kong. (Janice C. Y. Lun).
- Doc. 19* A review of the Philippine cetacean by-catch fisheries. (Mudjekeewis D. Santos and Noel C. Barut).
- Doc. 20* The present status of population and protection of dugongs in Chinese waters. (Han Jiabo and Wang Pielie).
- Doc. 21* The conservation programme for the Chinese white dolphin in Hong Kong. (Agriculture, Fisheries and Conservation Department [of Hong Kong], 2000).

Doc. 22 Dugong conservation activities conducted by the Department of Environment and Natural Resources [of the Philippines] from 1991-2002. (Daniel S. Torres).

Doc. 23 Komodo National Park cetacean surveys. A rapid ecological assessment of cetacean diversity, abundance and distribution. Monitoring report – April 2001. 1999-2000 synopsis. (Benjamin Kahn).

Doc. 24 Discussion paper on the establishment of a *Protected Marine Mammal Fisheries Area* in Indonesia's national and EEZ waters (Benjamin Kahn).

Doc. 25 Cetaceans in the Philippines: an update for 2002. (Andrea Leonor S. Bautista).

Doc. 26 Policies and updates on the management and conservation of marine mammals in the Philippines. (Jose Angelito M. Palma).

Doc. 27 A national marine mammal stranding response network: the Philippine experience. (Andrea Leonor S. Bautista, Jose Ma. Lorenzo Tan and Jo Marie V. Acebes).

Doc. 28 Rapid assessment of cetacean-fisheries interaction in priority sites of WWF-Philippines: a preliminary report. (Joe Pres. A. Gaudiano and Moonyeen Nida R. Alava).

Doc. 29 WWF cetacean-fisheries interaction assessment and conservation management in the Philippines. (Moonyeen Nida R. Alava).

Doc. 30 Draft outline of potential items for inclusion in: Regional Action Plan for Raising Awareness of Bycatch of Small Cetaceans in Fisheries in Southeast Asia.

Doc. 31 Review the status of cetaceans in Thailand. (Supot Chantrapornsy).

Doc. 32 WWF-Philippines activities to support the declaration of Green Island Bay, in Roxas, Palawan, Philippines as a Protected Area (Victor C. Reyes, A. A. Yaptinchay and M. T. R. Aquino)

Doc. 33 Occurrence of humpback whales (*Megaptera novaeangliae*) and other cetaceans in the Babuyan Islands, Northern Luzon, Philippines. (Jo Marie V. Acebes).

Doc. 34 Conservation status and management of marine mammals in riverine and coastal waters of Cambodia. (I. L. Beasley, P. Davidson, Phay Somany and P. W. Arnold).

Doc. 35 Current knowledge of dugongs (*Dugong dugon* Muller, 1776) in east Malaysian waters. (Saifullah A. Jaaman and Yuhana U. Lah-Anyi).

APPENDIX 5

Relative Abundance of Small-cetacean Species Encountered in Surveys in Southeast Asia

(Species acronym = first letter of genus + first three letters of trivial name)

Area	Dates	Survey Type	Effort	Species	No. of Sightings	Reference
E. Sulu Sea, Philippines	May '94 & May–June '95	Boat; Line transect	2313 km	SLON	97	Dolar 1999a
				SATT	57	
				GMAC	42	
				LHOS	39	
				GGRI	22	
				TTRU	21	
				KSIM	9	
				PELE	6	
				SBRE	3	
				FATT	1	
				OORC	1	
				MDEN	1	
				ziphiid	1	
				<i>Mesoplodon</i> sp.	8	
Tañon Strait, Philippines	May–June '95	Boat; Line transect	434km	SLON	42	Dolar 1999a
				KASIM	21	
				SATT	4	
				TTRU	2	
				PELE	2	
				GMAC	1	
S. Sulu Sea, Philippines	7–21 May '96	Boat; Line transect	406 km.	SLON	27	Dolar <i>et al.</i> 1997
				TTRU	10	
				SATT	9	
				KSIM	3	
				GGRI	1	
				PCRA	1	
				LHOS	1	
				GMAC	1	
				ZCAV	1	
				OBRE	1	
				SCHI	1	
Malampaya Sound, Philippines	30 June to 3 July & 12 July '99	Boat; Line transect	230 km.	OBRE	17	Dolar 1999b
				TTRU?	3	

Area	Dates	Survey Type	Effort	Species	No. of Sightings	Reference
Malampaya Sound, Philippines	6 – 9 August 2001	Boat; Line transect	154 km	OBRE	11	Smith <i>et al</i> 2002a; Doc. 14
				TTRU	2	
Malampaya Sound, Philippines	8 – 11 Oct. 2001	Boat; Line transect	154 km.	OBRE	7	Smith <i>et al</i> 2002a; Doc. 14
				TTRU	1	
N. Sulu Sea, Philippines	18 June to 15 July '99	Boat; Line transect	1301 km.	SLON	21	Dolar 1999b
				TTRU	19	
				SATT	10	
				KSIM	5	
				GGRI	4	
				PCRA	3	
				PELE	2	
				LHOS	2	
				MDEN	1	
Zambales – Lingayen Gulf – Subic Bay, Philippines	Mar – 02	Boat; Line transect	961.22	SBRE	3	WWF-Philippines data
				GMAC	1	
				LHOS	1	
				PELE	1	
				unidentified	2	
Albay Gulf – Lagonoy Gulf, Philippines	Apr – 02	Boat; Line transect	626.2	SATT	1	WWF-Philippines data
				LHOS	1	
				SLON	1	
				GMAC	1	
				unidentified	3	
Ragay Gulf – Masbate Gulf – Ticao pass – Burias Pass, Philippines	May – 02	Boat; Line transect	580.9	SLON	2	WWF-Philippines data
				<i>Tursiops</i> sp.	2	
				GMAC		
				PCRA	1	
				LHOS	1	
				unidentified	1	
					2	

Area	Dates	Survey Type	Effort	Species	No. of Sightings	Reference
Babuyan Islands, Northern Luzon, Philippines	Apr/00 (14 days)	Boat; Strip transect	1,120	MNOV SATT SLON GMAC PMAC	16 5 2 1 1	Doc. 33; Acebes <i>et al</i> 2000
Babuyan Islands, Northern Luzon, Philippines	March to May 01 (43 days)	Boat; Strip transect	3,130	MNOV SATT LHOS <i>Tursiops</i> sp. SLON PELE PCRA	47 23 1 5 3 2 1	Doc. 33
Babuyan Islands, Northern Luzon, Philippines	March–May 2002 (47 days)	Boat; Strip transect	1,811	MNOV SATT LHOS <i>Tursiops</i> sp. SLON PELE SBRE GMAC KSIM	91 9 7 3 1 3 4 1 1	Doc. 33
Balayan Bay, Batangas, Philippines	Feb/01 (1 day – 5 hours)	Boat; Strip transect	56	KSIM GGRI SATT	1 1 1	Cetacean Research and Conservation Project – Phase 2; WWF-Philippines Technical Report
Gulf of Tonkin, Vietnam	7?–16 October '99	Boat; Line transect	665 km	SCHI SATT <i>Tursiops</i> sp. NPHO	2 1 1 1	Smith <i>et al.</i> unpub. data

Area	Dates	Survey Type	Effort	Species	No. of Sightings	Reference
Gulf of Tonkin, Vietnam	2–11 April '00	Boat; Line transect	1146 km	SCHI <i>Tursiops</i> sp. SLON	2 1 1	Smith <i>et al.</i> unpub. data
Vietnam (Pho Quoc, Mekong Delta, Nha Trang, Halong Bay)	March, April and Oct. 1995	Boat; Line transect	1121 km	SCHI small whale small delphinid	2 1 1	Smith <i>et al.</i> 1995, 1997
Coastal west coast of Thailand	Mar – '98	ship-based	?	TADU SLON	3 1	Adulyanukosol <i>et al.</i> 2000
Offshore west coast of Thailand	Feb – Mar '00	ship-based	2854 km	SLON GMAC TADU small toothed whale baleen whale	3 3 2 13 3	Chantrapornsyl <i>et al.</i> unpub. data
Coastal west coast of Thailand	Mar – '01	ship-based	405 km	SATT/TADU? small toothed whale	1 3	Kittiwattanawong <i>et al.</i> unpub. data
Coastal west coast of Thailand	Mar – '01	ship-based	177 km	TADU	1	Kittiwattanawong <i>et al.</i> unpub. data
Coastal west coast of Thailand	Feb – '02	ship-based	578 km	TADU SATT small toothed whale	2 1 1	Kittiwattanawong <i>et al.</i> unpub. data
Coastal west coast of Thailand	Mar – '02	ship-based	1023 km	SCHI TADU NPHO SATT/TADU? small toothed whale	2 1 1 1 3	Kittiwattanawong <i>et al.</i> unpub. data

