Preliminary checklist of Cetacea in the Indonesian Archipelago and adjacent waters

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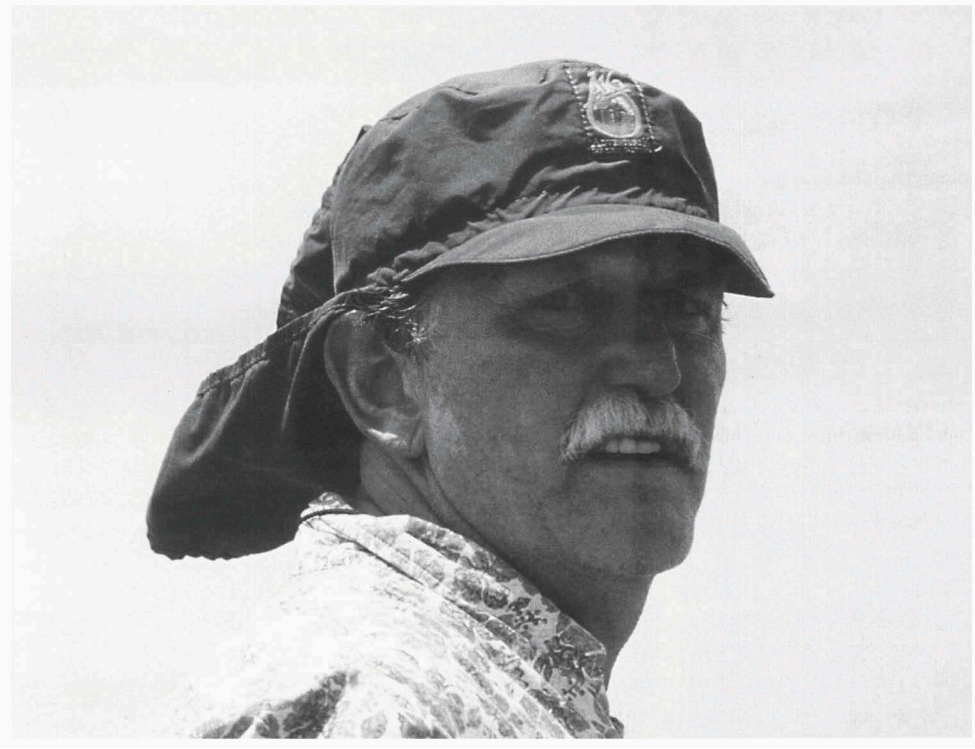
Key words: Cetacea; Indonesia; Malaysia; Brunei; Singapore; Indian Ocean; Pacific Ocean.
Records of 29 species of cetaceans from the Indonesian Archipelago have been gleaned from published and unpublished sources, representing five families: Phocoenidae (1 species), Delphinidae (16), Ziphiidae (3), Physeteridae (3), and Balaenopteridae (6). The presence of 26 species could be confirmed by material in museum collections, photographs or documentation by specialists. The occurrence of three species is still unconfirmed.

Obituary

Stephen Leatherwood died on 25 January 1997, at the age of 53, after a long illness. With him, marine mammalogy has lost one of its finest workers. His numerous publications, both scientific and popular, have contributed tremendously to the knowledge of marine mammals and the dissemination of this knowledge among a broad public. Those who worked with him were greatly impressed by his zeal and energy, his dedication to the animals and their environment, his clear writing, his charm and integrity, and his constant encouragement of others, professionals and laymen alike. It was Steve who brought up the idea of compiling our data for this checklist of Indonesian cetaceans, and he wholeheartedly let us have his records. Sadly, he did not live to see the final result. We will miss him badly as a wonderful friend and colleague, and an indefatigable fighter for the conservation of whales and dolphins all over the world.

Introduction

In 1979 the International Whaling Commission (IWC) declared all of the Indian Ocean north of 55° S to be a whale sanctuary (IWC, 1980). The sanctuary, in which commercial whaling was prohibited for at least ten years, with provision for extensions, consists of Northern Hemisphere waters from the coast of Africa to 100° E, including the Red and Arabian Seas and the Gulf of Oman, and Southern Hemisphere waters between 20° and 130° E, from the equator to latitude 55° S. Efforts to study the cetacean fauna of the sanctuary have focussed on describing the distribution and abundance of the many cetacean species in this region and determining the level of their involvement with fisheries (Keller et al., 1982; Leatherwood et al., 1984; Leatherwood, 1986; Leatherwood & Donovan, 1991). Forty-three species have been found within the sanctuary (IWC, 1980). Most are known from only fragmentary records,



Stephen Leatherwood. Photo by Thomas A. Jefferson; Vietnam, 1995.

and distribution and movements within particular sections of this area are generally poorly documented.

The majority of nations fringing the Indian Ocean are developing countries, with a high population growth and rapid industrialization. Many coastal waters, and some sections of the high seas, are affected by increasing pollution and growing fishing industries. Cetaceans occurring in these waters are threatened by incidental catch in fishing gear, by direct exploitation (e.g. Sri Lanka: Leatherwood & Reeves, 1989) and presumably by habitat degradation. However, the most elementary data needed to evaluate the effects of these possible threats on local populations are lacking for almost all areas. The eastern border of the sanctuary passes through Indonesia at longitude 100° E; thus, the sanctuary covers most of the Indonesian extended economic zone (EEZ). The Indonesian Archipelago contains some 5 million km^2 of territory (including water and land), of which 62% consists of seas within the 12-mile limit (Polunin, 1983). Indonesian seas are rich in dolphins, and the deeper eastern waters have been supposed to be an important migration route for some of the larger whales (Mörzer Bruyns, 1971; Polunin, 1983), though there is no clear evidence of this.

Although Indonesia is known as a former whaling ground for sperm whales, the abundance and distribution of cetaceans in Indonesian waters is poorly known. Sperm whales were hunted by British and American ("Yankee") whalers during the

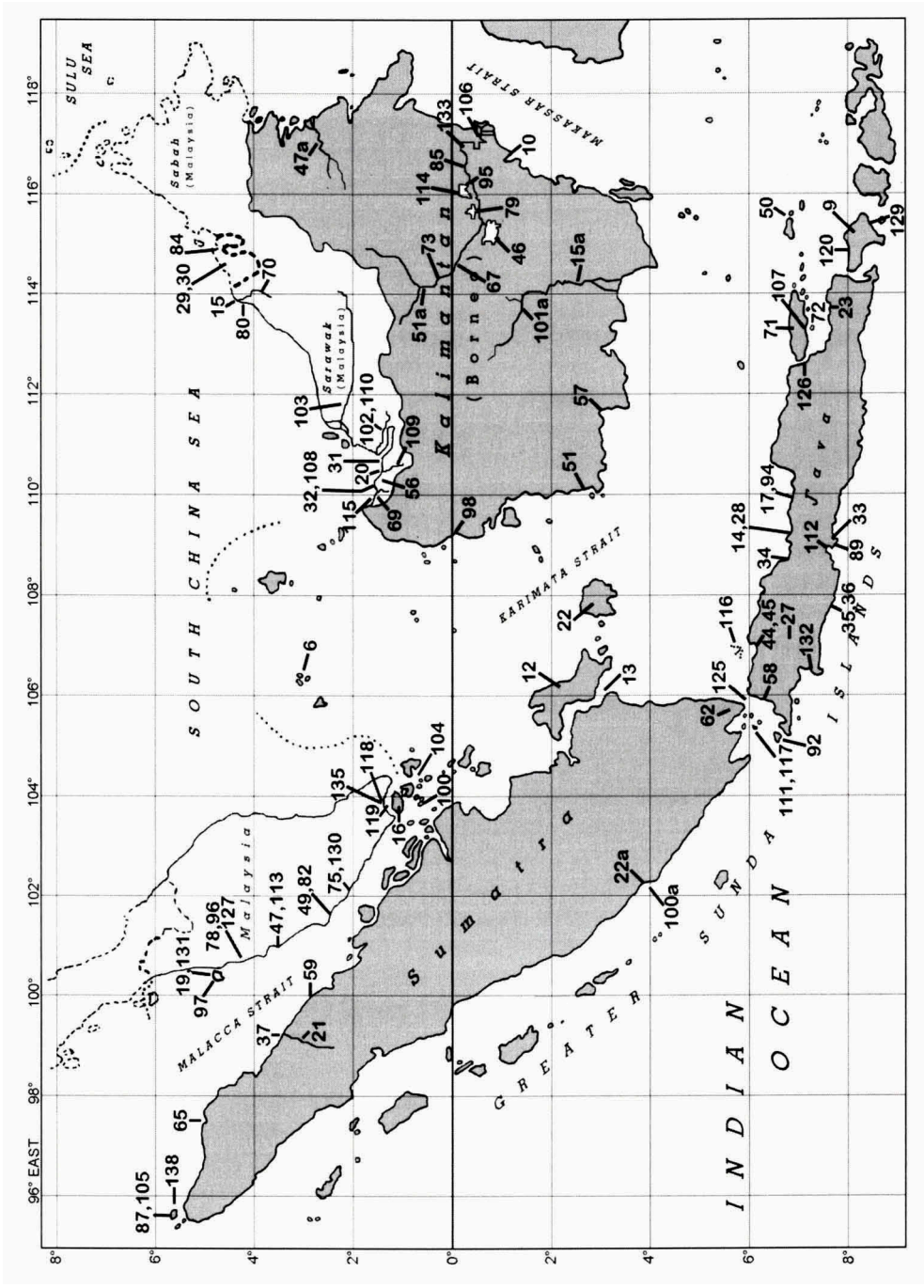
19th century, particularly in the deeper waters in the eastern part of the archipelago (Beale, 1839; Townsend, 1935; Barnes, 1991). Although the logbooks of some whaling captains who operated in Indonesian waters also contain information on other cetaceans seen and caught, these books have not been studied.

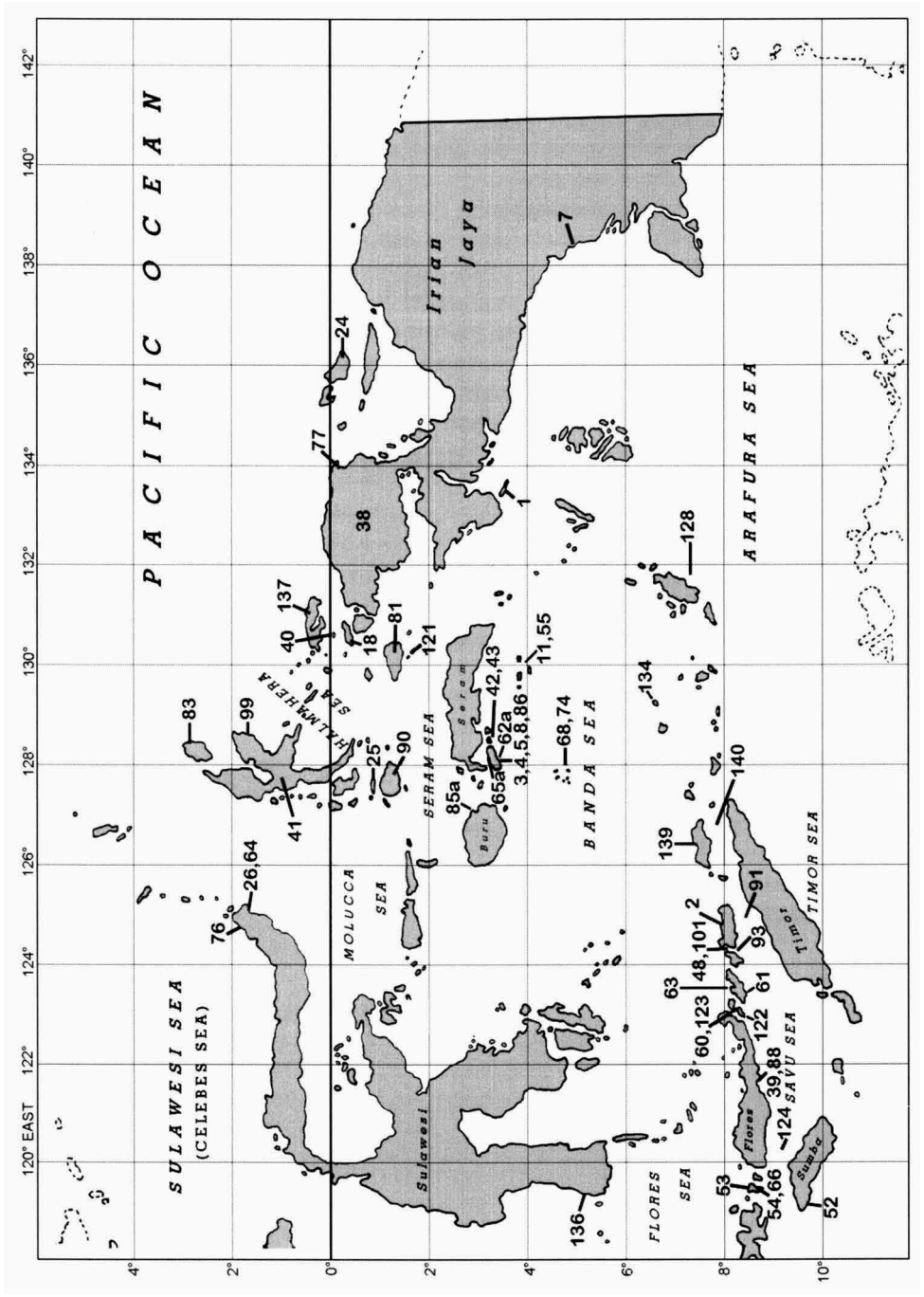
The first scientific records of cetaceans in Indonesia are from Dutch naturalists. Weber (1902, 1923), who visited the archipelago with the Dutch Siboga Expedition (1899-1900), compiled a list of 16 species based on stranded animals and on observations of the whale fishery in the villages of Lamakera on the island of Solor, and Lamalera (= Lamararap) on the island of Lembata (= Lomblen) in eastern Indonesia. Reuter (1919) published on a large *Balaenoptera* stranded on the south coast of Java; Dammerman (1924) reported on a mass stranding of pilot whales *Globicephala macrorhynchus* on the north-east coast of Java, including some notes on a few other species, and recorded a stranding of a Cuvier's beaked whale *Ziphius cavirostris* from northern Java (Dammerman, 1926). Two articles were published in Dutch: by Dammerman (1938) on a fin whale *Balaenoptera physalus* stranded on the south coast of Java, and by Van Bemmel (1939) on the finless porpoise *Neophocaena phocaenoides.* In his field guide to whales and dolphins, Mörzer Bruyns (1971) referred to several sightings of dolphins in Indonesian waters. In most cases, however, his species identifications are tentative and his descriptions and drawings of the animals do not allow reliable identifications. We have omitted those records.

