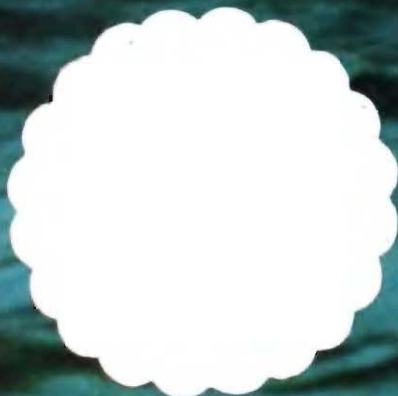


HANDBOOK



ON WHALES, DOLPHINS AND DUGONG



V. C. AGRAWAL
J.R.B. ALFRED

HANDBOOK

On Whales, Dolphins and Dugong from Indian Seas

V. C. AGRAWAL

J. R. B. ALFRED



**Zoological Survey of India
Calcutta
1999**

CITATION

Agrawal, V.C. and Alfred, J.R.B. 1999. *Handbook on whales Dolphins and Dugong from Indian Seas*, i-iv, 1-150. Published—Director, ZSI, Calcutta

Published : September, 1999

ISBN 81-85874-27-1

© Government of India, 1999

ALL RIGHTS RESERVED

- No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the prior permission of the publisher.
- This book is sold subject to the condition that it shall not, by way of trade, be lent, re-sold hired out or otherwise disposed of without the publisher's consent, in any form of binding or cover other than that in which it is published.
- The correct price of this publication is the price printed on this page. Any revised price indicated by a rubber stamp or by a sticker or by any other means is incorrect and should be unacceptable.

PRICE

India Rs. 200.00

Foreign \$ 10.00 ; £ 8.00

Published at the Publication Division by the Director, Zoological Survey of India 234/4, AJC Bose Road, 2nd MSO Building (13th floor), Nizam Palace, Calcutta-700 020 after laser type setting by East India Photocomposing Centre, 69 Sisir Bhaduri Sarani, Calcutta-700 006 and printed by the Manager, Govt. of India Press, (P.L.U.) Minto Road, New Delhi.

PREFACE

Whales, dolphins (Order Cetacea) and dugong (Order Sirenia) constitute one of the most important components of the aquatic ecosystem, due mainly to their gigantic size and the amount of food consumed by them. In turn, they provide us meat, fat and oil, bones for manure, ambergris (used as fixative in perfumes), protein rich solid and liquid residue, etc. That is why, these animals were killed in the past in large numbers, resulting in the dwindling of their population. However, this tendency has to a certain extent checked in recent years due to framing and promulgation of many national and international legislations.

The knowledge about whales found in the Indian waters is mainly confined to their stranding on our shores. Hence, it was thought worthwhile to write a handbook on this group of animals, giving a brief account of their diagnostic characters, distribution with particular reference to the Indian ocean, population, food, commercial exploitation and the threats leading to extinction.

It is my privilege that I am able to write the preface of this popular handbook by virtue of my position as Editor, and to this particular one of which I am the co-author. It is hoped that this illustrated book will serve as an informative document on cetaceans for scientists and naturalists who are interested in this group of animals as well as to create awareness among the public, at large.

Calcutta
July, 1999

Dr. J. R. B. Alfred
Director

CONTENTS

Introduction.....	1
Characters used in the identification	
Measurements	2
Order CETACEA	
Key to identification of families of order CETACEA	7
Family PLATANISTIDAE	
<i>Platanista gangetica</i> (Roxburgh).....	8
Family PHOCOENIDAE	
<i>Neophocoena phocaenoides</i> (Cuvier)	13
Family DELPHINIDAE	
Key to genera of family DELPHINIDAE	17
<i>Steno bredanensis</i> (Lesson)	19
<i>Sousa chinensis</i> (Osbeck)	23
<i>Grampus griseus</i> (G. Cuvier)	27
<i>Tursiops truncatus</i> (Montagu).....	31
Key to species of Genus <i>Stenella</i>	35
<i>Stenella attenuata</i> (Gray).....	36
<i>Stenella longirostris</i> (Gray)	40
<i>Stenella coeruleoalba</i> (Meyen)	44
<i>Delphinus delphis</i> Linnaeus	48
<i>Lagenodelphis hosei</i> Fraser	52
<i>Peponocephala electra</i> (Gray)	56
<i>Feresa attenuata</i> Gray	60
<i>Pseudorca crassidens</i> (Owen).....	64
<i>Orcinus orca</i> (Linnaeus)	68
<i>Globicephalus macrorhynchus</i> Gray	73
<i>Orcaella brevirostris</i> (Gray)	77
Family ZIPHIIDAE	
Key to genera of family ZIPHIIDAE	81
Key to species of genus <i>Mesoplodon</i>	81
<i>Ziphius cavirostris</i> G. Cuvier	82

<i>Mesoplodon densirostris</i> (Blainville)	86
<i>Mesoplodon ginkgodens</i> Nishiwaki & Kamiya.....	90
Family PHYSETERIDAE	
Key to genera of family PHYSETERIDAE.....	94
Key to species of genus KOGIA	94
<i>Physeter macrocephalus</i> Linnaeus.....	95
<i>Kogia breviceps</i> (Blainville)	100
<i>Kogia simus</i> (Owen).....	104
Family BALAENOPTERIDAE	
Key to genera of family BALAENOPTERIDAE	108
Key to species of genus <i>Balaenoptera</i>	108
<i>Megaptera novaeangliae</i> (Borowski).....	110
<i>Balaenoptera musculus</i> (Linnaeus)	114
<i>Balaenoptera physalus</i> (Linnaeus)	119
<i>Balaenoptera edeni</i> Anderson	123
<i>Balaenoptera borealis</i> Lesson	127
<i>Balaenoptera acutorostrata</i> Lacepede	131
Order SIRENIA	
Family DUGONGIDAE	
<i>Dugong dugon</i> (Müller)	136
Acknowledgement	139
References	140

INTRODUCTION

Cetaceans are aquatic mammals, having a fusiform body, a pair of pectoral flippers, and a horizontally compressed tail-fluke, with or without a notch in the middle. A dorsal fin is generally present but always devoid of external hindlimbs. Majority of the cetacean-species have teeth in one or both the jaws, whereas in a few, teeth are replaced by baleen plates which act as sieve to extract organisms during feeding. The eyes are small, ear orifice minute, and there is no trace of external ears. The nostrils open either separately or by a single crescentic hole, much above the extremity of the snout. Like other mammals, cetaceans are air breathers and come to the surface of water to breath or blow. The old idea that whales eject by the blow-holes the water taken in by the mouth is erroneous, the supposed jet being merely the expired air with watery and mucous particles, forming spray.

The term dolphin is generally used for small cetaceans having a slender body and beak-like snout, and porpoise for animals having a stocky body and blunt snout. However, this terminology has not been strictly followed in naming the species.

The dolphins and whales subsist mainly on crustaceans, cephalopods and fish. The quantum of food taken depends upon their body-size. A 26 m long Blue Whale, for example, has been reported to consume 5 million krills weighing about 2 tonne (Walker, 1968).

Habitatwise, the cetaceans of the Indo-Malayan region fall under three categories (Corbet and Hill, 1992) : (i) the river dolphin, (ii) coastal and estuarine forms and (iii) marine species which live in deep waters. The latter may be a resident of tropical waters or those which mainly live in cold waters but migrate seasonally towards the tropics like *Balaenoptera musculus*, *Balaenoptera physalus*, etc.

Detailed accounts of river-dolphins and toothed - and baleen whales have been compiled by Ridgway and Harrison (1985, 1989). The distributional records from Sri Lanka, India and Pakistan have been given by de Silva (1987), Leatherwood *et al.* (1987), Leatherwood and Reeves (1991), etc.

In this handbook, an attempt has been made to give morphological characters for easy identification of the cetaceans stranded on the shore, as also their distribution with particular reference to the Indian waters. Other aspects like population, threat, commercial use and trade data have also been furnished, wherever available.

CHARACTERS USED IN THE IDENTIFICATION

This booklet is in no way a taxonomic treatment, but some of the salient features of the body which are commonly used in identification of whales and dolphins have been shown in diagrams, and labelled (Figs. 1 & 2). The diagrams given in this booklet, however, are not according to scale.

MEASUREMENTS

The Committee on Marine Mammals of the American Society of Mammalogists, with the suggestions of several foreign authorities on cetaceans, has prepared a selected list of measurable characters which should normally be taken for all the animals either killed or stranded on the shore (Norris, 1961). The list, however, does not include measurements of the skull or appendicular skeleton. The value of these data will definitely be enhanced by preserving the skull, other skeletal parts or at least a few teeth for age determination, especially when several species of dolphins and beaked whales are known only from skulls or skeletal parts.

All measurements (Fig. 2 b) are straight line distances between two points (and not along curvature), and taken parallel to

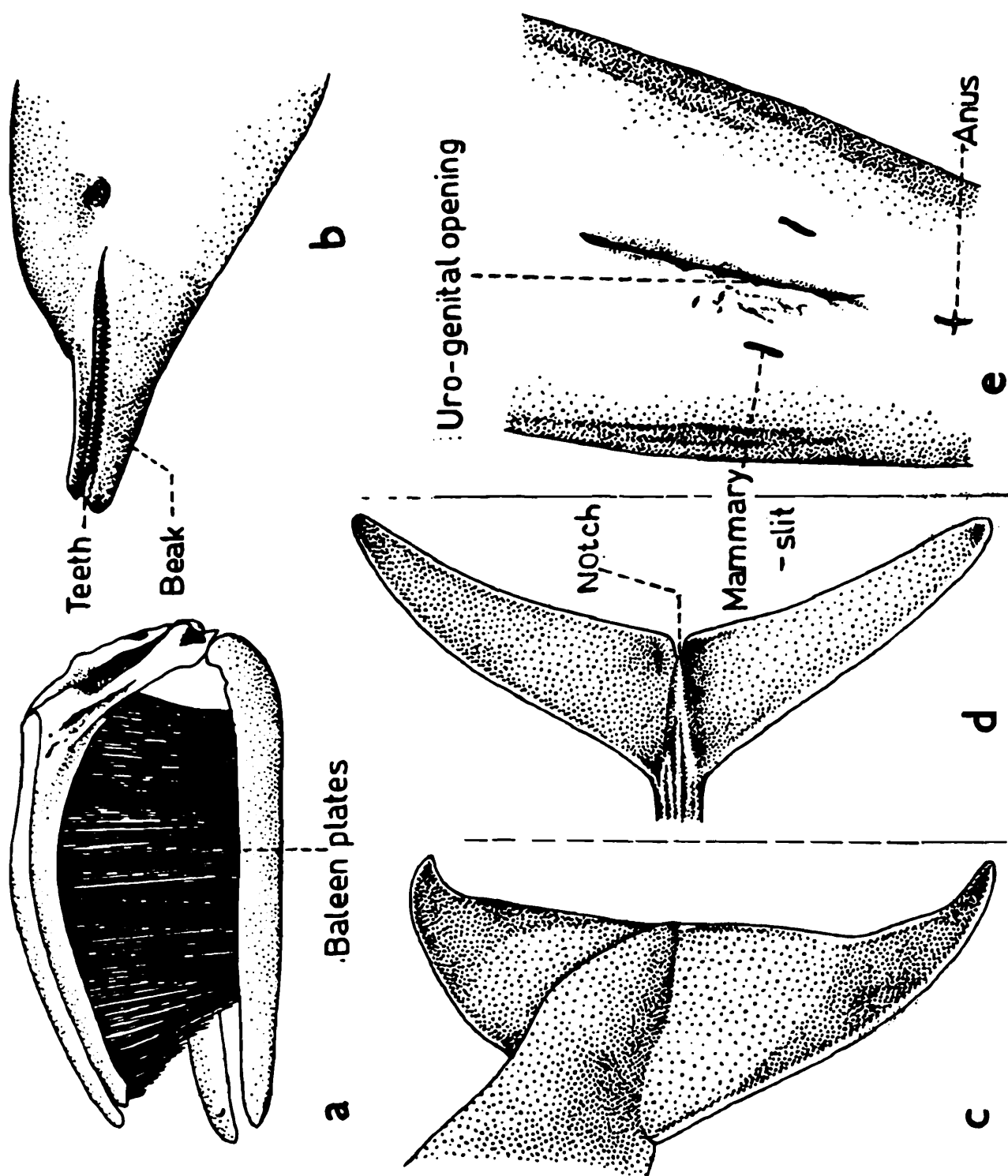


Fig.1 a) Baleen of a Baleen Whale, *Balaenoptera* sp.; b) Beak of a River Dolphin, *Sotalia* sp.; c) Tail - fluke of Cuvier's Beaked Whale, *Ziphius cavirostrus*; d) Tail - fluke of Pacific striped dolphin showing a notch in centre; e) Ventral surface of a dolphin showing the position of mammary slits, uro-genital opening and anus.

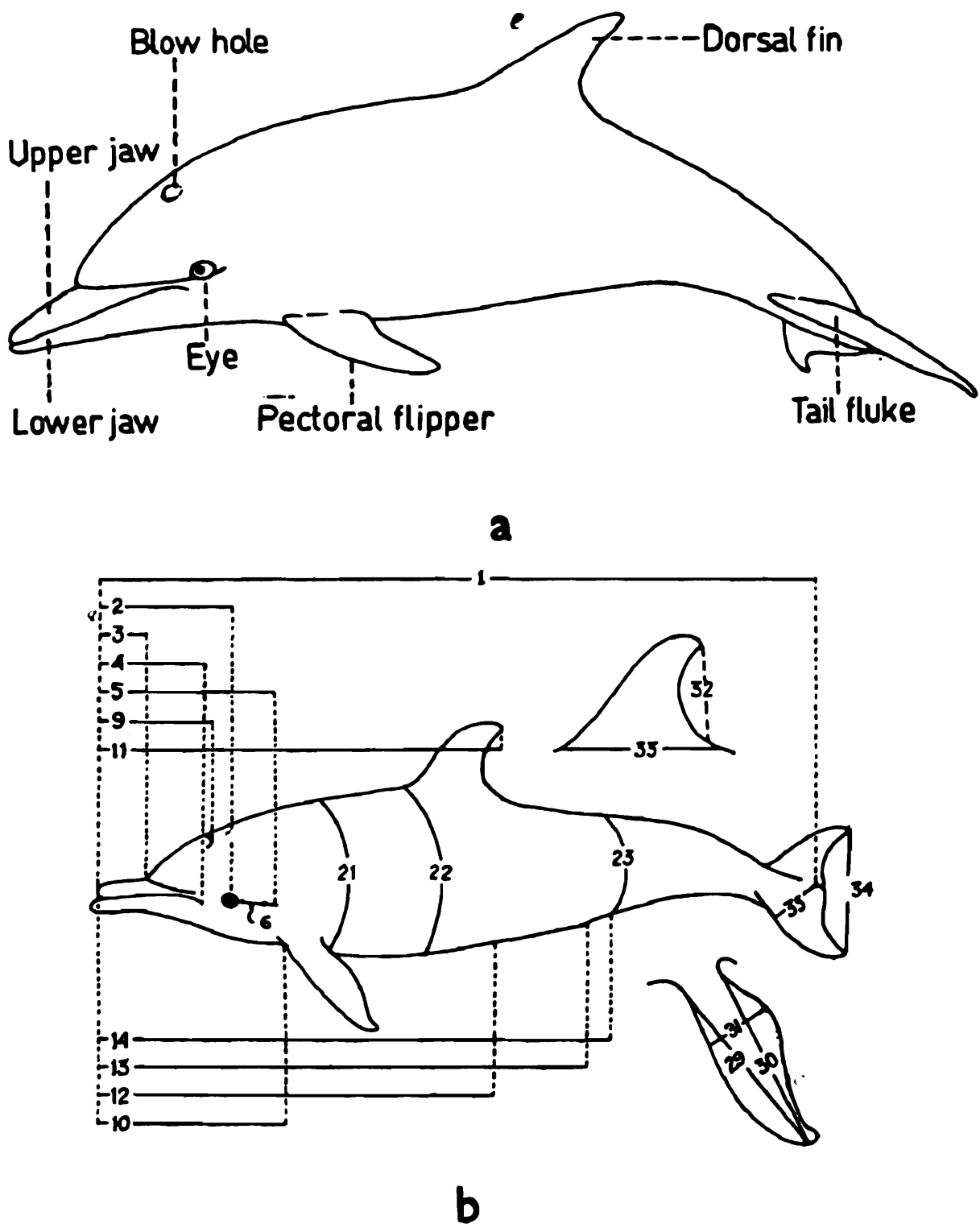


Fig.2 i) Diagrammatic view of a whale showing (a) parts of the body, and (b) external measurements taken for taxonomic identification.

longitudinal axis of the body. Some of the measurements (15-20, 24-28) which are self-explanatory, have not been shown in the diagram.

1. Total length (from tip of upper jaw to deepest part of notch between tail-flukes or middle of posterior fluke margin, if no notch is present.)
2. Length from tip of upper jaw to centre of eye.
3. Length from tip of upper jaw to apex of melon (fatty protuberance of the forehead in many whales and dolphins).
4. Length of gape (from tip of upper jaw to angle of gape).
5. Length from tip of upper jaw to external auditory meatus.
6. Length from centre of eye to external auditory meatus.
- 7 Length from centre of eye to angle of gape.
8. Distance between centre of eye and blowhole.
9. Length from tip of upper jaw to mid-line of blowhole.
10. Length from tip of upper jaw to anterior insertion of flippers.
11. Length from tip of upper jaw to tip of dorsal fin.
12. Length from tip of upper jaw to mid-point of umbilicus.
13. Length from tip of upper jaw to mid-point of genital aperture.
14. Length from tip of upper jaw to centre of anus.
15. Projection of lower jaw beyond upper (if reverse, state so).
16. Length from tip of upper jaw to posterior extremity of throat creases.
- 17 Thickness of blubber, mid-dorsal at anterior insertion of dorsal fin.
18. Thickness of blubber, mid-lateral at mid-length.
19. Thickness of blubber, mid-ventral at mid-length.
20. Length, throat creases : maximum/minimum.

21. Girth, on a transverse plane intersecting axilla.
22. Girth, maximum (describe location).
23. Girth, on a transverse plane intersecting the anus.

Apertures

24. Dimensions of eye ; height/length.
25. Length of mammary slits : right/left.
26. Length of genital slit and anal opening.
27. Dimensions of blowhole : width/ length.
28. Diameter of external auditory meatus, if present.

Appendages

29. Length of flippers from anterior insertion to tip.
30. Length of flippers from axilla to tip.
31. Width of flippers (maximum).
32. Height of dorsal fin from tip to base.
33. Length of base of dorsal fin.
34. Width of tail flukes from tip to tip.
35. Distance from nearest point on anterior border of flukes to notch.
36. Depth of notch between flukes (if none, so state).

Additional information

37. Number of teeth present in both jaws/both sides.
38. Details of baleen plates.

Order CETACEA**Key to identification of Families of Order CETACEA**

1. No teeth in both jaws, instead baleen plates present, projecting down from the upper jaw Balaenopteridae
Teeth present in one or both the jaws ; baleen plates absent. 2
2. Functional teeth present in lower jaw only. 3
Functional teeth present in both the jaws except in the genus *Grampus* 4
3. Lower jaw relatively smaller and underslung, ending ventrally far behind the snout ; more than 8 pairs of teeth present in lower jaw; all seven cervical vertebrae fused Physeteridae
Lower jaw extending at least as far as the tip of snout ; one or two pairs of teeth present in lower jaw ; first three cervical vertebrae fused Ziphiidae
4. Dorsal fin absent ; teeth small, spade-shaped and laterally compressed Phocoenidae
A dorsal fin present ; teeth numerous and conical 5
5. Long beak ; symphysis of mandible about half the length of ramus; all cervical vertebrae separate Platanistidae
Beak moderate in length ; symphysis of mandible never exceeding one-third of ramus ; two or more cervical vertebrae fused Delphinidae

GANGES RIVER DOLPHIN

Order : CETACEA

Family: PLATANISTIDAE

Platanista gangetica (Roxburgh, 1801)

Other common names : Assamese: Hiho, Seho, Bengali : Susuk; Hindi : Susu.

Scientific synonyms : *Delphinus gangeticus*

Delphinus rostratus

Platanista indi

Platanista minor

CHARACTERISTICS

General appearance : Fusiform body; head prolonged into a long and compressed beak, studded with 27-32 teeth on each side; dorsal fin low and ridge-like.

Measurements : Maximum length 2.5 m ; sexually mature ♂ 1.7 m ; ♀ 2.0 m ; newborn 0.67-0.89 m in length.

Body weight : 0.76 m long dolphin weighed 3.42 kg and 1.99 m long weighed 84.0 kg.

Group size : Found single or in small groups of 1-5 (Sinha, 1997).

Head : Forehead rising steeply, prolonged into a long beak.

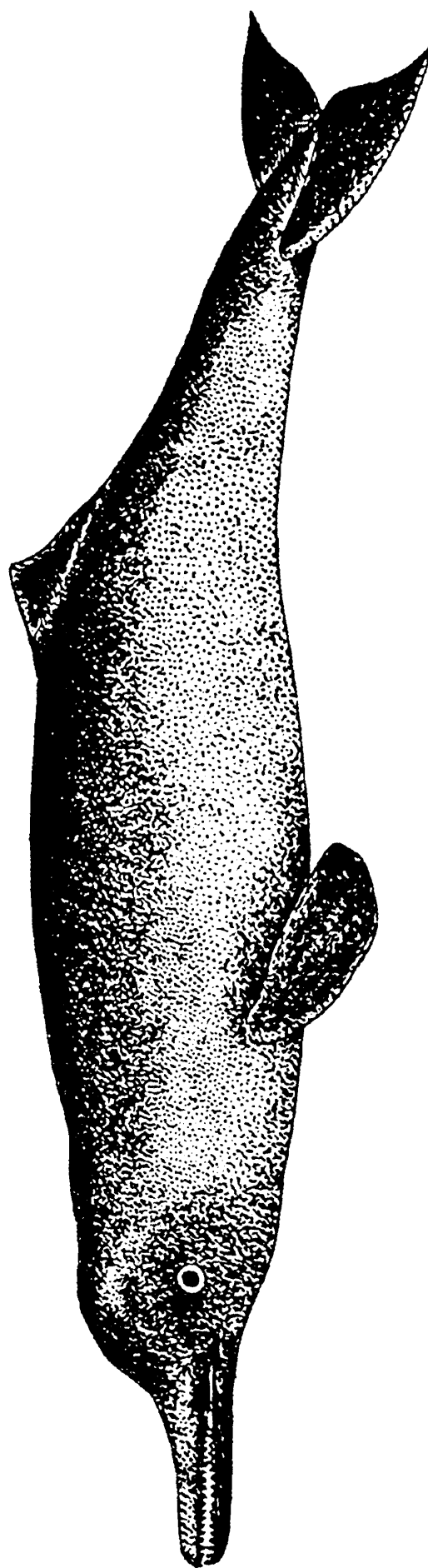
Neck : Distinct but short.

Dorsal fin : Low, ridge-like, located at mid-length of the body, excluding the beak.

Pectoral flippers : Short and broad, more or less triangular in shape.

Tail fluke : Horizontally placed, notched in the middle.

Teeth : Pointed and conical ; 27-32 teeth on each side of each jaw, enlarged towards the tip of rostrum.



Ganges River Dolphin
Platanista gangetica

Blowhole : A longitudinal slit on top of the head.

Skull : Maxilla forming high crest on each side.

Mandible : Symphysis of mandible about half the length of ramii.

Skeleton : Cervical vertebrae separate.

Body colour : Slaty to sooty black ; older animals having lighter patches on sides.

Sexual dimorphism : Females are larger than males ; rostrum longer in females than in males (about 20 cm in an animal of 1.5 m size).

Juvenile : Rostrum and mandibles in juveniles are nearly straight as against bent obliquely upward in adults.

Intraspecific variation : The Ganges river dolphin (*Platanista gangetica*) and the Indus river dolphin (*Platanista minor*) populations were treated as separate species by Pilleri *et al.* (1982), but disputed by Kasuya (1972) and Reeves and Brownell (1989). The latter workers suggested that atmost *P. minor* may be treated as a subspecies of *P. gangetica*.

FOOD

Feeds on crustaceans and fish, about 0.5-1.5 kg per day (Reeves and Brownell, 1989).

DISTRIBUTION

Found in Ganga, Brahmaputra and Meghna river systems, in India, Nepal, Bhutan and Bangladesh. However, *Platanista minor* occurs in the Indus river system of Pakistan.