Area	Dates	Survey Type	Effort	Species	No. of Sightings	Reference
Coastal west coast of Thailand	Apr – '02	ship-based	231 km	NPHO	2	Kittiwattanawong <i>et al.</i> unpub. data
Songkhla Lake, southern Thailand	May 2000, Feb/ May 2001	boat-based, line-transect	545.2km / 54 hr	OBRE	4	Beasley <i>et al.</i> 2002b
Canmbodia / Laos Mekong River	Jan – Jun 2001	boat, direct count	1325.8 km / 122 hr	OBRE	53	Beasley and Phay Somany 2002
Coastal Cambodian waters	Jan – Sept 2001	boat-based, line-transect	2058 km / 204 hr	OBRE SCHI NPHO TTAU/TTRU DCAP PCRA SATT SLON SLON/SATT UNK	20 4 8 9 1 1 3 2 2 8	Beasley <i>et al.</i> 2001, 2002 c
East Malaysian coastal and offshore waters	15 May – 29 Oct 1998	boat-based, line transect	980.6 km	OBRE SLON SATT SATT/SLON NPHO TADU? SCHI UNK	18 14 2 3 4 3 2 9	Beasley 1998
Buntal and Bako coastal waters, Sarawak, Malaysia	9 Apr – 10 May 1999	boat-based, line transect	647.1 km	OBRE NPHO SCHI	31 4 1	Beasley unpublished data
Offshore waters of southern Taiwan	13 April to 09 Sept. 2000	ship-based; exploratory survey	2723 km (227.1 hr or 12,888 kmxhr)	GGRI KSIM LHOS SLON SATT GMAC PCRA TTRU FATT PELE ACAV Hyperoodon sp. MES sp. KOG sp. <i>Tursiops</i> sp.	16 6 4 3 3 2 2 1 1 1 1 1 1 1 1	Wang <i>et al.</i> 2001a

Area	Dates	Survey Type	Effort	Species	No. of Sightings	Reference
Coastal waters of southern Taiwan	13 April to 09 Sept. 2000	ship-based; exploratory survey	44.3 hrs.	TADU	10	Wang <i>et al.</i> 2001a
				SLON <i>ros.</i>	1	
Coastal waters of southern Taiwan	14 July to 12 Sept. 2001	ship-based; opportunistic	105.9 hrs.	TADU	1	Doc. 6, 8
Coastal waters of southern Taiwan	6 June to 18 Dec. 2001	land-based observations	43.7 hrs.	TADU	6	Doc. 6, 8
				unk. delphinid	1	
Hualien, Taiwan	June 1996; July 1997	ship-based; exploratory survey	309.25 hrs.	GGRI	39	Yang <i>et al.</i> 1999
					33	
				SLON	17	
				SATT	13	
				TTRU	9	
				LHOS	4	
				PCRA	1	
				KSIM	1	
				OORC	1	
				MDEN	1	
				ziphiids	12	
				unk. delphinid		

APPENDIX 6

Draft Regional Action Plan to Address By-catch of Small Cetaceans and Dugongs in Fisheries in Southeast Asia

PHASE 1 - RAISING LEVEL OF AWARENESS OF THE PROBLEM

Phase of Action Plan	Objective	Generic Strategies	Specific Actions
Phase 1	Empower resource managers, NGOs, fishermen and the wider community to appreciate the scope of the problem in South East Asia	Identify regional coordinating institution and coordinator	
		For each nation, identify: <ul style="list-style-type: none"> • coordinating national institution • national coordinator • academic and NGO collaborators 	<ul style="list-style-type: none"> • Identify key personnel • Establish regional e-mail discussion lists • Identify national coordinating institution and coordinator
		Summarize and collate available information on fisheries for each nation in region, including: <ul style="list-style-type: none"> • details of target species • by-catch • gear type • effort • areas fished 	
		Use this information to perform comparative qualitative risk assessments, leading to: <ul style="list-style-type: none"> • evaluation of sustainability of by-catch in major fisheries • identification of fisheries with likely greatest impacts 	

Phase of Action Plan	Objective	Generic Strategies	Specific Actions
		<p>For each country:</p> <ul style="list-style-type: none"> • Review existing national conservation (including marine protected areas) and fisheries legislation and regulations relevant to management of by-catch of small cetaceans and dugongs • Identify potential for by-catch control and changes needed to mitigate by-catch 	
		Develop and implement targeted community consultation and education on marine mammal ecology and by-catch mitigation measures	<ul style="list-style-type: none"> • Develop resource website (interactive and tailored to audience)) • Develop culturally appropriate education programs for each country including popular articles, films • Develop briefing documents for governments and other decision-makers • Hold training workshops on collecting by-catch data and assessing impacts for resource managers, analysts, NGOs and fishermen
Phase 2	Mitigate problem	Rationalize/ introduce legislation to recognize by-catch as catch to be managed as part of sustainable fisheries strategy	
		<p>Identify appropriate mitigation actions for each fishery. Such actions might include:</p> <ul style="list-style-type: none"> • improving enforcement of fishing regulations especially at community level • identifying areas/ times where risk of by-catch is highest and negotiating spatial and/or temporal closures to reduce by-catch • closing fisheries and developing alternative livelihoods for fishers • modifying gear and fishing practices to reduce by-catch 	
		Monitor by-catch to provide feedback on the effectiveness of mitigation measures	

APPENDIX 7

Draft Regional Agreement on the Small Cetaceans and Dugongs of Southeast Asia (ASCDOSEA)

[Range states: Australia, Brunei, Cambodia, China (including Hong Kong, Macau and Taiwan), East Timor, Indonesia, Laos, Malaysia, Philippines, Singapore, Thailand, Vietnam. States with waters adjacent to Agreement area: Myanmar, Japan, Papua New Guinea.]

Preamble

Recognizing -

That a large proportion of global human population growth during at least the next two decades is expected to come from Asia;

That recorded and forecast regional population growth rates in Southeast Asia are relatively high;

That food security is a high-priority regional concern in Southeast Asia;

That seafood is a primary source of protein for more than 50% of Southeast Asians;

That no other environmental factor approaches fishing in its impact on marine resources;

That as a food source for humans, the seas of Southeast Asia are rapidly approaching exhaustion;

That regional fisheries can remain (or become) viable only if there are extensive and immediate changes in fishery management, so that emphasis is given to the rebuilding of fish populations within functional food webs rather than the traditional emphasis that focuses on the health of one or two commercially harvested fish species;

That high-order predators such as whales, dolphins, and sharks play a major role in the maintenance of population dynamics, balance, and functionality of food webs and

That the often illegal, unreported, and unregulated catch of these and other large marine animals continues in Southeast Asian countries, thereby jeopardizing the integrity and viability of the marine food chain,

The Parties agree to undertake, to the maximum extent of their economic, technical and scientific capacities, the following measures for the conservation of small cetaceans and dugongs, giving priority to conserving those species or populations identified by a Scientific Committee constituted under the Agreement as having the least favorable conservation status, and to undertaking research in areas or for species for which there is a paucity of data.

[Small cetaceans are defined to include all members of the cetacean suborder Odontoceti (toothed whales) with the exception of the sperm whale *Physeter macrocephalus*.]

1. Enforcement of existing national legislation and adoption of new measures

Parties to this Agreement shall adopt the necessary legislative, regulatory or administrative measures to give full protection to small cetaceans and dugongs (i.e. allow no deliberate or purposeful killing or capture) in waters under their sovereignty and/or jurisdiction and outside these waters in respect to any vessel under their flag or registered within their territory engaged in activities which may affect the conservation of small cetaceans or dugongs.

To this end, Parties shall:

- a) For commercial fisheries to obtain license to operate in EEZ waters, require proof of a credible strategy to minimize adverse effects of such fisheries operations on the conservation status of small cetaceans and dugongs. In particular, the potential impacts of driftnets on populations of small cetaceans and dugongs shall be carefully and fully considered before allowing them to be used in fisheries.
- b) Introduce or amend regulations with a view to preventing fishing gear from being discarded or left adrift at sea or in continental waters.
- c) Require the immediate release of small cetaceans and dugongs caught alive in fishing gear in conditions that assist their survival.
- d) Require under existing measures, or adopt new measures requiring, national port-based and boat-based fisheries observer programs to actively seek new data on small-cetacean and dugong by-catches, and require fishermen to report any by-caught small cetaceans or dugongs.
- e) Require impact assessments to be carried out in order to provide a basis for either allowing or prohibiting the continuation of the future development of activities that may affect small cetaceans and dugongs or their habitat in the Agreement area, including commercial fisheries, offshore exploration and exploitation, nautical sports, tourism or cetacean/dugong watching, as well as establishing the conditions under which such activities may be conducted.
- f) Regulate the discharge from land and at sea and in continental waters of, and adopt within the framework of other appropriate legal instruments stricter standards for, pollutants believed to have adverse effects on cetaceans, dugongs and aquatic life in general; and
- g) Identify and publicize a national institution with a view to furthering implementation of the Agreement.

2. Assessment and management of human-cetacean interactions

Parties shall, in co-operation with relevant international organizations, collect and analyze data and report on direct and indirect interactions between humans and small cetaceans and dugongs in relation to *inter alia* fishing, industrial and tourism activities, and land-based and maritime pollution. When necessary, Parties shall take appropriate remedial measures and shall develop guidelines and/or codes of conduct to regulate or manage such activities.

3. Habitat protection

Parties shall endeavor to establish and manage specially protected areas for small cetaceans and dugongs corresponding to the areas which serve as important habitats or migratory passages of these aquatic mammals and/or which provide important food resources for them. Such protected areas should, where possible, be established within the framework of appropriate national or international legal instruments and in collaboration with and cooperation of local communities.