More recent information on cetaceans in Indonesia was provided by Leatherwood et al. (1984), Leatherwood (1986), and Tas'an & Leatherwood (1983). In 1979 the World Wildlife Fund conducted a project on whaling off Lamalera and Lamakera (Barnes, 1980; Hembree, 1980). The primary objective of that study was to establish the significance of this fishery and its effect on the cetaceans in the area. Other objectives were to determine the cultural and economic importance of whaling to the local population and to provide a detailed account of the numbers and species hunted, and other biological information from the catches. In Lamalera, there are hunts for sperm whales *Physeter macrocephalus,* killer whales *Orcinus orca,* various dolphins and small toothed whales, manta rays *Manta birostris,* leatherback turtles *Dermochelys coriacea,* and smaller sea turtles (e.g. *Caretta caretta* and *Eretmochelys imbricata*), sun fish *Mola mola,* marlin *Makaira* sp., whale shark *Rhincodon typus,* and several other kinds of sharks. Barnes (1991) reported that villagers in Lamakera hunt a similar range of species but, except for an occasional Cuvier's beaked whale *Ziphius cavirostris,* do not take odontocetes, confining themselves instead to the baleen whales which enter the shallow Solor Strait. However, material collected from the same island by Weber (1902, 1923) includes both mysticetes and odontocetes.

Although a number of reports have been published on individual species or groups of species occurring in Indonesian waters as, e.g., on the Irrawaddy dolphin *Orcaella brevirostris* (Tas'an et al., 1980; Wirawan, 1989; Priyono, 1995), there has been no comprehensive account of this area's diverse and rich cetacean fauna. Furthermore, much information has remained unpublished and exists only in difficult-to-obtain "grey" literature or in researchers' field notes.

This paper summarizes information on the distribution, movements, abundance and seasonality of cetaceans known to occur in Indonesian waters (here defined as


SULU SEA
Sabah (Malaysia)
SOUTH CHINA SEA
Sarawak (Malaysia)
Kalimantan (Borneo)
MAKASSAR STRAIT
KARIMATA STRAIT
Malaysia
MALACCA STRAIT
Sumatra
GREATER SUNDA ISLANDS
Java
INDIAN OCEAN
96° EAST
98°
100°
102°
104°
106°
108°
110°
112°
114°
116°
118°
8°
6°
4°
2°
0°
2°
4°
6°
8°


PACIFIC OCEAN
SULAWESI SEA
(CELEBES SEA)
MOLUCCA SEA
SERAM SEA
HALMAHERA SEA
BANDA SEA
ARAFURA SEA
TIMOR SEA
FLORES SEA
SAVU SEA
Irian Jaya
Sulawesi
Seram
Buru
Timor
Flores
Sumba
120° EAST
122°
124°
126°
128°
130°
132°
134°
136°
138°
140°
142°
4°
2°
0°
2°
4°
6°
8°
10°

the marine waters from 6° N to 10° S and 95° to 142° E). This summary was prepared from data in the literature, material preserved in scientific collections, and from unpublished field notes by the authors and other workers. Quite obviously, we were unable to verify all published records and in many cases we had to rely on the authors' and correspondents' identifications. Wherever we have reasons for doubt, we have stated this.

Our list of cetaceans reported to occur in the seas of the Indonesian Archipelago contains 29 species, representing the families Phocoenidae (1 species), Delphinidae (16), Ziphiidae (3), Physeteridae (3) and Balaenopteridae (6). The presence of 26 species could be confirmed by skeletal and other material in museum collections, photographs, or documentation by specialists. Pending irrefutable evidence, we regard the occurrence of three species as still unconfirmed: *Stenella coeruleoalba, Balaenoptera acutorostrata* and *Megaptera novaeangliae*.

The Indonesian names for the various species have been taken from an unpublished list by I.S. Suwelo and his collaborators, dated 1 April 1996. The names in Lamaholot, the language spoken on eastern Flores, Solor and Lembata Islands, are based on Hembree (1980), Barnes (1991) and records by P. Rudolph made in 1993.

Museum abbreviations.— ANCA, Australian Nature Conservation Agency, Canberra; ANSP, Philadelphia Academy of Natural Science, Pittsburgh, Pennsylvania; BMNH, British Museum (Natural History), London; FMNH, Field Museum of Natur-

Figs 1, 2. Indonesian Archipelago, with numbers indicating localities mentioned in the text.

1, Adi Island; 2, Alor Island; 3, Ambon Bay; 4, Ambon City; 5, Ambon Island; 6, Anambas Archipelago; 7, Asmat Coast; 8, Baguala Bay; 9, Bali; 10, Balikpapan; 11, Banda Archipelago; 12, Bangka Island; 13, Bangka Strait; 14, Bangsri; 15, Baram; 15a, Barito River; 16, Batam Island; 17, Batang; 18, Batanta Island; 19, Batu Maung; 20, Beardi; 21, Belawan Deli River; 22, Belitung Island; 22a, Bengkulu; 23, Besuki; 24, Biak Island; 25, Bisa Island; 26, Bitung; 27, Bogor; 28, Brebes; 29, Brunei; 30, Brunei River; 31, Buntal; 32, Cape Sipang; 33, Cilacap; 34, Cirebon; 35, Cikelet; 36, Cilauteureun; 37, Deli District; 38, Doberai Peninsula; 39, Ende; 40, Gam Island; 41, Halmahera; 42, Haruku Island; 43, Haruku Strait; 44, Jakarta; 45, Jakarta Bay; 46, Jempang Lake; 47, Jeram; 47a, Kajan River; 48, Kalabahi Bay; 49, Kampong Sungei Layang; 50, Kangean Archipelago; 51, Kendawangan; 51a, Kiham Halo; 52, Kodi; 53, Komodo Island; 54, Komodo Village; 55, Kraka Island; 56, Kuching; 57, Kumai Bay; 58, Labuhan; 59, Labuhanruku; 60, Lamakera; 61, Lamalera; 62, Lampongs; 62a, Katuhalat; 63, Lembata Island; 64, Lembeh Strait; 65; Lhokseumawe; 65a, Liang (Ambon Island); 66, Liang Bay; 67, Longiram; 68, Lucipara Archipelago; 69, Lundu; 70, Lutong River; 71, Madura Island; 72, Madura Strait; 73, Mahakam River; 74, Mai Island; 75, Malacca Town; 76, Manado; 77, Manokwari; 78, Matang; 79, Melintang Lake; 80, Miri; 81, Misool Island; 82, Morib; 83, Morotai Island; 84, Muara Island; 85, Muarakamen; 85a, Namlea; 86, Natsepa; 87, Nias; 88, Nolopolo; 89, Nusa Kambangan; 90, Obi Island; 91, Ombai Strait; 92, Panaitan Island; 93, Pantar Island; 94, Pekalongan; 95, Pela River; 96, Perak; 97, Pinang Island; 98, Pontianak; 99, Pt. Lili; 100, Pul(a)u Sugi; 100a, Pul(a)u Tikus; 101, Pura Island; 101a, Purukcahu; 102, Pusa; 103, Rajang River; 104, Riau Archipelago; 105, Sabang; 106, Samarinda; 107, Sampang; 108, Santubong; 109, Sarawak River; 110, Saribas River; 111, Sebesi Island; 112, Segara Anakan; 113, Selangor; 114, Semajang Lake; 115, Sematan; 116, Seribu Island; 117, Sertung Island; 118, Singapore; 119, Singapore Strait; 120, Singaraja; 121, Sissie Island; 122, Solor Island; 123, Solor Strait; 124, Sumba Strait; 125, Sunda Strait; 126, Surabaya; 127, Taiping; 128, Tanimbar Archipelago; 129, Tanjung Batutiga; 130, Telok Mas; 131, Telok Tempoyah Kechil; 132, Tenate; 133, Tenggarong; 134, Teun Island; 135, Tuas Bay; 136, Ujung Pandang; 137, Waigeo Island; 138, Weh Island; 139, Wetar Island; 140, Wetar Strait.

al History, Chicago; GSJA, Gelanggang Samudera Jaya Ancol = Jaya Ancol Oceanarium, Jakarta; MCZ, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts; MNHN, Muséum national d'Histoire naturelle, Paris; MZB, Museum Zoologicum Bogoriense, Bogor; NMR, Natuurmuseum (National History Museum), Rotterdam; NMV, National Museum of Victoria, Melbourne; NMW, Naturhistorisches Museum, Wien; NSM, National Science Museum, Tokyo; NTM, Northern Territory Museum and Art Gallery, Darwin; RMNH, National Museum of Natural History (Rijksmuseum van Natuurlijke Historie), Leiden; SAM, Sarawak Museum, Kuching; USNM, National Museum of Natural History, Washington, D.C.; WAM, Western Australian Museum, Perth; ZMA, Zoölogisch Museum, Amsterdam; ZMAN, Zoological Museum of the Academy of Sciences, Moscow; ZRC, Zoological Reference Collection of the National University of Singapore (formerly of the Raffles Museum, Singapore).

Family Phocoenidae

Neophocaena phocaenoides (G. Cuvier, 1829) - Finless porpoise

Indonesian: Lumba-lumba tak bersirip.

The finless porpoise is found in the lower course of rivers and in coastal waters from the Persian Gulf through the Indian subcontinent to Southeast Asia and Indonesia, thence north along the Chinese coast to the Korean Peninsula and Japan. Finless porpoises are reported from mangrove areas, estuaries, deltas and a few freshwater lakes connected with rivers and are found in at least the lower courses of all major rivers in the area (Leatherwood & Reeves, 1983; Klinowska, 1991).

The first record of the finless porpoise in Indonesian waters was given by Kükenthal (1896), who mentioned five specimens, presumably mounted skins, in the Sarawak Museum (existence not confirmed), originating from rivers in Borneo (see also Banks, 1931; Gibson-Hill, 1949, 1950). Flower (1900) mentioned a mounted specimen (listed as *Phocæna phocænoides*) caught off Matang, Perak, Malaysia, in a museum at Taiping, Malaysia. Material of *N. phocaenoides* has been documented from Java, Sarawak, Singapore and an unknown locality on Borneo (Tomilin, 1957; Pilleri & Gihr, 1972; Van Bree, 1973; Tas'an & Leatherwood, 1983; L.M. Chou, L.R. Heaney, P.D. Jenkins and J.G. Mead, pers. comm.): skeleton and mounted skin (ZMAN 71-96 and 71-97) of a male (TL 1.16 m), Borneo, date unknown; mounted skin (BMNH 1953.12.11.1), Sarawak, date unknown; skull (BMNH 1966.12.6.1), Sarawak, date unknown; skeleton (MZB 2431), Jakarta Bay, Java, 3 May 1930. Van Bemmel (1939) reported a second specimen acquired by the Museum Zoologicum Bogoriense, collected near the coast of the Lampongs, south-eastern Sumatra, on 3 April 1939; however, the existence of this could not been confirmed; two incomplete skulls (ZRC 4.1571), presumably from Malaysian waters (L.M. Chou, pers. comm.), date unknown; skeleton (FMNH 99613), Santubong, Sarawak, 9 July 1966; skull (ZRC), Pasir Ris Park beach, Singapore, 3 July 1996. The records from river deltas along the Asmat coast, south-western Irian Jaya (New Guinea) mentioned by Watson (1981) are given without further comments or description. We regard them as unsubstantiated.

Tas'an & Leatherwood (1983) reported the species from the Java Sea near the coasts of south-eastern Sumatra and Java, between the islands of Bangka and Belitung, where it inhabits the shallow coastal belt. Two animals were held briefly at Jaya Ancol Oceanarium, Jakarta. They had accidentally been gill-netted in mid-November 1975 by fishermen working between Batang and Pekalongan, northern Java, at approximately 7°08' S 109°40' E. The smaller individual, about 75 cm long and of undetermined sex, died after only a few days. The larger animal, a female of about 1 m long, survived for one week (Tas'an & Leatherwood, 1983). Sigurdsson & Yang (1990) reported on two sightings of small, bluish grey, finless animals in the Johore estuary and Nanas Channel, in Singapore waters, which almost certainly were this species.

Family Delphinidae

Steno bredanensis (Lesson, 1828) - Rough-toothed dolphin

Indonesian: Lumba-lumba gigi kasar.

The rough-toothed dolphin is an oceanic species occurring in all tropical and warm temperate seas, but its distribution is poorly known (Miyazaki & Perrin, 1994).

Material is available from Java and Borneo: skull, complete (RMNH 31179), and rostrum with lower jaw (RMNH 31180), both specimens collected by C.G.C. Reinwardt in Java, during the period 1816-1822 (syntypes of *Delphinus reinwardtii* Schlegel, 1841); further one skull (RMNH 31178), "Java ?", 1863; foetus, alcohol (RMNH), Borneo, 1839. The seven skulls mentioned by Weber (1923) as most probably originating from the Indonesian Archipelago, may in fact be from Senegal (P.J.H. van Bree, pers. comm.).

We have only two sightings of rough-toothed dolphins in Indonesian waters: P. Rudolph observed two groups off Lamalera, Lembata Island, in September 1993. Thirty individuals were encountered close to a large mixed group of *Stenella longirostris* and *S. attenuata* at 8°35' S 123°28' E, on 11 September. The animals were scattered in subgroups of 2-3 or as single individuals and were milling in an area of about 1 km^2. Seven animals were seen at 8°37' S 123°26' E, moving slowly eastward in two subgroups (4 and 3), on 28 September. They were difficult to approach, avoiding the boat and reacting with erratic swimming and prolonged diving (>5 min). No calves were seen.

Sousa chinensis (Osbeck, 1765) - Indo-Pacific humpback dolphin

Indonesian: Lumba-lumba putih Cina.

The humpback dolphin is widely distributed in warm temperate and tropical coastal and inshore waters from South Africa to the Red Sea and Thailand, through the Indo-Australian Archipelago to the northern East China Sea and the Australian coast (Ross et al., 1995). The taxonomic relationships within the genus *Sousa* are poorly understood, because specimens and other data are scarce or lacking for large parts

of the distribution area. Ross et al. (1995) reviewed the taxonomic status of humpback dolphins, by studying samples from South Africa and Australia and additional data from the Arabian Gulf and Hong Kong. They concluded that the differences between these samples did not provide sufficient evidence for the presence of more than one species. However, humpback dolphins from Sarawak waters and from the Arafura Sea are characterized by a low and ridge-like dorsal fin. The authors suggest that this may be characteristic of *Sousa* throughout the Indonesian/Malayan region.