India : Ganga, Bhagirathi, Gogra, Gandak, Jamuna, Kosi, Dudwa, Banas, Son, Chambal (Singh and Sharma, 1986), Hugli, Tista,

Brahmaputra, Duduya (Ghosh, 1992), Dihang, Buri Dehang, Luhit and Kulsi (Lal Mohan *et al.*, 1998).

Nepal Narayani (offshoot of Gandak), Karnali, Kosi, Mahakali, and Gerwa (Reeves and Brownell, 1989).

Bangladesh : Meghana up to Sumanganj (Sylhet district), Padma, Karnaphuli (Chittagong district) below Kaptai dam.

POPULATION

Wild : Estimated population of Ganges river dolphin is between 4000 and 5000 animals (Jones, 1982) and that of the Indus river dolphin around 500 (Khan and Niazi, 1989). A break up shows about 100 dolphins in Nepal (Shrestha, 1986), 100 in river Karnaphuli (Haque, 1976), 772 in Meghana river system (Kasuya and Haque, 1972), 500 in Brahmaputra, 500-750 in Ganga and about 3000 in estuarine delta (Jones, 1982), and 45 in Chambal (Singh and Sharma, 1986). Recently, Dey *et al.* (1992) have estimated about 1326 dolphins in Brahmaputra, but according to them these probably belong to two species. Another 12 have been reported in Kulsi river (Lal Mohan *et al.* 1998), a tributary of Brahmaputra. Recently, Sinha (1997) surveyed the stretch of Ganga between Farakka Barrage and Calcutta Botanical Garden, West Bengal, and reported a best count of 151 dolphins. He (*loc cit*) also surveyed Karnali, Narayani, Kosi and Mahakali rivers in Nepal, in 1994, and recorded only seven dolphins.

Captive : Not known. It survived in captivity from 64 to 299 days.

COMMERCIAL VALUE

Hunted for its flesh, fat and oil. Its eyes are used in medicine, in Nepal.

Trade No official trade. However, about 350 dolphins are killed annually by gill-nets and consumed locally (Lal Mohan, 1992).

THREATS

- i) Habitat modification due to construction of dams and hydro-electric projects have restricted its movement and caused splitting of its population.
- ii) Deterioration of water quality has resulted in less production of its food fishes and crustaceans.
- iii) Water drawn from ganges for irrigation causes drastic decrease in water level in seasonal rivers, thus shrinking the available habitat especially in summer season.
- iv) Large scale sand extraction and operation of fishing gears are hazardous to the dolphin population. As mentioned above, about 350 dolphins are killed annually by gill-nets and poaching (Lal Mohan, 1992).

SIMILAR SPECIES

The Ganges river dolphin (*P. gangetica*) may be confused with the Indus river dolphin (*Platanista minor*). The distance between anus and tail notch is longer (38-46 cm) and the length of crest on caudo-dorsal side of frontals shorter (about 4 cm) in *P. minor* than in *P. gangetica* where these are 33-43 cm and 10 cm respectively.

PROTECTION STATUS

Legally protected from killing under Schedule I of Indian Wildlife (Protection) Act and from international trade under Appendix I of CITES.

BLACK FINLESS PORPOISE

Order : CETACEA

Family: PHOCOENIDAE

Neophocaena phocaenoides (Cuvier, 1829)

Other common names : Marathi : Bhulga ; Tamil : Molagan.

Scientific synonyms : *Delphinus phocaenoides*

Delphinus melas

Delphinapterus molagan

Neomeris kurrachinensis

Neomeris asiaeorientalis

Neophocaena sunameri

CHARACTERISTICS

General appearance : A small-sized porpoise, with abruptly rising forehead, without any beak; dorsal fin absent.

Measurements : Total length ♂ 1.44-1.87 m ; ♀ 1.55-1.64 m; newborn from 55 cm (Leatherwood & Reeves, 1983) to 80 cm (Kasuya *et al.* 1986).

Body weight : 1.3 m long pregnant female weighed approx. 27 kg (Walker, 1968).

Group size : Found in groups of 1-13 (mean 1.97) individuals (Kasuya and Kureha, 1979).

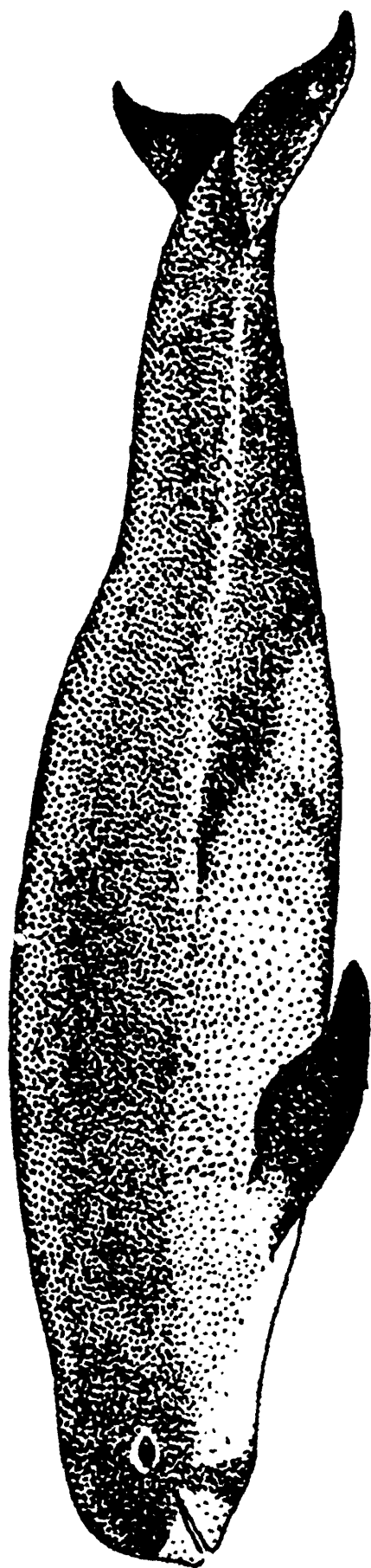
Head : Abruptly rising forehead, without any distinct beak.

Neck : Small but distinct.

Dorsal fin : No dorsal fin but a low ridge.

Pectoral flippers : Small and elliptical.

Tail fluke : Compressed horizontally ; width about 55 cm (Walker, 1968); notched in the middle.



Black Finless Porpoise
Neophocaena phocaenoides

Teeth : Spade-shaped ; laterally compressed ; 15-21 teeth on each side of each jaw.

Body colour : Dark slaty grey, with purplish white patch on throat and lips.

Sexual dimorphism : Males are slightly larger than females.

Juvenile : No information available.

Intraspecific variation : No subspecies. Pilleri and Gühr (1975) treated the forms *phocaenoides* (Pakistan to Borneo), *sunameri* (Korea to Japan) and *asiaeorientalis* (China) as three separate species. But according to Rice (1977) these do not warrant even subspecific recognition.

FOOD

Feeds on squids, shrimps and small fishes.

DISTRIBUTION

Coastal waters and estuaries from the Persian Gulf, through the Indian subcontinent (Pakistan, India, Sri Lanka, Bangladesh and Myanmar) to southeast Asia, north to China, Korea and Japan. Recorded 65 km inside from the mouth of Indus in Pakistan, and 1600 km away from sea in Yangtze river in China (Walker, 1968).

In India, reported from the west coast (Bombay, Goa, North and South Kanara, Calicut, and Trivandrum) and east coast (Madras and Calcutta) (de Silva, 1987).

POPULATION

Wild : No information on Indian population is available. The Japanese population, perhaps the largest, consists of about 4900 individuals (Kasuya and Kureha, 1979). Most commonly seen cetacean near the shore-waters of China (Wang, 1984). 71 individuals were reported from Yangtze river of China (Chen *et al.*, 1980).

Captive : In total, 94 animals have been kept in captivity in Japan, 11 in China and 2 in Java (IWC, 1984). The species can thrive well and breed in captivity.

COMMERCIAL VALUE

Hunted for its edible flesh, fat and oil.

Trade : No official trade is reported in India. During seventies, this porpoise was involved in the small cetacean fishery, particularly in the East China Sea (Oshumi, 1972). This exploitation has more or less ceased from 1982 onwards, with Japan reporting no direct takes, but about 10 animals were taken indirectly each year from 1982 to 1987 (IWC, 1984).

THREATS

Rivers, estuaries and mangrove areas are favoured by this species, rendering it vulnerable to habitat damage. Persecution by man for its meat and oil, pollution of rivers and inland seas, collision with motorised fishing vessels, and increased fishing activities are the main threats to survival of the Indian population.

SIMILAR SPECIES

(i) *Irrawaddy river dolphin (Orcaella brevirostris)* : Differs by its larger size (2-3 m in length) and presence of a dorsal fin.

(ii) *Hump-back dolphin (Sousa chinensis)* : Differs by its larger size (2-3 m in length), and presence of a long beak and dorsal fin.

PROTECTION STATUS

Legally protected from killing under Schedule I of Indian Wildlife (Protection) Act and from international trade under Appendix I of CITES.

FAMILY DELPHINIDAE

Family Delphinidae is characterised by dolphins, which may or may not be having a short beak, symphysis of mandible never exceeding one-third of ramus and 2 or more cervical vertebrae fused. Teeth present in both the jaws except in the genus *Grampus*. The family is represented by 13 genera and 15 species in the Indian Ocean.

Key to genera of family DELPHINIDAE

1. Dolphins with short or no beak 2
 Dolphins with a slender beak 9
2. Size large, more than 5 m in length 3
 Size small, less than 4m in length..... 5
3. Dorsal fin upstanding and tall (one-fifth of body length), in males; a patch behind eyes and flanks white ; 10-13 teeth present on each side of each jaw *Orcinus*
 Dorsal fin short ; patch behind eyes and flanks not white 4
4. Forehead bulbous ; a notch present between snout and forehead; 7-8 teeth present on each side of each jaw *Globicephalus*
 Forehead rounded and small ; no notch between snout and forehead ; 8-11 teeth present on each side of each jaw *Pseudorca*
5. No teeth in upper jaw ; 3-7 teeth present on each side of lower jaw ; head domeshaped ; dorsal fin tall..... *Grampus*
 Teeth present in both the jaws..... 6
6. Teeth more than 20 on each side of each jaw 7
 Teeth less than 20 on each side of each jaw 8

7. 39-44 teeth present on each side of each jaw ; a broad black stripe from eye to anus followed by a white stripe above it *Lagenodelphis*
 20-25 teeth present on each side of each jaw ; no distinct black or white stripe on the side of body *Peponocephala*
8. 10-13 teeth present on each side of each jaw; forehead not bulbous ; dorsal fin tall and backwardly pointed *Feresa*
 12-19 teeth present on each side of each jaw ; forehead bulbous; dorsal fin small, spatulate *Orcaella*
9. Teeth less than 30 on each side of each jaw 10
 Teeth more than 30 on each side of each jaw 11
10. Beak well defined from the forehead by a groove ; a dark stripe present between eyes and flippers *Tursiops*
 Beak not defined from the forehead by a groove ; no dark stripe between eyes and flippers *Steno*
11. A hump present below dorsal fin, if not, colour of body whitish; 30-38 teeth present on each side of each jaw *Sousa*
 No hump present on back ; body dark grey ; 35-65 teeth present on each side of each jaw 12
12. No stripe between eyes and flippers, and eyes and anus ; palate with deep groove on each side ; 40-50 teeth present on each side of each jaw *Delphinus*
 A stripe present from eyes to flippers or from eyes to anus ; palate devoid of any groove on each side ; 35-65 teeth present on each side of each jaw *Stenella*

ROUGH TOOTHED DOLPHIN

Order : CETACEA

Family: DELPHINIDAE

Steno bredanensis (Lesson, 1828)

Scientific synonyms : *Delphinus rostratus*

Delphinus bredanensis

Delphinus reinwardtii

CHARACTERISTICS

General appearance : Forehead slopes evenly into long, slender beak, so that beak not sharply demarcated from head. Body dark grey to blackish above, lips and underparts white, and pale blotches on sides; 20-27 teeth present on each side of each jaw.

Measurements : Total length : ♂ 2.25 - 2.65 m ; ♀ 2.1 - 2.55 m; newborn about 0.87 m (Perrin & Reilly, 1984).

Body weight : Not reported.

Age : At sexual maturity, males are about 14 years and females about 10 years in age.

Group size : Usually 10-50, up to several hundred individuals.

Head : No sharp demarcation between forehead and beak ; latter long and slender.

Dorsal fin : Large and sickle-shaped.

Pectoral flippers : Pointed at tip.

Tail fluke: Notched in the middle.

Teeth : 20-27 teeth present on each side of each jaw.

Body colour : As described under general appearance.

Sexual dimorphism : Nothing is reported.

Intraspecific variation : No subspecies.



Rough - toothed Dolphin
Steno bredanensis

FOOD

Feeds on pelagic octopus, other squids and fishes.

DISTRIBUTION

Worldwide, in tropical and warm temperate waters, mainly at the edges of the continental shelves. Recorded in the Gulf of Aden, Mozambique, seas off Pakistan, India (Nicobar Island). Sri Lanka and Java.

POPULATION

No estimate of its population is available. Not particularly numerous in any specific area, although schools of several hundred individuals have been occasionally observed (Miyazaki and Perrin, in press). Recent USA sightings, however, give an average of six.

Captivity : At least 43 specimens are known to have been taken into captivity, worldwide. In Hawaii Island, a female *Steno* mated with a male *Tursiops* producing an apparently healthy calf which survived for five years. There are no other reports of breeding in captivity.

THREATS

There is direct fishery for small cetaceans in West Indies, Solomon Is, Papua New Guinea and Japan, where this species is occasionally taken but in small numbers. These are also captured in Pacific Tuna fishery, Purse seine fishery in tropical waters and in gill-net fishery off Sri Lankan coast.

COMMERCIAL VALUE

Its meat is used for human consumption.

Trade data : Eight specimens were exported to U.K. and USA between 1981 and 1983 (CMC, 1987) from Africa.

SIMILAR SPECIES

- (i) Bottle-nose dolphin (*Tursiops truncatus*) : Shorter beak, uniform coloration and no pale blotches on sides.
- (ii) Pan-tropical spotted dolphin (*Stenella attenuata*) : More spots on body.
- (iii) Spinner dolphin (*Stenella longirostris*) : A grey stripe runs from eyes to flippers ; beak defined from the forehead by a notch.
- (iv) Hump-backed dolphin (*Sousa chinensis*) : A distinct notch between forehead and beak ; either a hump present on base of dorsal fin or if absent, colour of body whitish.

PROTECTION STATUS

Protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

HUMP-BACKED OR PLUMBEOUS DOLPHIN

Order : CETACEA
Family: DELPHINIDAE

Sousa chinensis (Osbeck, 1765)

Scientific synonyms : *Delphinus chinensis*

Delphinus plumbea

Steno lentiginosa

Sotalia borneensis

Sotalia fergusoni

CHARACTERISTICS

General appearance : Adults usually have a long low hump on the back, with a small triangular dorsal fin on top ; some forms lack the hump and have larger dorsal fin. Body colour variable, uniform dull grey where hump is present, otherwise white.

Measurements : Total length : ♂ 3.2 m, ; ♀ 2.44 m; new born about 1.0 m. (Perrin & Reilly, 1984).

Body weight : A 1.0 m long dolphin weighed 37 kg, and 2.3 m long weighed 139 kg.

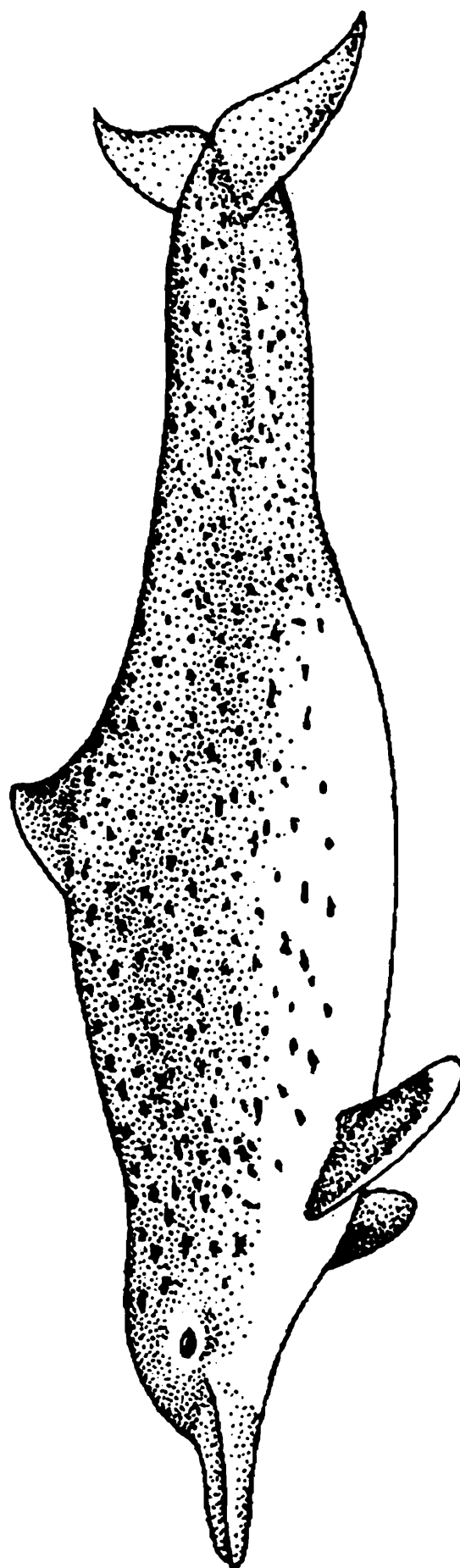
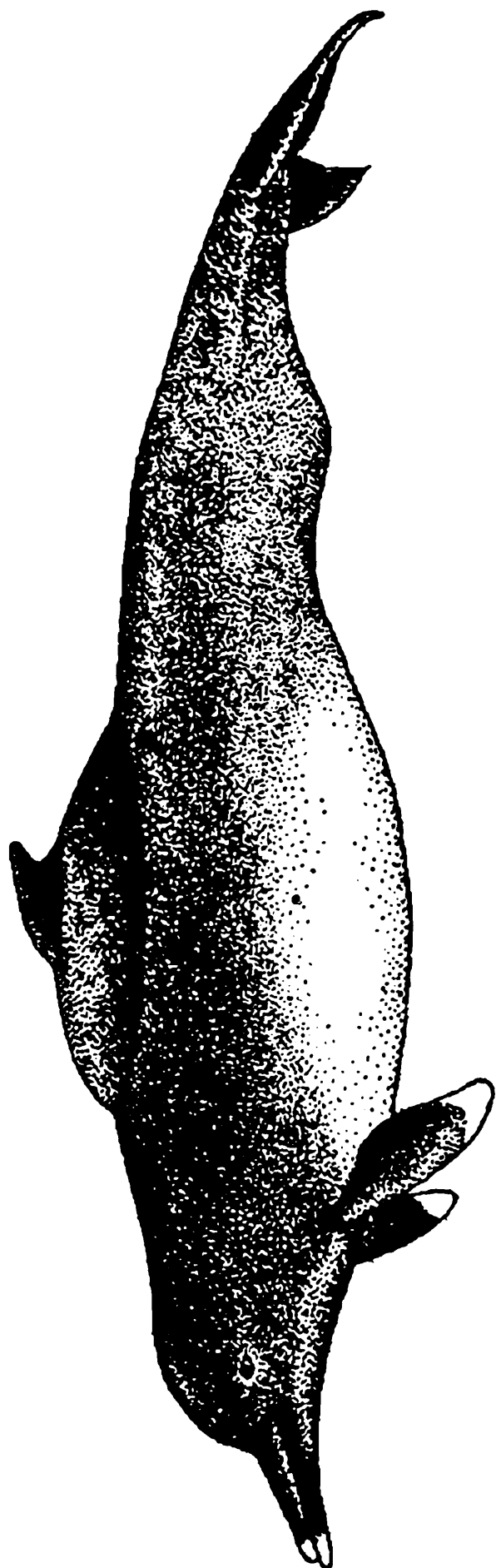
Group size : 3-5 in China (Wang, 1984) ; up to 30 individuals off Sri Lanka coast (Leatherwood *et al.*, 1984).

Head : Having a long beak demarcated from the forehead by a notch.

Dorsal fin : Usually triangular in shape ; may be small or large, a little elevated.

Pectoral flippers : Distinctly broad at base ; length of flipper one-seventh to one eighth of body length.

Tail fluke : Horizontally flattened and notched in the middle.



Hump - backed Dolphin
Sousa chinensis

Teeth : 30-38 conical teeth present on each side of each jaw.

Body colour Variable from uniform bluish grey in *plumbeus* and *lentiginosa* to white in *chinensis* and *borneensis* ; some with grey spots (*borneensis*) and some with brown spots (*lentiginosa*). Variation, however, appears to be related to age.

Sexual dimorphism : Males appear to be larger than females.

Intraspecific variation : Pilleri and Gahr (1974) considered *chinensis*, *borneensis*, *plumbea* and *lentiginosa* as distinct species. Leatherwood and Reeves (1983), however, have considered two main groups—

- (i) dark coloured, possessing a hump on back, found west of Indonesia, and
- (ii) white coloured, lacking a hump on back, found in Chinese waters.

Nothing definite can be said due to lack of sufficient material.

Distribution : Coastal and inshore waters from South Africa, east through the Indian subcontinent and Indonesia to southern China and Queensland (Australia). Frequents mangrove areas.

In Indian waters, this dolphin is recorded from Visakhapatnam, NE. Andamans, Trivandrum, Calicut and Bombay; also from Sri Lanka, Pakistan (Karachi coast) and tidal estuaries of Myanmar (de Silva, 1987).

POPULATION

Wild : Not known at least from the Indian subcontinent. About 200 animals are estimated on Natal coast of S. Africa, relatively common in N. Australia (Mitchell, 1975) and seen in groups of 3-5 in the Gulf of Tonkin (Wang, 1984).

Captivity : A female taken in 1968 survived for about 20 years in captivity, and another for more than 7 years. There are no reports of captive births.

COMMERCIAL VALUE

Hunted for its flesh and oil. In Kuwait, oil is used to waterproof the decks and hulls of dhows (Mitchell, 1975).

Trade data : Not known except two specimens from South Africa were sent to USA in 1984 (CMC, 1987).

THREATS

Occasional takes are reported in anti-shark nets, in Australia, and fishing nets off Pakistan, Iraq and Kuwait. The mean annual catch off South Africa is about 8 animals or about 4% of the estimated population.

Much concern has been expressed at the rate of destruction of mangrove areas (IUCN, 1987), where it frequently occurs.

SIMILAR SPECIES

- (i) Bottlenose dolphin (*Tursiops truncatus*) : Resembles with forms without a hump but differs in being dark grey in colour as against white in *chinensis*.
- (ii) Finless porpoise (*Neophocaena phocaenoides*) : Pale colour of body ; devoid of a beak and dorsal fin.

PROTECTION STATUS

Protected from killing under Schedule II of the Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

GREY OR RISSO'S DOLPHIN

Order : CETACEA

Family: DELPHINIDAE

Grampus griseus (G.Cuvier, 1812)

Scientific synonyms : *Delphinus griseus*

Delphinus cuvieri

Globicephalus chinensis

CHARACTERISTICS

General appearance : High, dome shaped forehead, bisected in the middle by a deep crease ; no beak ; no teeth in upper jaw in adults, and 3-7 at the anterior end of each ramus of lower jaw. Body light to dark grey above, traversed with irregular grey lines, probably healed scars ; lips, chin and belly white ; fins black.

Measurements : Total length ♂ 2.62-3.83 m ; ♀ 2.6- 3.66 m; newborn 1.35 - 1.66 m (Perrin & Reilly, 1984).

Body weight : Not reported.

Age : Oldest reported male was 13 years and female 17 years of age.

Group size : Found in groups of 3-150 individuals (mean 27) in the Indian Ocean.