4. Research and monitoring

Parties shall undertake coordinated, concerted research on small cetaceans and dugongs and facilitate the development of new techniques to enhance their conservation. Parties shall, in particular:

- a) ensure the elaboration of a national program to systematically collect the valuable scientific information that can be gleaned from such opportunistic events as strandings, by-catches and collisions with ships, due to the relative low-cost investment involved;
- b) monitor the status and trends of species covered by the Agreement, especially those in poorly known areas, or species for which few data are available, in order to facilitate the elaboration of conservation measures;
- c) co-operate regionally to determine the distribution, migration routes and the breeding and feeding areas of the species covered by the Agreement in order to define areas where human activities may need to be regulated as a consequence; in particular to facilitate, collaborate with, and grant permission to research vessels from neighboring countries to enter, if necessary, territorial waters to study these aspects;
- d) evaluate the feeding and migratory requirements of the species covered by the Agreement and adapt fishing regulations and techniques accordingly;
- e) develop or facilitate the set-up of a dedicated research program on dead, stranded, wounded or sick animals to determine the causes and dynamics of small cetacean and dugong mortality and morbidity and identify those related to interactions with human activities to permit their assessment as potential threats;

f) recognizing that by-catch in fisheries is a major threat to small cetaceans and dugongs globally, co-operate regionally to establish and conduct monitoring of by-catch, stock assessment of small-cetacean and dugong populations, assessment of population impact of by-catch, and, where necessary, programs to mitigate unsustainable by-catch, using as a blueprint for the initial stages the “Regional Action Plan for Addressing By-catch of Small Cetaceans and Dugongs in Fisheries in Southeast Asia.” The Action Plan should be updated regularly to reflect progress and meet evolving conservation needs.

5. Capacity building, collection and dissemination of information, training and education

Taking into account the differing needs and the developmental stages of the Range States, Parties shall give priority to capacity building in order to develop the necessary expertise for the implementation of the Agreement. Parties shall co-operate to develop common tools for the collection and dissemination of information about small cetaceans and dugongs and to organize training courses and education programs. Such actions shall be conducted at the sub-regional and Agreement level and supported by the Agreement secretariat and follow the activities outlined in the “Regional Action Plan for Building Capacity in Small Cetacean and Dugong Research and Conservation in Southeast Asia.” The Action Plan should be updated regularly to reflect progress and meet evolving education and conservation needs.

6. Response to emergency situations

Parties shall, in co-operation with each other, and whenever possible and necessary, develop and implement emergency measures for the species covered by the Agreement when exceptionally unfavorable or endangering conditions arise. In particular, Parties shall:

- a) prepare, in collaboration with competent bodies, emergency plans to be implemented in case of threats to small cetaceans or dugongs in the Agreement area, such as major pollution events, large and possibly unsustainable by-catches, illegal directed fisheries, mass strandings or epizootics; and
- b) evaluate capacities necessary for rescue or euthanizing operations and determining the cause of injury for wounded or sick small cetaceans and dugongs; and
- c) prepare a code of conduct governing the function of centers or laboratories involved in this work. In the event of an emergency situation requiring the adoption of immediate measures to avoid deterioration of the conservation status of one or more small-cetacean or dugong populations, a Party may request the relevant Co-ordination Unit to advise the other Parties concerned, with a view to establishing a mechanism to give rapid protection to the population identified as being subject to a particularly adverse threat.

APPENDIX 8

Provisional Inventory of Oceanaria and other Facilities in Southeast Asia Holding Small Cetaceans or Dugongs

as of 1 September 2002

	Country	Facility	Opened	Animals and Dates Received	Held as of 1 Sep '02	Origin	Source of Information; Comments
1	Cambodia	Koh Kong Int. Resort Hotel, Koh Kong Province	end 2002	12 <i>S. chinensis</i> , 8 <i>O. brevirostris</i> (2002)	8,2	Cambodia coastal	Beasley
2	China	Beijing Aquarium (Beijing Zoo), Haidian District	?	5 <i>Tursiops</i> sp. (date?)	5	?	Han; Liu et al. 2002
3	China	China Aquarium of Shanghai	?	\geq <i>N. phocaenoides</i> (1992)	?	?	Liu et al. 2002
4	China	Dalian Laohutang Polar Aquarium, Dalian, Liaoning Province	2002	4 <i>T. truncatus</i> (1999) 5 <i>T. truncatus</i> (2001) 3 <i>N. phocaenoides</i> (2002) 2 <i>D. leucas</i> (2001)	3 5	Drive fishery, Japan	Han; Liu et al. 2002; Beasley
5	China	Fujian Shishi Golden Coast Amusement Park	2000	2 <i>Tursiops</i> sp. (2000)	2	Qingdao Aquarium	R. Eiser, pers. comm.
6	China	Guangzhou Dolphinarium	?	\geq 5 <i>Tursiops</i> sp. (1995)	5	Drive fishery, Taiwan	Liu et al. 2002; rented from Qingdao Aquarium
7	China	Guangzhou Oceanographic Expedition	?	\geq 7 <i>Tursiops</i> sp. (1998)	7	Drive fishery, Japan	Hung; Han; Liu et al. 2002
8	China	Guangzhou Ocean World	1998	6 <i>T. truncatus</i> (1997) 1 <i>T. truncatus</i> (1998) 1 <i>T. truncatus</i> (1998)	3 1 1	Drive fishery, Japan Hawaii Captive-born	Liu et al. 2002 R. Eiser, pers. comm. R. Eiser, pers. comm.
9	China	Heping Park Dolphinarium, Shanghai	1994	8 <i>Tursiops</i> sp. (1994)	?	?	Hung; Zhou

	Country	Facility	Opened	Animals and Dates Received	Held as of 1 Sep '02	Origin	Source of Information; Comments
10	China	Nanjing Underwater World	2000	4 <i>Tursiops</i> sp. (2000)	4	Indonesia	Zhou
11	China	Nanning Zoo, Nanning, Guangxi Province	?	≥ 2 <i>Tursiops</i> sp. (date?)	?	?	R. Kinoshita, pers. comm.
12	China	Quihuang Island Aquarium	2000	2 <i>Tursiops</i> sp. (2000)	2	Qingdao Aquarium	Liu et al. 2002
13	China	Sanya Marine World, Hainan Province	1960s–70s	≥ 3 <i>Tursiops</i> sp. (date?) 2 <i>Tursiops</i> sp. (date?)	2 2	Drive fishery, Taiwan Captive-born	Han; R. Eiser, pers. comm. Liu et al. 2002
14	China	Shenzhen Sea World Co., Sui Mui Sha, Shenzhen	?	≥ 4 <i>T. aduncus</i> (1999)	?	Indonesia	Hung; R. Kinoshita, pers. comm.; Liu et al. 2002
15	China	Shanghai Zoo	1999	≥1 <i>N. phocaenoides</i> (1970-80)	?	?	Liu et al. 2002
16	China	Shishou Seminatural Reserve	?	≥20 <i>N. phocaenoides</i> (1990)	20	Yangtze River	Liu et al. 2002
17	China	Qingdao Dolphin Performing Hall, Tsing Dao, Shandong Province	?	≥8 <i>Tursiops</i> sp. (1995) ≥1 <i>N. phocaenoides</i> (1999)	6,1	Drive fishery, Japan	Han; R. Kinoshita, pers. comm.; Liu et al. 2002
18	China	Tonling Conservation Farm, Hebei Province	1995	5 <i>N. phocaenoides</i> (2001)	5	Yangtze River	Zhou; Liu et al. 2002
19	China	Institute of Hydrobiology, Wuhan	?1992	2 <i>N. phocaenoides</i> (1996) 1 <i>N. phocaenoides</i> (1999)	2 1	Yangtze River	D. Wang, pers. comm.
20	China	Underwater World Xiamen	2001	2 <i>Tursiops</i> sp. (2001)	2	Indonesia	Han; Zhou
21	China	Ocean Park, Aberdeen, Hong Kong	1975	15 <i>T. aduncus</i> (1978) 9 <i>T. aduncus</i> (1987) 6 <i>T. aduncus</i> (1997) 8 <i>T. aduncus</i> (1994-2001)	2 4 4 8	Drive fishery, Taiwan Indonesia Indonesia Captive-born	Reeves et al. 1994 Reeves et al. 1994 From Jaya Ancol Aquar. R. Kinoshita, pers. comm.
22	China	Hualien Ocean World, Taiwan	end 2002	14 <i>T. truncatus</i> (1998-2000)	10	Drive fishery, Japan	Wang; R. Elsner, pers. comm.

	Country	Facility	Opened	Animals and Dates Received	Held as of 1 Sep '02	Origin	Source of Information; Comments
23	China	Natural Museum of Marine Biology and Aquarium, Taiwan	2000	6 <i>D. leucas</i> (2002)	5	Russia	Wang
24	China	Ocean World (aka Keelung Aquarium), Taipei County, Taiwan	1988?	16-17 <i>T. aduncus</i> (date?) ≥1 <i>T. truncatus</i> (date?) ≥1 <i>P. crassidens</i> (date?)	16-17 1 1	Drive fishery, taiwan	Wang
25	Indonesia	Dolphin Lodge, Batam Island (near Singapore)	2001	14 <i>Tursiops</i> sp. (2001)	14	Indonesia	Beasley
26	Indonesia	Jaya Ancol Aquarium, Jakarta	1974	<i>T. aduncus</i> (no.?, 1975-82) 12 <i>T. aduncus</i> (1997) 2 <i>D. dugon</i> (2001)	? ? 2	Indonesia	Tas'an and Leatherwood 1984 R. Kinoshita, pers. comm. Beasley
27	Indonesia	Sea World Indonesia, Jakarta	?	1 <i>D. dugon</i> (2000)	1	Indonesia	L. Tjhin, pers. comm.
28	Myanmar	Jim Styers Dolphin World, Salone Island, Myanmar / Thailand border	2002	3 <i>Tursiops</i> sp. (2002)	3	Myanmar	Beasley; Smith
29	Philippines	Ocean Adventures Park, Subic Bay, Luzon	2001	6 <i>P. crassidens</i> (2001)	4	Drive fishery, Japan	Concepcion
30	Singapore	Underwater Singapore World, Sentosa Island	before 1999	1 <i>D. dugon</i> (1998) 6 <i>S. chinensis</i> (1999)	1 5	Singapore Thailand	Lin 1999
31	Thailand	Oasis Seaworld, Chantaburi Province	1990	13 <i>O. brevirostris</i> (2002) 8 <i>S. chinensis</i> (date?)	13 8	Thailand (and maybe Cambodia)	Beasley
32	Thailand	Safari World, Minburi, Bangkok	1988	14 <i>Tursiops</i> sp. (date?) 4 <i>D. leucas</i> (2002)	? 4	Indonesia Russia	M. Rajit, CITES Thailand, pers. comm.
33	Vietnam	Cultural House of 5 th District, Ho Chi Minh City	2002?	3 <i>T. truncatus</i> (1999)	2	Russia	Bui
34	Vietnam	Suoi Mo Park, Thu Duc District, Ho Chi Minh City	2002?	≥1 <i>Tursiops</i> sp. (date?)	1	Russia	Bui
35	Vietnam	Au Lac Parak, Tuan Chau Island, Ha Long City, Haiphong	2001	2 <i>D. leucas</i> (1999)	2	Russia	Bui