Material is known from Sarawak and from the Arafura Sea (Weber, 1923; Medway, 1977; Ross et al., 1995; L.M. Chou, L.R. Heaney and P.D. Jenkins, pers. comm.): skull (ZRC 4.1572), presumably from Malaysian waters (L.M. Chou, pers. comm.), date unknown; skeleton (BMNH 1914.1.14.1), Sarawak, date unknown; specimen (NTM U660), Arafura Sea at 9°36' S 135°37' E, date unknown; skeleton and mounted skin of a female (BMNH 1901.2.16.1), Cape Sipang, Sarawak River, Sarawak, 12 December 1900, type of *Sotalia borneensis* Lydekker, 1901 and catalogued as *Sousa plumbea*; skull of male (FMNH 99607), Santubong, Sarawak, 19 June 1964; skull of female (FMNH 99611), Santubong, Sarawak, 4 August 1965; skeleton of male (FMNH 99612), Santubong, Sarawak, 17 June 1966, catalogued as *Sotalia fluviatilis* (specimens at FMNH were formerly in the Sarawak Museum); photograph (ANCA) of an adult male (TL 2.54 m), Arafura Sea at 12°57' S 126°24' E, taken on 14 October 1984.

Humpback dolphins are regularly seen in Singapore waters (Mörzer Bruyns, 1971; Sigurdsson & Yang, 1990; Chou, 1995).

Grampus griseus (G. Cuvier, 1812) - Risso's dolphin (fig. 3)

Indonesian: Lumba-lumba abu-abu.
Lamaholot: Temu bura.

Risso's dolphin occurs in tropical and warm temperate seas throughout the world, generally in water deeper than 1000 m (Klinowska, 1991). Risso's dolphins were seen during surveys conducted for small cetaceans in the Indian Ocean between the months of November and June (Gambell et al., 1975; Keller et al., 1982; Leatherwood et al., 1984; Leatherwood, 1985; Alling, 1986; Leatherwood & Reeves, 1989). Kruse et al. (1991) summarized the available information on Risso's dolphin in the Indian Ocean till December 1986.

The occurrence of the species in Indonesian waters has been documented by the following material (Weber, 1923; Medway, 1977; P.J.H. van Bree and L.R. Heaney, pers. comm.): two damaged calvariae (ZMA 7793 and 7794), Lamakera, Solor Island, 1899/1900; skull (FMNH 99609), Lundu, Sarawak, 1955 (formerly in the Sarawak Museum).

Mörzer Bruyns (1971) observed a group of 20 Risso's dolphins off Manokwari, Irian Jaya (New Guinea), with about 50 "*Stenella malayana*" (= *S. attenuata*?). Hembree (1980) saw a total of 19 animals in three pods in the waters adjacent to the whaling village of Lamalera, Lembata Island, on 25 August, 1 September and 3 September 1979. S. Leatherwood saw approximately 25 animals in Pantar Strait between Pura and Alor Island on 16 August 1991. Risso's dolphins were seen on two occasions in May and June 1993 by Eyre (1995): one animal south of the Tanimbar Archipelago,

Fig. 3. Two surfacing Risso's dolphins, in a herd of approximately 100 with a large herd of spinner and spotted dolphins south-east of Lamalera, Lembata Island at 8°38' S 123°28' E (11 September 1993). Photo by P. Rudolph.

Arafura Sea, on 27 May; and two animals with unidentified dolphins, south of Timor, Timor Sea at 10°25' S 125°30' E, on 29 May. P. Rudolph observed a total of 150 Risso's dolphins during five sightings off Lamalera between 11 September and 2 October 1993. A group of approximately 100 animals was observed with a large herd of spinner *Stenella longirostris* and spotted dolphins *S. attenuata* at 8°38' S 123°28' E, on 11 September (fig. 3); 7 animals were seen at 8°39' S 123°29' E, on 25 September; 15 individuals at 8°40' S 123°22' E, on 30 September; 8 and 20 animals, respectively, at 8°39' S 123°23' E and 8°40' S 123°21' E, on 2 October. Four of the groups (seen on 11, 30 September and 2 October) contained calves.

Tursiops truncatus (Montagu, 1821) - Bottlenose dolphin

Indonesian: Lumba-lumba hidung botol.

The bottlenose dolphin is found throughout the world in temperate and tropical waters, both inshore and offshore (Klinowska, 1991). The genus *Tursiops* has been divided into several putative species and subspecies; however, most recent reviews favour recognizing it as monotypic, albeit with several distinct geographical forms

Table 1. Sighting records of *Tursiops truncatus* in the Indonesian Archipelago

Date	Location	Details / Source
Oct./Nov. 1978	South-eastern Malaysia, South China Sea	several animals seen (Abel & Leatherwood, 1985)
10 July 1979	Singapore Strait	approx. 15 (Sigurdsson & Yang, 1990; Chou, 1995)
20 July 1979	c. 1 km south of Lamalera	3 (Hembree, 1980)
2 April 1983	6°01' S 105°38' E, south-east of Sebesi Island, Sunda Strait	4-5 (Leatherwood et al., 1984; Leatherwood, 1986)
3 April 1983	2°28' S 107°05' E, east of Bangka Island	approx. 10 animals (Leatherwood et al., 1984; Leatherwood, 1986)
3 April 1983	2°02' S 106°41' E, east of Bangka Island	4-5 (Leatherwood et al., 1984; Leatherwood, 1986)
3 April 1983	1°24' S 106°32' E, north-east of Bangka Island	5 (Leatherwood et al., 1984; Leatherwood, 1986)
4 April 1983	1°16' N 104°47' E, Riau Archipelago	7-8 (Leatherwood et al., 1984; Leatherwood, 1986)
5 April 1983	1°40' N 102°40' E, Malacca Strait	6-7 (Leatherwood et al., 1984; Leatherwood, 1986)
5 April 1983	2°18' N 101°52' E, Malacca Strait	approx. 20 (Leatherwood et al., 1984; Leatherwood, 1986)
5 April 1983	2°18' N 101°51' E, Malacca Strait	3 (Leatherwood et al., 1984; Leatherwood, 1986)
5 April 1983	2°30' N 101°40' E, Malacca Strait	15 (Leatherwood et al., 1984; Leatherwood, 1986)
5 April 1983	2°50' N 101°08' E, Malacca Strait	5 (Leatherwood et al., 1984; Leatherwood, 1986)
6 April 1983	5°42' N 100°08' E, Malacca Strait	2 (Leatherwood et al., 1984; Leatherwood, 1986)
4 January 1984	5°11' S 119°15' E, Makassar Strait	3 (Snellius-II Expedition, C. Smeenk)
15 January 1985	2°19' N 128°45' E, off Morotai Island, Halmahera	some tens in company of *Globicephala macrorhynchus* (Snellius-II Expedition, C. Smeenk)
18 January 1985	2°27' S 128°03' E, Seram Sea	approx. 10 (Snellius-II Expedition, C. Smeenk)
15 June 1985	5°50' S 106°40' E, Java Sea	approx. 5 (Snellius-II Expedition, C. Smeenk and other observers)
?	2 km north of Batam Island, Singapore Strait	3-4 (Hiscock, 1991)
27 May 1993	9° S 131°E, south of Tanimbar Archipelago, Arafura Sea	1 animal (Eyre, 1995)

(some of which are discussed by Ross & Cockcroft, 1990). The form *Tursiops aduncus* (Ehrenberg, 1833) in the Indian Ocean and tropical western Pacific is, according to some authors, characterized by a spotted ventral surface in adults and there are good reasons to regard this as a distinct subspecies of *T. truncatus* (see Ross & Cockcroft, 1990). In Indonesian waters, spotted adult bottlenose dolphins have been recorded in the Java and Arafura Seas (Tas'an, 1985 cited from Ross & Cockcroft, 1990; Ross & Cockcroft, 1990).

We know of the following material collected in Indonesia (Weber, 1923; Tas'an & Leatherwood, 1983; Leatherwood, 1986; Miyazaki, 1986; Strack, 1993; P.J.H. van Bree and E.J.O. Kompanje, pers. comm.): calvaria (ZMA 22.547), Panaitan Island, western Java at 6°36' S 105°14' E, date unknown; skull (NSM 25372) of a female (TL 2.52 m), caught off Irian Jaya, Pacific Ocean at 5°14' N 131°03' E, date unknown; calvaria (ZMA 7967), Sissie Island, eastern Seram Sea, date unknown; calvaria (ZMA 7964), Cheribon (= Cirebon), northern Java, around 1890; calvaria (ZMA 7963), Lamakera, Solor Island, 8 February 1900; calvaria (ZMA 7965), Deli District, north-eastern Sumatra, between 1905 and 1917; skull (RMNH 12715), Biak Island, north-eastern Irian Jaya, about 10 December 1954; skull of a dolphin which died in 1979 at Jaya Ancol Oceanarium, deposited in the Museum Zoologicum Bogoriense (cited as *T.* cf. *aduncus* by Tas'an & Leatherwood, 1983); calvaria (ZMA 21.414), Ujung Pandang, Sulawesi, November 1980 (found under water); skull of an adult male (NMR 91019c, five photographs in file at NMR), Ambon Island, Molucca Sea, bought at the market of Ambon town on 16 November 1990 (the animal had been found entangled in fishing gear in Ambon Bay).

Experimental catches of bottlenose dolphins were conducted off Penang (Pinang) Island, Malacca Strait, Malaysia, by an Australian marine park in 1975; the animals were subsequently killed by fishermen for food (Leatherwood et al., 1984). Tas'an & Leatherwood (1983) report bottlenose dolphins for the Java Sea and west of Sumatra. Twenty-eight animals were captured by staff of Jaya Ancol Oceanarium, Jakarta, in the Java Sea at 6°21' S 110°02' E, in 1975, 1976, 1977, 1979 and 1982 (Tas'an & Leatherwood, 1983). In addition, one animal accidentally netted by fishermen near Manado, north-eastern Sulawesi, died before it could be transported to Jakarta. Nine bottlenose dolphins held at Ocean Park, Hong Kong, were imported from Indonesia in December 1987, where they had presumably been taken in the Java Sea (Reeves et al., 1994). Sightings from the following localities in Indonesian waters have been reported (see table 1): Malacca Strait, Singapore Strait, Riau Archipelago, east of Bangka Island, Sunda Strait, Java Sea, Molucca Sea, Seram Sea, and Arafura Sea.

Stenella attenuata (Gray, 1846) - Pantropical spotted dolphin

Indonesian: Lumba-lumba totol.
Lamaholot: Temu kirã.

The pantropical spotted dolphin occurs in all tropical seas, both in coastal waters and in the open ocean (Perrin & Hohn, 1994). Its distribution in the Indian Ocean was reviewed by Gilpatrick et al. (1987).

The species has been documented from various localities in the Indonesian Archi-

pelago (Weber, 1923; Leatherwood, 1986; Miyazaki, 1986; Gilpatrick et al., 1987; Robineau, 1990; J.L. Bannister, pers. comm.): mounted specimen (MNHN CGZ n° 21, holotype of *Delphinus brevimanus* Wagner, 1846) and two skulls (MNHN A.3028 and 1882-113, wrongly designated paratypes of *D. brevimanus* by Robineau, 1990), all from either Bangka Strait or "mer de Singapour", between 1837 and 1840; skull (RMNH 21634), between Java and Celebes (= Sulawesi), date unknown but before 1841, figured in Schlegel (1841) as *D. malayanus* Lesson, 1826; two skulls, incomplete: rostrum and lower jaw (RMNH 21632 and 21633), Java, between 1816 and 1822; two skeletons, incomplete (USNM 49633 and 49873), Malacca Strait, 9 April 1902 and 14 February 1906; seven skulls, incomplete (ZMA 13.183 - rostrum, ZMA 13.183a and ZMA 13.185 - calvariae, ZMA 13.343-13.346 - all damaged calvariae), Lamakera, Solor Island, 1 May 1899; skull (NSM 25371) of a female (TL 1.9 m), off Irian Jaya, Pacific Ocean at 5°14' N 131°03' E, date unknown; skull (WAM M23109), Indonesia, date unknown but presumably 1979 - this skull belongs to the material which Hembree (1980) collected during his study in Lamalera, but there are no further data (J.L. Bannister, pers. comm.). However, Hembree (1980) documented the harpooning of a male spotted dolphin (TL 2.13 m) at Lamalera, on 30 August 1979.

Alverson (1981) observed *S. attenuata* in the Banda Sea at 3°48' S 125°43' E, on 21 August 1976; and at 8°10' S 125°10' E, on 22 August 1976. C. Smeenk and co-observers saw >20 spotted dolphins west of Sumatra at 0°10' S 97°46' E, on 18 June 1985. S. Brasseur and co-observers saw several animals in Haruku Strait, between Ambon and Haruku Islands, Moluccas, in May/June 1990 (G.D.C. de Jong, pers. comm.). S. Leatherwood saw approximately 400 animals in the Savu Sea at 10°22' S 121°39' E, on 13 August 1991. P. Rudolph made 13 sightings off Lamalera, between 6 September and 5 October 1993. In ten sightings spotted dolphins were seen in mixed groups with spinner dolphins *S. longirostris*. Mixed groups ranged between an estimated 200 and 1500 individuals. On three occasions mixed groups of spotted and spinner dolphins were seen in company with rough-toothed dolphins *Steno bredanensis* (at 8°34' S 123°28' E, on 11 September), with Risso's dolphins *Grampus griseus* (at 8°36' S 123°28' E, on 11 September), and with Fraser's dolphins *Lagenodelphis hosei* (at 8°38' S 123°29' E, on 5 October). Three single-species groups of *S. attenuata* were recorded: an estimated 300 animals including calves were seen with tuna and birds (*Sterna* sp., *Anous* sp.) at 8°40' S 123°26' E, on 25 September; 40 animals with no calves at 8°36' S 123°24' E, on 28 September; and a group of 50 with several calves at 8°36' S 123°25' E, on 1 October.