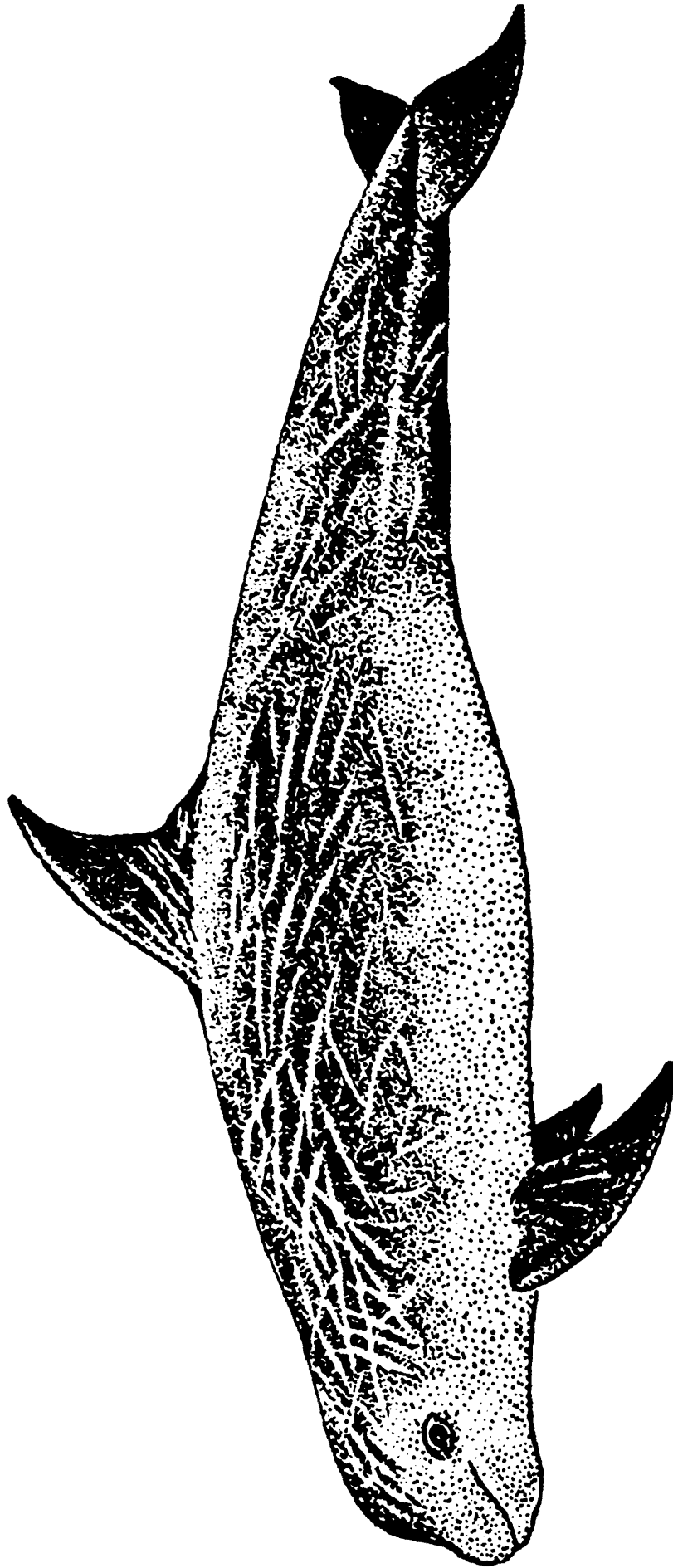
Head : Forehead rising abruptly in a convex curve ; no beak.

Dorsal fin : High, triangular in shape, pointed at tip, slightly curved backwards, located in the middle of the back.

Pectoral flippers : Narrow, somewhat pointed at tip and directed backwards.

Tail fluke : Horizontally flattened ; notched in the middle ; black in colour.

Teeth : No teeth in upper jaw; 3-7 pairs in lower jaw.



Risso's Dolphin
Grampus griseus

Body colour : As described under general appearance.

Sexual dimorphism : Nothing is reported.

FOOD

Feeds mainly on cephalopods and fishes.

DISTRIBUTION

Worldwide, from tropical to warm temperate oceanic waters, generally deeper than 1000 m. Recorded from North and South Atlantic, Pacific and Indian Oceans. Common in the East China Sea, NW. coast of Borneo, around Sri Lanka, Maldives, Gulf of Oman and Red Sea.

POPULATION

No information on population is available but the species is said to be abundant (Leatherwood and Reeves, 1983). Studies in the Indian Ocean revealed it to be the third most frequently encountered species (Kruse *et al.*, 1987).

Captivity : More than 50 Risso's dolphins are known to have been live-captured; the vast majority in Japan (IWC, 1984). No birth is reported in captivity.

COMMERCIAL VALUE

The meat of this dolphin is consumed by human beings.

Trade data : Five specimens were exported from S. Africa and Peru to USA in 1984 and 1985 (CMC, 1987).

THREATS

Killing for meat and indirect take in gill-nets are the main threats.

This species comprised 25% of the cetaceans landed after being caught incidentally in gill-nets off Sri Lanka between 1983 and 1986 (Mitchell, 1975).

SIMILAR SPECIES

- (i) Bottlenose dolphin (*Tursiops truncatus*) : Presence of a long beak.
- (ii) Hump-back dolphin (*Sousa chinensis*) : Presence of a long beak.
- (iii) False killer whale (*Pseudorca crassidens*) : Body colour dark and unscarred.
- (iv) Beaked whales (*Mesoplodon spp.*) : Large size, tapered head and small dorsal fin.

PROTECTION STATUS

Protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

BOTTLENOSE DOLPHIN

Order : CETACEA

Family: DELPHINIDAE

Tursiops truncatus (Montagu, 1821)

Scientific synonyms : *Dolphinus truncatus*

Delphinus aduncus

Delphinus perniger

Tursiops fergusonii

CHARACTERISTICS

General appearance : A stout dolphin, having a moderately short but well-defined beak, separated by a groove from the forehead. Body above plumbeous grey to black, as also the dorsal fin, pectoral flippers and tail fluke; no stripes on sides; belly and lower jaw white.

Measurements : Total length : ♂ 2.39-3.81 m ; ♀ 2.33-3.67 m; newborn 0.84-1.22 m (Perrin and Reilly, 1984).

Body weight : Adults weigh 150-200 kg (Walker, 1968) ; 150-650 kg (*vide* Whale calendar 1997).

Age : Sexually mature male is about 19 years and female about 26 years of age. Oldest known is reported to be 39 years (♂) and 49 years (♀) (Klinowska, 1991).

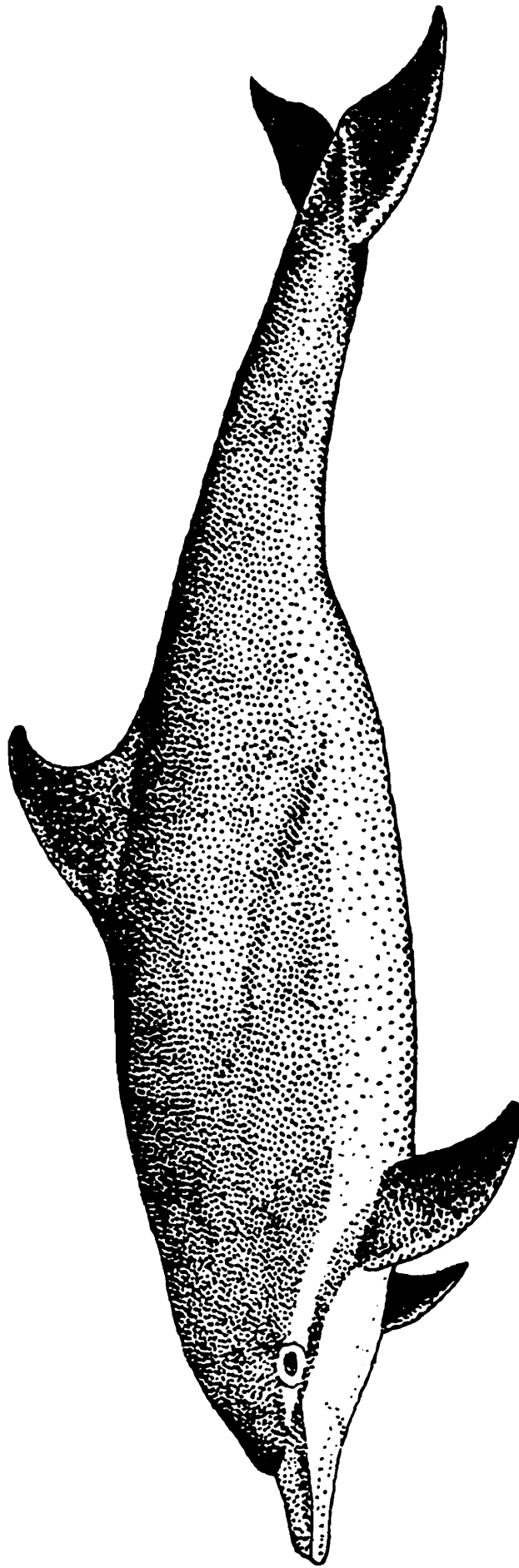
Group-size : Generally ranges from 2 to 18 ; maximum size reported to be 200 for inshore school and 500 for offshore ones.

Head : Moderately large, with a short but well defined beak, demarcated by a groove from the forehead.

Dorsal fin : Tall and sickle-shaped ; black in colour.

Pectoral flippers : Sickle-shaped ; tip pointed ; black.

Tail fluke : Horizontally flattened ; notched in the middle ; width about 0.6 m ; black.



Bottlenose Dolphin
Tursiops truncatus

Teeth : Large, conical and about 1 cm in diameter ; 20-26 teeth on each side of each jaw.

Body colour : As described under general appearance.

Sexual dimorphism : There is practically no difference between the two sexes. Females are known to live longer than males.

Intraspecific variation : Indian Ocean population has been treated specifically distinct as *Tursiops aduncus* (Pilleri and Gahr, 1974), characterised by small body size and spotted venter. However, it was considered to be no more than of subspecific value by Ross and Cockroft (1990).

FOOD

Mainly feeds on fishes and cephalopods. Captive specimens consumed from 6 to 30 kg of fish per day (Tomilin, 1957).

DISTRIBUTION

Worldwide; found in temperate and tropical waters, both offshore and inshore. The species is absent from polar waters. The inshore range includes river mouths, bays, lagoons, estuarine complexes and shallow marine region (0.5-20 m deep).

In the Indian Ocean, reported from the Gulf of Oman, Gulf of Aden, Pakistan (Karachi coast), India (Travancore, Trivandrum and Visakhapatnam), Sri Lanka, east up to Java, Sumatra and Australia (Leatherwood and Reeves, 1990; de Silva, 1987).

POPULATION

Wild : No population estimate is available from the Indian Ocean. However, rough estimates from the Pacific and Atlantic oceans are given below.

Northeastern USA 10000-13000 (less than 1000 inshore stock); Southeastern USA 1500-2000 ; Gulf of Mexico 40,000 ; Mediterranean 10,000 ; South African coast 1000 ; Japanese waters 35000 (Klinowska, 1991).

Captivity : About 2700 individuals have been taken for display from 1860 to 1983 (IWC, 1984), of which 1595-1635 from USA and 580 from Japan. De Master and Dervonak (1988) found a mean overall annual survival rate of captive bottlenose dolphins as 0.93.

THREATS

Increased boat-traffic, collection for display and scientific research, killing for meat, oil and bait, predation by sharks and killer whales, indirect take in gill-nets, purse seine fishery and beach netting, killed by human beings for inflicting damage to fisheries, as also death due to chemical pollution of waters are the threats for this species.

SIMILAR SPECIES

- (i) Hump-backed dolphin (*Sousa chinensis*) : Possesses a hump on back, if not, colour of body white.
- (ii) Rough-toothed dolphin (*Steno bredanensis*) : No demarcation between forehead and beak ; a very narrow cape.
- (iii) Risso's dolphin (*Grampus griseus*) : No distinct beak; adults white around head.
- (iv) Pantropical spotted dolphin (*Stenella attenuata*) : Body profusely spotted.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

Key to Species of Genus *Stenella*.

Body spotted ; a black lateral stripe runs from gape to flippers,
35-48 teeth present on each side of each jaw

..... *Stenella attenuata*

Body not spotted ; black stripes present between eyes and
flippers and eyes and anus ; beak short and thick, with 43-49 teeth
on each side of each jaw *Stenella coeruleoalba*

Body not spotted ; no black lateral stripes but a grey stripe
runs between eyes and flippers ; beak long and slender ; 46-65 teeth
on each side of each jaw *S. longirostris*

**PANTROPICAL
SPOTTED DOLPHIN**

Order : CETACEA
Family: DELPHINIDAE

Stenella attenuata (Gray, 1846)

Scientific synonyms : *Steno attenuatus*
Delphinus velox
Delphinus brevimanus
Delphinus microbrachium

CHARACTERISTICS

General appearance : A medium-sized spotted dolphin, having a short and thick beak ; body divided into dark upper and light (whitish or greyish) lower portion ; a black stripe connects the angle of the gape with the flipper ; a portion of rostrum and lower jaw white.

Measurements : Total length : ♂ 2.0 - 2.57 m ; ♀ 1.87 - 2.40 m ; newborn about 0.85 m in offshore form.

Body weight : Not reported.

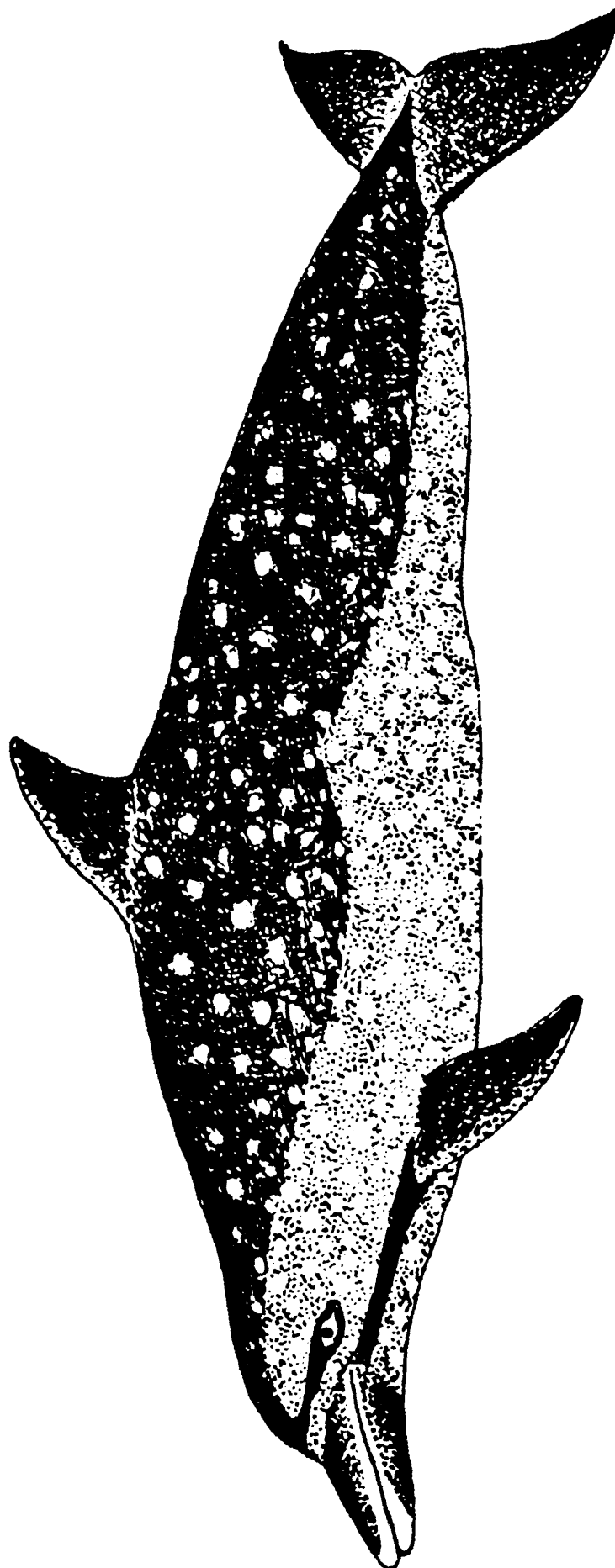
Age : At sexual maturity, the age, in males, is on average 14.7 years and in females 10-12 years. Maximum longevity in both sexes is reported to be about 45 years (Kasuya, 1985).

Group-size : From a few to several thousand individuals (Scott *et al.*, 1985).

Head : A short and thick beak, well demarcated from forehead; a portion of rostrum and lower jaw white up to the gape, in adults.

Dorsal fin : Tall and black, located in the middle of the back, pointed backwards.

Pectoral flippers : Falcate and black ; a black stripe present between the angle of gape and flipper.



Pantropical Spotted Dolphin
Stenella attenuata

Tail fluke : Notched in the middle ; black.

Teeth : 35-48 (mean 41) on each side of upper jaw and 34-47 (mean 40) in the lower (Perrin *et al.*, 1987).

Body colour : As described under general appearance.

Sexual dimorphism : Females tend to have longer rostrum, and males a larger braincase ; there is, however, great overlap.

Intraspecific variation : No subspecies. However, varies geographically in body-size, cranial measurements and coloration. In the eastern Tropical Pacific, dolphins close to the coast are more heavily spotted than those from offshore.

FOOD

Feeds mainly on fishes, cephalopods and crab larvae.

DISTRIBUTION

Worldwide, in tropical and subtropical waters both coastal and offshore, including the Indian Ocean and the Javan Sea (Perrin *et al.*, 1987). In the Indian Ocean, recorded from Sri Lanka, India (Sunderbans), Maldives, Gulf of Oman and Red Sea (de Silva, 1987).

POPULATION

Wild : Northern offshore dolphin population in eastern Tropical Pacific was 2.5 million, in 1981-1986 ; southern offshore stock varied from 2,50,000 to 5,00,000 individuals (Buckland and Anganuzzi, 1988). Nothing is known about the Indian Ocean.

Captive : Over 60 dolphins have been kept in Hawaii Island and over 70 in Japan (IWC, 1984). It is neither hardy nor easily trainable.

THREATS

There is a serious concern about the depletion of eastern tropical Pacific population through incidental kills in Tuna Purse Seine Fishery. Efforts to reduce these kills have been less successful than previously thought.

Trade : 1790 specimens of this dolphin were exported from 1981 to 1985 from countries of Europe to North America and vice versa.

SIMILAR SPECIES

- (i) Hump-backed dolphin (*Sousa chinensis*) : Thickened base to dorsal fin and more uniform mantle pattern.
- (ii) Bottle-nose dolphin (*Tursiops truncatus*) ; Thicker and robust beak and body unspotted.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

SPINNER DOLPHIN

Order : CETACEA

Family: DELPHINIDAE

Stenella longirostris (Gray, 1828)

Scientific synonyms : Delphinus longirostris

Delphinus roseiventris

CHARACTERISTICS

General appearance : Stream-lined body ; beak long and narrow; a grey stripe runs from eye to flipper. Body dark grey above, white below, sides pale ; adults not spotted ; pattern vary geographically, sometimes all grey in the Eastern Pacific.

Measurements : Total length : ♂ 1.7 - 2.4 m ; ♀ 1.65 - 2.0 m ; newborn 0.7 - 0.85 m (mean 0.77 m).

Body weight : 1.7 m long dolphin weigh 55-60 kg.

Age : At sexual maturity, ♂ 10-12 years ; ♀ 7-10 years.

Group size : Found in large schools ranging from less than 200 to over 1000 individuals.

Head : Small, with a long and narrow beak, well demarcated from forehead by a notch.

Dorsal fin : Subtriangular, located in the middle of the back ; tip backwardly directed but not pointed.

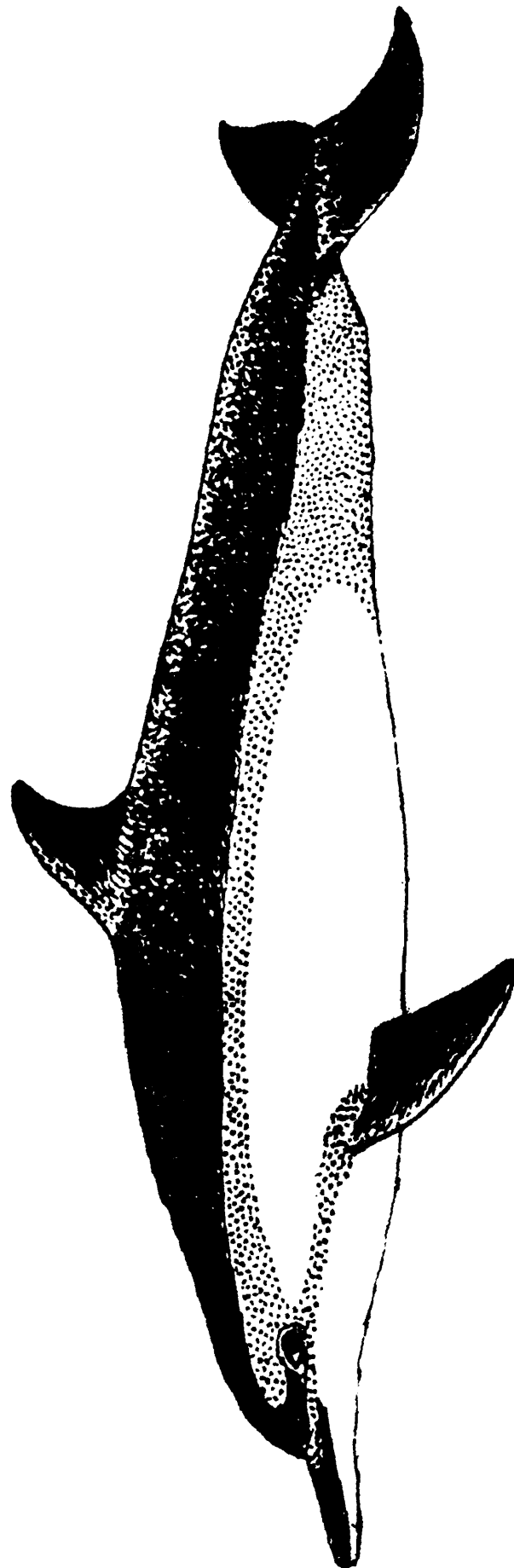
Pectoral flippers : Subovate and black.

Tail fluke : Base strongly keeled ; notched in the middle ; black.

Teeth : 45-65 (mean 50) on each side of each jaw.

Body colour : As described under general appearance.

Sexual dimorphism : Females are slightly smaller than males, in the same age group.



Spinner Dolphin
Stenella longirostris

Intraspecific variation : Perrin (1990) recognised the nominate subspecies, *S. l. longirostris* to occur in the northern Indian Ocean. A dwarf form was earlier recognised from the Gulf of Thailand (Perrin *et al.*, 1987).

FOOD

Feeds mainly on fishes and squids.

DISTRIBUTION

World wide, in tropical waters. Mainly pelagic in distribution. In the Indian Ocean, recorded around Sri Lanka, Malabar coast of India, Maldive Is, Gulf of Oman, Gulf of Aden and Red Sea (de Silva, 1987); also reported from Gulf of Thailand and Javan Sea (Perrin & Gilpatric, in press ; Gilpatric *et al.*, 1987).

POPULATION

Wild : No population estimates are available for the Indian Ocean. However, in the Pacific, eastern spinner's stock was about 600,000 in 1986, and northern white belly spinner's stock and southern white belly spinner's stock were 500,000 and 100,000 respectively, in 1980.

Captivity : About 100 dolphin's (85 in Hawaii, 9 in Java and 1 in the Philippines) are known to have been kept in captivity worldwide (IWC, 1984) in the past but none of them survived.

THREATS

This species is caught in large numbers in eastern tropical Pacific tuna fishery, small cetacean fishery off Solomon Is, St. Vincient and Lesser Antilles, and in the gill-net fishery in SW India and Sri Lanka (Lal Mohan, 1988).

Trade data : About 760 specimens were exported to USA, France, UK, Japan, Canada and FR Germany between 1981 and 1985 (CMC, 1987).

SIMILAR SPECIES

- (i) Bottlenose dolphin (*Tursiops truncatus*) : Large size, short beak, curved and narrow dorsal fin and pale lips.
- (ii) Common dolphin (*Delphinus delphis*) : Presence of V-shaped saddle on the sides of body ; no stripe from eye to flipper.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

STRIPED DOLPHIN

Order : CETACEA

Family: DELPHINIDAE

Stenella coeruleoalba (Meyen, 1833)

Scientific synonyms : *Delphinus coeruleoalba*

Predelphinus petersii

Delphinus styx

Delphinus euphresyne

CHARACTERISTICS

General appearance : A medium-sized dolphin, with short and thick beak; body dark grey to bluish grey, sides light grey, belly white; long, narrow black stripes run from eye to flipper and from eye to anus.

Measurements : Total length : 1.8 - 2.6 m (average 2.2 m); new-born about 1.0 m.

Body weight : Not reported.

Age : At sexual maturity, from six to nine years.

Group size : Ranges from twenty to a few hundred individuals, sometimes to several thousand.

Head : Possesses short and thick beak, demarcated from the forehead by a notch.