APPENDIX 9

Abstracts of Papers Presented at Symposium Immediately Before Workshop

Monitoring of Cetaceans in the Southern Tañon Strait Area through Dolphin Watching Boats from Bais City, Negros Oriental

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Information gathered from dolphin watching boats operated by Bais City Tourism Office at Negros Oriental allowed monitoring of cetaceans in the southern Tañon Strait area from June 1997 to April 2001. Some basic information including species composition, estimated herd size, presence or absence of calf, behavior, time and sea state were recorded. To date, ten species (spinner, spotted, Risso's, bottlenose and Fraser's dolphins, and pilot, melon-headed, pygmy killer, dwarf sperm, and pygmy sperm whales) have already been recorded. The most frequently sighted species was the spinners ($n=494$) followed by the spotted ($n=187$). The largest cetacean species most frequently sighted was the pilot whale ($n=74$) followed by the melon-headed ($n=33$). The least sighted species include the pygmy sperm whale ($n=2$), Fraser's dolphin ($n=3$) and the pygmy killer whale ($n=6$). The annual mean herd size for the spinner (a) and spotted (b) dolphins appears to be increasing (1997 a=28, b=33; 1998 a=77, b=68; 1999 a=77, b=80; 2000 a=93, b=98; and 2001 a=132, b=154). The trend in the annual mean herd size for the pilot (a) and melon-headed (b) whales was almost similar (1997 a=42, b=52; 1998 a=63, b=54; 1999 a=64, b=67; 2000 a=56, b=64). Cetacean abundance appears to peak during the lull between monsoons (April-May) and through the SW monsoon months (June-November). Calving for spinners and spotted appears to be dispersed throughout the year. However, peaks appear to occur during the months of April through August. Also, multi-species associations have often been observed between spinners and spotted, spinners and Risso's, Risso's and pilots, Risso's and melon-headed, and sometimes between spinners and pilots, and among bottlenose, Risso's and melon-headed. This study shows that a systematic collection and analyses of data from regularly operating dolphin watching boats could serve as an important tool in monitoring cetaceans in a particular area.

Conservation Status and Management of Marine Mammals in Riverine and Coastal Waters of Cambodia

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The first dedicated research project investigating marine mammals of Cambodia was initiated by the Wildlife Conservation Society, in collaboration with the Cambodian Department of Fisheries and James Cook University. The project consists of boat and interview surveys in the upper reaches of the Cambodian Mekong River and also throughout Cambodian coastal waters.

This research indicates that the Cambodian Mekong River Irrawaddy Dolphin (*Orcaella brevirostris*) population is small (with the total population possibly as low as 100 individuals) and restricted in range (at least during the dry season) to the upper 190 km from Kratie to the Lao/Cambodian border. Four dedicated surveys have been conducted over this stretch of river (a total of 914 km of survey effort during 82.4 hours). Although a number of threats have been identified, by-catch in local gillnet fisheries appears to be the most significant current threat to the population's survival.

Dedicated boat-based marine mammal coastal surveys were conducted from February to September 2001, totalling 203.8 hours of survey time, covering a total distance of 2058 km. Eight cetacean species were sighted (six of these new cetacean records for Cambodia). Evidence of remnant Dugong (*Dugong dugon*) populations within Cambodian waters were obtained through the retrieval of fresh carcasses and from accounts of fishermen who continue to target the species for medicinal and consumption purposes. The other threats to Cambodian marine mammals include; habitat degradation, direct takes for aquaria, by-catch in subsistence and commercial fisheries and over-fishing of prey species.

The results of this research have provided baseline data for future research and conservation efforts on marine mammals in Cambodia. Management actions will be difficult to implement and enforce. However, strategies will be developed and undertaken in collaboration with local government departments and through community-based consultation and management programs.

The (IUCN Critically Endangered) Dugongs (*Dugong dugon*) of Hinatuan, Surigao del Sur, Mindanao, Philippines

Bryne, Rowan

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Modern records support the presence of dugongs (*Dugong dugon*) in Hinatuan as far back as 1950, but they most likely inhabited the area even before this date. Over the past several decades, dugong numbers have slowly decreased due to (1) illegal fishing techniques such as, dynamite & cyanide fishing; (2) the extensive uncontrolled use of fish corrals and illegal mesh size fishing in protected areas; and (3) illegal over - expansion of fish ponds.

For decades, the DENR (Department for Environment and Natural Resources) assumed the population was extinct in Surigao. As a result, no new endeavours were initiated to protect or preserve this endangered species in the Surigao del Sur region. My initial research indicates that, in the Surigao region, dugongs can only be found in Hinatuan. They appear to be extinct in the surrounding areas of Surigao del Sur, with unconfirmed recent reports in Sairgao Island, Surigao del Norte.

In April 2001, a baby dugong was killed in a fish corral accident, and after conducting interviews with local people, I found that 2 other baby dugongs had been killed in the last 6 months. I contacted national governmental agencies and the World Wildlife Fund For Nature (WWF), who acknowledged that they were unaware of the presence of dugongs in the Hinatuan area, and stated that they had terminated recent surveys 200 Km south of Hinatuan area, thus missing the whole area.

From October 2000 to June 2002, six (6) baby dugongs have been killed and two sub adults, and one tagged and released by fishermen, all in Hinatuan municipal waters. This is strong evidence that either the population did not go extinct, or that the area has been re-populated in recent years. But, with 5 infants killed in the past year, and increasing fishing intensity, is there hope for continued recovery? At present the future is bleak for this majestic loveable creature. Only conservation on both local and international level can save dugongs from extinction.

A Review of the Results of the Study on Marine Mammals in Vietnamese Waters

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There are only few studies on the marine mammals in Vietnamese waters as well as in South East Asia (Perrin 1994, Smith *et al.* 1995). Blue whale was firstly recognised by Gruvel (1925). There was no specific study focusing on marine cetaceans along Vietnam 3,260 km of coast line until 1995 (Smith *et al.* 1995). Two species of small marine mammals was described by Bui Dinh Chung (1964) in the Gulf of Tonkin and the dugong has been recorded several times from the waters of South Vietnam (Tran Ngoc Loi 192 ; van Bree and Duguy).

In March and April 1995 the first marine mammals study was conducted in South-Central Part, Mekong River Delta and Phu Quoc Island (Gulf of Thailand) areas of Vietnam. The checklist consists 16 species of marine mammals was the results of this study. In October 1999 and April 2000 the same study was out in the Gulf of Tonkin, North Vietnam with ten species was recognized. Both study was conducted by IUCN SSC Cetacean Specialist Group, Ocean Park Conservation Foundation together with Vietnamese scientists from different national institutes.

Recently some species of marine cetaceans with individuals stranded or caught by fishing net, reorganized by the authors of this report was added. The report found the need to establish cetaceans managing and monitoring program in Vietnam also in the Southeast Asia Region.

Status of the Dugong *Dugong dugon* in Vietnam and Cambodia and Recommendations for its Conservation

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As with similar relic dugong populations scattered around SE Asia, very little reliable information is available about the status and abundance of dugongs in Vietnam and Cambodia. Recent surveys undertaken in Con Dao National Park in the south of Vietnam have revealed important information about behaviour and seagrass habitat visitation on the local scale, but only anecdotal information is available for all the other sites that could potentially support small dugong populations.

Similar anecdotal evidence collected from the Gulf of Thailand suggests that small groups of dugongs from a larger meta-population may be moving between habitats along the coastline shared by Thailand, Cambodia and Vietnam. Urgent collaborative research is needed in order that a dugong conservation action plan can be formulated.

Given the urgent situation, it is recommended that satellite tagging be used in conjunction with conventional survey methods to ascertain movement patterns in relation to key seagrass sites. Also recommended is the establishment of the dugong as a flagship species for raising conservation awareness at the national and international level, and as an indicator species for healthy seagrass habitats. Building the support of local communities, national research institutions and governments is critical if the dugong is to remain an important part of the marine biodiversity of the region.

Status and Incidence Of Irrawaddy By-Catch in Malampaya Sound

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Based on primary and secondary data, a total of nine confirmed and unconfirmed reports of Irrawaddy dolphin (*Orcaella brevirostris*) mortalities were recorded to have occurred in 2000 and 2001. Of the seven mortalities that supposedly occurred in 2001, the team was able to identify four cases that appeared to be distinctive of each other. The cause of death in three out of these four distinct mortalities was determined to be drowning due to *matang quatro* (gillnet) entanglement. Although the rate of *matang quatro*-related dolphin mortality appeared to be high, it was concluded that the threat of dolphin by-catch was not limited to this specific fishing gear and that further conservation activities should also look at the threat posed by other fishing gear types, especially other forms of gillnets, used in the Sound.