All animals seen had only moderate spotting and coloration was highly variable. The following two basic colour patterns were observed: lighter overall coloration with no spotting or only dark spots in the abdominal region, resembling the two-toned and speckled stages of juveniles described by Perrin (1969); and darker coloration (well-defined contrast between dark cape and grey sides) with spotted peduncle, some spots on cape, and spotting on the ventral margin of the cape over the eye, resembling the mottled stage of adults described by Perrin (1969). Several individuals showed circular scars and open wounds, probably inflicted by cookie-cutter sharks *Isistius brasiliensis* (see Jones, 1971).

Stenella longirostris (Gray, 1828) - Spinner dolphin (fig. 4)

Indonesian: Lumba-lumba paruh panjang.
Lamaholot: Temu kirā.

The spinner dolphin inhabits tropical and subtropical waters all over the world (Perrin & Gilpatrick, 1994). Its distribution and behaviour have been well described for the eastern tropical Pacific (Perrin et al., 1983) and the Hawaiian Islands (Norris & Dohl, 1980; Norris et al., 1994). Less is known about the species' distribution in the Indian Ocean. Spinner dolphins in the Indian Ocean are characterized by a distinct tripartite colour pattern consisting of a dark-grey dorsal cape, a lighter grey lateral field and a white underside (Perrin, 1972, 1990; Douglas et al., 1992). Perrin et al. (1989) discussed the possible existence of a north-south cline in body size of spinner dolphins in the eastern Indian Ocean, judging from measurements of a dwarf form in the Gulf of Thailand and of small spinners bycaught in the gillnet fishery in the Timor and Arafura Seas off northern Australia. If there proves to be a distinct (dwarf) form of the species in Southeast Asia, the name *Delphinus roseiventris* Wagner, 1846 may apply; according to Perrin (1990), the probable holotype of this form is a small skull (MNHN 1882-104) from the Moluccas.

Robineau (1990) discusses the material of *Delphinus roseiventris* in the Muséum national d'Histoire naturelle, Paris. He does not mention the skull referred to by Per-

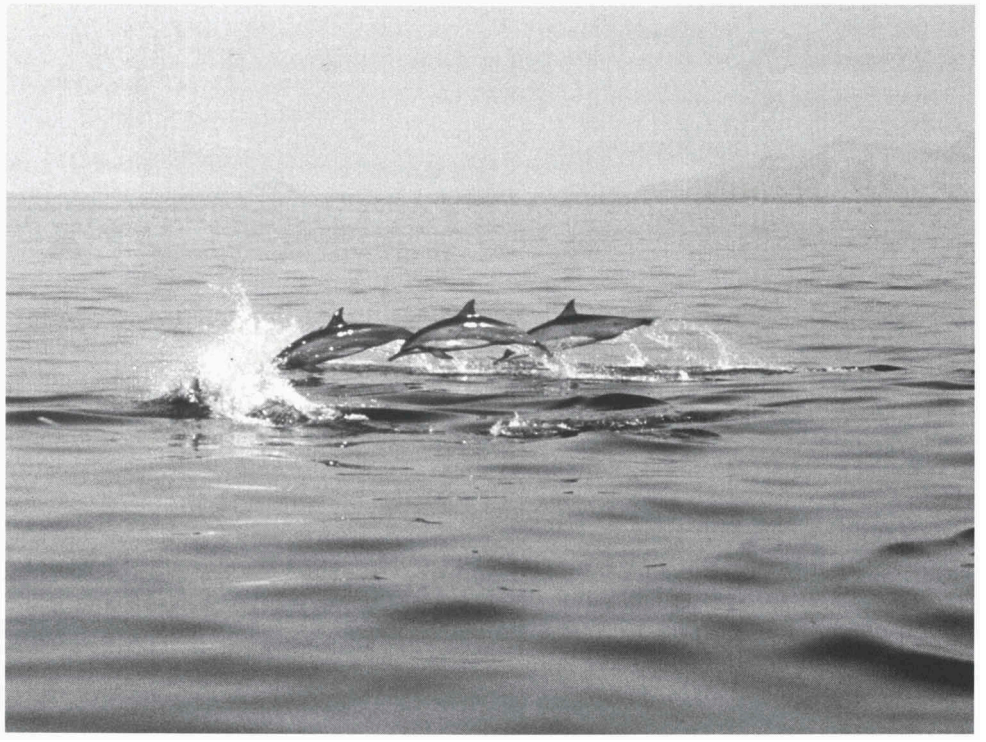


Fig. 4. Three spinner dolphins making an arcuate leap, in a mixed herd of approximately 300 with spotted dolphins off Lembata Island at 8°36' S 123°21' E (29 September 1993). Photo by P. Rudolph.

rin (1990) which apparently could not be found again (D. Robineau, pers. comm.), and was unable to identify with certainty any of the other specimens as the holotype of this form. According to him, skull (incomplete) MNHN A.3026, probably belonging with skeleton 1880-553, Molucca Sea, 4 March 1839, agrees best with the holotype; he wrongly designates this the lecotype of *Delphinus roseiventris* Wagner, 1846. By the same action, he unjustly regards the other specimens as paralectotypes: skull (incomplete) MNHN A.3027, probably belonging with skeleton 1880-554; calvaria (incomplete, MNHN 1928-192); and mounted skin (TL 1.08 m, MNHN CGZ n° 19), all collected in the Molucca Sea, between 1837 and 1840. Other material of *S. longirostris* has been documented from various localities (Dammerman, 1924; Hembree, 1980; Leatherwood, 1986; Gilpatrick et al., 1987; J.L. Bannister, J.G. Mead and W.F. Perrin, pers. comm.): skull (MZB 399), unknown locality and date, identified as *Delphinus roseiventris* by Dammerman (1924). This author believed that the skull was "derived from a place in the Indo-Australian Archipelago where people are hunting and eating these dolphins" and assumed that it came from either Solor or Lomblen (= Lembata) Island; skeleton of a male (USNM 049661), north coast of Sumatra, Malacca Strait, 6 April 1903; skull of a male (FMNH 99608), Santubong, Sarawak, 8 August 1965; skull (WAM M18643) of a female (TL 1.78 m), Lamalera, Lembata Island, 5 July 1979; skull (NMV 028546), Sertung Island, Sunda Strait at 6°60' S 105°23' E, 19 September 1984.

Nine spinner dolphins were caught by Jaya Ancol Oceanarium in the Java Sea at 6°02' S 110°02' E, in November 1976 (Tas'an & Leatherwood, 1983). No data are available on the sex and size composition of this catch. Eight of these dolphins were taken to the oceanarium, where seven died within 22 days; the eighth survived for 296 days, till 21 September 1977. Hembree (1980) reported the take of three animals in 1979 in the subsistence whale fishery in Lamalera, Lembata Island: two females, TL 1.78 m (WAM M18643) and 1.53 m and one male, TL 1.85 m. Sightings of the species in Indonesian waters from 1976 to 1995 are summarized in table 2. Spinner dolphins are regularly observed off northern Bali, west of Singaraja on a coast locally known as "Lovina Beach" (L. Koch and A. Hohn, pers. comm.). Between 70 and 100 boats were assumed to operate in "dolphin-watch" tours along the coast in March 1994 (L. Koch, pers. comm.).

Stenella coeruleoalba (Meyen, 1833) - Striped dolphin

Indonesian: Lumba-lumba bergaris.

The striped dolphin inhabits tropical and warm temperate waters around the world (Perrin et al., 1994b). In the Southeast Asian region the occurrence of the striped dolphin has been confirmed for China, Hong Kong, the Philippines, and Thailand (Andersen & Kinze, 1995; Parsons et al., 1995; Perrin et al., 1995; Zhou et al., 1995). No material of *S. coeruleoalba* is known from Indonesian waters and only one sighting has been published: a large group south off Java at 6°09' S 104°14' E, date unknown (Watson, 1981; Wilson et al., 1987). This record was given without further details and documentation. We regard this as unsubstantiated and the occurrence of the species in Indonesian waters as still unconfirmed.

Table 2. Sighting records of *Stenella longirostris* in the Indonesian Archipelago

Date	Location	Details / Source
20 November 1976	6°02' S 110°02' E, Java Sea	9 collected by Jaya Ancol Oceanarium (Tas'an and Leatherwood, 1983)
Oct./Nov. 1978	South-eastern Malaysia, South China Sea	sighting (Abel & Leatherwood, 1985)
4 July-18 September 1979	off Lamalera, Lembata Island, Savu Sea	about 3000 in 27 groups, landing of three animals (Hembree, 1980)
2 April 1983	north-west of Seribu Island, Java Sea	35-40 (Leatherwood et al., 1984)
3 April 1983	1°15' S 106°33' E, Java Sea	20-25 (Leatherwood et al., 1984)
5 April 1983	2°18' N 101° 52' E, Malacca Strait	10 (Leatherwood et al., 1984)
4 September 1984	3°45' S 128° 08' E, Seram Sea	sighting (Snellius-II Expedition)
13 October 1984	6°35' S 121°12' E, Flores Sea	50-60 (Snellius-II Expedition)
4 January 1985	5°13' S 119°03' E, Makassar Strait	about 10 (Snellius-II Expedition, C. Smeenk)
13 January 1985	0°32' S 126°45' E, Molucca Sea	some tens (Snellius-II Expedition, C. Smeenk)
21 January 1985	3°45' S 128°05' E, Seram Sea	some scores of *S. longirostris* with some scores of (probably) *S. attenuata* (Snellius-II Expedition, C. Smeenk)
23 January 1985	4°21' S 132°50' E, eastern Banda Sea	10-15 (Snellius-II Expedition, C. Smeenk)
29 January 1985	9°05' S 123°01' E, Savu Sea	15-20, associated with some scores of (probably) *S. attenuata* (Snellius-II Expedition, C. Smeenk)
2 February 1985	6°57' S 130°03' E, eastern Banda Sea	some tens (Snellius-II Expedition, C. Smeenk)
6 February 1985	3°46' S 128°03' E, Seram Sea	30-40 (Snellius-II Expedition, C. Smeenk)
15 June 1985	5°52' S 106°00' E, Sunda Strait	10+ (Snellius-II Expedition, C. Smeenk and other observers)
22 May 1986	2°09' N 122°16' E, north of Sulawesi, Sulawesi Sea	sighting (I.O. Stauch, cited in Gilpatrick et al., 1987)
7 June 1990	north coast of Irian Jaya	sighting (L. Hobbs)
8 June 1990	east of Pt. Lili, Halmahera Sea	sighting (L. Hobbs)

Table 2. Sighting records of *Stenella longirostris* in the Indonesian Archipelago

Date	Location	Details / Scource
11 June 1990	Channel between Obi and Bisa Island, eastern Molucca Sea	sighting (L. Hobbs)
15 June 1990	east of Alor Island	about 300 (L. Hobbs)
16 June 1990	8°53' S 121° 56' E, Savu Sea	sighting (L. Hobbs)
17 June 1990	8°50' S 119°31' E, Sumba Strait	15 (L. Hobbs)
24 July 1991	Kodi, Sumba Island, Savu Sea	sighting (L. Hobbs)
26 July 1991	Kodi, Sumba Island, Savu Sea	sighting (L. Hobbs)
28 July 1991	bay east of Lamalera, Lembata Island, Savu Sea	sighting (L. Hobbs)
29 July 1991	Kalabahi Bay, Alor Island	sighting, seen with tuna (L. Hobbs)
14 August 1991	8°43' S 122°46' E, Savu Sea	about 75 (S. Leatherwood)
16 August 1991	entrance Kalabahi Bay, Alor Island	about 100 (S. Leatherwood)
16 August 1991	8°16' S 124°31' E, Savu Sea	60-70 (S. Leatherwood)
19 August 1991	Kraka Island, Banda Archipelago, Banda Sea	sighting (S. Leatherwood)
21 August 1991	in embayment south-east of Misool Island, eastern Seram Sea	two groups (S. Leatherwood)
22 August 1991	Gam Island, eastern Halmahera Sea	12 (S. Leatherwood)
22 August 1991	Gam Island (off Waigeo Island), eastern Halmahera Sea	about 20 (S. Leatherwood)
6 Sep.-5 Oct. 1993	off Lamalera, Lembata Island, Savu Sea	sightings of 36 groups (P. Rudolph; see fig. 4)
October 1995	Liang Bay, Komodo Island	sighting (Hoffmann, in prep.)

Delphinus cf. *capensis* Gray, 1828 - Long-beaked common dolphin

Common dolphins of the genus *Delphinus* have a cosmopolitan distribution in tropical and temperate waters. Heyning & Perrin (1994) distinguish two species: the short-beaked common dolphin *Delphinus delphis* Linnaeus, 1758 and the long-beaked common dolphin *D. capensis* Gray, 1828. Both forms are distinct by colour pattern, external morphology and skeletal characters. The sample size of *Delphinus* sp. from the Indian Ocean is small, and the specimens examined by Heyning & Perrin (1994) belong to the long-beaked species. In their study, Heyning & Perrin (1994) did not include material of a very long-beaked form from the Indian Ocean, earlier given specific rank by Van Bree (1971) as *D. tropicalis*. They keep open the possibility that this may prove to be an extremely long-beaked population of *D. capensis*. The observations and measurements by Smeenk et al. (1996) of such dolphins in the Red Sea and from the Arabian Peninsula clearly point in that direction.

We can only confirm the occurrence of a long-beaked form in Indonesian waters, by a skeleton (USNM 49977) collected in 1907 in the South China Sea, probably near Pontianak, western Kalimantan, which was identified by Van Bree & Gallagher (1978) as *D. tropicalis*. A second specimen of *Delphinus* sp. from the Indonesian Archipelago (incomplete skeleton, USNM 49750) was collected in April 1905 at Selangor, Malacca Strait, Malaysia (Leatherwood & Clark, 1983).

In addition, we know of three sightings of common dolphins in Indonesian waters: Leatherwood et al. (1984) saw 35 animals in water of less than 100 m deep, in Malacca Strait at 2°35' N 101°35' E, on 5 April 1983. The animals had an exceptionally long, slim beak, a somewhat muted coloration (cf. Smeenk et al., 1996) and a distinct genital blaze (see Evans, 1975) extending far forward onto the lateral field (Leatherwood & Clark, 1983). Sightings of unidentified *Delphinus* in Indonesian waters in May 1984, made by observers of the Centre National d'Etude des Mammifères Marins, La Rochelle, France, are given by Leatherwood (1986): 80 animals off northern Sumatra at 6°11' N 95°03' E, on 15 May; 100 animals north of the Anambas Archipelago, South China Sea at 4°50' N 106°70' E, on 19 May.