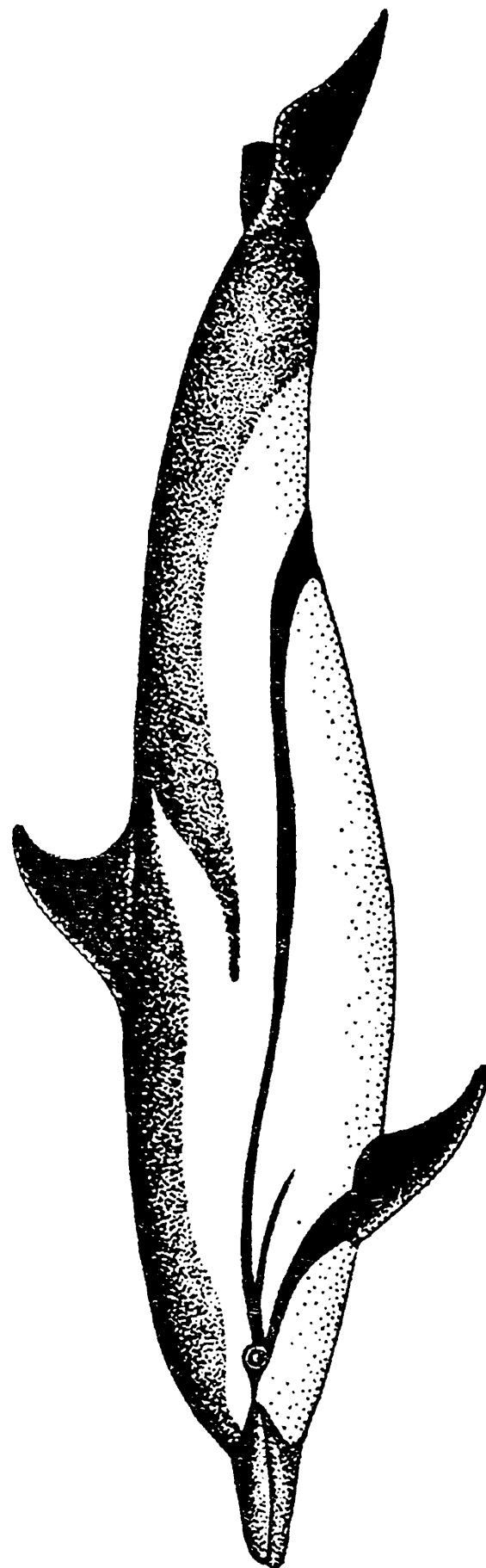
Dorsal fin : Of moderate length, slightly curved backwards, located at the middle of the back.

Pectoral flippers : Falcate and black.

Tail fluke : Notched in the middle; black in colour.

Teeth : 43-49 conical teeth present on each side of each jaw.

Body colour : As described under general appearance.



Striped Dolphin
Stenella coeruleoalba

Sexual dimorphism : Males are slightly larger than females.

Intraspecific variation : Nothing is known.

DISTRIBUTION

Found offshore in most tropical and warm temperate waters. Reported from South Africa, eastern tropical Pacific, western north Pacific, Mediterranean and Red Sea (Perrin & Kasuya, in press; Wilson *et al.*, 1987). Large schools have been recorded south of Java, Sri Lanka, the Gulf of Oman and Maldive Is. (de Silva, 1987).

POPULATION

Wild : There is no population estimate for this species except in the Pacific coast of Japan where it is estimated between 1,76,000 and 2,50,000 individuals (Kasuya, 1985).

Captivity : Striped dolphins have been kept in captivity in Japan and South Africa. A single animal stranded in South Africa in 1985 survived for about 2 years.

THREATS

The hunting of striped dolphin on the Pacific coast of Japan, much more than its maximum sustainable yield for several decades, is a big threat for this species. This coupled with its occasional killing in eastern tropical Pacific tuna purse seine fishery, in gill nets off Sri Lankan Coast and in scaring the animals away from tuna nets in Mediterranean have compounded the problem. However, after 1986, the killing has been substantially reduced.

Trade data : About 26 specimens and two skeletons were exported mainly to USA from South Africa and France (CMC, 1987) between 1981 and 1985.

SIMILAR SPECIES

- (i) Common dolphin (*Delphinus delphis*) : No black stripe from eye to flipper or from eye to anus.
- (ii) Bottlenose dolphin (*Tursiops truncatus*) : Lacks stripes on the sides.
- (iii) Fraser's dolphin (*Lagenodelphis hosei*) : Broader black stripe runs between eye and anus, followed by a narrow white stripe above it.
- iv) Pantropical spotted Dolphin (*Stenella attenuata*) : Body spotted; lacks black lateral stripes.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES

COMMON DOLPHIN

Order : CETACEA

Family: DELPHINIDAE

Delphinus delphis Linnaeus, 1758

Scientific synonyms : *Delphinus tropicalis*

Delphinus frithii

Delphinus pomeegra

CHARACTERISTICS

General appearance : Body slender; head small; snout prolonged into a narrow beak and demarcated from the forehead by a groove; teeth small, 40-50 in number, present on both sides of both jaws. Body dark grey to black above, white on the undersurface; sides with criss-cross stripes of fulvous, grey or white; no black stripes between eyes and flippers.

Measurements : Total length : ♂ 1.7 - 2.6 m; ♀ 1.5 - 2.3 m; new born 0.79 - 0.90 m. Black Sea specimens are smaller than those from the Indian Ocean.

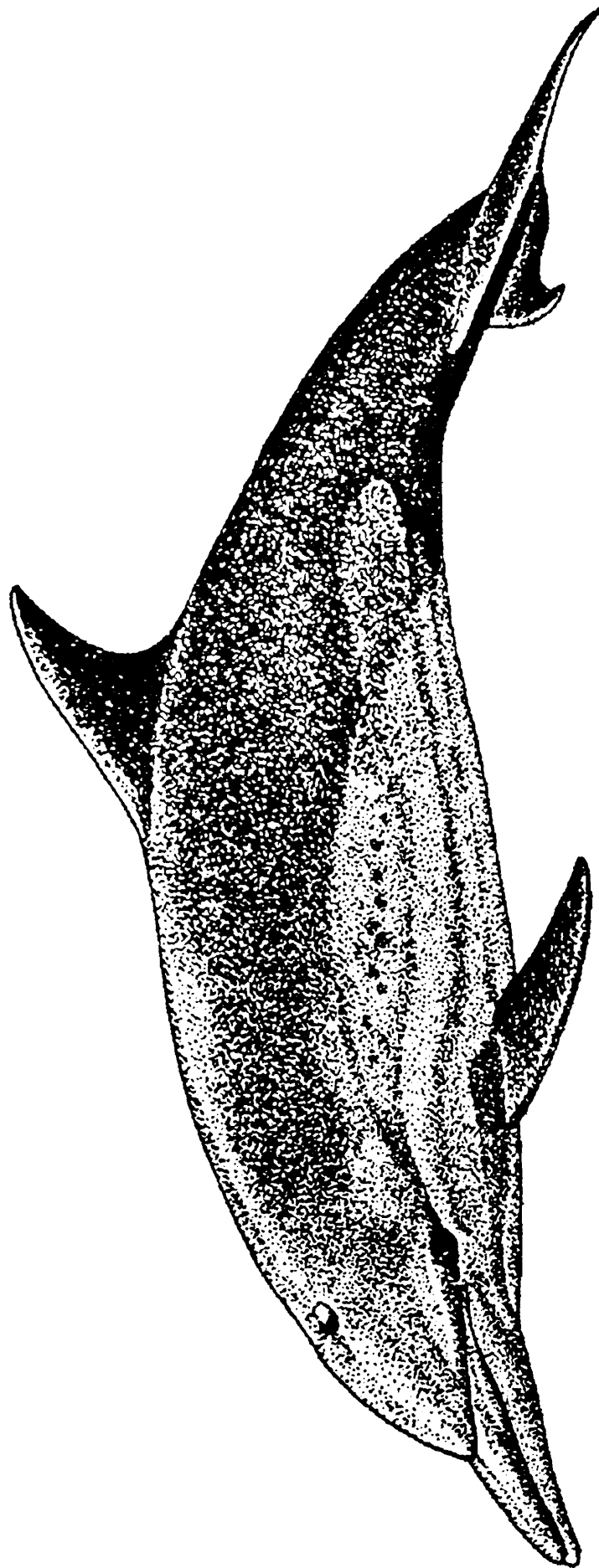
Body weight : 70 - 110 kg.

Age : At sexual maturity, males are 3-4 years of age in Black Sea, 5-7 years in Atlantic and 6-7 years in Eastern Pacific. In the same order, females are 2-4, 6-7 and 7-12 years of age. Maximum age reported is about 22 years in Black Sea.

Group size : Mean school-size around 20, sometimes numbering over a thousand.

Head : Small; long and narrow beak, separated from forehead by a groove.

Dorsal fin : High, triangular, ends in a backwardly directed tip, situated at the middle of the back.



Common Dolphin
Delphinus delphis

Pectoral flippers : Fins three times as long as broad, pointed at tip; black in colour.

Tail fluke : Horizontally flattened, medially notched; black.

Teeth : Conical; 40-50 in number, on each side of both jaws.

Body colour : As described under general appearance.

Sexual dimorphism : Males are slightly larger than females.

Intraspecific variation : Inshore animals around the Indian Ocean tend to have longer beaks and considered specifically different as *Delphinus tropicalis* (*vide* Van Bree and Gallagher, 1978). However, recent workers consider them as conspecific to *D. delphis*.

FOOD

Subsists mainly on fishes and cephalopods.

DISTRIBUTION

Worldwide, from warm temperate to tropical waters, both coastal and offshore. In the Indian Ocean, reported from the Gulf of Oman, Gulf of Aden, Arabian Sea (Goa and Malabar coast), Bay of Bengal (Madras coast), off Sri Lanka, Maldives Is. and Andaman Is; also straits of Molucca and Gulf of Thailand (de Silva, 1987).

POPULATION

Wild : No estimate is available for the Indian Ocean. Estimated population in South Pacific was around 1.8 million in 1986 and 0.6 million in 1987 (Halt & Sexton 1988), and in eastern tropical Pacific 10,000,00 in 1980-1982 (Buckland and Anganuzzi, 1988). Wang (1984) noted tens to hundreds dolphins in PR China-waters as well as off Taiwan.

Captivity : At least 90 dolphins are known to have been kept in captivity worldwide (37 in Pacific coast, USA; 1 in Japan; 22 in Mediterranean; 2 in W. Europe and 28 in New Zealand, IWC, 1984).

COMMERCIAL VALUE

Main products derived from this dolphin are oil, meat and animal-feed.

Trade data : 43 dolphins in 1979, 45 in 1983, 1612 in 1984, and 728 in 1985 were exported/imported between USA, UK, France, Japan and Canada (CMC, 1987).

THREATS

Over-exploitation, increase in number of its prey species, its hunting by sport-persons, etc., are some of the threats to this species. No breeding of this species has yet been achieved in captivity, hence conservation through captive breeding is not feasible.

SIMILAR SPECIES

- (i) Striped dolphin (*Stenella coeruleoalba*) : Black stripes present between eyes and flippers and eyes and anus.
- (ii) Spinner dolphin (*Stenella longirostris*) : Grey stripe present between eyes and flippers.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

FRASER'S DOLPHIN

Order : CETACEA

Family: DELPHINIDAE

Lagenodelphis hosei Fraser, 1957

Scientific synonyms : None

CHARACTERISTICS

General appearance : A short beak, large, triangular dorsal fin, pointed at tip; 40-44 teeth present on each side of both jaws, facial part having a pair of deep palatal groove and premaxillary bones fused dorsally in mid-line. Body dark grey above, white below, a broad dark stripe runs between eyes and anus and a white stripe above it.

Measurements : Total length : ♂ 2.31-2.64 m; ♀ 2.06-2.64 m; new born about a metre.

Body weight : 160 - 210 kg.

Age : At sexual maturity ♂ 7 years and ♀ 8 years of age.

Group size : 4-100, upto 1000 animals.

Head : Sloping forehead; a short beak, demarcated from the forehead by a notch.

Dorsal fin : A large, triangular dorsal fin, pointed at tip.

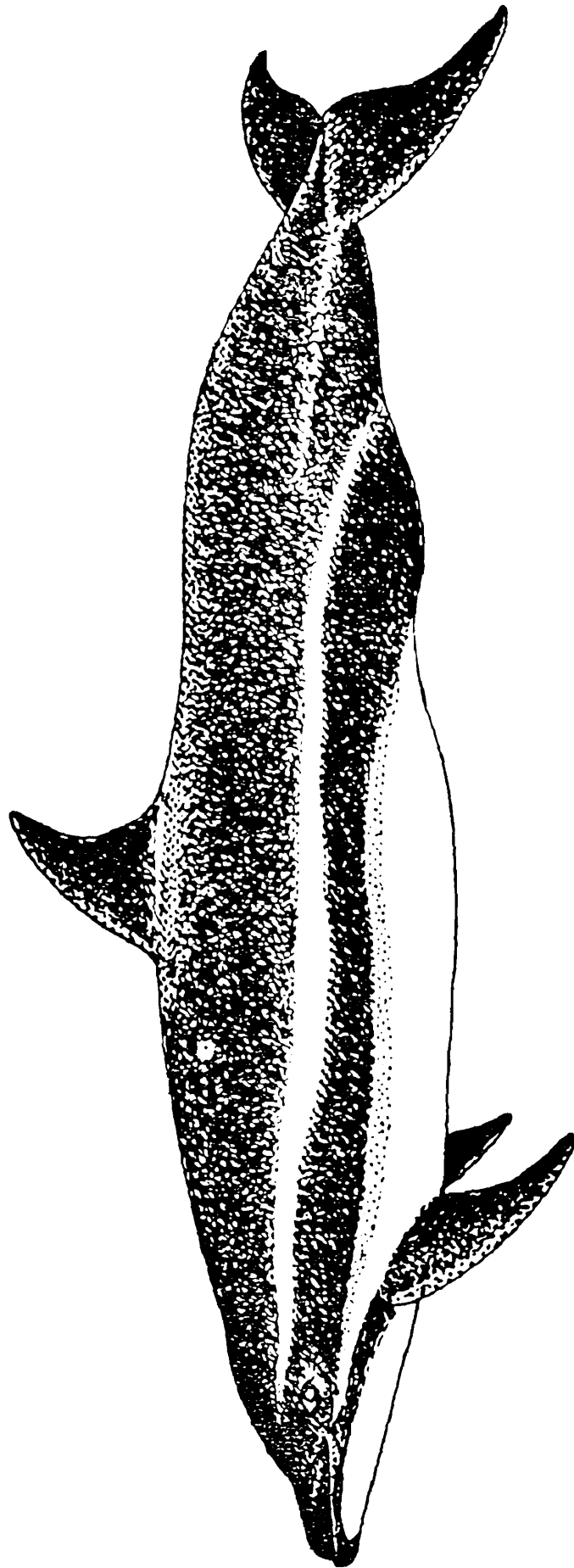
Pectoral flippers : Small; tip not pointed.

Tail fluke : Horizontally flattened, medially notched and black.

Teeth : 40-44 teeth present on each side of each jaw.

Body colour : As described under general appearance.

Sexual dimorphism : Nothing is reported.



Fraser's Dolphin
Lagenodelphis hosei

FOOD

Feeds on mesopelagic fishes, shrimps and squids.

DISTRIBUTION

Mainly oceanic form, avoiding shallow inshore waters. Found in tropical waters around the world including Sri Lanka, Borneo, Taiwan and the Philippines. (Miyazaki and Wada, 1978).

POPULATION

Wild : A maximum of 1,36,000 individuals have been estimated to inhabit the eastern tropical Pacific. No population estimate is available for other parts of the range. But the species is not rare (Perrin *et al.*, in press).

Captivity : 16 individuals were kept in captivity at the Ocean Park in the Philippines in July 1975, of which 4 survived for 30-100 days. This is not a large species and conservation through captive breeding might, however, be feasible with appropriate modern husbandry.

THREATS

No regular fishery in this species is reported. Small numbers are taken in local harpoon fisheries (off Lesser Antilles and Indonesia), in gill nets (off Sri Lanka), in tuna purse seine fishery (eastern tropical Pacific) and in drive fishery (off Taiwan). However, the level of incidental take is not of much significance for the status of this population.

Trade date : Two specimens were exported from S. Africa to USA in 1984 for scientific purpose.

SIMILAR SPECIES

- (i) Spinner dolphin (*Stenella longirostris*) - Side stripe narrow, and a forward pointing dark mark below the fin.
- (ii) Common dolphin (*Delphinus delphis*) - Larger dorsal fin and distinctive pale pattern on the sides.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

MELON-HEADED WHALE

Order : CETACEA

Family: DELPHINIDAE

Peponocephala electra (Gray, 1846) •

Scientific synonymis

Lagenorhynchus electra

Delphinus fusiform

Electra obtusa

CHARACTERISTICS

General appearance : Forehead steeply sloping forward; body elongated and slim; no beak; 20-25 teeth present on each side of each jaw; dorsal fin tall and falcate. Body blackish above, with white blaze mark in pectoral region and on belly.

Measurements : Total length : ♂ 2.12-2.73 m; ♀ 2.29-2.75 m; new born 0.65 - 1.12 m (Perrin & Reilly, 1984).

Body weight : Not reported.

Age : At sexual maturity, about 14 years, in both sexes.

Group size : The school consists of 100-500 individuals or even more.

Head : Shape like that of Globicephalids; forehead rounded, steeply sloping forward; no beak; blowhole located at posterior end of head.

Dorsal fin : Tall and curved backwards.

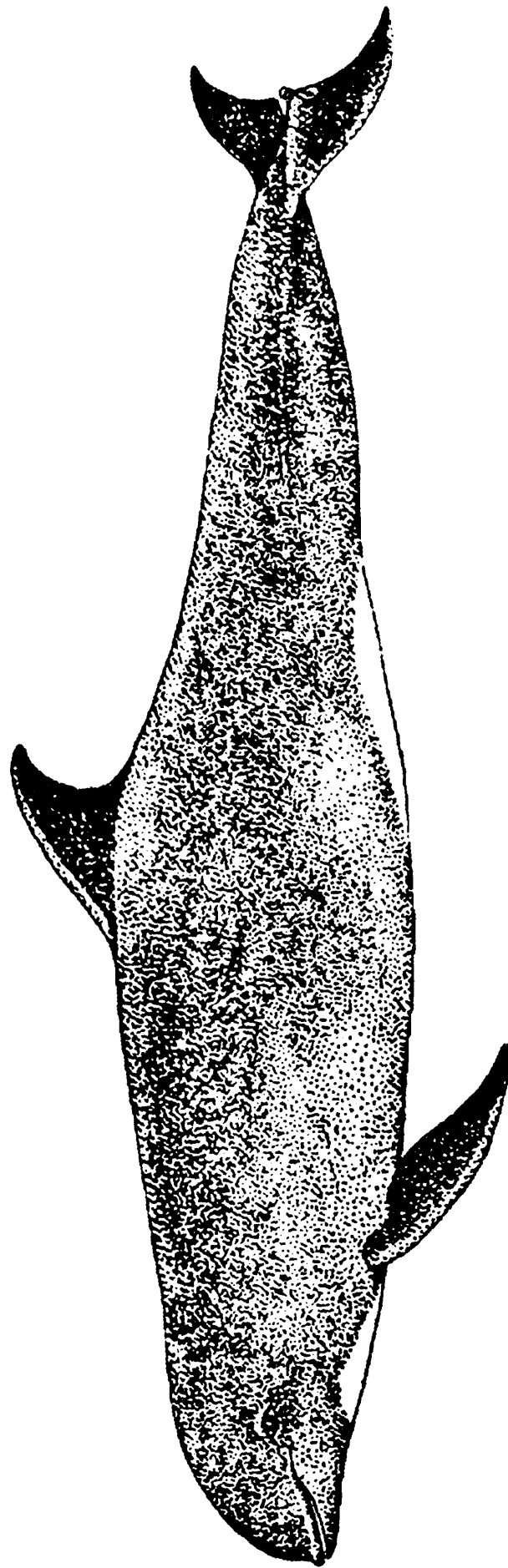
Pectoral flippers : Long, slim and falcate.

Tail fluke : Horizontally flattened, notched in the middle.

Teeth : 20-25 conical teeth on each side of each jaw and confined to anterior two-thirds of rostrum.

Body colour : As described under general appearance.

Sexual dimorphism : Nothing is reported.



Melon - headed Whale
Peponocephala electra

Intraspecific variation : None

FOOD

Food consists of small fishes and squids.

DISTRIBUTION

Worldwide, in tropical and subtropical waters. A rare species, known from a few widely scattered records; appears to stay mainly in equatorial waters (Leatherwood and Reeves, 1983).

In the Indian Ocean, reported from Mekran coast, Pakistan (Roberts, 1977), India (Visakhapatnam), Sri Lanka (Palk strait), Gulf of Thailand, Lesser Sunda Island and the Philippines.

POPULATION

Wild : No population estimate is available except that it is common near Cebu Island in the Philippines.

Captivity : Survived in captivity for 30-45 days, though very aggressive; hence, its breeding in captivity is not feasible.

THREATS

No regular fishery in this species is reported. Small numbers are taken in small cetacean fisheries off Japan, Indonesia and Caribbean, in Tuna Purse Seine in the tropical Pacific and in gill nets off Sri Lanka.

Trade data : One specimen was exported from Saudi Arabia to USA in 1985.

SIMILAR SPECIES

- (i) False killer whale. (*Pseudorca crassidens*) : Large size of body and bent flippers.
- (ii) Pygmy killer whale (*Feresa attenuata*) : A grey brown cape, contrasting with paler sides.
- (iii) Short-finned pilot whale (*Globicephala macrorhynchus*) : Larger body-size, bulbous forehead and broader lower portion of dorsal fin.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

PIGMY KILLER WHALE

Order : CETACEA

Family: DELPHINIDAE

Feresa attenuata Gray, 1875

Scientific synonyms : None

CHARACTERISTICS

General appearance : Head rounded, with no marked beak; dorsal fin tall and curved backwards; 10-13 teeth present on each side of each jaw (Walker, 1968). Body dark grey, with narrow white bands around lips and another white area around vent.

Measurements : Total length : ♂ 2.01-2.87 m; ♀ 2.21-2.43 m; new born 0.53-0.82 m (Perrin & Reilly, 1984).

Body weight : Not reported.

Age : Not recorded.

Group size : 50 or less; may occasionally occur in large schools of several hundred animals.

Head : Rounded, with no marked beak.

Dorsal fin : Tall and curved backward, located in the centre of back.

Pectoral flippers : Rounded at tip.

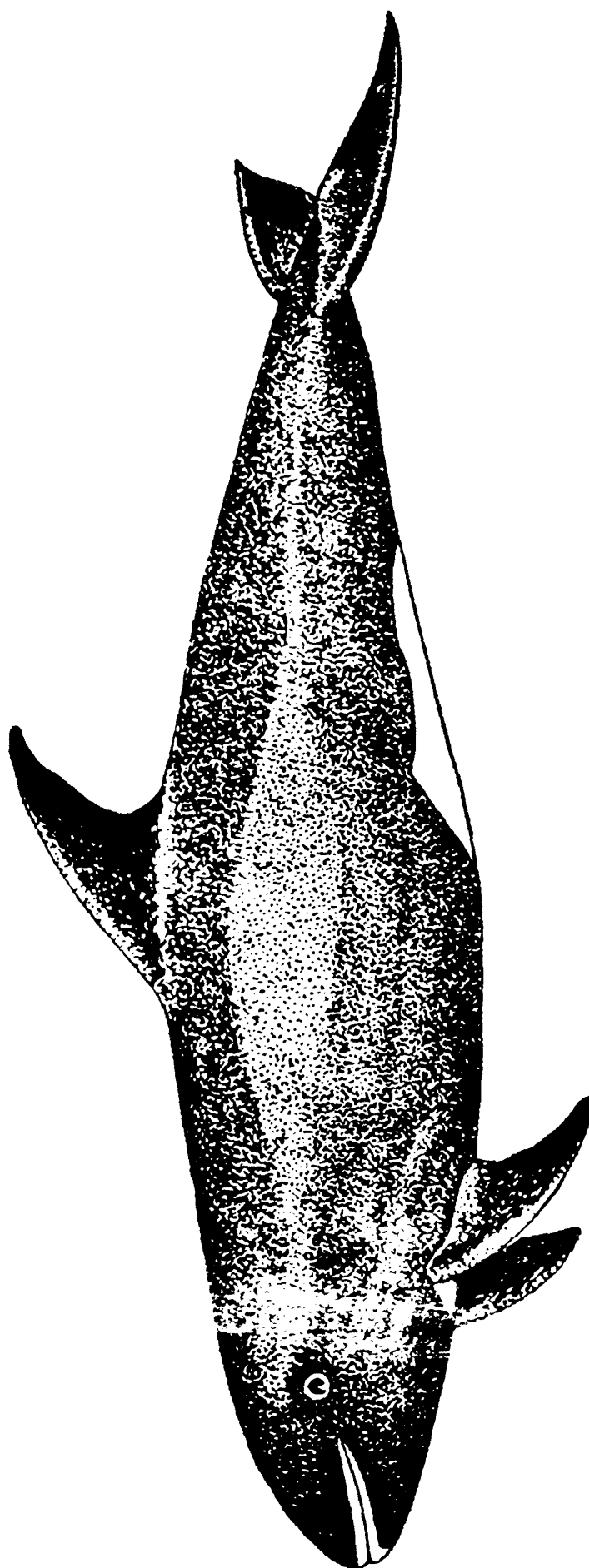
Tail fluke : Horizontally flattened, notched in the middle.