Given that the estimated size of the dolphin population in Malampaya Sound is only 60 individuals, the 2001 mortalities are more than the population can afford. Considering this and the fact that the Malampaya habitat faces other threats in various forms, it is strongly recommended that the Malampaya population be listed as critically endangered under the IUCN red data, its existence be recognized by BFAR through the immediate amendment of FAO 208 and that the Philippine government take an active role in its conservation. As of writing, WWF Philippines has already proposed the creation of an Irrawaddy task force in the Municipality of Taytay which has legal jurisdiction over Malampaya Sound. Other community-based conservation-linked activities have, likewise, been initiated in the area. These, however, are small steps towards the long journey of conserving the Irrawaddy population in the Sound.

Cetacean Habitats in the Eastern Sulu Sea and Tañon Strait

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This paper examines the cetacean fauna of two contiguous habitats, the eastern Sulu Sea and Tañon Strait. Species composition, associations and abundances are compared as well as the distributional patterns of the most common species. The environmental parameters tested were water depth, water temperature and sea state. Abundances were estimated using the line transect method and the program DISTANCE. Data on environmental parameters were organized using ArcView GIS, and correlation between the environmental parameters and sighting rates was analyzed using multiple regression. The eastern Sulu Sea has twice as many cetacean species as Tañon Strait. The spinner dolphin, *Stenella longirostris*, was the most abundant species in both habitats. However, the densities and abundance ranks of the other species varied, with generally higher densities in the Sulu Sea than in Tañon Strait, with the exception of the dwarf sperm whale, *Kogia sima*, whose density was 15 times higher in Tañon Strait than in the eastern Sulu Sea. Fraser's dolphin, *Lagenodelphis hosei*, the third most abundant species in the eastern Sulu Sea was not sighted in Tañon Strait. Significant correlation was found between sighting rates and one or more environmental factors except for the spinner dolphin. The question of movement between these two habitats is addressed using the short-finned pilot whale, *Globicephala macrorhynchus*, as an example.

The Present Status of Population and Protection of Dugongs in Chinese Waters

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The dugongs off coastal of China are considered as the original geographic population. Dugongs are primarily distributed along the coastal waters of Hainan Province and Guangxi Zhuang Autonomous Region (GZAR) of China, and historical records also showed occasional occurrences in western Guangdong Province and southern waters of Taiwan. Due to massive hunt along the coast by fishermen from 1958 to 1962, the resource of dugongs was seriously diminished close to local extinction level. The Chinese government listed the dugong as "Grade 1 National Protected Species" in 1983 and prohibited any direct hunt, but the protection action did not succeed efficiently. In 1988 the Chinese government listed the dugong among the important protective wild animals of the first order. In addition, the National Hepu State Dugong Natural Reserve was established in GZAR in 1991. However, there was no evidence of dugong population recovery. In 1996 and 1997, there were occurrences of dugong death in GZAR. According to recent information, there were sighting of dugongs in small group in the coastal waters of Hepu of GZAR and Dongfang of Hainan Province in 1998 and 2000 respectively, which provides proofs that the dugongs are not locally extinct yet in Chinese waters. The threats to this species are mainly from the human activities and the habitat reduction causing by environmental deterioration. In order to prevent the dugongs from disappearing and locally extinct in the Chinese waters, the further protective measures are urgently needed. Therefore, it is recommended that the establishment of Dugong Natural Reserve should be sought in the immediate future.

Conservation of the Dugong (*Dugong dugon*) in Thailand

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Once commonly seen along tropical coasts from East Africa to Australia, dugongs are currently considered rare over most of this range. The IUCN classifies the dugong as vulnerable on a global scale based on declines in occurrence and quality of habitat, and human exploitation. The Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) has banned international trade in dugong products.

In Thailand, dugongs used to be seen regularly along the Andaman and Gulf of Thailand coasts, but are now largely confined to islands off the Andaman coast. The dugong in Thailand has been declared a reserved and protected marine species under the Thai Fisheries Act since 1947. We estimate the number of dugongs remaining in Thailand to be approximately 200. Trang Province, along the Andaman coast in southern Thailand, is a primary feeding site for dugongs, and has the largest population group of dugongs remaining in Thailand. One of the largest threats for the dugong in coastal Thailand is that of being caught in stationary nets, gillnets, and pushnet trawlers. It is also believed that dugongs are being actively hunted in the eastern Gulf. The meat of the dugong is considered delicious. Dugong oil, teeth, tusks, and bones are considered to have valuable medicinal properties, and are also commonly used as protective amulets. A pair of tusks can be sold for as much as 15,000 Thai baht (approximately US\$320). Dugong tears, a mucous secretion that protects the eyes, are commonly considered a powerful aphrodisiac. However, incidental catch and entanglement in fishing gears is the largest threat to dugongs. Among various types of gears, gillnets are considered to be the main cause of death for dugongs. While most incidents of entanglement are not reported, the numbers of by-catch deaths that are reported place the dugong population of Thailand in imminent danger of extirpation.

A Review of Cetacean Research in Hong Kong and Adjacent Waters

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We review recent progress in cetacean research in Hong Kong and adjacent waters. Fifteen cetacean species have been recorded either alive or stranded in the Hong Kong SAR. Among them, two resident species, the Indo-Pacific humpback dolphin (*Sousa chinensis*) and the finless porpoise (*Neophocaena phocaenoides*), can be found year-round in Hong Kong waters. Since 1995, long-term monitoring and conservation programs have been dedicated to humpback dolphins and finless porpoises, and a great deal of information has been collected in the past several years. Indo-Pacific humpback dolphins (locally known as Chinese white dolphins) occur in all the western waters of Hong Kong and throughout the Pearl River Estuary, with a strong preference for estuarine habitat. Line transect surveys revealed that there are over 150 animals in Hong Kong waters, and the minimum estimate of the Pearl River Estuary population is roughly 1,400 dolphins. On the other hand, finless porpoises can be found primarily in the southern and eastern waters of Hong Kong. Abundance estimates indicated that there are over 150 porpoises residing in Hong Kong during the peak season, and a preliminary estimate suggested that the minimum population size, including adjacent waters south of Hong Kong, is 217 animals. Social organization, behaviour and ranging patterns have been studied in detail for both humpback dolphins and finless porpoises. From stranded carcasses, samples were collected for various studies on population structure, feeding habits, life history parameters and contaminant levels. The humpback dolphin and finless porpoise are under great pressure resulting from human activities, which may affect their long-term survival. The major threats include fishery bycatch, vessel collision and high levels of environmental contaminants (such as heavy metals and organochlorines) from water pollution. The Hong Kong SAR government has implemented conservation measures on the local dolphin and porpoise populations by establishing marine protected areas, enforcing the Environmental Impact Assessment Ordinance to minimize negative impacts from coastal development, providing funding for long-term monitoring research programs, and raising public awareness by distributing educational materials.

Summary of Current Knowledge of Cetaceans and Dugongs in Malaysian Waters

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The Marine Mammals and Whale Shark Research and Conservation Programme of University Malaysia Sabah was started in October 1996. Until now, it remains as the only active programme in studying the animals and continuously receiving supports from various government agencies, NGOs and the private sector throughout the country. Research is mostly focussed on addressing the population status of dugongs and inshore cetaceans, and their interactions with humans, particularly in East Malaysian waters. The research methods used have included boat, aerial, interview, and questionnaire surveys, literature reviews, and site investigations on stranded or incidentally caught animals.

To date, a total of 20 species have been confirmed either to reside or transient within Malaysian territorial and Exclusive Economic Zone. The species are the blue whale (*Balaenoptera musculus*), Bryde's whale (*B. edeni*), minke whale (*B. acutorostrata*), sperm whale (*Physeter catodon*), pygmy sperm whale (*Kogia breviceps*), Cuvier's beaked whale (*Ziphius cavirostris*), Irrawaddy dolphin (*Orcaella brevirostris*), killer whale (*Orcinus orca*), short-finned pilot whale (*Globicephala macrorhynchus*), false killer whale (*Pseudorca crassidens*), melon-headed whale (*Peponocephala electra*), Indo-Pacific humpback dolphin (*Sousa chinensis*), Risso's dolphin (*Grampus griseus*), inshore bottlenose dolphin (*Tursiops truncatus*, *aduncus*-type), pantropical spotted dolphin (*Stenella attenuata*), long-snouted spinner dolphin (*S. longirostris*), long-beaked common dolphin (*Delphinus capensis*), Fraser's dolphin (*Lagenodelphis hosei*), finless porpoise (*Neophocoena phocoenoides*), and dugong (*Dugong dugon*). There is also evidence to suggest that a further 8 species of cetaceans stray or pass through Malaysian waters at least occasionally.

All cetaceans and dugongs are protected by laws in Malaysia. Nevertheless, some populations are threatened by traditional hunting for meat, incidental catches in fishing gear, degradation of coastal habitats caused by sedimentation and pollution, dynamite fishing and intense navigation. Measures to implement effective conservation strategies are needed to reduce the pressure on the populations.