Lagenodelphis hosei Fraser, 1956 - Fraser's dolphin

Indonesian: Lumba-lumba Fraser.
Lamaholot: Temu notong.

Fraser's dolphin is found in tropical waters around the world (Jefferson & Leatherwood, 1994). The occurrence and distribution of this species in the Indian Ocean and the central and western Pacific is poorly known (Perrin et al., 1994a). Fraser's dolphin has been recorded from eastern Australia to Japan and Taiwan, as well as in the Indian Ocean from South Africa, Madagascar and Sri Lanka (Leatherwood & Reeves, 1983; Parsons et al., 1995; Zhou et al., 1995).

L. hosei (holotype, skeleton, BMNH 1895.5.9.1) was described by Fraser (1956) from a specimen collected in the mouth of the Lutong River, Baram, Sarawak, prior to 1895. Hembree (1980) recorded the capture of two Fraser's dolphins (local name "temu notong") from Lamalera, Lembata Island, between July and September 1979;

one skull (WAM M16294), September 1979, has been preserved (J.L. Bannister, pers. comm.). A skull (ZMA 24.777) collected at Natsepa, Baguala Bay, Ambon Island, on 18 September 1993, is in the Zoölogisch Museum, Amsterdam.

S. Leatherwood recorded four sightings of Fraser's dolphin in Indonesian waters: 150 animals 15 km east of Alor Island, Savu Sea at 8°18' S 125°16' E, on 15 June 1990 (L. Hobbs, pers. comm., photograph in Reeves & Leatherwood, 1994: 25); a large group in Ombai Strait, south of Alor Island, in June or July 1990 (L. Blair, pers. comm.); 100-140 animals south-east of Komodo Village, in Liang Bay, Komodo Island at 8°40' S 119°30' E, on 12 August 1991; two groups on 16 August 1991: about 10 animals with melon-headed whales *Peponocephala electra* in Kalabahi Bay, Alor Island, and about 20 animals north of Alor Island at 7°40' S 124°50' E. Perrin et al. (1994a) cited a record from Celebes (Sulawesi) that was provided by an officer of HMNZS Otago (date unknown). P. Rudolph observed Fraser's dolphin on three occasions near Lamalera, in September and October 1993: several individuals in a group of approximately 100 spinner dolphins *Stenella longirostris* at 8°36' S 123°23' E, on 10 September: the group was chased by an outboard-driven hunting boat for an hour, but no animal was killed; a group of an estimated 150 animals, containing several calves and moving slowly westward, was encountered with a group of 100 melon-headed whales at 8°35' S 123°29' E, on 23 September; several dolphins were seen in a large (approximately 1500) mixed group of spinner *S. longirostris* and spotted dolphins *S. attenuata* at 8°38' S 123°29' E, on 5 October.

[*Lissodelphis peronii* (Lacepède, 1804) - Southern right-whale dolphin. The northernmost confirmed records of this species in the Indian Ocean are from about 23° S off South Africa (Brown, 1982; Jefferson et al., 1994). The reason to mention the species here is the publication by Weber (1923), who cited field observations by Quoy & Gaimard (1824, not seen): "Sans mentionner içi plusieurs individus à couleurs obscures que nous vîmes dans divers parages, nous distinguerons le dauphin à museau blanc et long [Delphinus Peroni de Lacépède], que nous trouvâmes par 2° de latitude, près de la Nouvelle Guinée". Klinowska (1991) included Indonesia and New Guinea within the range of the species, without giving new references except wrongly citing Leatherwood & Reeves (1983). The occurrence of *L. peronii* in tropical waters would seem very unlikely and its occurrence in Indonesian waters is therefore rejected here.]

Orcaella brevirostris (Gray, 1866) - Irrawaddy dolphin

Indonesian: Lumba-lumba Irawadi, pesut (Kalimantan), wersut (Java).

The Irrawaddy dolphin is an inhabitant of tropical waters throughout much of the Indo-Pacific region, from the Bay of Bengal to the eastern Australian coast, between about 25° N and S (Marsh et al., 1989). The species prefers coastal areas, particularly the muddy, brackish waters in estuaries, and even ascends far up the larger rivers (Leatherwood & Reeves, 1983). Stacey & Leatherwood (1995) and Stacey (1996) compiled the available records of Irrawaddy dolphins and summarized the distribution and abundance of the species throughout its known range.

There are several old field observations of Irrawaddy dolphins from rivers in Kalimantan (the former Dutch Borneo). An anonymous author ("D.H.", 1922, with a comment by "H.C.D." = H.C. Delsman) reported groups of 3-15 "porpoises" in the Mahakam River between Samarinda and Longiram, and above that place as far as the foot of the rapids (Kiham Halo), as well as from smaller tributaries of the river. He also observed the species in the Barito River just below Poeroek-Tjahoe (= Purukcahu) and in the Kajan River. In his editorial comment, Delsman correctly referred to these animals as *Orcaella*. Witkamp (1932) found the species to be common in the Mahakam River below the falls, its tributaries and in the great lakes. Van Maarseveen (1939) mentioned the occurrence of "porpoises or dolphins" in the Mahakam River, probably at Samarinda.

The first specimen from Indonesia was documented by Weber (1923) and pertains to a skull found in November 1900 near Longiram, in the middle course of the Mahakam River, Kalimantan (calvaria, ZMA 5070). We know of the following additional records of material, mainly skulls, collected in Indonesian waters (Medway, 1977; Tas'an & Leatherwood, 1983; Leatherwood, 1986; Stacey & Leatherwood, 1995; Stacey, 1996; J.G. Mead, pers. comm.): skull (MZB), date and locality unknown; tail, skull and flippers (USNM 00199743), Mahakam River, Kalimantan, May 1914; skull (USNM 00486170), Labuhanruku, Sumatra at 3°12' N 99°33' E, June 1972; skull and body cast (GSJA), Mahakam River, 1974; skull and skeleton (GSJA), Mahakam River, 1978; skull (MZB), Seribu Islands, Java Sea, 1980. Ten specimens have been recorded from Brunei, Malaysia and Singapore (Thomas, 1892; Flower, 1900; Banks, 1931; Medway, 1977; Pilleri & Gihr, 1974; L.M. Chou, L.R. Heaney, P.D. Jenkins and J.G. Mead, pers. comm.): calvaria and skeleton (BMNH 1888.5.28.1), Muara Island, Brunei River, date unknown; skull (Museum Pisa, Italy), Baram River, Sarawak, date unknown; skeleton (BMNH 1964.2.24.1), Batu Maung, Penang (= Pinang) Island, Malaysia, date unknown; skin and skeleton (formerly in the Sarawak Museum), Buntal, Sarawak, date unknown; skeleton (MCZ 021929), Sarawak, 1892; skull (FMNH 99610), Santubong, Sarawak, 29 July 1964; skeleton (ZRC 4.7895), Singapore, date unknown; skull (BMNH 1883.11.20.2), Singapore, date unknown. Flower (1900) reported on a mounted skin (TL 1524 mm) in a museum at Taiping, Malaysia, collected off Matang, Perak, Malaysia. However, we have no information about the remains of this specimen.

Mörzer Bruyns (1966) observed Irrawaddy dolphins on twelve occasions between 1956 and 1959 in the Belawan Deli River in north-eastern Sumatra and reported sightings from the Rajang River, Sarawak, Belitung Island, Cilacap (south coast of Java), Surabaya (north-eastern Java), Ujung Pandang (= Makassar, Sulawesi), and from Irian Jaya near Biak Island and in the mouths of muddy rivers on the south-west coast.

Tas'an & Leatherwood (1983) reported that the Irrawaddy dolphin in Kalimantan was formerly distributed in coastal waters near the mouth of the Mahakam River and upstream its major tributaries and lakes, over a distance of at least 200 km. Surveys conducted by Jaya Ancol Oceanarium, Jakarta, in February 1974 confirmed the presence of a significant population in Semajang Lake, Pela River, and the adjacent part of the Mahakam River. In 1978 that group was stated by the Indonesian Directorate of Nature Conservation and Protection to consist of at least 100-150 animals. Similar groups have been reported for Melintang and Jempang Lakes. However, Priyono

(1995) estimated the population of Irrawaddy dolphins in the Mahakam River and its vicinity at about 68 individuals only in 1993. Although previously reported as far downstream as Tenggarong and Samarinda, the dolphins now apparently occur only above Muarakamen, presumably due to human disturbance in the lower course of the river caused by the timber industry (Tas'an & Leatherwood, 1983). Sixteen Irrawaddy dolphins were removed from Semajang Lake for display at Jaya Ancol Oceanarium: six in 1974 and ten in 1978 (Tas'an & Leatherwood, 1983). Six more dolphins were captured by the oceanarium in the Mahakam River system in 1984 (Wirawan, 1989). On 1 April 1995, two of these were still alive (Stacey & Leatherwood, 1995). Kartasantana & Suwelo (1994) reported that Irrawaddy dolphins are frequently observed in Kumai Bay, South Kalimantan; they are also reported from Kendawangan, West Kalimantan (I.S. Suwelo, in litt.). Priyono (1995) estimated that about 30 animals inhabit the Segara Anakan coastal area on the south coast of central Java. Kamminga et al. (1983) studied the acoustic behaviour of the Irrawaddy dolphin at Jaya Ancol Oceanarium in December 1982.

Peponocephala electra (Gray, 1846) - Melon-headed whale (fig. 5)

Indonesian: Paus kepala semangka.
Lamaholot: Temu kebong.

Melon-headed whales are found throughout the world in tropical and subtropical seas (Perryman et al., 1994). The distribution is oceanic, from the continental shelf seaward and around oceanic islands, and the species appears to occur mainly in equatorial waters (Leatherwood & Reeves, 1983). The only area from where the melon-headed whale has been described as common so far is near Cebu Island in the Philippines (Hammond & Leatherwood, 1984). Leatherwood et al. (1991) give a summary of records in the Indian Ocean for the years 1853-1986.

Material has been documented from north-eastern Sulawesi; Lamakera, Solor Island; Lamalera, Lembata Island; and from an unknown locality: four calvariae (ZMA 8022-8025) and two mandibles (ZMA 8026, 8027), 1 May 1899, referred to as *Lagenorhynchus electra* Gray, 1846 by Weber (1923); and one skull (MZB 398), date and locality unknown. Dammerman (1924) believed that the latter skull, together with four skulls of *Globicephala macrorhynchus* (MZB 395, 396, 397, 516) and one which he identified as *Delphinus roseiventris* Wagner, 1846 (MZB 399), were "from a place in the Indo-Australian Archipelago where people are hunting and eating these dolphins" and assumed that it came from either Solor or Lomblen (= Lembata) Island. There is one skull (WAM M16295) from Lamalera collected in September 1979 by D. Hembree, no further data (J.L. Bannister, pers. comm.); and six calvariae (RMNH 38434-38439) from Lembeh Strait, Bitung, north-eastern Sulawesi, probably the remains of a multiple stranding, collected in October 1994 by J.J. Staats, RMNH Sulawesi Expedition.

Hembree (1980) observed small black dolphins, estimated length 2.5 m, which might have been either melon-headed whales or pygmy killer whales *Feresa attenuata*, in the waters off Lamalera, Lembata Island: five animals on 9 July 1979 and two groups on 28 August 1979. Hembree also reported the harpooning of a male (TL 2.15 m) on 29 August 1979 in Lamalera and cited reports from local fishermen on three other individuals killed during the summer of 1979. Correspondence directed to the

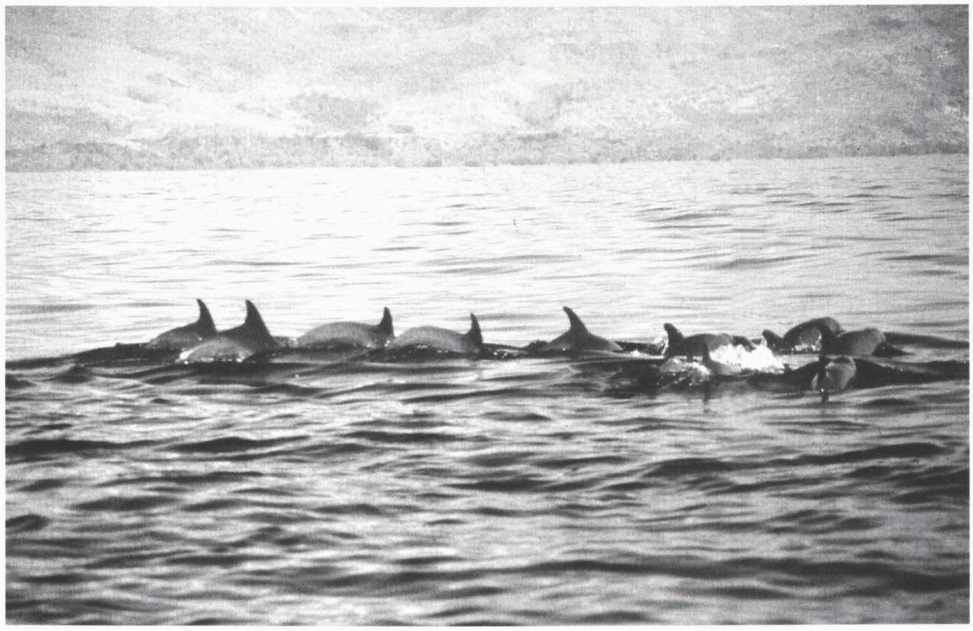


Fig. 5. A group of melon-headed whales, in a herd of approximately 100 seen in company of Fraser's dolphins, east of Lamalera, Lembata Island at 8°35' S 123°29' E (23 September 1993). Photo by P. Rudolph.

International Whaling Commission reported that four melon-headed whales were taken during the 1982 hunting season (R. Gambell, pers. comm. to Perryman et al., 1994). S. Leatherwood observed two groups in Indonesian waters between 2 and 29 August 1991: about 45 animals seen with Fraser's dolphins *Lagenodelphis hosei* in Kalabahi Bay, Alor Island at 7°40' S 124°50' E, on 16 August 1991; 40 animals north of Doberai Peninsula, Irian Jaya at 0°18' N 133°14' E, on 29 August 1991. P. Rudolph observed a group of approximately 100 melon-headed whales in company with Fraser's dolphins near Lamalera, Lembata Island at 8°35' S 123°29' E, on 23 September 1993 (fig. 5). The group consisted of several subgroups of 3-5 animals and moved slowly in a westerly direction. Subgroups dived and surfaced in synchrony, the animals swimming almost parallel to each other. The distance between individuals was less then one body length. No calves were observed.