Teeth : 10-13 teeth present on each side of each jaw (Walker, 1968).

Body colour : As described under general appearance.

Sexual dimorphism : No marked difference between the sexes.

Intraspecific variation : Not reported.



Pigmy Killer Whale
Feresa attenuata

FOOD

Feeds mainly on squids and fishes.

DISTRIBUTION

Tropical and subtropical waters of the world but the range is not well known; confined to deep waters. Recorded from Trincomalee, Sri Lanka in 1983.

POPULATION

Wild : No population estimate is available. So far the species does not appear to be abundant.

Captivity : Three specimens in Hawaii and 14 in Japan were kept in captivity but did not survive for more than a month (Reeves & Leatherwood, 1984; Nishiwaki *et. al.*, 1965).

COMMERCIAL VALUE

Meat is used for human consumption and oil for cooking and medicinal purposes.

Trade : No official international trade is reported.

THREATS

No direct threat except incidental catches in small cetacean fishery (Japan, Lesser Antilles, Senegal, Peru and Indonesia), in gill nets (Sri Lanka) or in Tuna Purse Seine Fishery (in eastern tropical Pacific).

SIMILAR SPECIES

- (i) Melon-headed whale (*Peponoc~~o~~phala electra*) : Head smaller; flippers pointed.
- (ii) False killer whale (*Pseud~~o~~rca crassidens*) Larger in size (5-6 m); more uniformly black.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

FALSE KILLER WHALE

Order : CETACEA

Family: DELPHINIDAE

Pseudorca crassidens (Owen, 1846)

Scientific synonyms : Phocaena crassidens

CHARACTERISTICS

General appearance : Long, slender body; smaller, rounded head; no distinct beak, though snout projects slightly beyond the tip of lower jaw; backwardly bent flippers; teeth large and conspicuous, 8-11 on each side of both jaws. Body mainly black, white on the chest.

Measurements : Total length : ♂ 3.7-5.9 m; ♀ 3.5-5.0 m; new born 1.57-1.83 m (Perrin & Reilly, 1984).

Body weight : Largest whale weighed about 1.5 tonne (Walker, 1968).

Age : At sexual maturity, ♂ and ♀ range between 8 and 14 years of age.

Group size : Generally 1-10 animals (McBrearty *et al.*, 1986); larger schools of more than a hundred are also reported (Leatherwood and Reeves, 1983).

Head : Rounded but relatively smaller; no white spot behind eyes; no distinct beak.

Dorsal fin : Conspicuous and curved backwards.

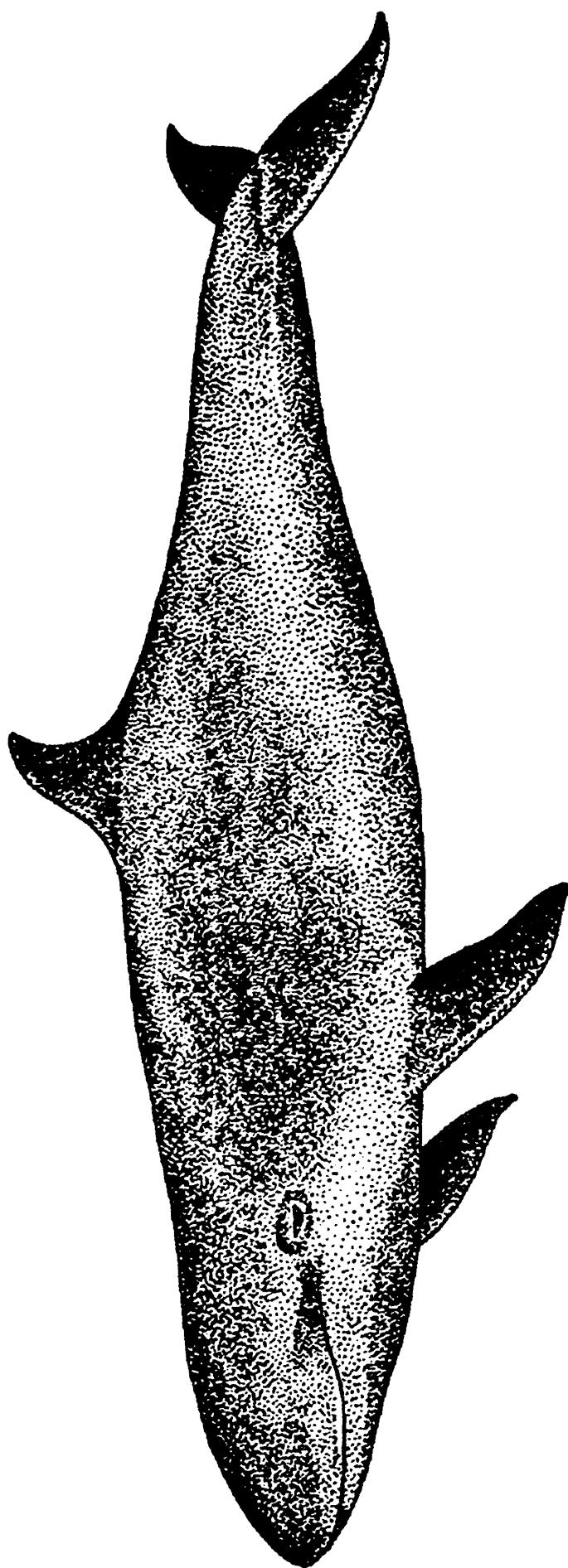
Pectoral flippers : Elongated and tapering, bent backwards; black.

Tail fluke : Dorso-ventrally flattened and notched in the middle.

Teeth : 8-11 in number on each side of both jaws; large and conspicuous.

Body colour : As described under general appearance.

Sexual dimorphism : Males are slightly larger than females.



False Killer Whale
Pseudorca crassidens

FOOD

Primarily cephalopods and large fishes.

DISTRIBUTION

Worldwide, in tropical and warm temperate oceans including the Indian Ocean. Mainly a deep water oceanic form. Recorded from Pakistan (Pilleri & Gühr, 1976), India (Calicut, Trivandrum, Gulf of Cambay, Cape Comorin and Port Blair (James, 1984), Cambell Bay (Sivaprakasam, 1980), off Sri Lanka and from Sumatra to Banda Sea.

POPULATION

Wild : No population estimate is available. Leatherwood and Reeves (1983) suggest that this species is no where abundant.

Captivity : 18 specimens were kept alive in captivity upto 1983 (10 in Hawaiï, 1 in USA, 2 in Australia and 5 in Japan). They survived for about 2 years in Australia. They are too large for conservation through captive breeding.

THREATS

This species is occasionally taken in Japan, Taiwan, China and Carribean Is. in small cetacean fisheries, and some are accidentally killed in gill-nets off Sri Lanka (Leatherwood *et al.*, 1987). They are also killed for damaging fisheries especially to Tuna Long Line Fishery in Japan.

Trade data : About 282 specimens were exported from Japan and South Africa to Australia, Austria, Hongkong, Korea and USA (CMC, 1987) between 1982 and 1984.

SIMILAR SPECIES

- (i) Killer whale (*Orcinus orca*) : Large body size, tall dorsal fin, ovate flippers and white patch behind eyes.
- (ii) Short-finned pilot whale (*Globicephala macrorhynchus*) : Bulbous head, long pointed flippers and sickle-shaped dorsal fin.
- (iii) Pigmy killer whale (*Feresa attenuata*) : Smaller body size and white lips.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

KILLER WHALE

Order : CETACEA

Family: DELPHINIDAE

Orcinus orca (Linnaeus, 1758)

Scientific synonyms : *Delphinus orca*
 Delphinus gladiator

CHARACTERISTICS

General appearance : A large dolphin (5-10 m in length), with bluntly rounded snout, devoid of a beak, high and erect (about 2 m in height) dorsal fin and broadly oval pectoral flippers. Body blackish above, white below, forming a trident posteriorly; a white patch behind eyes and an obscure patch behind dorsal fin.

Measurements : Total length : ♂ 8-9 m; ♀ 4.5-7.0 m (Walker, 1968); newborn 1.83-2.28 m. Longest ♂ 9.8 m; ♀ 8.5 m; height of dorsal fin 1.8 m.

Body weight : A 4.0 m long female weighed 850 kg (Walker, 1968); adults weigh 2.6 - 9.0 tonne.

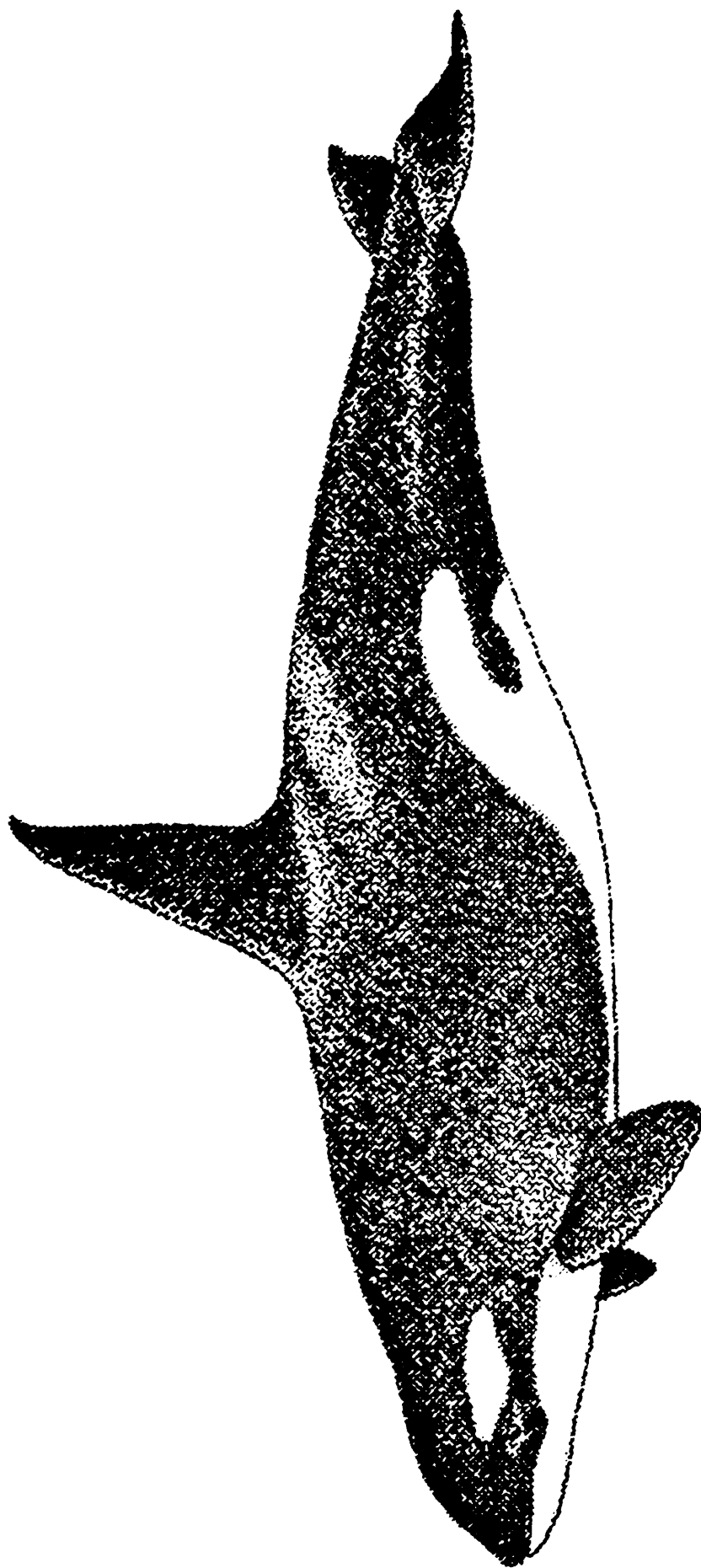
Age : At present, the oldest (completely documented) age recorded is 12.5 years. The highest count from a wild specimen is 52 layers in cementum, however, workers in the field are not confident that this count is equivalent to age in years.

Group size : Generally 5-20 individuals, occasionally up to 100 or even more.

Head : Bluntly rounded snout, devoid of a beak; forehead slopes forward.

Pectoral flippers : Large, broadly ovate; fins broaden with age; narrower in females; black in colour.

Dorsal fin : High and erect (about 2 m in height), somewhat triangular; taller in male than in female (about one-third as high as in males).



Killer Whale
Orcinus orca

Tail fluke : Horizontally flattened; notched in the middle.

Teeth : Large, stout, an inch in diameter and oval; 10 (rarely 12) teeth on both sides of each jaw.

Body colour : As described under general appearance.

Sexual dimorphism : Males are larger (8-9m), having tall and triangular dorsal fin and almost oval pectorals. Females are relatively smaller (4-6m), having low falcate dorsal fin (about 1/3rd as high as in males), and narrower pectorals.

Intraspecific variation : There is a lot of variation in size and colour pattern. Two recently described Antarctic species, *Orcinus nausis* (Mikhalev *et al.* 1981) and *O. glacialis* (Berzim and Vlademirov, 1982) seem to refer to the same population of smaller individuals.

FOOD

Virtually all Oceanic cetaceans and pinnipeds; also penguins, sea birds, sea turtles and fishes. Captive adult animals consume food 4-5 per cent of their body weight per day (IWC 1987).

DISTRIBUTION

Cosmopolitan, most common in Arctic and Antarctic waters but occurs in all other oceans including the Indian Ocean (Leatherwood *et al.*, 1987). Recorded from Pakistan (Mekran coast and Karachi), India (Baroda and North of Andamans), Sri Lanka, around the Lesser Sunda Islands and Borneo.

POPULATION

Wild : No exact estimate of Indian Ocean population is available. It has been casually estimated to a few thousand animals. Sightings indicate that it occurs virtually in all parts.

Some of the estimates other than Indian Ocean are 70,000 in Antarctic region South of 60° latitude, 6618 in North Atlantic, 324 off Alaska, 330 off Vancouver Is, 30 off Mexico in N. Pacific and 35 off Argentina (IUCN RDB).

Captivity : By 1983, 107-115 killer whales were reported to have been captured live, of these 58-66 were taken on the west coast of N. America, 9 off Japan and 39 off Iceland (IWC, 1984). Removal from 1981 to 1987 are - 5 (1982), 3 (1983), 5 (1984), and 4 (1987) (IWC, 1989). Captive killer whales have had few opportunities to breed, being frequently kept singly. Hence, it is not clear whether sufficiently high survival rates amongst captive animals can be achieved to enable the maintenance of self sustaining populations, in captivity.

COMMERCIAL VALUE

The killer whale is caught for its meat and oil. One carcass yields 750-950 kg of oil.

THREATS

Killer whales are killed for human consumption and to check damage to fish and pinnipeds. In total, 2661 catches were made in N. Atlantic between 1938 and 1981; 2-77 (1970-78) and 916 (1979-80) were caught in Antarctica, and 50-170 each year in Japan.

Hundreds of killer whales were killed in the past with machine guns, etc. in Iceland and Norway to check the damage to fish and pinnipeds. Out of 80,000 tonnes of tuna caught in Tuna Fishery in the Indian Ocean, about 4% of fish were lost to killer whales and sharks.

Trade : Ten live animals were captured for commercial purposes between 1980 and 1985 throughout the world (CMC, 1987)

SIMILAR SPECIES

- (i) False killer whale (*Pseudorca crassidens*) : Slender body, shorter dorsal fin, bent flippers and no white spot behind eyes.
- (ii) Risso's dolphin (*Grampus griseus*) : Smaller body-size (3-6 m), paler body colour in adults, and no teeth in upper jaw.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

SHORT-FINNED PILOT WHALE

Order : CETACEA

Family: DELPHINIDAE

Globicephala macrorhyncha Gray, 1846

Scientific synonyms : *Globicephalus indicus*
Globicephalus sieboldii

CHARACTERISTICS

General appearance : Body long and slender, with bulbous forehead, and protruding lips; teeth moderately large, 7-8 on each side of both jaws, confined to anterior half of rostrum. Body black above, with a white mark on throat and a pale patch behind dorsal fin.

Measurements : Total length : ♂ 4.74-6.1 m; ♀ 3.64-5.5 m; new born 1.4-1.85 m.

Body weight : A 4.2 m long whale weighed 680 kg (Walker, 1968).

Age : At sexual maturity, ♂ 7-17 (mean 14.6) years; ♀ 7 - 12 (mean 9.0) years of age. Longevity ♂ 46 years, ♀ 63 years.

Group size : 15-50 animals, normally 20-55.

Head : Bulbous forehead, beak in form of protruding lips; a notch present between forehead and snout.

Dorsal fin : Located at the middle of the back; broad on base; half crescent in shape.

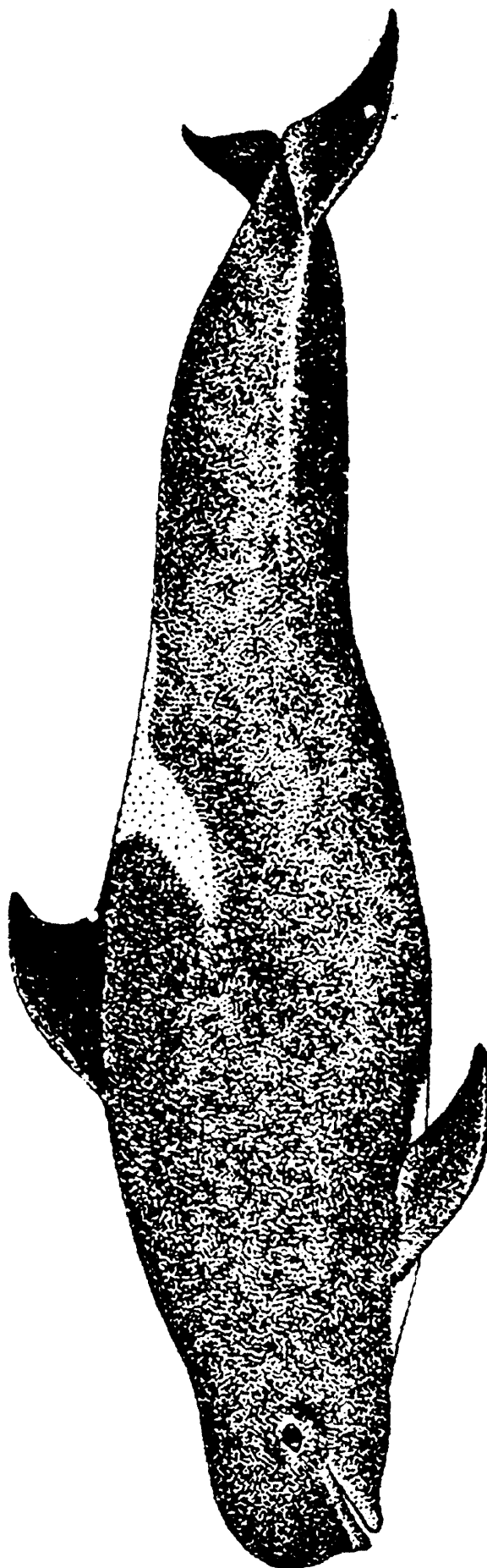
Pectoral flippers : Long, narrow and tapering.

Tail fluke : Horizontally flattened; about 1.3 m in width; medially notched.

Teeth : 7-8 in number, on each side of both jaws.

Body colour : As described under general appearance.

Sexual dimorphism : Males are slightly larger than females.



Short-finned Pilot Whale
Globicephala macrorhyncha

Intraspecific variation : No subspecies. But there appears to exist two populations off Japan to be genetically distinct from each other. One occurring between 40° and 43° N latitudes and the other between 25° and 37° N latitudes (Kasuya *et al.*, 1988).

FOOD

Feeds mainly on squids; also small fishes.

DISTRIBUTION

Found in warm temperate and tropical waters of the world including the Indian Ocean from South Africa to Australia. Recorded from the Bay of Bengal (Hugli river and Salt Lake), Maldives Is., off Sri Lanka coast, the Savu Sea, and seas around Java, Sumatra and Borneo (Leatherwood *et al.*, 1987).

POPULATION

Wild : No population estimate is available for the Indian Ocean or adjacent seas except for the area off Japan. Northern Japanese form was estimated between 819 and 9669, (mean 5334) and southern Japanese form between 18409 and 87597 (mean 53003) animals.

Captivity : At least 226 specimens were kept in captivity in 1983 (20 in Hawaii, 50 in USA, 156 in Japan) for display (IWC, 1984).

COMMERCIAL VALUE

Meat is used for human consumption and oil for cooking and as medicine. Teeth are sold to tourists.

THREATS

Regular whale fisheries is practiced in Japan. An estimated 2367 animals were caught between 1962 and 1970, and about 400 from 1983 to 1987. About 200-300 animals a year were caught in early seventies in the Caribbean Sea. This species is also taken accidentally in gill nets off Sri Lanka.

Trade data : None, officially.

SIMILAR SPECIES

- (i) Long-finned pilot whale (*Globicephala melas*) : Similar but not known to occur in tropics. Slightly larger in size, possesses 8-12 teeth and long flippers.
- (ii) False killer whale (*Pseudorca crassidens*) : Tapered head and a more slender, erect dorsal fin.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

IRRAWADDY RIVER DOLPHIN

Order : CETACEA

Family: DELPHINIDAE

Orcaella brevirostris (Gray, 1866)

Scientific synonyms : *Phocaena (Orca) brevirostris*
Orcaella fluminalis

CHARACTERISTICS

General appearance : Of the size of the Ganges river dolphin, with a bulging forehead, no beak, downwardly pointed mouth, everted lips, dorsal fin blunt at tip, and elipsoid flippers. Teeth 12-19, present on each side of both jaws. Body bluish grey above, paler below; no distinct pattern.

Measurements : Total length : 2.0-2.75 m; newborn about 0.85 m in length.

Age : Maximum age around 30 years.

Group size : 3-10 individuals.

Head : Bulging forehead; no beak.

Dorsal fin : Small, blunt at tip situated at the posterior half of back.

Pectoral flippers : Elipsoid, with oval tip.

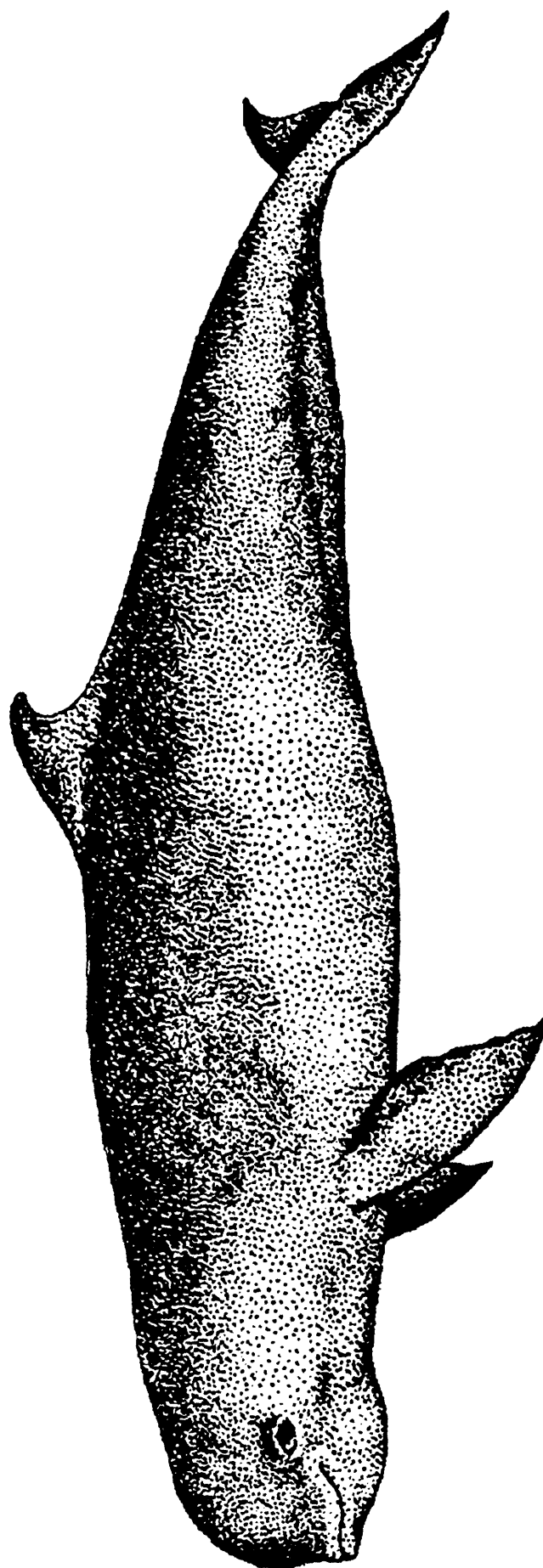
Tail fluke : Horizontally flattened and notched in the middle.