Abundance and Trends in Size of the Indo-Pacific Humpback Dolphin Population in the Pearl River Estuary, P.R. China

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Line transect surveys using 12-15 m vessels have been conducted since late 1995 to estimate the abundance and population trends of Indo-Pacific humpback dolphins (*Sousa chinensis*) in Hong Kong and adjacent waters of China's Pearl River Estuary (an area of 3,856 km²). Distribution patterns, as well as data from photo-identification and molecular genetic studies, indicate that a single population inhabits this area. We used 43,376 km of sighting effort collected during conditions of Beaufort 3 or lower, along with 1,673 on-effort sightings, to estimate abundance in nine survey areas in which dolphins were sighted. All of the areas with dolphin sightings were influenced to varying degrees by freshwater discharge from the Pearl River. Four other areas in Hong Kong's eastern waters with little or no influence from the Pearl River had no dolphin sightings. There were seasonal fluctuations in the densities of dolphins in different areas. The highest total of the estimates for any one season was 1,383 dolphins in winter. This represents a minimum estimate of total population size. Mark-recapture analysis of photo-identification data provided an alternative population size estimate of 753 dolphins, but we believe that this is an underestimate. We also examined trends in abundance in North Lantau. Line transect estimates were made for 12 6-month periods, and the resulting pattern was for a decline from the start of the study until summer/autumn 1998, and an increasing trend since then. The apparent reversal in the trend occurred at about the time of the opening of Hong Kong's new international airport. The trends analysis could suggest that the population is increasing, or at least stable, but there is uncertainty due to the potential for animals to have moved into and out of the trends study area.

Indonesia's Cetacean Migration Corridors: Management Implications of Long-Term Visual and Acoustic Cetacean Surveys in Komodo National Park and Alor, Indonesia.

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In the May 1999 – April 2001 survey periods a total of 18 cetacean species were identified during 207 survey hours over 71 field days during five intermonsoon field seasons. The surveys covered an estimated 4706 nautical miles. The species encountered were predominantly oceanic odontocetes, but also included a several balaenopterid species. An estimated total of 7082 individual cetaceans were sighted during 299 encounters. Acoustic contact with cetaceans was recorded during 38.1% of the 217 listening stations. Temporal and spatial patterns are apparent on the species level. Major species-specific results include relative abundance indices, site preferences and calving rates. A regionally distinct baleen whale, the pygmy Bryde's whale *Balaenoptera edeni*, was positively identified with genetic profiling techniques. The Alor surveys were initiated in 2001. Preliminary results indicate this region is one of the prime cetacean habitats in Indonesia. Critical habitats, including regional migration corridors, have been identified. Major environmental impacts observed include reef bombing (acoustic habitat degradation) and other fisheries interactions. Cetacean watching potential has increased due to the survey results. However, this may not be an appropriate tourism activity without strict controls and enforcement in place first.

Significant extensions to KNP's legislative boundaries have been designed to include preferred habitats of the Park's cetaceans. These extensions are incorporated in the 25-year management plan and will increase the protective status of cetaceans in KNP. The long-term surveys have also shown that cetaceans should be an important component of resource management plans, conservation measures and alternative livelihood options for Marine Protected Areas in eastern Indonesia.

An Indonesian Whale Sanctuary will be crucial, as for migratory whales and dolphins the degrading forces on their ecology often occur outside the current areas of protection. Such a sanctuary would complement the Indian Ocean Sanctuary and protect the tropical Indo-Pacific cetacean migration corridors.

Identification of Dugong (*Dugong dugon*) Tissues Using Isozymes

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Two tissue specimens, suspected of being dugong, were tested by analysis of isozymes. The first tissue specimen was collected from Ban Paklok, Phuket on 26 October 2000 and the second was collected from a fresh market in Phuket town on 29 October 2000. The suspected tissues were compared to known tissues from 5 dugongs (*Dugong dugon*), 3 cows (*Bos taurus*), 3 pigs (*Sus scrofa*), 3 chickens (*Gallus domesticus*) and 1 finless porpoise (*Neophocaena phocaenoides*). The study employed seven enzymes namely dihydrolipoamide dehydrogenase, glucose-6-phosphate isomerase, lactate dehydrogenase, isocitrate dehydrogenase, malate, mannose-6-phosphate isomerase and phosphoglucomutase.

Using the zymograms of these seven enzymes, the first tissue specimen was identified as dugong tissue, while the second tissue specimen was not. Due to incompatibility of protein patterns, we were unable to assign the second tissue specimen to any of the compared organisms. An electrophoretic analysis of isozymes has proven to be an effective tool for recognition of dugong tissue and shows potential for identification of other conserved organisms that are poached.

Conservation Effort to Protect the Indo-Pacific Humpback Dolphins in Hong Kong

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The population biology of Indo-Pacific humpback dolphins (*Sousa chinensis*) in Hong Kong and adjacent waters has been studied intensively since 1995. The dolphin population appears to occur in the Pearl River Estuary and the western Hong Kong waters. Currently, the best available estimate of the total population in the Pearl River Estuary is 1,400 dolphins, in which 253 individuals have been photographically identified. From the mark-recapture analysis of the photo-identification data, about 343 dolphins of the population use Hong Kong waters, at least seasonally. An extensive stranding investigation programme has also been initiated since 1995 and a number of human-related threats have been found among stranded dolphins. The threats include habitat loss, marine pollution, depletion of food resources, intensive vessel traffic and fishery by-catch. In order to enable the humpback dolphins to continuously use Hong Kong waters as a portion of their population range and to enhance their continued survival in the Pearl River Estuary, a conservation programme for the dolphins was prepared in 2000. A four-pronged approach involving management, public education, research, and cross-boundary cooperation were recommended in the conservation programme. Management will aim at improving the habitat for the dolphins and at minimizing the effects from human activities that may threaten the short-term and long-term survival of the dolphins in Hong Kong. Public education will improve the community's understanding of the issue and solicit their support for the conservation programme. Research will increase our knowledge of the species and provide the scientific basis and input for improving, refining, and updating the conservation strategy. Cross-boundary cooperation will help to improve co-ordination with Mainland authorities in developing and implementing joint conservation actions.

The Status of Marine Mammals in the Coastal Waters of Northern Australia

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Australian waters in Southeast Asia extend from Northwest Cape in the west to the tip of Cape York Peninsula in the east, including Torres Strait. The region is remote and sparsely populated by small indigenous communities and isolated nodes of industrial development, usually associated with land-based mining and/or offshore oil and gas. Eleven species of cetacean have been confirmed from anecdotal reports of stranded animals, by-catch and/or sightings: humpback whale, rough-toothed dolphin; Indo-Pacific humpbacked dolphin, bottlenose dolphin, spinner dolphin, striped dolphin, common dolphin, false killer whale, short-finned pilot whale, Irrawaddy dolphin, and goose-beaked whale. Cetaceans in the region of North-west Cape have been surveyed, prompted by concern about the impact of seismic surveys on migrating hump-back whales. Dolphins have also been recorded during aerial surveys for the dugong, the most abundant marine mammal in coastal waters. Since 1996, aerial surveys for dugongs have been conducted between North-West Cape and the De Grey River in Western Australia (population estimate $2046 \pm \text{se } 376$), the Queensland coast of the Gulf of Carpentaria ($4266 \pm \text{se } 657$) and in Torres Strait ($27881 \pm \text{se } 3216$ in 1996; $14106 \pm \text{se } 2314$ in 2001). The confounding effects of large-scale dugong movements apparently associated with seagrass diebacks make the differences between surveys difficult to interpret. The largest source of dugong mortality is traditional hunting, especially in Torres Strait where hunting rights are protected by international treaty between Australia and Papua New Guinea. Hunting is generally restricted to areas close to Indigenous communities. The inshore dolphins and the dugong are subjected to incidental take in gill net fisheries. There are few conservation measures specifically directed at marine mammals, apart from isolated spatial closures to protect dugongs from gillnet by-catch. An endangered species awareness course has been developed for gillnetters in Queensland and information on measures to reduce marine mammal bycatch is supplied to fishers in the Northern Territory.

The Status of the Dugong in Southeast Asia

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The dugong (*Dugong dugon*), the only herbivorous mammal that is strictly marine, is listed as vulnerable to extinction by the IUCN. The dugong's range spans the coastal and island waters of coastal nations from east Africa to Vanuatu, between about 26° and 27° north and south of the equator. The dugong's historic distribution was believed to be broadly coincident with the tropical Indo-Pacific distribution of its seagrass food. Between 1997 and 2001, we collated information from experts in all countries and territories in the dugong's range in southeast Asia with the exception of Macao and Myanmar in the course of developing a global status report and action plan for IUCN and UNEP. Most of the information was anecdotal although dedicated surveys have been carried out in parts of China, Philippines, Peninsular, Malaysia, Singapore, East Malaysia and Brunei, Indonesia and northern Australia. Only in Australia, have quantitative population estimates been attempted. The information collected indicates that the dugong is believed to be extinct in parts of the Chinese region including Taiwan and the Pearl River estuary and to be declining in most of the rest of its south-east Asian range outside Australia. The major concerns in the south-east Asian region are mortality associated with fishing variously including gill nets, trap nets, trawls and explosives, hunting and poaching (all countries except Singapore), boating (seven countries) and habitat loss associated with coastal development, fishing and agricultural runoff (all countries). The dugong is technically protected by legislation in all Southeast Asian countries where it still occurs and for which we have information, except Brunei, Cambodia, Singapore and Vietnam and by marine parks in seven countries. However, only in Thailand and China do these parks include protection areas designed specifically for dugongs.