Feresa attenuata Gray, 1875 - Pygmy killer whale (fig. 6)

Indonesian: Paus pembunuh kerdil.
Lamaholot: Temu kebung.

The pygmy killer whale appears to be widely distributed in all tropical and subtropical waters, but its range is not well known (Leatherwood & Reeves, 1983). Records of the species in the Indian Ocean from 1968 to 1985 have been summarized by Leatherwood et al. (1991).

We know of only four records of pygmy killer whales from Indonesia. Hembree

Fig. 6. A group of pygmy killer whales moving slowly westward off Lamalera at 8°39' S 123°21' E (24 September 1993). Photo by P. Rudolph.

(1980) on two occasions saw three pods of black dolphins off Lamalera, Lembata Island, which were either pygmy killer whales or melon-headed whales (see above). P. Rudolph saw a group of 30 pygmy killer whales with several calves, moving slowly westward off Lamalera at 8°39' S 123°21' E, on 24 September 1993 (fig. 6). When closely approached, the animals formed a "chorus line" and accelerated, a behaviour described for pygmy killer whales and melon-headed whales fleeing from an approaching ship (Leatherwood et al., 1988; Ross & Leatherwood, 1994).

Pseudorca crassidens (Owen, 1846) - False killer whale

Indonesian: Paus pembunuh palsu.
Lamaholot: Temu blã.

The false killer whale is an oceanic species with a world-wide distribution. It has been reported from all tropical, subtropical and warm temperate seas (Stacey et al., 1994). The species rarely approaches land except where there is deep water near oceanic islands or land masses (Klinowska, 1991). False killer whales are found throughout the Indian Ocean; records from the period 1890-1986 have been documented by Leatherwood et al. (1991).

There are only two specimens known from Indonesian waters: a skeleton (NSM 24616) of a male (TL 3.35 m) west of Sumatra, Indian Ocean at 4°33' S 98°38' E, 20 October 1967 (Miyazaki, 1986); and one tooth (ANSP 0002), Batanta Island, northwest of Doberai Peninsula, Irian Jaya at 0°50' S 130°40' E, August 1938 (J.G. Mead, pers. comm.).

We know of only five sightings (one in Singapore waters): two animals tentatively identified in Sunda Strait, on 1 August 1959 (Mörzer Bruyns, 1969); a group of 70 moving eastward 11 km south-southeast of Lamalera, Lembata Island, on 31 July 1979 (Hembree, 1980); four animals in the southern Savu Sea at 10°21' S 121°39' E, on 13 August 1991 (S. Leatherwood); a group of an estimated >500 animals in several subgroups, moving westward approximately 1-2 km off Lamalera, on 17 September 1993 (P. Rudolph); and a single animal (female, TL 3.75 m) in Tuas Bay, Singapore, in January 1994 (Chou, 1995).

Orcinus orca (Linnaeus, 1758) - Killer whale

Indonesian: Paus pembunuh.
Lamaholot: Seguni.

Killer whales have a cosmopolitan distribution, though they are believed to be most abundant at higher latitudes and within about 800 km off continents (Matkin & Leatherwood, 1986; Leatherwood et al., 1991). Abundance and distribution in the Indian Ocean have hardly been studied. Records from the Indian Ocean for the period 1772-1986 have been summarized by Leatherwood et al. (1991).

Material of the species in the Indo-Malayan region was collected at Miri, Sarawak: skeleton in the Sarawak Museum, May 1912 (Gibson-Hill, 1950; Medway, 1977; C. Leh, pers. comm.); and at Lamalera, Lembata Island: skull (ZMA 13.489), 1899/1900 (Weber, 1923; P.J.H. van Bree, pers. comm.).

From 1952 to 1963, tuna longline fishermen working in various places in the Indian Ocean observed animals which they identified as killer whales around the Greater and Lesser Sunda Islands, and in the Banda and Timor Seas (Sivasubramaniam, 1964; Leatherwood et al., 1991). Leatherwood & Clark (1983) reported a sighting of 4-5 killer whales, made by observers of the Centre National d'Etude des Mammifères Marins, La Rochelle, France, off the north-western tip of Sumatra at 5°43' N 95°40' E, on 4 September 1976. Killer whales were seen on two occasions in the Banda Sea in February 1985: a group of five animals south of Adi Island at 4°23' S 133°27' E, on 23 February (Snellius-II Expedition, P.A.W.J. de Wilde and others); and a single animal, in company with a group of short-finned pilot whales *Globicephala macrorhynchus* on the same date and position as the latter sighting, 40 minutes later, tentatively identified as a killer whale (animal with high, "orca-like" dorsal fin: G.C. Cadée). C.J. Heij & C.W. Moeliker (pers. comm.) saw three killer whales from the coast near Liang, Ambon Island, on 9 November 1990.

Killer whales are sometimes taken by subsistence hunters at Lamalera, Lembata Island: 24 animals recorded killed between 1960 and 1994 (Hembree, 1980; Barnes, 1991; P. Rudolph, field notes 1993; pers. comm. by Guru Ben Ebang, Lamalera, March 1994). Hembree (1980) documented three sightings from Lamalera in 1979: two pods of six and four animals approximately 10 km south of Lamalera, on 10 July 1979, swimming fast in an easterly direction. The pod of six whales was composed of one adult bull (harpooned: TL 5.5 m) and five females estimated to be of the same size; the other pod consisted of four females swimming approximately 1 km north-east of the large pod. One whale was reported struck and lost on 23 July 1979. P. Rudolph made six sightings and witnessed the landing of five killer whales on Lamalera in

1993: three animals (1 male, 2 females/large juveniles) moving slowly westward at 8°40' S 123°23' E, on 14 September; a group of four animals observed from the shore on 17 September (three females harpooned, one male struck and lost); one male and two females/large juveniles, chased by an outboard-driven hunting boat, moving eastward at a distance of 1 km from the shore, on 18 September, no animal landed; two sightings of three animals (male, female and calf) and of one animal (male) approximately 1 km from the shore, chased by hunting boats, on 20 September, one male killed; and two animals moving eastward approximately 4 km offshore in the morning of 5 October (one female landed in the afternoon on the same date).

Globicephala macrorhynchus Gray, 1846 - Short-finned pilot whale (figs 7-9)

Indonesian: Paus pemandu sirip pendek.
Lamaholot: Temu bélã.

The short-finned pilot whale inhabits tropical and warm temperate waters all over the world (Klinowska, 1991). The species is well known from the Indian Ocean and the records from this area for the period 1831-1986 have been summarized by Leatherwood et al. (1991).

Material has been collected from several areas in the Indonesian Archipelago (Weber, 1923; Dammerman, 1924; Leatherwood, 1986; Leatherwood et al., 1991; P.J.H. van Bree, pers. comm.): two skulls (BMNH 1897.10.13.1 and 1897.10.13.2), Alor Island, date unknown; skeleton (BMNH 1912.10.27.1), Malacca Town, Malaysia, date unknown; four skulls, incomplete (MZB 395, 396, 397, 516), date and locality unknown: Dammerman (1924) believed that these were "from a place in the Indo-Australian Archipelago where people are hunting and eating these dolphins" and assumed that they came from either Solor or Lomblen (= Lembata) Island; mandible (ZMA 1908), Indonesia, date and locality unknown (acquired in 1957); eleven skulls, incomplete (three calvariae: ZMA 5055-5057, Lamalera, Lembata Island, 6-8 February 1900; eight mandibles: ZMA 8871-8878, Lamalera, Lembata Island, or Lamakera, Solor Island, 1899/1900); six calvariae (ZMA 5058-5063), Lamakera, Solor Island, 1899/1900.

Four mass strandings have been documented: 52 animals which were presumably short-finned pilot whales at Lhokseumawe, north-eastern Sumatra, at the turn of the year 1901/1902 (archive RMNH); 8 individuals at Jeram, Selangor, Malaysia, on 29 March 1912 (Gibson-Hill, 1949), two specimens preserved in the Zoological Reference Collection of the National University of Singapore (L.M. Chou, pers. comm.): one skeleton (uncatalogued) and one skull (ZRC 4.7897); 27 animals at the village of Nias near Sabang, Weh Island, northern Sumatra, in the spring of 1914 (Weber, 1923), two specimens preserved in the Zoölogisch Museum, Amsterdam: one skull (ZMA 1706) and a cervical vertebrae complex (ZMA 1708); and 55 animals at Besuki, Madura Strait, eastern Java, on 2 January 1923 (Delsman, 1923: wrongly identified as *Kogia* sp.; Dammerman, 1924; see figs 7, 8). Material from the latter stranding is in the Museum Zoologicum Bogoriense, Bogor: skeleton of a male (MZB 392) and a female (MZB 390); skull (MZB 393) and incomplete skull (MZB 394); and skull of a foetus (MZB 391).

Figs 7, 8. Short-finned pilot whales, Mlandingan, near Besuki, Strait Madura, north-eastern Java, 2 January 1923. There were 55 animals in this stranding. Photos by J.H. Maronnier (archive National Museum of Natural History, Leiden).

Table 3. Sighting records of *Globicephala macrorhynchus* in the Indonesian Archipelago

Date	Location	Details / Source
20 October 1981	7°07′ S 116°02′ E, Kangean Archipelago, Java Sea	33 (K. Scott, cited in Leatherwood et al., 1991)
8 August 1983	0°16′ S 132°10′ E, Doberai Peninsula, Irian Jaya	8 (Capt. H. Barber, cited in Leatherwood et al., 1991)
3 May 1984	5°41′ N 96°55′ E, north of Sumatra	50 (U. Ureel, cited in Leatherwood et al., 1991)
30 June 1984	1°36′ S 117°11′ E, Balikpapan, East Kalimantan, Makassar Strait	12 (Capt. Burley, cited in Leatherwood et al., 1991)
15 January 1985	2°19′ N 128°45′ E, off Morotai Island, Halmahera	20-30, with *Tursiops* (Snellius-II Expedition, C. Smeenk)
16 January 1985	1°13′ N 129°05′ E, Halmahera Sea	10-15 (Snellius-II Expedition, C. Smeenk)
27 January 1985	9°16′ S 126°33′ E, Wetar Strait, Savu Sea	20-30 (Snellius-II Expedition, C. Smeenk)
10 February 1985	3°49′ S 130°32′ E, south of Seram Island, Banda Sea	about 70 (Snellius-II Expedition, G.C. Cadée)
18 February 1985	4°27′ S 133°27′ E, near Adi Island, Banda Sea	about 30 (Snellius-II Expedition, G.C. Cadée)
23 February 1985	4°23′ S 133°27′ E, south of Adi Island, Banda Sea	2 sightings: one of 5 animals, and one of 5 animals with 1 (probably) *Orcinus orca* (Snellius-II Expedition, P.A.W.J. de Wilde and others)
20 March 1985	8°08′ S 115°53′ E, north-east of Bali, Java Sea	10 (S. Miller, cited in Leatherwood et al., 1991)
8 October 1986	8°12′ S 125°45′ E, between Alor and Wetar Islands	4 (T.A. Meharry, cited in Leatherwood et al., 1991)
June 1990	east of Obi Island, eastern Molucca Sea	sighting (L. Blair)
11 June 1990	channel between Obi and Bisa Islands, eastern Molucca Sea	75-100 (L. Hobbs)
13 June 1990	off Mai Island, Lucipara Archipelago, Banda Sea	20 (L. Hobbs)
15 June 1990	east of Alor Island, Savu Sea	40 (L. Hobbs)
21 July 1991	north of eastern Timor, Savu Sea	90 (L. Hobbs)
30 July 1991	off Nolopolo, near Ende, eastern Flores, Savu Sea	20 (L. Hobbs)
13 August 1991	10°21′ S 121°39′ E, east of Sumba Island, Savu Sea	about 20 (S. Leatherwood)
29 August 1991	0°18′ N 133°00′ E, north of Doberai Peninsula, Irian Jaya	about 120 (S. Leatherwood)
1 October 1993	8°41′ S 123°20′ E, off Lamalera, Lembata Island, Savu Sea	about 70 (P. Rudolph; fig. 9)

Fig. 9. A herd of approximately 70 short-finned pilot whales resting in calm water off Lamalera at 8°41' S 123°20' E (1 October 1993). Photo by P. Rudolph.

Hembree (1980) reported on four contacts with short-finned pilot whales totalling 245 animals, and the catch of two specimens in August 1979 at Lamalera, Lembata Island. The take of 46 animals in the subsistence whale fishery at Lamalera has been documented for the period 1959-1994 (Hembree, 1980; Leatherwood et al., 1991, P. Rudolph, field notes 1993; pers. comm. by Guru Ben Ebang, Lamalera, March 1994). Sightings of the species from 1981 to 1993 are summarized in table 3.

Family Ziphiidae

Mesoplodon spp. - Beaked whales

Lamaholot: Ika mea.

Most *Mesoplodon* species are known from only few records and so are often considered rare (Klinowska, 1991). The distribution of the various species is known almost entirely from records of stranded individuals. This is due to the relative rarity of sightings at sea and the difficulty of identifying these animals to the species level (Mead, 1989a). Leatherwood (1986) listed seven species as occurring in the Indian Ocean cetacean sanctuary: *M. densirostris* (de Blainville, 1817); *M. mirus* True, 1913; *M. layardii* (Gray, 1865); *M. grayi* von Haast, 1876; *M. bowdoini* Andrews, 1908; *M. ginkgodens* Nishiwaki & Kamiya, 1958; as well as *Indopacetus* (or *Mesoplodon*) *pacificus* (Longman, 1926).

Only the occurrence of *M. ginkgodens* (Indonesian: paus gigi gingko) has been confirmed for Indonesian waters, by the presence of a skull (BMNH 1957.4.5.1) of a male (TL 4.24 m) stranded near Telok Mas, 6.75 miles south of Malacca Town, Malaysia, in

November 1954 (Mead, 1989a). Hembree (1980) recorded two sightings (ten and two animals) of beaked whales in July and August 1979, which he identified as not being Cuvier's beaked whale *Ziphius cavirostris* or scamperdown whale *Mesoplodon grayi*. The animals probably were another *Mesoplodon* species.

Ziphius cavirostris G. Cuvier, 1823 - Cuvier's beaked whale

Indonesian: Paus paruh Cuvier.
Lamaholot: Ika mea.