Teeth : 12-19, conical, in each half of both jaws.

Body colour : As described under general appearance.

Sexual dimorphism : Males slightly longer than females.

Intraspecific variation : None.



Irrawaddy River Dolphin
Orcaella brevirostris

FOOD

Primarily takes fishes, also crustaceans and cephalopods.

DISTRIBUTION

Coastal waters from East coast of India through Myanmar, Thailand and Indonesia to northern Australia; particularly found in larger rivers like Ganga, Krishna, Irrawaddy and Mekong (Marsh *et al.*, 1989).

Within the Indian limits, recorded from Visakhapatnam (Andhra Pradesh), Chilka Lake (Orissa) and Hugli river (West Bengal). Prefers inshore waters and estuaries.

POPULATION

Wild : Current population is not known. Population in Chilka Lake (Orissa) in India is isolated and in danger of extermination (Dhandapani 1992). About 20 dolphins are estimated to be present in the Lake, though only 5 were sighted between 1985 and 1987

Species is common in lower parts of Irrawaddy but exact estimate is not known (Leatherwood *et al.*, 1984).

About 100-150 animals are reported from Mahakam river, Pola river and Semayang Lake in E. Borneo (Kalimantan) (Tasan and Leatherwood, 1984).

Captivity : Sixteen dolphins caught in Semayang lake in Indonesia in 1978 were kept in an oceanarium. Eight animals were alive up to 1983. Two females gave birth to healthy young. Captive breeding could, therefore, be a conservation option, if necessary.

COMMERCIAL USE

In India and Myanmar, its oil is considered as a cure for rheumatism, when applied externally. Meat is utilised for human consumption.

THREATS

In India, hunting for oil as well as catching of dolphins accidentally in gill-nets appear to be the main threat to the survival of this species. Pollution of water through industrial wastes, sewer, etc., silting of the lake, and introduction of prawn fishery in mass scale in Chilka Lake will further adversely effect its population.

Trade : The only international trade recorded is the movement of an unspecified number of dolphins from Australia to Canada for scientific purposes in 1984 (CMC, 1987).

SIMILAR SPECIES

- (i) Finless porpoise (*Neophocaena phocaenoides*) : Smaller size of body (1.2 - 1.6 m), and devoid of a dorsal fin.
- (ii) Hump-backed dolphin (*Sousa chinensis*) : Larger in size, longer beak (35 cm) and larger dorsal fin.

PROTECTION STATUS

Protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

FAMILY ZIPHIDAE

Medium-sized cetaceans, having a distinct beak which is not marked off from the forehead; tail flukes not notched in the centre; one or two pairs of large functional teeth present in lower jaw only. First three cervical vertebrae fused.

Family Ziphiidae is represented in Indian Ocean by 2 genera *Ziphius* and *Mesoplodon*.

Key to Genera of Family ZIPHIIDAE

Forehead sloping; beak poorly defined; two conical teeth present at tip of lower jaw *Ziphius*

Forehead low but not sloping; beak distinct; two laterally compressed, massive teeth present near middle of lower jaw *Mesoplodon*

Key to Species of Genus *MESOPLODON*

Teeth in lower jaw single-lobed *M. densirostris*

Teeth in lower jaw bilobed *M. ginkgodens*

CUVIER'S BEAKED WHALE

Order : CETACEA

Family: ZIPHIIDAE

Ziphius cavirostris G. Cuvier, 1823

Scientific synonyms : None in this region.

CHARACTERISTICS

General appearance : Sloping forehead; poorly defined beak, not demarcated from the forehead; lower jaw longer than upper, studded with a pair of conical tooth at its anterior end; no teeth in upper jaw. Body colour dark grey to greyish fawn; face and upper back cream-coloured; sides covered with linear scar in males; greyish white spots in abdominal region in females.

Measurements : Length of sexually mature animal : ♂ 5.26 - 6.93 m; ♀ 5.12 - 6.60 m; new born 2.7 m in length, on average.

Body weight : Average weight around 1600 kg; a female, 6.6 m in length, weighed 2592 kg (Walker, 1968).

Group size : 1-7 individuals.

Head : Sloping forehead, not demarcated from beak; lower jaw longer than upper.

Dorsal fin : Small, pointed and backwardly directed; situated behind middle of body.

Pectoral flippers : Oblong in shape.

Tail fluke : No median notch.

Teeth : A pair of conical tooth present at the anterior end of lower jaw; no teeth in upper jaw.

Body colour : As described under general appearance.

Sexual dimorphism : There is no outward difference between males and females.

Intraspecific variation : No subspecies.

FOOD

Mesopelagic or deep water benthic organisms especially fishes, squids, etc. constitute its main food items.

DISTRIBUTION

Worldwide, from tropical to subpolar waters including the Mediterranean. In the region, recorded around India, Pakistan and Sri Lanka (de Silva, 1987) and from Javan waters eastwards to Moluccas (Heyning, 1989). Mainly a deep water form.

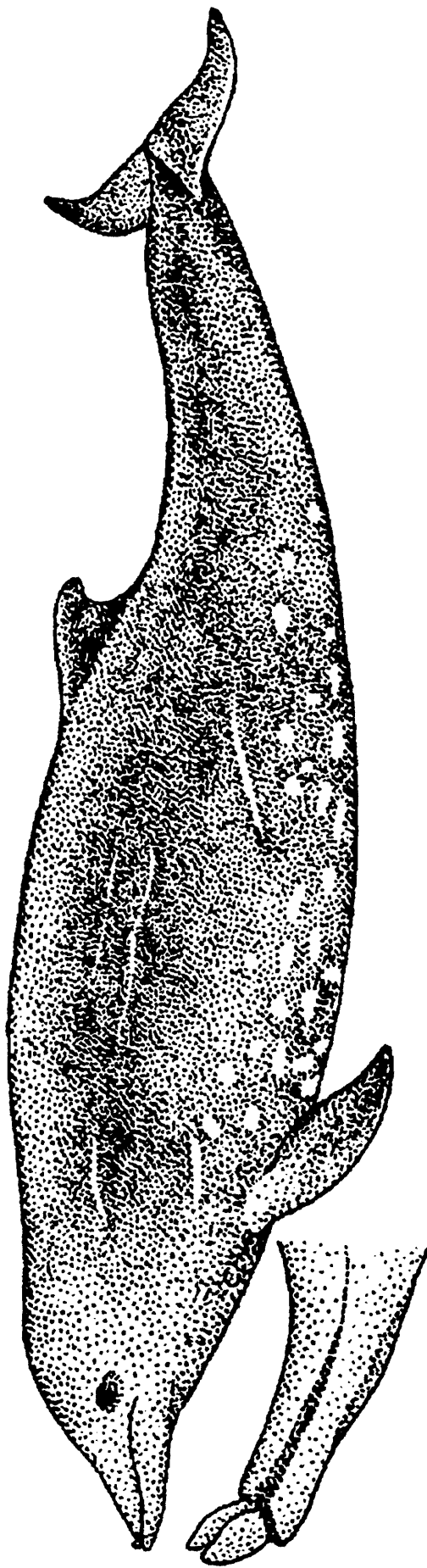
POPULATION

Wild : There is no estimate of its population in the wild. However, it is the most frequently sighted medium-sized cetacean in the eastern tropical Pacific (IWC, 1989).

Captivity : None. There is no report of any attempt to keep this species in captivity except one in USA. The animal remained alive for a few days.

COMMERCIAL USE

Meat is used for human consumption in Japan and Lesser Antilles.



Cuvier's Beaked Whale
Ziphius cavirostris

Trade : Two specimens in 1981, and four in 1982 were exported from France to USA (CMC, 1987).

THREATS

Formerly taken in Japan in small whaling operations but now largely ceased. Accidental or occasional catch in off shore fisheries is common.

SIMILAR SPECIES

Blainville's beaked whale (*Mesoplodon densirostris*) : Longer beak; a pair of teeth present near the middle of lower jaw.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

BLAINVILLE'S BEAKED WHALE

Order :

CETACEA

Family:

ZIPHIIDAE

Mesoplodon densirostris (Blainville, 1817)

Scientific synonyms : *Delphinus densirostris*
Ziphius sechellensis

CHARACTERISTICS

General appearance : Forehead low, with a distinct beak; lower jaw highly arched, especially in males; a pair of large, single lobed tooth present in the middle of lower jaw growing from top of heavy bulges, in males; teeth do not erupt in females. No tooth in upper jaw. Body dark grey to bluish black, paler below, often with pale blotches or white scars.

Measurements : Total length : ♂ 3.50 - 5.8 m; ♀ 3.9 - 4.71 m (Mead, 1989); new born less than 2.4 m; longest foetus 1.9 m (Mead, 1984).

Body weight : 1.9 m (60 kg); 3.95 m (700 kg); 4.56 m (1033 kg).

Age : At sexual maturity, about 9 -11 years.

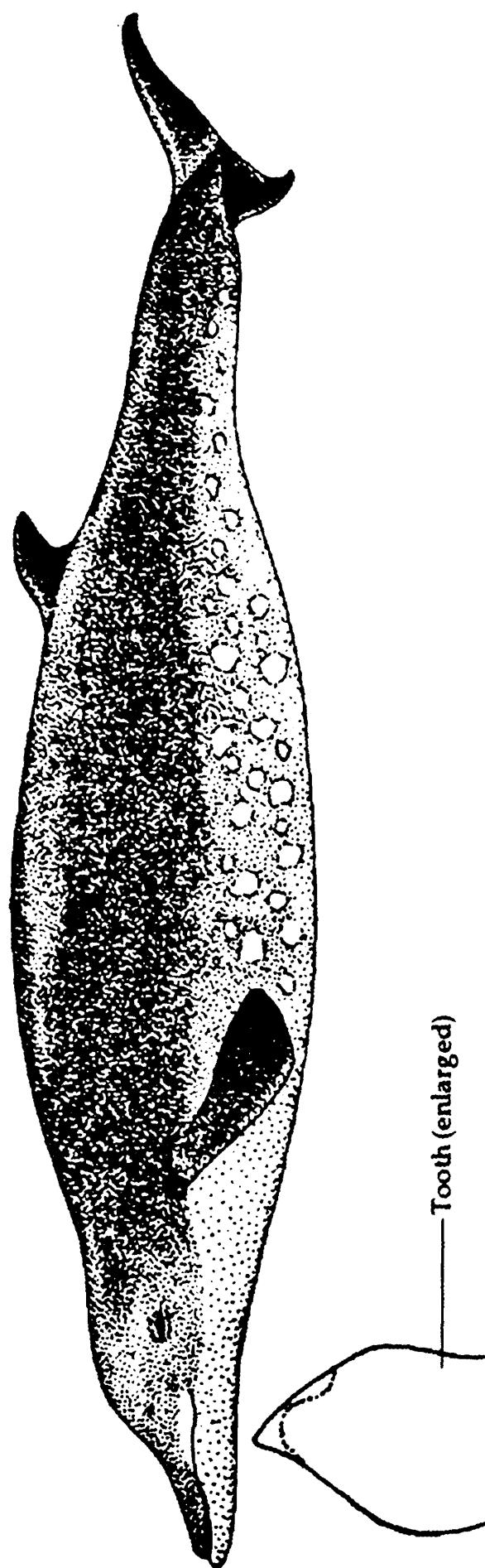
Group size : 1-7 individuals, sometimes more.

Head : Forehead low but less so than in *Ziphius cavirostris*, with a prominent beak; lower jaw heavily arched, in males.

Dorsal fin : Small, subtriangular and located about two-thirds of the way back on the animal.

Pectoral flippers : Oblong, 20-50 cm in length.

Tail fluke : No notch in the middle of the flukes.



Blainville's Beaked Whale
Mesoplodon densirostris

Teeth : No tooth in upper jaw; a pair of massive tooth present in the middle of lower jaw in mature males, absent in females; tooth flattened and single lobed, only tip exposed above the gum.

Body colour : As described under general appearance.

Sexual dimorphism : A pair of teeth present in the lower jaw only in mature males, absent in females.

Intraspecific variation : None reported.

FOOD

Feeds mainly on squids and fishes.

DISTRIBUTION

Worldwide, in tropical to subtropical waters. In the Indian Ocean, recorded from Seychelles, Mauritius and India (Nicobar Island); also reported from South Africa, Taiwan and Australia (Kasuya and Nishiwaki, 1971). Found in deep waters (700 - 1000 m depth) off the shore.

POPULATION

Wild : No estimate of population of this species is available. Known only from a few records, hence, considered rare or very rare.

Captivity : None. Two attempts were made in USA to keep this species in captivity but failed.

COMMERCIAL VALUE

Nothing is reported

Trade : No international trade in the species is reported.

THREATS

No direct threat to this species except accidental catch in small cetacean fishery off Japan, Korea and Taiwan, and poisoning due to DDT and PCB-contamination of its food (squids).

SIMILAR SPECIES

Cuvier's beaked whale (*Ziphius cavirostris*) : More sloped forehead, less prominent beak and a pair of tooth at the anterior end of the lower jaw.

Ginkgo-toothed beaked whale (*Mesoplodon ginkgodens*) : Smaller size (less than 5 m) and a pair of bilobed teeth in the middle of lower jaw.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

**GINKGO-TOOTHED
BEAKED WHALE**

Order : CETACEA
Family: ZIPHIIDAE

Mesoplodon ginkgodens Nishiwaki & Kamiya, 1958

Scientific synonym : Mesoplodon hotaula

CHARACTERISTICS

General appearance : Similar to *Mesoplodon densirostris* in shape but slightly smaller; a pair of bilobed tooth (shaped like the leaves of Ginkgo tree) present in the middle of lower jaw, in males; absent in females. No tooth in upper jaw. No notch in tail fluke. Body darkly pigmented above in males, grey in females; faint light patch present on anterior half of rostrum and lower jaw; white spots (3-4 cm in diameter) present on the posteroventral-third of the animal.

Measurements : Total length : ♂ 4.77 m; ♀ 4.9 m (Mead, 1984).

Body weight : Not known.

Group size : Not recorded.

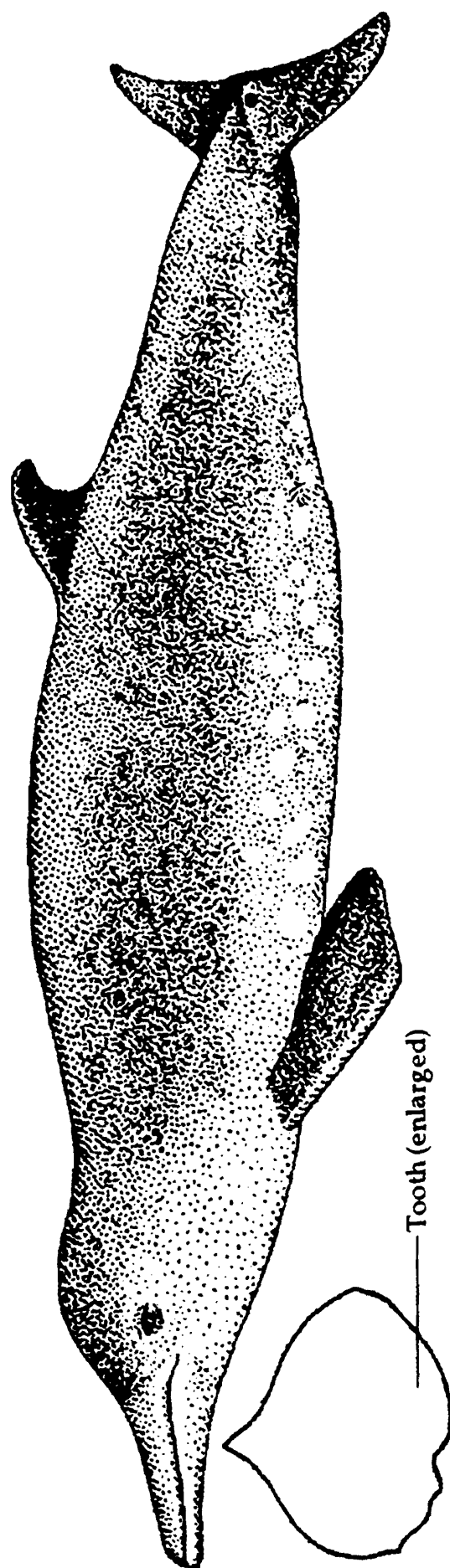
Head : Low, with a prominent beak.

Dorsal fin : Small, subtriangular and situated at posterior two-thirds of the back.

Pectoral flippers : Oblong in shape.

Tail fluke : No notch in the middle.

Teeth : No teeth in upper jaw; a pair of large tooth (bilobed) present in the middle of lower jaw in males, absent in females; only tip of tooth exposed.



Ginkgo - toothed Beaked Whale
Mesoplodon ginkgodens

Body colour : As described under general appearance.

Sexual dimorphism : A pair of bilobed tooth present in lower jaw in mature males, absent in females and young.

Intraspecific variation : None.

DISTRIBUTION

Known from warm temperate to tropical Pacific ocean and the Indian Ocean. Recorded from North Pacific (S. California, Mexico, Galapagos Is, Japan, PR China and Taiwan), South Pacific (New South Wales, and Chatham Is) and Indian Ocean (Sri Lanka : Ratnamala and Trincomalee). (Mead, 1989; Wang, 1984; de Silva, 1987).

POPULATION

Wild : There is no population estimate for this species. It is known by 12 specimens only from Northern Hemisphere (Mead *et al.*, 1988) and six from Southern Hemisphere, hence, considered as very rare.

Captivity : Two specimens were kept in captivity in 1982 and 1984 in Japan but no further details are available.

THREATS

Not commercially hunted, hence, no direct threat to the species except accidental catch.

Trade : No international trade is reported in this species (CMC, 1987).

SIMILAR SPECIES

Cuvier's beaked whale (*Ziphius cavirostris*) : More slopy forehead, less prominent beak and a pair of teeth at the anterior end of lower jaw.

Blainville's beaked whale (*Mesoplodon densirostris*) : Slightly larger in size and tooth in lower jaw single-lobed.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

FAMILY : PHYSETERIDAE

Family Physeteridae is characterised by the presence of spermaceti organ in the head, underslung lower jaw and no teeth in the upper. All seven cervical vertebrae are fused. Represented in the Indian Ocean by two genera *Physeter* and *Kogia*.

Key to Genera of Family PHYSETERIDAE

Size large, 8-18 m in length; enormous truncate forehead, one-third to one-fourth of body length; dorsal fin obscure; teeth in lower jaw 18-27 on each side *Physeter*

Size small, less than 4 m in length; bulbous forehead, one-sixth of body length; dorsal fin distinct; teeth in lower jaw 8-16 on each side *Kogia*.

Key to Species of Genus *Kogia*

Size larger, 2.6-3.4 m in length; dorsal fin smaller (height less than 1/20th of total length of body) and located in posterior half of body *K. breviceps*

Size smaller, 2.1-2.7 m in total length; dorsal fin larger (height more than 1/20th of total length of body) and located in anterior half of body *K. simus*

SPERM WHALE

Order : CETACEA

Family: PHYSETERIDAE

Physeter macrocephalus Linnaeus, 1758

Scientific synonyms : *Physeter catodon*
Physeter microps
Physeter tursio

CHARACTERISTICS

General appearance : Enormous truncate head, almost one-third size of the body containing a large organ filled with spermaceti; narrow, underslung lower jaw, studded with 18-27 large teeth on each side; no teeth in the upper. Dorsal fin low, ridgelike, followed by a series of humps up to the tail; blow-hole present near tip of snout. Body colour deep bluish grey above, with white marblings about lips; under surface lighter.

Measurements : Total length : sexually mature ♂ 10-12 m; ♀ 8-9 m; newborn 3.5-4.5 m. Maximum length reported : ♂ 18 m, ♀ 12 m.

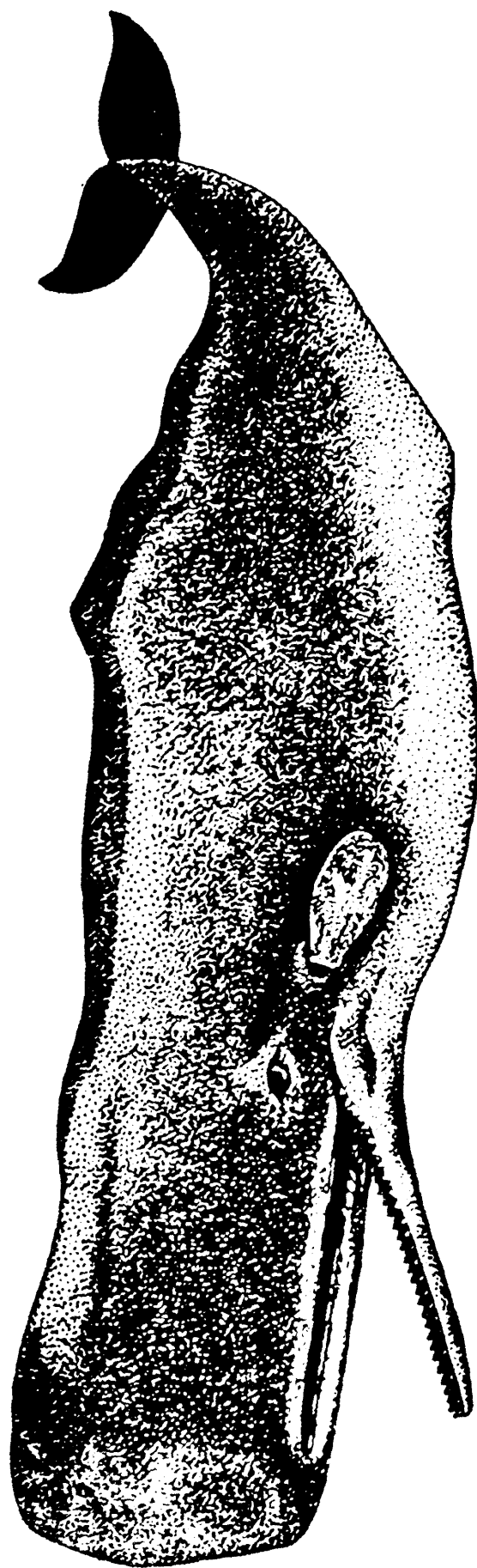
Body weight : ♂ 35-40 tonne.

Age : Sexual maturity is attained between 18 and 21 years in males, and 7-11 years in females; full size is achieved in about 30 years in males, 25 years in females. Maximum age reported 60-70 years (Klinowska, 1991).

Group size : Breeding group size is 20-40 (mean 25) individuals; may be up to 150. Bachelor group size 6-22, upto 50 animals.

Head : Enormous, truncate head, one-third of total length; narrow underslung lower jaw.

Dorsal fin : Low, ridge-like, two-thirds way back on body, followed by a series of humps.



Sperm Whale
Physeter macrocephalus

Pectoral flippers : Broad, paddle-like, surprisingly small for such a large animal.

Tail fluke : Broad and notched in the middle; dark below.

Teeth : No functional teeth in upper jaw; 18-27 large teeth on each side of lower jaw.

Blow-hole : An anymmetrical, S-shaped blow-hole on the left side of the upper anterior extremity of the forehead.

Body colour : Same as described under general appearance.

Sexual dimorphism : Males are nearly one and a half times as large as females; end of snout squarish in males and rounded in females.

Intraspecific variation : None. However, Northern and Southern Hemisphere populations may differ from each other due to their different reproductive cycles — March to June in the former and September to December in the latter, thus offering little opportunity for gene exchange.

FOOD

Feeds mainly on cephalopods and fishes. Consumes food equivalent to 3.0-3.5% of body weight (Rice, 1989).