Live and Mass Strandings of Marine Mammals in Japan and their Status and Conservation

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Starting in 1993, the sighting and stranding reports were gathered by surfers, kayakers, divers, fishermen, local aquariums and museums in Japan. Japan has a different role to play in culture that has traditionally viewed marine mammals as a food source, whose government continues to hunt whales in defiance of the international whaling ban. We analyzed 325 cases of cetacean live stranding recorded in Japan in the past ten years. Of large species, the majority were killer whales (*Orcinus orca*), short-finned pilot whales (*Globicephala macrorhynchus*), false killer whales (*Pseudorca crassidens*) and Cuvier's beaked whales (*Ziphius cavirostris*). Of small species, the majority were striped dolphins (*Stenella coeruleoalba*), spotted dolphins (*Stenella attenuata*), Risso's dolphins (*Grampus griseus*), common dolphins (*Delphinus delphis*) and *Kogia* sp. Most of these species are thought to have a well developed social structure. Most of them are subtropical and pelagic. On the other hand, though large numbers of Pacific white-sided dolphins (*Lagenorhynchus obliquidens*) and finless porpoises (*Neophocaena phocaenoides*) are washed-up, they are rarely stranded alive. Most stranded cetaceans only survive up to 48 hours. The survival rate of stranded cetaceans rescued and cared for in aquariums is under 13% after one year. There have been a number of live strandings in the last three years with associated rescue attempts including:

- 1 (*Physeter macrocephalus*) rescued by fishermen in 1998
- 1 (*Physeter macrocephalus*) beached in 2000
- 1 (*Megaptera novaeangliae*) released from a fisherman's net in 2001
- 2 (*Globicephala macrorhynchus*) rescued by fishermen & surfers in 1999
- A mass stranding of 50 (*Peponocephala electra*) in 2001
- A mass stranding of 170 (*Peponocephala electra*) in 2001
- A mass stranding of 30 and 80 (*Peponocephala electra*) in 2002
- A mass stranding of 14 (*Physeter macrocephalus*) in 2002

The primary focus of Marine Mammal Center-Japan is to continue to expand our conservation work and workshop for stranding with local surfers, fishermen in the education programs. We will continue to develop a program to collect marine mammal tissue samples for analysis of pollutants, prey, parasites, and disease.

Can the Developing Countries Do Anything About By-catch of Cetaceans in Fisheries?

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By-catch in fisheries is the major conservation problem for small cetaceans in many developing countries in Asia, Africa and South America. In principle, bycatch problems can be solved through technology (research and implementation) and management (regulations and enforcement). An example is the reduction of dolphin kill in the tuna fishery in the eastern tropical Pacific from 100s of thousands annually in the 1960s to a few thousand currently, a hundred-fold reduction to levels that are likely sustainable. However, the funds expended by government and industry to achieve and maintain this reduction have well exceeded \$100 million. These kinds of resources are not available for this use in the developing countries. Funds do not exist to fully assess the impacts of by-catch by estimating cetacean population size and monitoring bycatches. Nor do they exist to support the development of technological solutions and enforcement of management regulations. These resources will not materialize (either domestically or from international assistance) unless and until public opinion requires and supports cetacean conservation in a serious way. So what is to be done? Three important steps are possible without massive funding: 1) inventory fisheries to identify those with potentially significant by-catch, 2) prioritize the fisheries/areas, giving preference to rare species, relatively healthy populations, relatively vulnerable habitats, and areas of remaining high species diversity, and 3) increase public awareness (through education, publication and lobbying) to focus opinion on the need to provide resources for meaningful mitigation of bycatch in the fisheries inflicting the greatest damage. This is a strategy aimed at a future when national will and resources may grow to solve the problems across the board, but it will yield incremental progress as well. In any case, without these underpinnings there can be no solutions.

Cetacean Rehabilitation in Taiwan

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Rehabilitation of cetaceans has improved much in this decade in Taiwan. Some of the improvements have been due to advancements in technology and others to differences in the approach to caring for these animals. Since establishment of the Taiwan Cetacean Stranding Network (TCSN) in 1996, the number of cetaceans admitted for rehabilitation has increased. By 2001, twenty-three stranded cetaceans have been rehabilitated including five rough-toothed dolphins (*Steno bredanensis*), five pygmy sperm whales (*Kogia breviceps*), three dwarf sperm whales (*Kogia simus*), four Risso's dolphins (*Grampus griseus*), three pantropical spotted dolphins (*Stenella attenuata*), one spinner dolphin (*Stenella longirostris*), one bottlenose dolphin (*Tursiops truncatus*), and one melon-headed whale (*Peponocephala electra*). The most common problems seen are respiratory problems. Other common problems include GI tract infection, parasites infestation, malnutrition, electrolyte imbalance, cookie-cutter shark-bitten wounds, skeletal muscle injury, and anthropogenic objects in stomach. All animals that are admitted to the critical care pool have a physical examination performed, blood drawn for a CBC and biochemical analysis, fecal analysis for parasites, cultures taken when indicated, and an individual treatment regimen prescribed. Some weak cetaceans that cannot float well by themselves are given 24-hr supportive care with fluids and antibiotics if their CBC shows a significant elevation of white blood cells. Most of the rehabilitated cetaceans died in one week. A male adult pygmy sperm whale with severe respiratory syndrome and hyperthermia died in five days and morbillivirus infection was confirmed by using pathology and PCR. Moderate antibody titer to Brucella was detected in a female adult rough-toothed dolphin which died after six days of rehabilitation. The impact of these two kinds of pathogens to cetaceans in Taiwan should be monitored. Fortunately, a male adult Risso's dolphin was successfully rehabilitated after 64 days and released in September 2000 and was sighted in Okinawa, Japan. However, we need to make the use of diagnostic equipment routinely during the rehabilitation of cetaceans, such as radiology, sonography, thermography, endoscopy, even magnetic resonance imaging and computed tomography. Facilities also have to be changed from portable or shallow pools to hospitals designed specifically for the better care of dolphins and whales.

Status and Conservation of Irrawaddy dolphins *Orcaella brevirostris* in Malampaya Sound, Palawan, Philippines

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A geographically isolated population of Irrawaddy dolphins was recently discovered in Malampaya Sound, Palawan, Philippines. Line-transect surveys conducted in April – November 2001 covered 884km of trackline and resulted in a total population estimate of 77 individuals (CV=27.4%), confined to the inner portion (133.7km²). For all Irrawaddy dolphin sightings, where ecological data were collected (n=47), the mean temperature was 30.20°C, depth 6.5 m, salinity 28.3 ppt, and turbidity 2.2 NTUs. Significantly higher turbidity, lower salinity, and shallower depth were recorded in the inner Sound compared to adjacent waters. Bottlenose dolphins *Tursiops sp.* (probably *truncatus*) were observed in waters just outside of where Irrawaddy dolphins were recorded. During the study, two Irrawaddy dolphins were accidentally killed in bottom-set nylon gill nets used to catch crabs, locally called *matang quatro*. Reports from local fishermen also indicated that as many as three additional animals may have been killed in these nets during the same period. These findings suggest strongly that the Irrawaddy dolphin population in Malampaya Sound is in immediate danger of extirpation due to low numbers, limited range, and high mortality. This is the only known population of the species in the Philippines, and the nearest area where another population is known to occur is in northern Borneo, some 550 km to the south. Recommendations for conserving the population include that (1) socioeconomic alternatives be developed to promote the conservation goal of reducing the incidence of dolphin entanglement in *matang quatro* gillnets; (2) gillnet free zones be established in core areas of dolphin distribution; (3) Irrawaddy dolphins be promoted as a flagship species of environmental health in the Sound; (4) a long-term program be established to monitor the dolphin population; and (5) further research be conducted on fisheries and dolphin interactions, with particular emphasis on gillnets.

Dugong Conservation and Carcasses in the Great Barrier Reef Marine Park, Queensland, Australia

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Dugong numbers have declined by over 90% since the 1960s on the urban coast of Queensland, Australia, a coastal distance of about 2000 km. Since the 1980s, the Great Barrier Reef Marine Park Authority has funded aerial surveys to assess numbers remaining in the Great Barrier Reef Marine Park (GBRMP). Widespread public and government concern about the decline has resulted in high priority management actions including establishment of a chain of Dugong Protection Areas, buy-out of large-mesh net fishers displaced by the DPAs, voluntary boating controls, enhanced surveillance and enforcement, and improved systems to retrieve and necropsy stranded live animals and carcasses. This presentation will report on Australian Government initiatives over the past two decades for dugong conservation in the GBRMP, current directions and conclusions derived from the enhanced stranded animal inspection program.

Legal Hunting of Cetaceans in Indonesia

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For marine mammals, Indonesia remains an important refuge for the dugong and cetaceans in Southeast Asia. Little scientific information is available on the abundance, distribution and behavior of marine mammals in Indonesian waters. The size of the dugong population is unknown. In the 1970's, it was estimated to be around 10,000.

There are some 31 species of cetaceans of which seven are baleen whales and the rest dolphins and relatives (IUCN, 1991). Some of these evidently have restricted ranges while others are widely distributed, found in all seas under the national jurisdiction of Indonesia and shared with the Indian and Pacific Oceans south to the Antarctic. Whales breed and calve in warmer waters, but it is not known whether this occurs in Indonesia.

The hunting of cetaceans is traditionally prescribed in many regions. There are the whaling villages of Lamalera and Lamakera in East Nusa Tenggara. Whale hunting is usually done from May to August. The people of Lamalera hunt sperm whale, *Physeter catodon*, while the people of Lamakera hunt sei whales, *Balaenoptera borealis*. Although this is small-scale traditional subsistence hunting, it needs to be regulated by the government in line with development of tourism and whale watching.

No data are available on incidental catches of cetaceans in fishing nets by Indonesia-flag vessels. For purposes of dolphin shows, some delphinariums and oceanariums have been permitted to catch dolphins. During 1990-2001, the Directorate General of Forest Protection and Nature Conservation (PHKA) issued permits to four delphinariums (Batam, Bogor, Jakarta and Solo) for catching about 65 bottlenose dolphins (*Tursiops sp.*). The local government of Kutai, Kalimantan also has a plan to capture pesut or Irrawaddy dolphins from the Mahakam River, in spite of the fact that the population is in critical condition.

The Indonesia Cetacean Specialists Group has made a suggestion to the government to limit the capture of marine dolphins as well as freshwater dolphins. Indonesia is a party to the Convention on the Law of the Sea, which establishes the territorial sea and the 200-mile Exclusive Economic Zone. As whales and dolphins are already protected, Indonesia should become a party to the Whaling Convention and join the International Whaling Commission.