This species is probably the most widely distributed of the beaked whales (Heyning, 1989). In the Indian Ocean it is known from South Africa (Ross, 1984), the Comoro Islands (Robineau, 1975), Seychelles (Keller et al., 1982), Oman (Alling, 1986), and Sri Lanka (de Silva, 1987).

Dammerman (1926) documented the stranding of one animal near Brebes, between Cirebon and Pekalongan on the north coast of Java, in August 1924 (skeleton, MZB 793). Barnes (1991) stated that the species is occasionally hunted by villagers of Lamakera, Solor Island and Lamalera, Lembata Island. S. Leatherwood reported three sightings of Cuvier's beaked whale in Indonesian waters: one group of ten, and a single animal north-west of Irian Jaya, on 6 June 1990 (L. Hobbs, pers. comm.); and three animals north of Doberai Peninsula, Irian Jaya at 0°35' N 133°51' E, on 29 August 1991.

Hyperoodon sp. - Bottlenose whales

Indonesian: Paus hidung botol.

The southern bottlenose whale *Hyperoodon planifrons* Flower, 1882 has a circumpolar distribution, occurring mainly in cold and temperate deep waters of the Southern Hemisphere (Mead, 1989b). The northern limit of its regular range is usually given as about 30° S, but there are several records of bottlenose whales from much further north. The type specimen of *H. planifrons* is a skull that was collected on the beach of Lewis Island in the Dampier Archipelago, north-western Australia (Flower, 1882) at about 20° S, which is within the tropical Indian Ocean. During the period 1965-1988 there have been 16 sightings of bottlenose whales in the eastern and central tropical Pacific, and in the western North Pacific as far as 34° N (Miyashita & Balcomb, 1988; Pitman et al., 1988; IWC, 1989); photographs of animals in the central Pacific were published by Leatherwood et al. (1982, 1988) and Balcomb (1987). Pending the availability of skeletal material, it remains uncertain whether these are *H. planifrons* or an as yet undescribed species. Best et al. (1986) saw what they regard as most probably *H. planifrons* in the tropical Atlantic Ocean in November 1981. Alling (1986) tentatively identified that species off Sri Lanka in April 1983 and 1984. Leatherwood et al. (1994) refer to a bottlenose whale caught by subsistence whalers on Pamilacan Island in the Philippines, in about 1984. Jefferson (1995) reports on an observation of what were probably bottlenose whales in the Gulf of Mexico in 1991. Finally, Ballance et al. (1996; pers. comm.) recorded three sightings of bottlenose whales in the central Arabian Sea at 7° N, in April and May 1995.

During the Snellius-II Expedition, C. Smeenk observed three bottlenose whales off Teun Island in the Banda Sea at 7°00' S 129°07' E, on 2 February 1985. The record was made very close to the volcanic island, in shallow water. The animals were briefly but very clearly seen at a distance of approximately 200 m under excellent viewing conditions (fine weather, sea state 0) from a rubber dinghy. They were estimated to be 7-8 m long, with a relatively high dorsal fin. One of the animals raised its head above the water in the characteristic manner of bottlenose whales. Its bulbous forehead and protruding beak ruled out confusion with other species. Due to light conditions, the coloration could not be distinguished, the whales appearing as sharp silhouettes against the blue sea. They disappeared below the surface and were not seen again.

Given the paucity of known records, bottlenose whales appear to be uncommon in tropical waters. If the Philippine record is reliable, then we would have a series of observations of bottlenose whales from tropical Australia through the Banda Sea and the Philippines to the western North Pacific, as well as from other places in the Indian, Pacific and Atlantic Oceans. The records are from different times of the year, which may point at the existence of resident populations in tropical waters. Further material is needed to unravel the identity, distribution and possible seasonal movements of these bottlenose whales.

Family Physeteridae

Physeter macrocephalus Linnaeus, 1758 - Sperm whale (fig. 10)

Indonesian: Paus sperma.
Lamaholot: Kote kelema.

The sperm whale has perhaps a more extensive distribution than any other marine mammal except the killer whale *Orcinus orca*. It ranges throughout the deep oceans of the world, from the equator to the edges of the pack ice (Rice, 1989). The species inhabits offshore waters, and usually is not found in waters of less than 1000 m deep (Watkins, 1977). The general distribution of sperm whales is quite well known from the records of the British and American whale fishery of the 19th century (Beale, 1839; Townsend, 1935; Barnes, 1991). In Indonesian waters the Sulu, Celebes, Halmahera, Molucca, Flores, and parts of the Banda Sea are known as whaling grounds where sperm whales were taken in considerable numbers, as well as the areas north of New Guinea and south of Java (Townsend, 1935).

In the village of Lamalera, Lembata Island, there still exists a subsistence whaling tradition for sperm whales, and each year a few animals are caught with hand harpoons for local use. Whaling probably has existed here for more than 500 years (Barnes, 1974, 1980, 1991; Hembree, 1980). For the period 1959-1994 the take of 612 animals (table 4) has been documented at Lamalera (Barnes, 1991; P. Rudolph, field notes; pers. comm. A. Dupont, catholic priest at Lamalera, 1993). Hembree (1980) recorded 14 sightings in the waters of Lamalera between July and September 1979. All whales seen by Hembree were small animals (females or immatures) swimming in small pods. Nine sperm whales were captured during his study period, ranging from 6 to 10 m in length. There are also reports of the presence of large males off Lamalera, which would indi-

Fig. 10. Sperm whale, female, Pulau Tikus off Bengkulu, south-western Sumatra, 1934. Photo by W. Groeneveldt (archive National Museum of Natural History, Leiden).

cate that the region is a breeding ground (Fuchs, 1978, cited from Hembree, 1980). Sperm whales are found in these waters at all times of the year, but nothing is known about the relationship of this population with other stocks. The passages between the Lesser Sunda Islands are supposed to be a migration route of sperm whales between the Indian and Pacific Ocean (Rice, 1989).

Material has been documented from the following localities (Weber, 1902, 1923; Tas'an & Leatherwood, 1983; J.G. Mead and P.J.H. van Bree, pers. comm.): lower jaw, received from whalers on Banda Island, 1843 (National Museums of Scotland, Edinburgh); calvaria (ZMA 23.943), Lamalera, Lembata Island, 6-8 February 1900; tooth

Table 4. Annual catch of sperm whales at Lamalera, Lembata Island, 1959-1994. (Data collected by A. Dupont, catholic priest at Lamalera; * from Barnes, 1991)

Year	1959	1960	1961	1962/64	1965	1966	1967	1968	1969
Sperm whales taken	35*	26*	31*	no data	34*	15*	25*	45	56*
Year	1970	1971	1972	1973	1974	1975	1976	1977	1978
Sperm whales taken	37*	43*	36*	23*	26*	21*	no data	21*	15*
Year	1979	1980/81	1982	1983	1984	1985	1986	1987	1988
Sperm whales taken	15*	no data	8*	2*	7	9	9	7*	7
Year	1989	1990	1991	1992	1993	1994			
Sperm whales taken	5	11	15	10	8	10		**Total:**	**612**

(MCZ 008440), Molucca Sea, exact locality unknown, 1907; two teeth (ZMA 22.573), Sabang, Weh Island, northern Sumatra, 1920; skull (MZB), Tanjung Batutiga, eastern Bali, 29 September 1928; teeth and photos, on display at Jaya Ancol Oceanarium, Jakarta, and private collection of Tas'an, Tenate, south-western Java, 1975; skeleton, 9 m long (Ambon Museum), Latuhalat, Ambon Island, 14 November 1990 (C.J. Heij, pers. comm.). In the archives of the RMNH there are photographs of a female stranded on Pul(a)u Tikus (= Tikus Island) off Bengkoelen (= Bengkulu), south-western Sumatra, in 1934 (no data given; fig. 10).

In addition, we know of several sightings in Indonesian waters: one animal west of the Obi Islands, on 30 September 1855 (Bleeker, 1856); twelve animals north of Sumatra at 6°11' N 95°05' E, on 15 May 1984 (A. Collet, pers. comm.); one animal in the Banda Sea at 5°19' S 134°13' E, on 11 August 1984; and two animals at 7°25' S 127°41' E, on 31 January 1985 (Snellius-II Expedition, C. Smeenk and other observers); five animals east of Alor Island at 8°18' S 125°16' E, on 15 June 1990 (L. Hobbs, pers. comm.); one animal off Lamalera, on 30 September 1993 (P. Rudolph). Sperm whales are regularly observed around Komodo Island (UNEP/IUCN, 1988).

Kogia breviceps (de Blainville, 1838) - Pygmy sperm whale

Indonesian: Paus sperma kerdil.

Because whales of the genus *Kogia* are only rarely identified at sea, and then usually not to the species level, it is difficult to establish the distribution of the two living species (see below). The pygmy sperm whale appears to be cosmopolitan, occurring in nearly all warm temperate and tropical waters (Leatherwood & Reeves, 1983; Caldwell & Caldwell, 1989). Specimens in the Indian Ocean have been recorded from South Africa, Sri Lanka and India (Chantrapornsyl et al., 1991).

We know of only two records in the Indonesian Archipelago: a skeleton and a foetus collected at Buntal, Sarawak, on 19 February 1958 (Harrisson & Jamuh, 1958, photographs in archive BMNH), according to Leatherwood (1986) preserved in the Sarawak Museum which, however, has not confirmed their existence; S. Leatherwood saw three animals north of Doberai Peninsula, Irian Jaya at 0°35' N 133°51' E, on 29 August 1991.

Kogia simus (Owen, 1866) - Dwarf sperm whale

Indonesian: Paus sperma cebol.
Lamaholot: Fefa kumu.

The distribution of the dwarf sperm whale appears to be similar to that of the pygmy sperm whale, though *K. simus* apparently occurs more frequently in slightly warmer seas (Caldwell & Caldwell, 1989). Stomach contents indicate that the dwarf sperm whale inhabits more inshore waters, perhaps concentrated along the edge of the continental shelves (Leatherwood & Reeves, 1983). In the Indian Ocean the species is known from South Africa, Oman, Pakistan, India, Sri Lanka, Thailand and Australia (Chantrapornsyl et al., 1991).

In the Indonesian Archipelago the dwarf sperm whale is only known from the Savu Sea. Weber (1902, 1923) collected two specimens at Lamalera, Lembata Island, on 8 February 1900. He identified these as *K. breviceps*. They are, however, *K. simus* (Van Bree & Duguy, 1967; Gallagher & Van Bree, 1980; P.J.H. van Bree, pers. comm.): damaged calvaria (ZMA 5068) and dorsal part of a calvaria (ZMA 14.639). P. Rudolph saw two animals (confirmed by photographs) near Lamalera at 8°37' S 123°25' E, on 16 September 1993. The mandibles of an animal called "fefa kumu" by the local population, caught in the summer of 1993 by fishermen, were photographed and identified as *K. simus* (P. Rudolph, field notes, identification confirmed by P.J.H. van Bree, pers. comm., February 1995).

Family Balaenopteridae

Lamaholot names for all baleen whales except the blue whale: kelaru (Lamalera), keraru (Lamakera).

Balaenoptera acutorostrata Lacepède, 1804 - Minke whale

Indonesian: Paus minke.

The minke whale is a cosmopolitan species. Its distribution is oceanic, from the pack ice to the tropical Atlantic, Indian and South Pacific Oceans (Klinowska, 1991).

A skeleton (BMNH 1908.7.9.5) catalogued as *B. acutorostrata*, collected in Sarawak in 1908, is most likely of *B. edeni* (C.C. Kinze, pers. comm.). Hembree (1980) documented the minke whale from Lamakera, Solor Island, by baleen plates from an animal taken by local fishermen. This material does not seem to have been preserved, so the identification cannot be confirmed. Kasuya & Wada (1991) reported sightings by Japanese scouting and research vessels south of Java and the Lesser Sunda Islands during the months of October, November and December in the period 1966/67 to 1984/85. Pending irrefutable evidence, we regard the occurrence of the minke whale in Indonesian waters as still unconfirmed.

Balaenoptera borealis Lesson, 1828 - Sei whale

Indonesian: Paus sei.

The sei whale has a world-wide distribution. Although its range and movements are poorly known, the species appears to favour temperate oceanic waters (Leatherwood & Reeves, 1983). One problem of mapping its distribution in the tropics is the difficulty of distinguishing the sei whale at sea from Bryde's whale *B. edeni*.

We know of only one confirmed record of the sei whale from the Indonesian Archipelago: a skeleton (RMNH 31166: holotype of *Sibbaldius schlegelii* Flower, 1864), Pekalongan, north coast of Java, 1864 (Weber, 1923). Weber (1923) further mentioned a juvenile skull from Java in the Leiden museum; however, this specimen could not be found. The Muséum national d'Histoire naturelle, Paris, preserves the vertebrae of a specimen labelled as *B. borealis* (MNHN 1890-679), collected in Java in about 1828. However, according to D. Robineau (pers. comm.), species identification of this mate-

rial is not possible. Japanese scouting and research vessels reported sighting ten sei whales per 10.000 nautical miles of searching in an area south of Sumatra during the months of November in the period 1974/75 to 1984/85 (Kasuya & Wada, 1991).

Balaenoptera edeni Anderson, 1878 - Bryde's whale

Indonesian: Paus Bryde.

Bryde's whale is found in tropical and warm temperate waters around the world, often inshore in areas of high productivity (Leatherwood & Reeves, 1983). Confusion with the sei whale *B. borealis* occurs widely, leading to uncertainties about the exact distribution areas of both species. In the Indian Ocean, Bryde's whale ranges from the Cape of Good Hope north to the Persian Gulf and the Gulf of Martaban, Burma, and east and south to Shark Bay, Western Australia. There are also animals in the central Indian Ocean (Best, 1977; Cummings, 1985; IWC, 1977; Leatherwood & Reeves, 1983). Bryde's whale shows a considerable variation from one locality to another. The existence of geographic or microallopatric ecological forms of different body size has been described for Japan (Omura, 1977) and South Africa (Best, 1977). Bryde's whales that are similar to the relatively small coastal form in South African waters were described from Thailand (Andersen & Kinze, 1993), the Philippines (Perrin et al., 1996), Solomon Islands (Ohsumi, 1978; Shimada & Pastene, 1995) and from the eastern Indian Ocean south of Java (Ohsumi, 1980). Genetic analyses indicate that this "pygmy Bryde's whale" should be assigned to an as yet undescribed species (Wada & Numachi, 1991; Dizon et al., 1995).