DISTRIBUTION

Worldwide; found in deep waters. Females and young males are mostly confined between 45°N and 45°S latitudes; only mature males range up to Arctic and Antarctic Oceans. In the Indian Ocean, reported from India (Madras, Mahabalipuram, Krusadai Island, Andaman and Nicobar Is, Quilon and Karwar), Pakistan (Sind and Baluchistan coasts) and Sri Lanka (de Silva, 1987).

POPULATION

Wild : No estimate of population is available from northern Indian Ocean. Borchers *et al.* (1990) estimated 32000 sperm whales in January-February, South of 30°S. The population declined in Southern Hemisphere between 60°E and 30°W longitudes around Africa from 2,00,000 in 1912 to 1,00,000 in 1979.

About 2,50,000 sperm whales have been caught in the N. Pacific in the 20th Century, with a peak of 16,000 in 1968 alone and a world catch of 29,255 in 1964. Kasamatsu and Oshumi (1985) estimated 40,000-80,000 whales from a partial survey of western N. Pacific, south of 40°N latitude. About 20,000 sperm whales have been caught in N. Atlantic between 1950 and 1985. The population declined from 1,30,000 in 1912 to 45,000 in 1981 in SE Pacific (60°W - 100°W).

Captivity : None. Because of their large size, sperm whales have never been deliberately captured for keeping in captivity. A few of the newborns were kept but none survived for more than a few days.

COMMERCIAL VALUE

Sperm Oil (to be used as lubricants, leather tanning and chemical industry), wax, ambergris (used as a fixative in perfumes), teeth (for carving of ornaments and jewellery) and protein rich solid and liquid residue after extraction of oil (used as additive in the formulation of livestock feed) are of commercial value. In 1976-77, a catch of 11977 sperm whales yielded 3,70,170 barrels of sperm oil.

THREATS

At present no threat except indirect take through entanglement in fishing gears. Otherwise whaling in this species is completely banned.

Trade : Only 14 international movements are listed for this species in 1985, consisting of small quantities of teeth or carving. Otherwise this species is protected from whaling by IWC, since 1986.

SIMILAR SPECIES

(i) Hump-back whale (*Megaptera novaeangliae*) : Very long pectoral flippers (about 1/3rd to 1/4th of body-length) and tail fluke deeply notched.

(iii) Beaked whales (*Mesoplodon* spp) : High forehead, long beak, prominent dorsal fin and blowhole over neck.

PROTECTION STATUS

Protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix I of CITES.

PYGMY SPERM WHALE

Order : CETACEA

Family: PHYSETERIDAE

Kogia breviceps (Blainville, 1838)

Scientific synonym : Physeter breviceps

CHARACTERISTICS

General appearance : Head obtusely pointed; forehead bulbous; underslung lower jaw, studded with 12-16 pairs of teeth; no teeth in upper jaw; mouth being ventral, far short of snout; blowhole on top of snout; dorsal fin low, located in posterior half of body. Body colour dark bluish grey above, whitish on throat and belly; gill-shaped white marks on the sides of head.

Measurements : Total length : 2.6-3.4 m; newborn about 1.2 m in length.

Body weight : A 1.88 m long male weighed 109 kg, and 2.98 m long weighed 417 kg (Tomilin, 1957).

Group size : 1-5, up to 7 individuals (Leatherwood and Reeves, 1983).

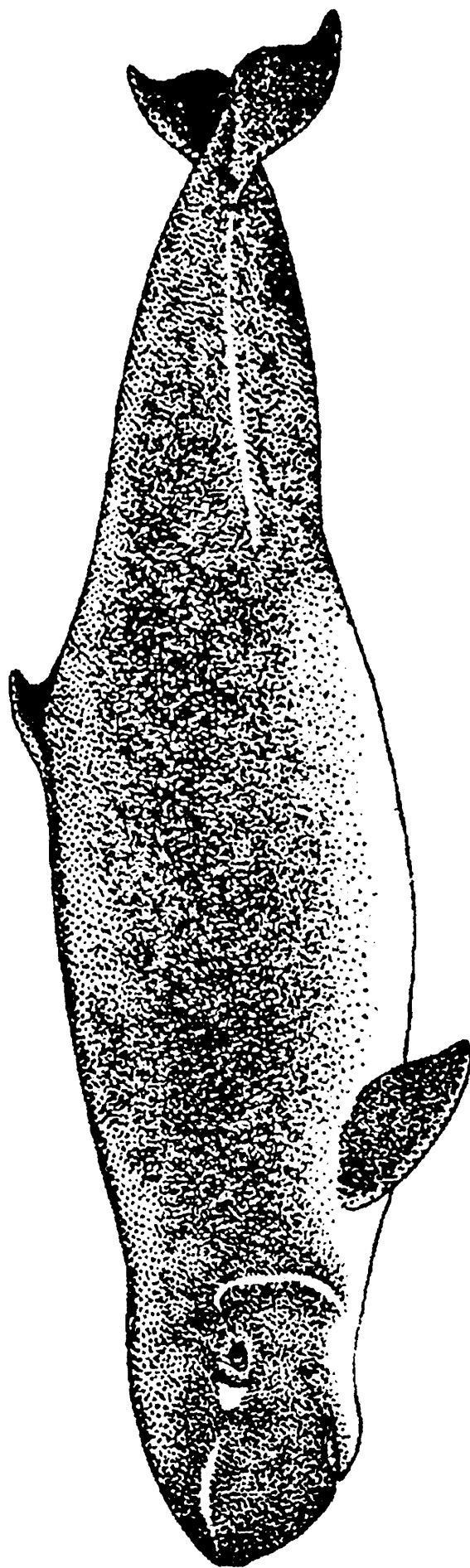
Head : Bulbous forehead; lower jaw under slung; head about 1/6th of body length.

Dorsal fin : Low about 1/20th of total length of body, located in the posterior half of back.

Pectoral flippers : Obtusely falcate and tapering; black in colour.

Tail fluke : Dorso-ventrally flattened and notched.

Teeth : Thin and sharp, curved inwards; none in the upper, 12-16 pairs in the lower jaw.



Pygmy Sperm Whale
Kogia breviceps

Blow-hole : Crescentic, situated on top of forehead, anterior to eyes and tilted towards the left from the mid-line.

Body colour As described under general appearance.

Sexual dimorphism : None. Males and females are almost similar in shape and size.

Intraspecific variation : None.

FOOD

Mainly feeds on cephalopods; also takes fishes.

DISTRIBUTION

Throughout the tropical and warm temperate oceans of the world. Recorded from the eastern coast of India, Sarawak and South China Sea (Caldwell and Caldwell, 1989).

This species is principally oceanic, staying most often seaward.

POPULATION

Wild : Nothing is known about its population estimate in the Indian Ocean. According to Caldwell and Caldwell (1989) more Pygmy than Dwarf Whales strand in Florida (USA) but Ross (1979) found equal numbers in South African samples.

Captivity : None.

COMMERCIAL VALUE

Its meat is used for human consumption.

THREATS

No major threat to the species except through accidental catch or taken for scientific study.

Trade : Two specimens were exported from France to USA in 1981 and 1982 (CMC, 1987).

SIMILAR SPECIES

Dwarf sperm whale (*Kogia simus*) Slightly smaller, dorsal fin relatively taller and located in anterior half of back, and teeth in lower jaw fewer (8-13 pairs) than in Pygmy sperm whale.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

DWARF SPERM WHALE

Order : CETACEA

Family: PHYSETERIDAE

Kogia simus (Owen, 1866)

Scientific synonym : Physeter simus

CHARACTERISTICS

General appearance : Similar to Pygmy sperm whale in having a bulbous forehead and underslung lower jaw, but differs in being slightly smaller, dorsal fin taller (height more than 1/20th of total body length) located in the anterior half of back, and teeth in lower jaw 8-13 pairs and smaller. Body dark grey above, whitish below and gill-shaped white marks on the sides of head.

Measurements : Total length : 2.1-2.7 m; newborn about a metre in length.

Body weight : Estimated weights are between 180-320 kg (Walker, 1968).

Group size : Encountered in groups of not more than 10 animals (Ross, 1979; Leatherwood & Reeves, 1983).

Head : Bulbous forehead; underslung lower jaw; white gill-shaped marks on sides.

Dorsal fin : Large (height more than 1/20th of total body length) and located in anterior half of back.

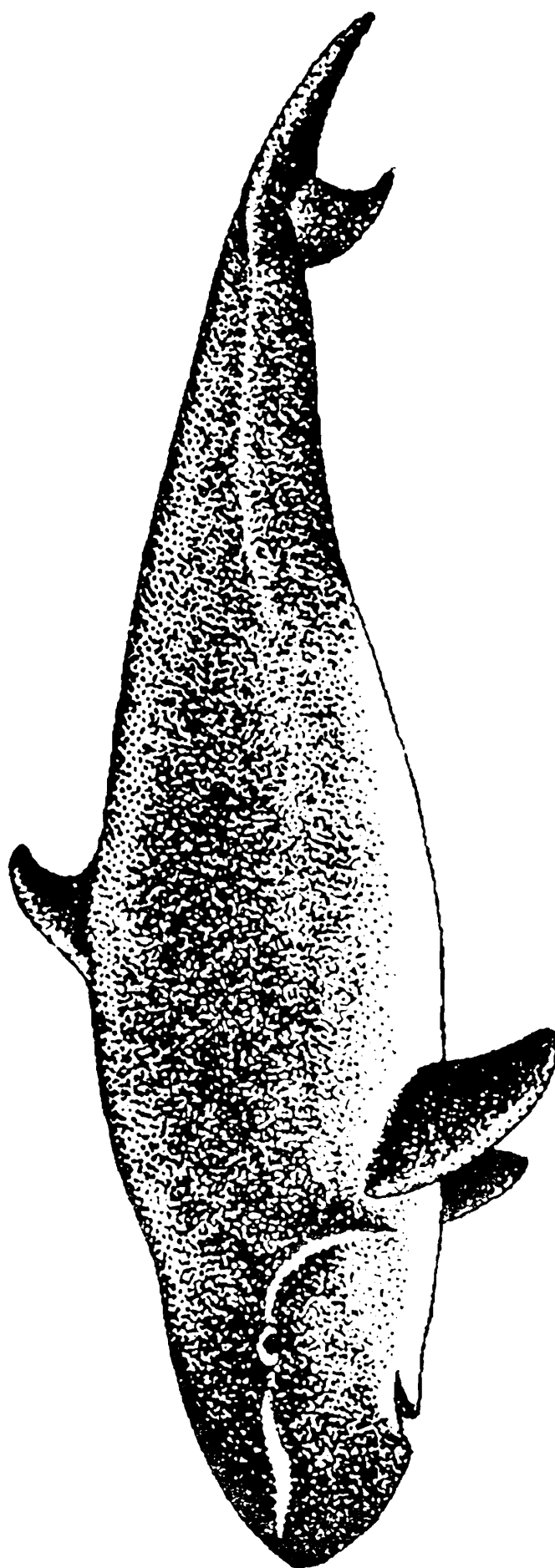
Pectoral flippers : Obtusely falcate and black.

Tail fluke : Horizontally flattened and notched; black in colour.

Teeth : Small; none in the upper, and 8-13 pairs in the lower jaw.

Blow-hole : Located at the anterior end of forehead.

Body Colour : As mentioned under general appearance.



Dwarf Sperm Whale
Kogia simus

Sexual dimorphism : Males and females are generally similar in appearance and size. However, according to Walker (1968) males are usually larger and heavier than females.

Intraspecific variation : None.

FOOD

Primarily takes squids, sometimes fishes and crustaceans.

DISTRIBUTION

Found in all the tropical and warm temperate oceans of the world. Recorded from the eastern and western coasts of India (Visakhapatnam, and Trivandrum), Pakistan (Sind and Mekran coast), Sri Lanka, Sunda Islands, Taiwan, Ryukyu Islands (de Silva, 1987). This species lives somewhat more inshore than the Pygmy Sperm whale which is oceanic in distribution (Caldwell and Caldwell, 1989).

POPULATION

Wild : Nothing is known about population estimate, abundance and stock identity.

Captivity : None survived in captivity for more than a few days (Sylvestre, 1983).

COMMERCIAL VALUE

Meat is used for human consumption.

THREATS

No major threat to this species except accidental or sporadic catch.

Trade : Two specimens were exported to USA in 1984 (CMC, 1987).

SIMILAR SPECIES

- (i) Dolphins of similar size have beaked heads.
- (ii) Pygmy killer whale (*Feresa attenuata*) and Melon-headed whale (*Peponocephala electra*) have different shapes of their head and longer dorsal fin. They are more active and live in large groups.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix II of CITES.

FAMILY : BALAENOPTERIDAE

The baleen whales are characterised by large size, teeth replaced by numerous keratinous baleen plates, projecting down from the upper jaw and serving as a filter (Fig. 2a). External openings of the two nostrils separate and longitudinal. Rami of mandible arched outwards, not united in a true symphysis at the distal extremities.

The family is represented by two genera *Balaenoptera* and *Megaptera* characterised by small head, short baleen, throat furrows, a small dorsal fin and free cervical vertebrae. Whales belonging to this family are large in size, and mostly migrate seasonally between cold and warm waters.

Key to Genera of Family BALAENOPTERIDAE

Throat having about 14 lengthwise folds; pectoral flippers very long, about one-third of body length and white; chin and jaws with tubercles *Megaptera*

Throat having more than 14 lengthwise folds; pectoral flippers about one-eighth of body length, and black; chin and jaws without tubercles *Balaenoptera*

Key to Species of Genus *Balaenoptera*

1. Body length 7-11 m; baleen yellowish white anteriorly and greyish black posteriorly; a broad white band present across outer side of pectoral flippers *B. acutorostrata*

Body length 12-27 m; pectoral flippers black above 2

2. Body 20-27 m in length; baleen plates and fringes black.

..... *B. musculus*

Body 17-20 m in length; right lower jaw and anterior one-third of baleen plates white, rest striped bluish grey; fringes dull white.

.....*B. physalus*

Body 12-15 m in length; head V-shaped; lips and baleen plates dark grey 3

3. Throat furrows extend up to navel; three ridges present on the head, anterior to blow-hole.

..... *B. edeni*

Throat furrows extend between flippers and navel; single ridge present on the head, anterior to blow-hole

..... *B. borealis*

HUMPBACK WHALE

Order : CETACEA

Family: BALAENOPTERIDAE

Megaptera novaeangliae (Borowski, 1781)

Scientific synonyms : *Balaena novaeangliae*
Megaptera indica

CHARACTERISTICS

General appearance : Head short and broad; irregular knobs and protuberances occur on head and flippers; throat folds about 14 in number; pectoral flippers very long, about one-third of body length, and white; baleen short, broad, and blackish. Body colour black above, and white on throat, breast and pectoral flippers.

Measurements : Length in adults ♂ 11.5-15.0 m; ♀ 12.0-16.0 m (Nishiwaki, 1959; Gaskin, 1972); newborn 4 m.

Age : At sexual maturity, 4-5 years (Tomilin, 1957); oldest animal reported is of 48 years.

Body weight : Whales averaging 12.6 m in length weighed about 29 tonne. Newborn 4 m in length weighed 1350 kg (Walker, 1968).

Group size : Found in large schools, at times, may be made up of several small groups.

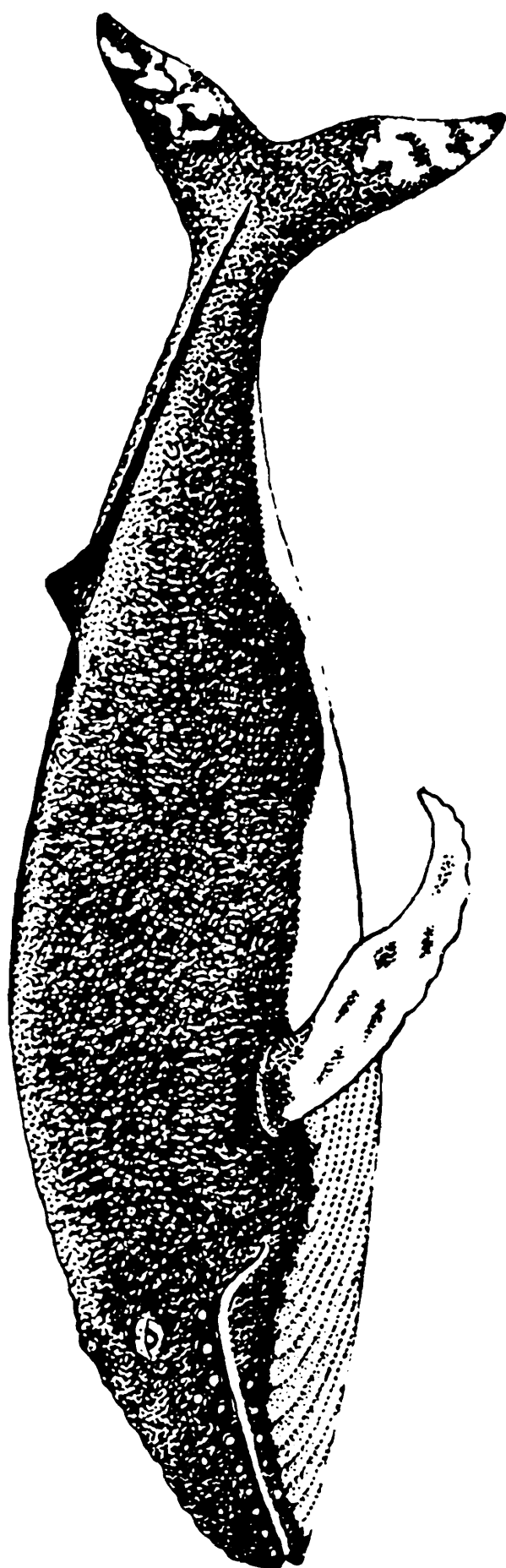
Head : Moderate in size; sides covered with tubercles; spotted with white.

Dorsal fin : Low and located at posterior one-third of body; black in colour.

Pectoral flippers : Very long, being one-third of total length of body; white below and partially white above.

Tail fluke : Distinctive notch in middle, and with white markings.

Blow-hole : Tall, situated at the posterior end of head.



Humpback Whale
Megaptera novaeangliae

Baleen : Baleen plates short and broad, and blackish; 70 x 30 cm in size; bristles olive brown.

Body colour : As described under general appearance.

Sexual dimorphism : Females are slightly larger than males of the same age group.

FOOD

Feeds on crustaceans (krills), cephalopods and fish. The diet contains animals of both pelagic and benthic layers.

DISTRIBUTION

Worldwide, from polar to tropical waters. There is a calving area to the west of India and Sri Lanka. Reported from India (Travancore), Pakistan (Baluchistan Coast), Sri Lanka (off Colombo and Gulf of Mannar), Taiwan, Sarawak and Japan (de Silva, 1987).

POPULATION

Wild : There were about 1,50,000 humpback whales worldwide initially, and possibly about 25000 now, including about 500 in the Indian Ocean (Winn and Reichley, 1985).

Captivity : None. The species is too large to be maintained in captivity.

COMMERCIAL VALUE

Oil, meat, and bones for manure are of commercial value. Oil yield was about 8 tonne from a 12.2 m long humpback, as also 0.5 tonne of meal and 1-2 tonne of meat (Walker, 1968).

THREATS

Heavy commercial exploitation is reported between 1910 and 1963, until it was protected by IWC. It is also vulnerable to shoreline pollution, boat traffic, entanglement in fishing gear, as food of killer whale and to other human coastline activities.

Trade : No international trade in the species is reported now. However, a few are killed every year for local consumption.

SIMILAR SPECIES

Balaenoptera spp : Smaller pectoral flippers and more number of thoracic furrows.

Sperm whale (*Physeter macrocephalus*) : Very large, squarish head, small lower jaw and smaller pectoral flippers.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix I of CITES.

BLUE WHALE

Order : CETACEA

Family: BALAENOPTERIDAE

Balaenoptera musculus (Linnaeus, 1758)

Other common names : Marathi : Devmasa; Tamil: Thimingilam.

Scientific synonyms : *Balaena musculus*

Balaenoptera intermedia

Balaenoptera indica

CHARACTERISTICS

General appearance : Largest of the whales ; head U-shaped from above and having a ridge on it; 60-100 parallel pleats present on the throat and chest ; pectoral flippers blackish above ; baleen and its fringes all black. Body bluish grey above, mottled with white; inside of flippers, lower side of tail fluke and undersurface of body lighter.

Measurements : Total length : ♂ 20-25 m, maximum 34 m ; ♀ 21-27 m ; newborn 6.0-7.0 (Yochem and Leatherwood, 1985)

Pygmy blue whale : ♂ 18-21 m, maximum 24.4 m ; ♀ 19-22 m.

Body weight : 80-86 tonne, maximum 112 tonne ; newborn weigh 2.5-3.0 tonne.

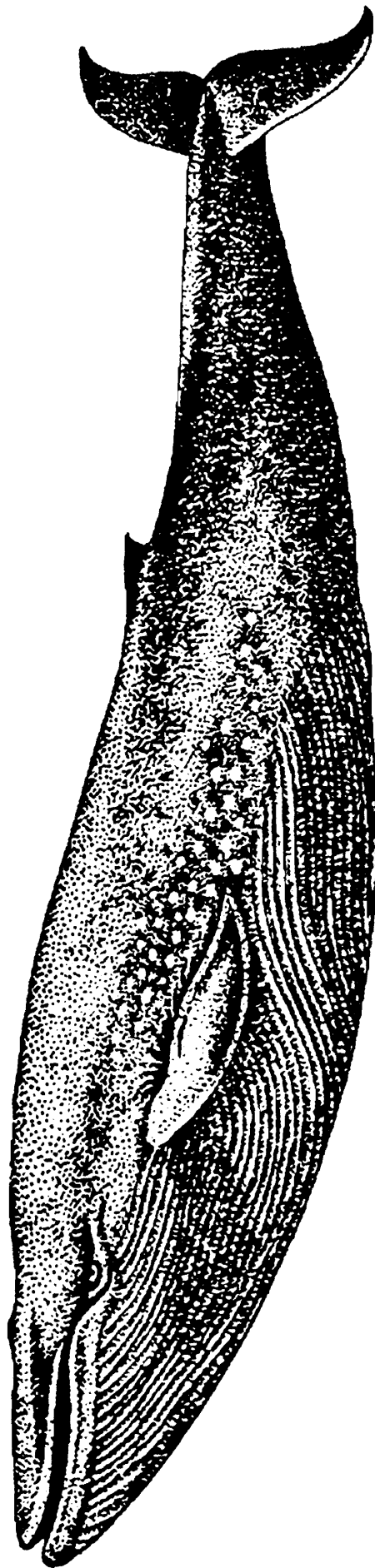
Age : Both sexes become sexually mature at an age of about 10 years (Ichihara, 1966).

Group-size : Commonly encountered singly or in pairs, seldom in large schools.

Head : Broadly U-shaped, about a quarter of body length.

Dorsal fin : Small, falcate and low (15-45 cm in height), placed in the last quarter of the back.

Pectoral flippers : Small and tapering, about 1/7-1/8th of body length ; blackish above.



Blue Whale
Balaenoptera musculus

Tail fluke : Dorsoventrally compressed and notched medially.

Teeth : No teeth, instead baleen plates are present.

Baleen : Consists of rows of transverse plates of keratin with hair-like bristles on the inner edge, hanging down from either side of the upper jaw. Baleen and its fringes all black, about 100 x 55 cm in size ; 260-400 plates on each side, and up to 30 bristles per sq. cm.

Blow hole : Located on top of posterior end of head.

Body colour : As described under general appearance.

Sexual dimorphism : Females are slightly larger than males of the same age group (Gaskin, 1972).

Intraspecific variation : Three subspecies are recognised (Yochem and Leatherwood, 1985), namely, *B. m. musculus* from N. Hemisphere, *B. m. intermedia* from S. Hemisphere, and *B. m. brevicauda* (Pygmy Blue Whale) from subantarctic waters of Indian Ocean, northern Indian Ocean up to Sri Lanka, India, and SE. Atlantic.

FOOD

Main food is euphausiids (krills); amphipods, copepods and cephalopods are also consumed. A 26 m long whale contained 5 million krills in its stomach weighing about 2 tonne (Walker, 1968).

DISTRIBUTION

Worldwide ; prefers cold waters and open seas ; occurs in polar seas during summer, migrating towards the equator in winter. The southern animals enter the Indian Ocean in winter. But since, blue whales have been recorded in the north Indian Ocean at all times of the year, there may be a population separate from that in southern hemisphere. These are probably of Pygmy Blue Whales. They have been recorded around Sri Lanka, east and west coast of India (Sondip and Jambu Is, Mangalore, Cochin, Tuticorin, Calicut, S.