The migration route of whales entering or leaving the Indian Ocean from or to the Pacific Ocean lies exclusively in Indonesian waters. The government has not recognized the Indian Ocean Whale Sanctuary, which extends over the entire Indian Ocean. The Indonesian Cetacean Specialist Group in this case has also proposed that the government declare all Indonesian seas as a whale sanctuary, referring to the Act on Conservation of Biodiversity and its Ecosystem of 1990 and the Act on Fisheries of 1985.

Ratification of the whaling Convention and declaration of a whale sanctuary would demonstrate Indonesia's commitment to collaboration with neighboring states in regional and global efforts to conserve shared marine resources.

Impacts of Fishery By-catch on Cetaceans in Hong Kong Waters

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The aim of this paper is to investigate impacts of fishery by-catch on cetaceans in Hong Kong waters through interviews with local fishermen, stranding program records and literature review. The findings show that interactions between the fishermen and cetaceans occur not only in Hong Kong waters, but also in the South China Sea, as the majority of local fishermen also fish outside Hong Kong waters. Finless porpoises (*Neophocaena phocaenoides*), Indo-Pacific humpback dolphins (*Sousa chinensis*) and unidentified "grey dolphin" species are the most commonly sighted and net-caught species in Hong Kong and nearby waters. Water depth of fishing grounds appears to be related to cetacean habitat, and affects level of the interaction between different cetacean species and fishermen.

The threats from fishery by-catch faced by cetacean species in Hong Kong and nearby waters have been recorded since the early 1970s and still commonly occur. From the results of survey questionnaires and the stranding records, gillnet and trawl net entanglement is the major cause of death of cetaceans in Hong Kong and nearby waters. It is felt the numbers of net-caused mortalities are an underestimate due to the reluctance of fishermen to report any case of bycatch or stranding to authorities. In addition, cause of death for most stranded carcasses cannot be determined as the bodies are too decomposed. It is impossible to determine the actual number of incidental mortalities through the existing stranding program as the proportion of carcasses from by-catch that end up on the beach is unknown.

An on-board observer program should be carried out to assess the true magnitude of the by-catch of local cetaceans. Fishermen also should be encouraged to report by-catches and strandings of cetaceans without facing penalties for causing the by-catch, and should be prosecuted for not reporting by-catches.

Indo-Pacific Bottlenose Dolphins (*Tursiops aduncus*) of Nan Wan and Adjacent Waters in Southern Taiwan

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During a survey of cetaceans of southern Taiwan in 2000, the first confirmed sightings of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) at sea were recorded in Nan Wan (South Bay) and adjacent waters of southern Taiwan. In 2001, the first long-term study of the Indo-Pacific bottlenose dolphin in Chinese waters was launched with the main goal of increasing our knowledge of the biology of this poorly known coastal species (which has experienced substantial exploitation in the recent past). Data were collected from a small research vessel and three land-based platforms. By combining data from 2001 and 2000, some preliminary but important insights into these dolphins were gained. The preliminary estimate of abundance and density of these dolphins in southern Taiwan was very low (about 24 individuals in the study area of about 85 km²). Of these dolphins, nine individuals were identified from distinct characteristics (e.g., shape, scars, pigmentation) of their dorsal fins. Other preliminary findings on the movement, distribution and behaviour of these dolphins will be presented with discussions about the human threats in the region, conservation implications and future research plans.

Update on the Marine Mammals in the Waters of Taiwan: 1995-2002

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Since 1995, there have been many developments in cetacean research and ecotourism. Ship-based surveys of the waters of eastern and southern Taiwan have been conducted, a stranding network was established and more information on direct and indirect catches of cetaceans by fisheries has accumulated. A long-term study on an exploited coastal species (Indo-Pacific bottlenose dolphin, *Tursiops aduncus*) was launched recently to begin understanding its biology in more detail. Updates on developments in many aspects of marine mammal biology and conservation in Taiwan, will be provided (following the format of the report of the 1995 workshop on the biology and conservation of small cetaceans and dugongs of southeast Asia). In addition, the state of fisheries interactions and estimates of the level of cetacean mortality due to fisheries will be presented. Finally, the present state, future plans and needs of research and conservation in Taiwan will be discussed and a bibliography of recent studies on cetaceans found in the waters of Taiwan is included.

Feasibility Study of Acoustical Dolphin Deterrence

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The conservation of cetaceans in Pescadores was originated in 1990. However, the conflict between the fishery loss and cetacean protection keeps growing. The fishery loss caused by cetaceans are mainly: "steal fish" and "frighten fish group", and the others like "damage fishing gear" and "interfere fishing operation", and etc. By the understanding of dolphins behavior, this study proposed acoustical deterrent methods: 1. Harassment – look for echolocation system frequency range, and broadcast disarrange signals to produce an illusion, and prevent dolphins from locating the target. 2. Threat – broadcast sounds of its predators which is killer whales to scare dolphins from approaching the fishing vessels. 3. Warning – loud noise or alert sounds of dolphins. The circuits of generating above sounds are designed, test and modified after the field test. We broadcast some sounds like 10 kHz signals, 20 kHz signals, killer whales sound and stress call of dolphins to captive dolphins. The test results showed these dolphins avoided the sound source, especially during killer whales sound and stress call of dolphins. They were effective to threatening dolphins to reduce stealing fish. More effective pingers should be developed through this study to reduce the loss of fisherman, and achieve the cetacean conservation goal.

The Breeding Ground Distribution of the Humpback Whales (*Megaptera novaeangliae*) in the Western North Pacific and Their Trans-Movements among the Ogasawara Islands, the Ryukyu Islands and the Babuyan Islands, Philippines

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The Ogasawara Islands (27°N, 142°E) and Ryukyu (Kerama) Islands (26°N, 127°E), which locate in the southern part of Japan, have been known as major breeding grounds for the humpback whales (*Megaptera novaeangliae*). It is approved by continuous researches showing existence of newborn calves and mating pods, and re-sightings of individual whales in the same season or over seasons proved by fluke photo identification. The biological research on this species has been operated in the Ogasawara and Ryukyu Islands since 1989 and in the Babuyan Islands, northern Luzon, Philippines since 1999 respectively. During 1989-1994, 490 individuals were identified in the Ogasawara Islands (including photos taken in 1987-88) and 89 in the Ryukyu Islands, and 28 individuals were found in both waters. The dense interchanges of species between these two regions indicates that the species that migrate to both regions belong to the same population so-called "Asian stock". Furthermore, to determine the southern margin of the Asian stock distribution, sighting surveys were conducted in the water of the Mariana Islands in 1995 and 1996. Although no humpback whales were sighted in those surveys, some sightings were reported by residents with photographs as evidence. Additionally, five of ten whales, which have been identified in the northern part of the Philippines since 1999, were matched to the ones in Ogasawara-Ryukyu ID photo collections. Of these five whales, three were found in Ogasawara, one was in Ryukyu and one was in both regions. Although it is assumed that the humpback whales in the breeding ground of the western North Pacific are still densely distributed in the Ogasawara and Ryukyu Islands, their recent distribution extends to the waters of the Philippines and the Mariana Islands.

Songs of a Humpback Whale (*Megaptera novaeangliae*) in Taiwan

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There were 1~60 humpback whales whaled every year during 1920~1967 in southern Taiwan. However, only a few sights were recorded in the past twenty years. A male humpback whale was sighted on the east coast of Taiwan in March, 2000. His songs recorded during between three-day tailing were analysed. There were five themes and nine units in the songs, a complete song duration lasted about 14.2 minutes. The maximal sound pressure level was 189.6 dB (n=32, SEM =2.81). The acoustic characters (i.e., signal duration, time between two signals, theme duration, fundamental frequency) of the songs were not significant different. A visual comparison of the spectrograms of the sound units from this particular whale with those northwest Pacific Ocean showed similarity. This individual was a member of the population in the northwest Pacific Ocean. This conclusion was also supported by the result of Photo-ID of its fluke.

Population Status and Bycatches of Cetaceans in Chinese Waters

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Thirty five species of cetaceans have been reported from Chinese waters. The population of the baiji (*Lipotes vexillifer*), Yangtze finless porpoise (*Neophocaena phocaenoides asiaeorientalis*), Pacific humpbacked dolphin (*Sousa chinensis*) and Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) have been estimated. The habitat degraded as a result of extensive development along the coast. Pollution assessment data indicated that there was a drop in water quality in Bohai Bay; Laizhou Bay; the northern Yellow Sea; Jiaozhou Bay; off the Jiangsu coast; Hangzhou Bay; the Yangtze River estuary; the Zhoushan Fishing Ground and the Pearl River estuary. Main pollutants in Chinese coastal waters included inorganic nitrogen, inorganic phosphorous and oil. Fisheries resources have declined dramatically in the coastal zone. By-catches of cetacean in the coastal fisheries include finless porpoise, long-beaked common dolphin (*Delphinus capensis*), bottlenose dolphin (*Tursiops* sp.), pantropical spotted dolphin (*Stenella attenuata*), false killer whale (*Pseudorca crassidens*), Risso's dolphin (*Grampus griseus*), common minke whale (*Balaenoptera acutorostrata*), and fin whale (*B. physalus*). In 1994, the annual incidental catches of small cetacean in coastal waters south of the Yangtze River were about 3045 ± 2120 individuals, of which more than seventy per cent were the finless porpoise. A series of laws and provisions to protect wildlife, including cetaceans, have been enacted at various levels. However, surveys to assess cetacean abundance, and impacts of habitat degradation and by-catch to cetaceans are recommended.