Seven specimens from the Indonesian Archipelago are known to exist (Weber, 1923; Junge, 1950; Gibson-Hill, 1950; Medway, 1977; Tas'an & Leatherwood, 1983; Leatherwood, 1986; C.C. Kinze, pers. comm.): right tympanicum (NMW 7819), probably from Indonesia, before 1893 (F. Spitzenberger, pers. comm.); two skulls (ZMA), Lamakera, Solor Island, 1899/1900; skull (ZMA), near the village of Bangsri, Brebes, Java, 25 October 1907. Weber (1923) also mentioned a scapula, sternum and 2.-6. cervical vertebrae belonging to the latter specimen; however, this material is not in the Zoölogisch Museum, Amsterdam (P.J.H. van Bree, pers. comm.). Further, a skeleton, 7.25 m long (Sarawak Museum, labelled as *B. musculus*), Pusa, mouth of the Saribas River, Sarawak, January 1909; skull (RMNH 4003), Pul(a)u Sugi (= Sugi Island), Riau Archipelago, 1936; skeleton, 9 m long (GSJA, on display), Labuhan, western Java, 1975. A skeleton (BMNH 1908.7.9.5, labelled as *B. acutorostrata*), Sarawak, 1908, is also most likely *B. edeni* (C.C. Kinze, pers. comm.). Other strandings in Malaysian waters have been reported from the following localities (Harrisson & Jamuh, 1958; Berry et al., 1973): two live-strandings, one at Beardi, delta of the Sarawak River, 15 June 1956, and one at Buntal, Sarawak, 22 January 1958; a live animal (TL about 13 m) at Telok Tempoyah Kechil, Penang (= Pinang) Island, Malacca Strait, 29 July 1965; and a specimen (TL 14.05 m) washed ashore at the village of Sungei Layang, 5 miles south of Morib, Selangor, Malacca Strait.

Bryde's whales make up part of the catch in the subsistence whale fishery at Lamakera, Solor Island (Barnes, 1991; Hembree, 1980). The species was taken by Japanese whalers during the seasons 1976/77-1978/79 south of Java and the Lesser Sunda

Islands (Ohsumi, 1980). The following specimens have been preserved: five nasal bones (NSM 24284-24288) of animals caught on 7 November 1978: male (TL 10.9 m), 12°49' S 114°47' E; male (TL 12.8 m), 12°46' S 114°50' E; male (TL 12.3 m), 12°42' S 114°39' E; female (TL 12.6 m), 12°07' S 113°57' E; and female (TL 13.9 m), 10°54' S 112°30' E (Omura et al., 1981; Miyazaki, 1986). In addition, Omura et al. (1981) mention a complete skull of a female (whale N° 78N33, TL 14.2 m), also caught on 7 November 1978, at 12°31' S 114°18' E. Kasuya & Wada (1991) reported sightings by Japanese scouting and research vessels from the same area during the months of November, December and March in the period 1972/73 to 1984/85. Hoffmann (in prep.) recorded two sightings of Bryde's whales in Liang Bay, Komodo Island, in October 1995.

Balaenoptera musculus (Linnaeus, 1758) - Blue whale (figs 11, 12)

Indonesian: Paus biru.
Lamaholot: Lelangaji.

The blue whale occurs in all oceans (Klinowska, 1991). A small form: *B. m. brevicauda* Ichihara, 1966, the "pygmy blue whale", is at present known from the subantarctic waters of the Indian and Southeast Atlantic Ocean and has also been reported for other parts of the world (e.g. northern Indian Ocean, Chile and Peru) (Yochem & Leatherwood, 1985). Records from the Indian Ocean are given by Yukhov (1969),

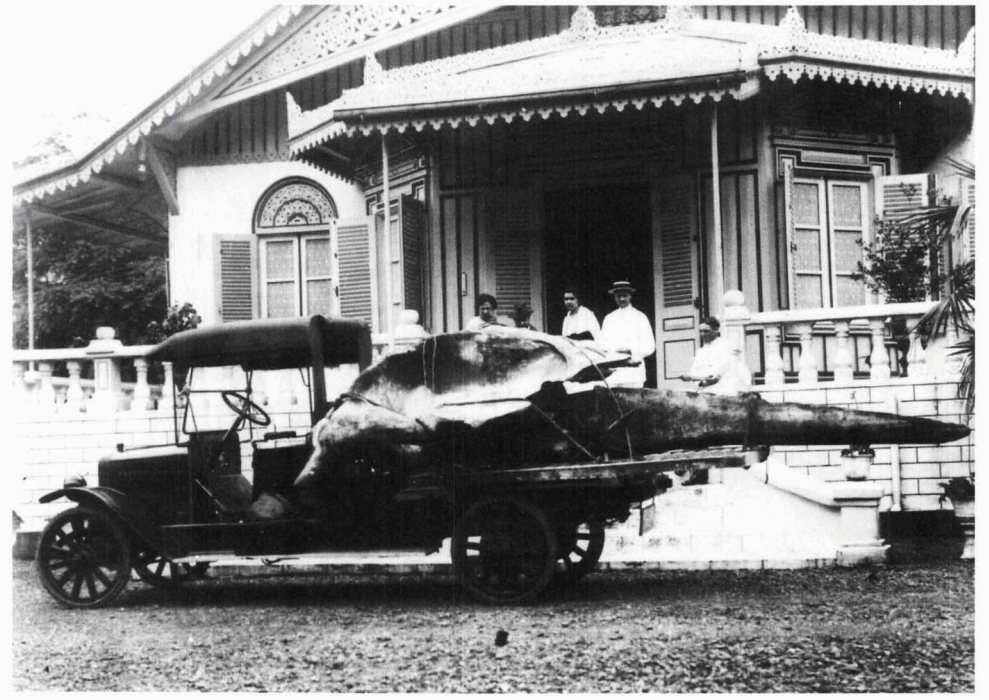


Fig. 11. Skull of blue whale *Balaenoptera musculus*, between Cilauteureun and Cikelet, south coast of Java, December 1916. The skull arrives here at the museum in Buitenzorg, now Bogor. Photo in the archive of the National Museum of Natural History, Leiden.

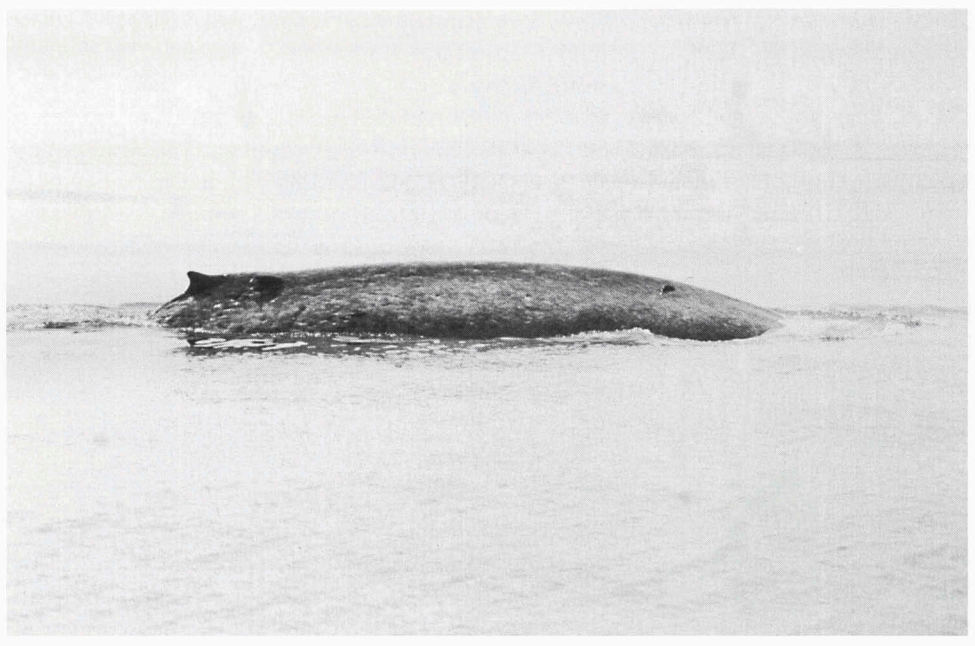


Fig. 12. A slowly moving blue whale south of Lamalera, Lembata Island at 8°40' S 123°27' E, on 30 September 1993. Photo by P. Rudolph.

Leatherwood et al. (1984), Leatherwood (1985, 1986), Alling et al. (1991), and Kasuya & Wada (1991). Nothing is known about the stock affinities of blue whales in the northern Indian Ocean. Observations on blue whales off Sri Lanka indicate a non-migratory stock, since sightings occur throughout the year (Yochem & Leatherwood, 1985).

An animal (TL 27 m) stranded in December 1916 on the south coast of Java between Tjilauteureun (= Cilauteureun) and Tjikelet (= Cikelet) was described by Reuter (1919) as *Balaenoptera* sp. However, Weber (1923) referred to this specimen as *B. musculus* (skeleton and baleen plates on display in the Museum Zoologicum Bogoriense, see fig. 11). Delsman (1932) reported the stranding of a blue whale (TL 17 m) at Sampang, Madura Island, in December 1931. An animal (TL 23.5 m) stranded near Namlea, Buru Island, on 22 June 1987 was identified as *B. musculus* (skeleton in the Ambon Museum: C.J. Heij, pers. comm.). A skeleton catalogued as *B. musculus* (see Leatherwood, 1986), 34 km south of Malacca Town, Malacca Strait, 19 June 1892 (present whereabouts unknown, formerly in the Raffles Museum in Singapore; photos in file N° 206 in BMNH) is in fact *B. edeni* or *B. borealis* (C.C. Kinze, pers. comm.).

Hembree (1980) saw 21 blue whales on 14 occasions in the period 1-4 September 1979. The animals appeared to be milling in no definite direction and were of an estimated 20-26 m in size. Hembree mentioned that at least some of the animals may have been pygmy blue whales. In addition, we know of the following sightings: one adult and calf in the Savu Sea at 8°45' S 122°35' E, on 16 June 1990 (L. Hobbs, pers. comm.); one adult and calf between Flores and Sumba Islands, Savu Sea, in June 1990 (L. Blair, pers. comm.); S. Leatherwood observed three animals (possibly pygmy blue whales) 8 miles south-west of Lamalera, Lembata Island, on 14 August 1991; P. Rudolph saw

two animals milling south-west of Lamalera on 13 September 1993, and one moving westward at 8°40' S 123°27' E, on 30 September 1993 (fig. 12). Interviews by P. Rudolph with fishermen from Lamalera revealed that blue whales are seen throughout the year off Lamalera, with a peak abundance in April and May. Blue whales are regularly observed around Komodo Island (UNEP/IUCN, 1988).

Balaenoptera physalus (Linnaeus, 1758) - Fin whale

Indonesian: Paus sirip.

The fin whale has a world-wide distribution, though it tends to be less common in tropical waters (Leatherwood & Reeves, 1983). In the western North Pacific fin whales winter from the Philippine Sea to at least 40° N, with concentrations in the East China Sea, Yellow Sea and the Sea of Japan (Leatherwood & Reeves, 1983). Southern Hemisphere fin whales migrate from the summer grounds around 50° S, to winter in the Indian Ocean along the coast of South Africa and the islands north of Australia and New Zealand, as well as in the central Indian Ocean (Gambell, 1985; Klinowska, 1991). In the eastern Indian Ocean both northern and southern animals have been reported wintering in the Banda Sea (Watson, 1981). However, this information was given without further details and documentation, and we regard it as unsubstantiated.

There is a record of a baleen whale, over 60 ft in length, stranded near Lundu, Sarawak, around the turn of the 19th century, which could have been a fin whale or a blue whale *B. musculus* (Shelford, 1916; Gibson-Hill, 1950; Leatherwood, 1986). We know of only two confirmed records of the species in Indonesia: Dammerman (1938) reported on a stranding on Nusa Kambangan near Tjilatjap (= Cilacap) on the south coast of Java, in December 1937. Baleen plates collected in the eastern Flores Sea in 1975 are on display at Jaya Ancol Oceanarium, Jakarta (Tas'an & Leatherwood, 1983; Leatherwood, 1986).

Megaptera novaeangliae (Borowski, 1781) - Humpback whale

Indonesian: Paus bongkok.

Humpback whales are widely distributed in all oceans, from tropical wintering grounds around islands and along continental coasts where they breed and calve, to high-latitude summer grounds where they feed (Leatherwood & Reeves, 1983). At least two stocks of humpbacks are known to occur in the Indian Ocean south of the equator. One moves from Antarctica Area III to Madagascar and the east coast of Africa, at least as far north as Kenya. The other migrates between Antarctica Area IV and north-western Australia (Mackintosh, 1965; Mackintosh & Brown, 1974; Winn & Winn, 1985). Stock affinities of northern Indian Ocean humpbacks from the Arabian Sea and Sri Lanka waters are still unresolved (Reeves et al., 1991). Whitehead (1982, 1985) assumes that some humpbacks remain in the northern Indian Ocean all year round, probably making only short migrations between their feeding and breeding grounds. The occurrence of humpback whales in Southeast Asian waters has only been confirmed from the Philippines (Leatherwood et al., 1992) and Vietnam (Smith et al., 1995).

Records from the Indonesian Archipelago are scarce and not entirely reliable. The records of humpback whales published by Slijper et al. (1964) mainly concern sightings by sailors: northern Sumatra, the Java, Banda and northern Arafura Seas, and off northern Borneo. Species identification, however, remains unconfirmed. Basing himself on logbook records of American whaling ships from the period 1761-1920, Townsend (1935) documented the catch of humpback whales in the months August and September in the northern Arafura Sea off Irian Jaya (New Guinea). Payne et al. (1985) reported one sighting off Sarawak. However, this information was given without further details and documentation, and we regard it as unsubstantiated. Japanese scouting and research vessels reported the sighting of 11 humpbacks per 10.000 nautical miles of searching in an area just south of the Lesser Sunda Islands during the months of November-March in the period 1965/66 to 1984/85 (Kasuya & Wada, 1991). D. Hembree (pers. comm., cited in Reeves et al., 1991) stated that he was convinced that the humpback does occur near Lembata and Solor Islands and that he believed they are taken in the latter area. However, he did not obtain definite evidence of the species' occurrence during his research at Lamalera in June-September 1979. Fishermen of Lamalera, interviewed by P. Rudolph in September-October 1993, did not know the species from their hunting grounds. Pending irrefutable evidence, we regard the occurrence of the humpback in Indonesian waters as still unconfirmed.

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