Kanara, Surat, Okha), Pakistan (Mekran coast), from Java to the Banda Sea and Moluccas (Watson, 1981 ; de Silva, 1987).

POPULATION

Wild : A rough estimate of blue whales in the world is about 27000 individuals (15000 in N. Atlantic, 5000 in N. Pacific, 660 in Antarctic, south of 50°S latitude and 6500 north of 50°S latitude). Pygmy blue whales in the Indian Ocean off Sri Lanka are about 32 in number (Klinowska, 1991).

Captivity : None. Not possible to keep and maintain them in captivity.

COMMERCIAL VALUE

In the past, the primary objective of whaling was oil which was used as a cheap base for glycerine, margarines, and soaps. To-day the most valuable product is meat for human consumption. Also bone meal is prepared. The average oil yield of a blue whale is 70-80 barrels (Walker, 1968).

THREATS

Since the blue whale is a oceanic species, there is little scope of recovery of the population through habitat protection. Hence, hunting is the biggest threat to whales. The best chance of undisturbed recovery is through comprehensive protection from catching. Over 2,80,000 blue whales were taken between 1924-1971, with a peak of 30,000 individuals in 1930-31 (Chapman, 1974).

Trade Official trade in blue whales was stopped after 1971. CITES parties recorded export of 20 specimens between 1983 and 1985 (CMC, 1987).

SIMILAR SPECIES

Fin whale (*Balaenoptera physalus*) : Smaller (18-20m), grey back and asymmetrical white on the underparts, a V-shaped head and larger dorsal fin; right lower jaw and baleen white.

Sei whale (*Balaenoptera borealis*) : Smaller (12-14m), belly whitish, dorsal fin more conspicuous and taller ; baleen black but its fringes white.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix I of CITES.

FIN WHALE

Order : CETACEA

Family: BALAENOPTERIDAE

Balaenoptera physalus (Linnaeus, 1758)

Scientific synonyms

Balaena physalus

Balaena boops

Balaenoptera swinhoii

Balaenoptera blythii

Swinhoia chinensis

CHARACTERISTICS

General appearance : A medium-sized whale, having a V-shaped head and a central ridge over it. Body dark grey to blackish above, with no mottling, white underneath ; colour of head asymmetrical , right lower jaw and anterior one-third of right baleen plates white, left grey ; fringes coarse and dull white.

Measurements : Northern Hemisphere : Total length ♂ 17.7-22.0 m (18.0) ; ♀ 18.3-24.0 m (18.5)

Southern Hemisphere : Total length ♂ 19.2-25.0 m (20.5) ; ♀ 19.9-27.0 m (22.0)

Newborn : Length on average 6.4 m (Laws, 1959).

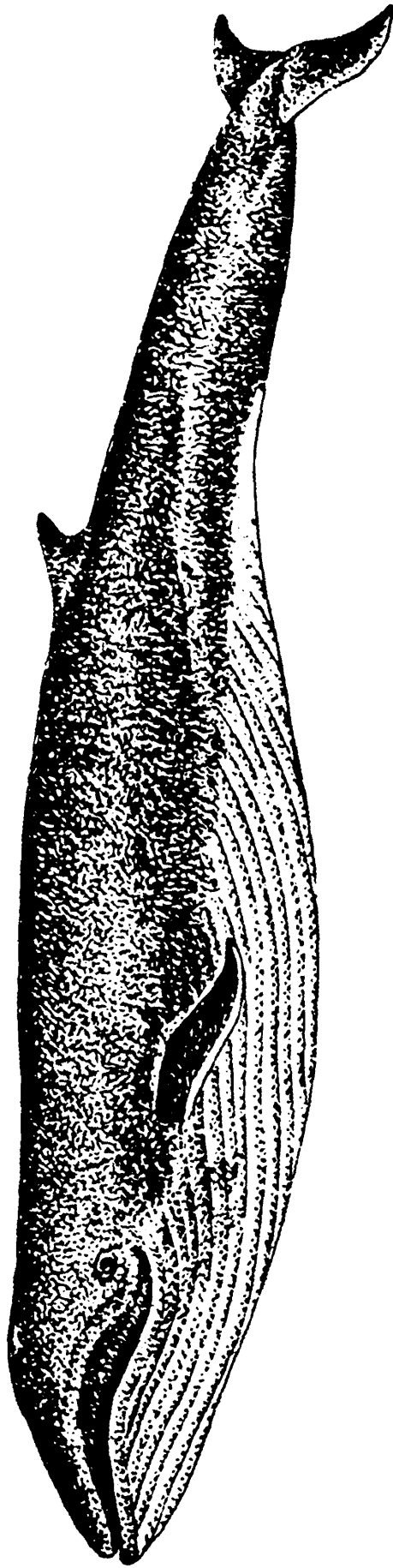
Body weight : 30-80 tonne ; newborn about 1.9 tonne.

Age : At sexual maturity, the age of the whale is 6-7 years (Ohsumi, 1972).

Group size : 3-10 individuals, up to 20 ; may coalesce to form larger schools in feeding ground.

Head : Wedge-shaped, having a central ridge.

Dorsal fin : Small, sharply angled and situated at posterior one-third of back ; black in colour.



Fin Whale
Balaenoptera physalus

Pectoral flippers : Falcate; and black in colour above.

Tail fluke : Horizontally flattened ; black in colour.

Blow hole : Tall, cone-shaped and situated at posterior end of head.

Baleen : 72 x 30 cm in size ; 260-480 plates on each side ; up to 35 bristles per sq. cm ; anterior one-third of right baleen white, rest striped bluish grey ; fringes greyish white.

Body colour : As described under general appearance.

Sexual dimorphism : Females are slightly larger than males.

Intraspecific variation : At present a single species *B. physalus* is recognised. But because the form in the S. Hemisphere grows larger than that in N. Hemisphere, some workers recognise two subspecies, a northern form, *B. p. physalus* and a southern one, *B. p. quoyi* (Gambell, 1985).

FOOD

Feeds mainly on krills, squids and copepods (Gambell, 1985)

DISTRIBUTION

Worldwide, migrating from temperate feeding ground in summer towards the tropics in winter. In Southern Hemisphere, occurs between Antarctic sea and 10° S latitude. Reported in the Indian Ocean from Sri Lanka, eastern (Calcutta) and western coasts (Bombay) of India and Pakistan (Baluchistan coast) (de Silva, 1987).

POPULATION

Wild : The most widely quoted figures for the current population in Southern Hemisphere, North Pacific and North Atlantic are 1,00,000, 20,000 and 14,000 individuals (Allen, 1980 , Gambell, 1985). Its population in the Indian Ocean is about 500 animals.

Captivity : None. It is quite impractical to keep and maintain it in captivity.

THREATS

A heavily hunted species in North Atlantic and Antarctic. It has been a major item of commercial fishery up to 1985. Still some quota for this species is earmarked in Greenland, Iceland, etc. The heavy metal-ions from Industrial wastes dumped in Mediterranean waters not only contaminate the euphausiid-crustaceans present there but also to fin-whales which consume them, resulting in their death.

Trade : Most of the international trade recorded by CITES under this species consists of scientific specimens taken from Iceland and Spain and sent to UK (CMC, 1987). It is likely that some of the large commercial shipments for example between Iceland and Japan recorded under *Cetacea spp.* contained fin-whale products, mainly meat for human consumption.

SIMILAR SPECIES

Blue whale (*B. musculus*) : Blue grey body, V-shaped head, and baleen and its fringes black.

Sei whale (*B. borealis*) : Size small ; lower lip and baleen all grey.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix I of CITES.

BRYDE'S WHALE

Order : CETACEA

Family: BALAENOPTERIDAE

Balaenoptera edeni Anderson, 1878

Scientific : *Balaenoptera brydei*

CHARACTERISTICS

General appearance : A medium-sized whale, larger than *B. acutorostrata* but smaller than other species of *Balaenoptera*. Head V-shaped, having three prominent ridges on it, anterior to blowhole; throat-furrows extend up to naval ; baleen fringes coarse, stiff and thick, white streaked with grey and black, in parts. Body dark grey above, whitish below.

Measurements : Total length : Sexually mature ♂ 12.2 m, ♀ 12.5 m; maximum 15.5 m ; newborn about 4.3 m in length, on average.

Body weight : Average weight about 13.6 tonne.

Age : Age of sexually mature ♂ 9-13 years, ♀ about 10 years.

Group-size : 1-7 individuals (Rice, 1979 ; Cummings, 1985).

Head : V-shaped, having three prominent ridges on it.

Dorsal fin : Moderate in size, located at posterior one-third of back; black in colour.

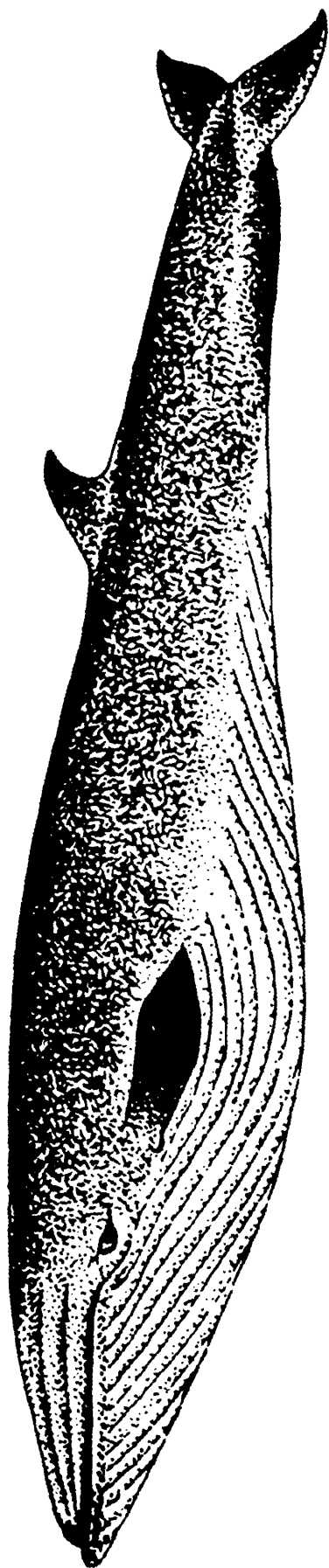
Pectoral flippers : Oblong and wholly black.

Tail fluke : Horizontally flattened, grey above and white below.

Baleen : 42 x 24 cm in size ; 230-370 plates on each side ; 15-35 bristles per sq. cm ; plates slaty grey ; fringes coarse, stiff and thick.

Body colour : As described under general appearance.

Sexual dimorphism : Females are slightly larger than males of the same age group.



Bryde's Whale
Balaenoptera edeni

Intraspecific variation : Bryde's whale shows quite a lot of variation. There seems to be a larger offshore form showing seasonal movement, and a smaller inshore form having sedentary life (Leatherwood and Reeves, 1983 ; Cumming, 1985).

FOOD

Consists of euphausiids (krills), bonito and cephalopods.

DISTRIBUTION

Found in tropical and warm temperate waters of the world (between 40°N and 40°S latitudes), both off and close to the shore. In the Indian Ocean, ranges from Cape of Good Hope to Shark Bay (Western Australia). Recorded from Sri Lanka (Trincomalee and Koddigar Bay), Arabian Sea off Pakistan, Persian Gulf and Bay of Bengal (Best, 1977; IWC, 1977 ; Cumming, 1985 and de Silva, 1987).

POPULATION

Wild : About 13,854 individuals of this species were estimated to be present in the Indian Ocean, south of Equator, in 1980. In addition, about 28,000 were said to be present in North Pacific (IWC, 1979) and 72,500 in South Pacific. No data is available for Atlantic Ocean.

Captivity : None. It is too large to be kept and maintained in captivity.

THREATS

It has been subjected to coastal whaling off Peru, Chile, S. Africa, Japan, USSR, etc., and to pelagic whaling in N. Pacific and S. Atlantic. The declaration of Indian Ocean Sanctuary by IWC in 1979

extended full protection to all species of whales in this area (IWC, 1980).

COMMERCIAL VALUE

Oil, meat, blubber and collagen peptide are of commercial use. About 1.660 tonne of oil and 9.3 tonne of usable products were obtained from one animal.

Trade : One bone and 1 skull were officially exported from Pakistan to UK in 1984 (CMC, 1987). It is, however, reasonable to assume that some of the large consignments exported to Japan and reported as Cetacea spp. contained Bryde's whale products.

SIMILAR SPECIES

Balaenoptera spp. All baleen whales are larger than the Bryde's whale in size except the Minke whale which has a white band on pectoral flippers and one ridge on head. Fin whale has its right lower lip white.

PROTECTION STATUS

Protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix I of CITES.

SEI WHALE

Order : CETACEA

Family: BALAENOPTERIDAE

Balaenoptera borealis Lesson, 1828

Scientific synonyms : *Balaenoptera alba*
Sibbaldius schlegelii

CHARACTERISTICS

General appearance : A medium-sized whale, smaller than blue and fin whales ; head V-shaped and having a single ridge on it ; throat-furrows extend between pectoral flippers and naval ; baleen fringes silky and curly. Body colour bluish black above, with ovoid white spots ; white below ; lower lip and baleen grey, fringes white.

Measurements : Total length : Norther Hemisphere : ♂ 12.7-17.1 m; ♀ 13.1-18.6 m. Southern Hemisphere : ♂ 13.0-17.7 m; ♀ 13.6-21.0 m. Newborn 4.5-4.8 m in length.

Body weight : Not reported.

Age : At sexual maturity, 5-6 years of age ; life span 60 years (Horwood, 1987 ; Gambell, 1985 ; Leatherwood and Reeves, 1983).

Group size : 2-5 individuals ; larger groups may be seen in feeding grounds.

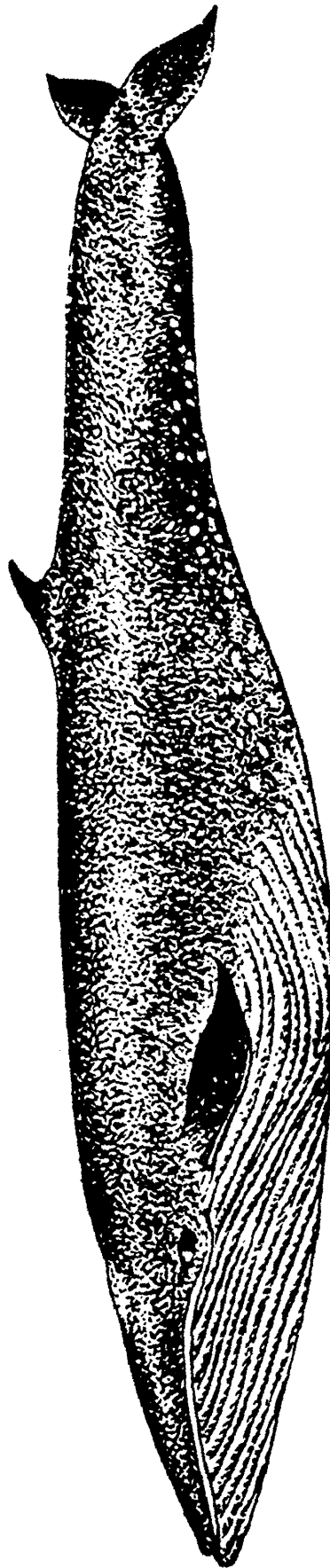
Head : V-shaped, having a single ridge on it, anterior to blowhole.

Dorsal fin : Conspicuous, located in posterior one-third of back; black in colour.

Pectoral flippers : Oblong, unusually short (1/11th of total length of body) and black on both sides.

Tail fluke : Horizontally flattened ; grey on both sides.

Baleen : 73 x 40 cm in size ; 300-410 plates on each side ; 60 bristles per sq. cm ; fringes silky, curly and white, plates dark grey.



Sei Whale
Balaenoptera borealis

Body colour : As described under general appearance.

Sexual dimorphism : Females are slightly larger than males of the same age group.

FOOD

Feeds on surface swarming plankton, krills, copepods, amphipods, etc.

DISTRIBUTION

Worldwide ; found in temperate and subtropical waters, with less clearly defined seasonal migrations. They are deep water animals, rarely found in marginal sea areas. There are records of this species from Borneo, Java, the Gulf of Thailand and the eastern coast of India (Tuticorin, Mandapam and Naduvattum) (de Silva, 1987; Venkataramanujam *et al.*, 1988).

POPULATION

Wild : No population estimate is available for the northern portion of the Indian Ocean. About 40,000 animals were estimated in the southern portion, south of 30°S latitude. In addition, about 13,000 in N. Pacific (in 1974) and a few thousand in N. Atlantic are also reported.

Captivity : None. Sei whale is too large to be kept and maintained in captivity.

THREATS

The whale fishery was prevalent during the 19th and 20th Century (upto 1970) in Norway, U.K., Ireland, Iceland, Canada, Alaska, USA, USSR, Kamchatka, Australia, New Zealand, S. Africa and S. Georgia. The IWC progressively shut down Sei whaling

operations in N. Pacific and Southern Hemisphere during 1970's except in Iceland where hundreds of Sei whales are caught every year.

COMMERCIAL VALUE

Apart from meat which is used for human consumption, oil is the most important product (Horwood, 1987 ; Gambell, 1985).

Trade : Between 1980 and 1985, 684 kg of bones, 15 kg. oil, 3767 kg meat and 12 live-specimens were exported from one country to another (CMC, 1987).

SIMILAR SPECIES

Fin whale (*B. physalus*) : Colour of head asymmetrical, right lower jaw white, left dark grey ; shallow dorsal fin, visible just after the blow hole.

Bryde's whale (*B. edeni*) : Slightly smaller in size ; three ridges on top of head.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix I of CITES.

MINKE WHALE

Order : CETACEA

Family: BALAENOPTERIDAE

Balaenoptera acutorostrata Lacepede, 1804

Scientific synonyms : *Balaenoptera rostrata*
Balaenoptera bonaerensis

CHARACTERISTICS

General appearance : Smallest of the whales ; head narrow and V-shaped, having a single ridge on it ; pectoral flippers oblong and having a broad white band on it; baleen and its fringes yellowish white anteriorly in northern, and dark grey in southern population. Body dark grey to black above, white below, and pale grey areas on sides.

Measurements : Length : Northern Hemisphere ♂ 6.7-9.2 m ; ♀ 7.3 m. Southern Hemisphere ♂ 7.3-9.8 m, ♀ 7.9-10.7 m. Newborn 2.4-2.8 m in length.

Body weight : Whales measuring 6 m in length weigh between 2.0 and 2.7 metric tonne ; up to 10 tonne in S.Hemisphere.

Age : At sexual maturity, ♂ 5-8 years and ♀ 6-8 years. Life span 30-50 years (Stewart and Leatherwood, 1985).

Group size : 1-3 individuals, rarely more.

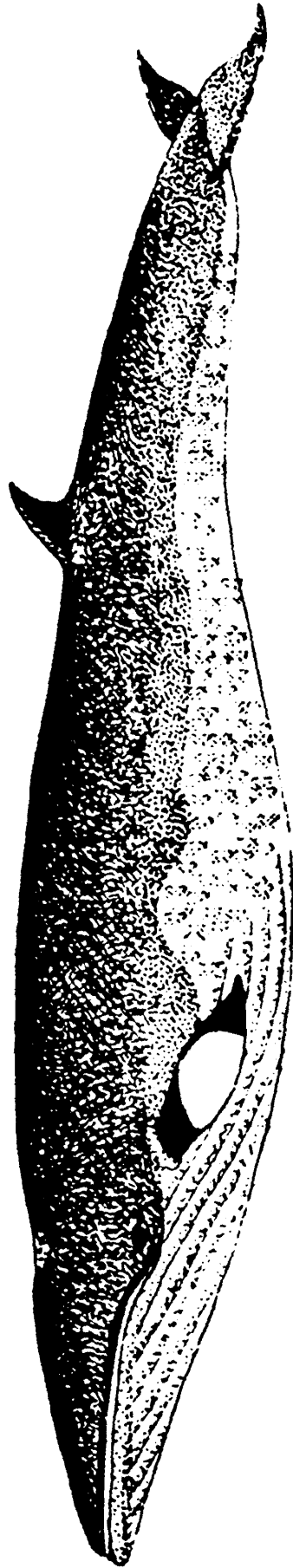
Head : V-shaped, narrow and pointed, having a single ridge on it.

Dorsal fin : Relatively larger, located at posterior one-third of back.

Pectoral flippers : Oblong ; a broad white band on it.

Tail fluke : Horizontally flattened, notched and black.

Baleen : 20 x 12 cm in size ; 230-360 plates on each side ; up to 25 bristles per sq. cm ; plates from whitish to dark grey in colour.



Minke Whale
Balaenoptera acutorostrata

Body colour As described under general appearance.

Sexual dimorphism Females are slightly larger than males of the same age group.

Intraspecific variations : Three geographically isolated populations are recognised in N. Pacific, N. Atlantic and S. Hemisphere, namely, *davidsoni*, *acutorostrata* and *bonarensis* (Stewart and Leatherwood, 1985). A dwarf form has been reported from S. Africa (Arnold *et al.*, 1987) and another subspecific name *B. a. thalmanha* has been proposed for Sri Lankan population.

FOOD

Consists of pelagic crustaceans, small fishes, etc.

DISTRIBUTION

Worldwide ; found in temperate and polar waters, migrating towards the equator in winter but rarely entering the tropics. Recorded near Sri Lanka (Jaffna, Mannar), straits of Molucca, Savu Sea and the Philippines.

POPULATION

Wild : About 54,900 minke whales are estimated to be present in N. Atlantic and 7,60,396 (IWC, 1991) in Southern Hemisphere including 5000 in the Indian Ocean.

Captivity : On three occasions, Minke whales have been captured and maintained live in Japan for a period from 15 to 90 days. But is not possible to keep and maintain enough animals in captivity due to lack of sufficient resources.

THREATS

Minke whales became a major target for modern whalers after 1930's in the Northern Hemisphere and around 1970 in the Antarctica, following the depletion of larger species. The larger species came under increasing protection, so that by 1980 the minke whale was the most important species for modern whaling.

COMMERCIAL VALUE

Meat is used for human consumption and oil for other uses. Tomilin (1957) reported that a 8.7 m long female weighing 5 tonne yielded 2400 kg of meat and about one tonne of oil.

Trade data : Between 1981 and 1985, about 20,00,000 kg of meat and 3300 live-specimens were exported from one country to another, the major recipient being Japan.

SIMILAR SPECIES

- (i) Fin, Sei and Bryde's whales (*B. physalus*, *B. borealis* and *B. edeni*): All species are larger and lack a white band on pectoral flippers.
- (ii) Beaked whales have similar dorsal fins but distinctive head shapes.

PROTECTION STATUS

Legally protected from killing under Schedule II of Indian Wildlife (Protection) Act and from international trade under Appendix I of CITES.

ORDER SIRENIA

Sirenians are massive, spindle-shaped animals, having paddle-like fore-limbs, a horizontally flattened tail but no hindlimbs or dorsal fin. Skin is tough, wrinkled and hairless. Head is rounded, muzzle abruptly cut off, mouth small, nostrils separate and valvular, located on upper surface of muzzle, eyelids small, capable of contraction and having a well developed nictitating membrane, and external ears lacking. The dentition is highly modified and reduced.

This order is known by two families, (i) Dugongidae represented by the dugongs and (ii) Trichechidae by the manatees. Former is characterised by a deeply notched tail, a pair of tusk-like incisors, in males, and 3/3 functional cheek-teeth. The latter is recognised by an evenly rounded tail, no functional incisors and numerous cheek-teeth (up to 10 in each half of each jaw).

The family Dugongidae is represented by a single live genus *Dugong*, and species *Dugong dugon*. The manatees are not found in the Indian Ocean.

DUGONG OR SEA COW

Dugong dugon (Müller, 1776)

Order : CETACEA

Family: DUGONGIDAE

Other common names : Bengali : Sindhu Gavi ; Tamil ; Kadalpasu.

Scientific synonyms : *Trichecus dugon*

Halicore dugong

CHARACTERISTICS

General appearance : Streamlined body, with massive head, truncated anteriorly ; upper lip fleshy, pad-like, projecting over lower, and provided with stiff bristles around the muzzle ; forelimb flipper-like, more long than broad. Incisors tusk-like, in males. Body colour brownish grey above, whitish below.

Measurements : Total length of body 2.5-3.2 m (Walker, 1986).

Body weight : A male, 2.75 m long weighed 170 kg. and a female, 2.43 m long weighed 140 kg (Walker, 1968).

Group size : Occur in pairs or in groups of 3-6 individuals.

Head : Massive, truncated anteriorly, provided with stiff bristles around the muzzle ; nostrils situated on top of head.

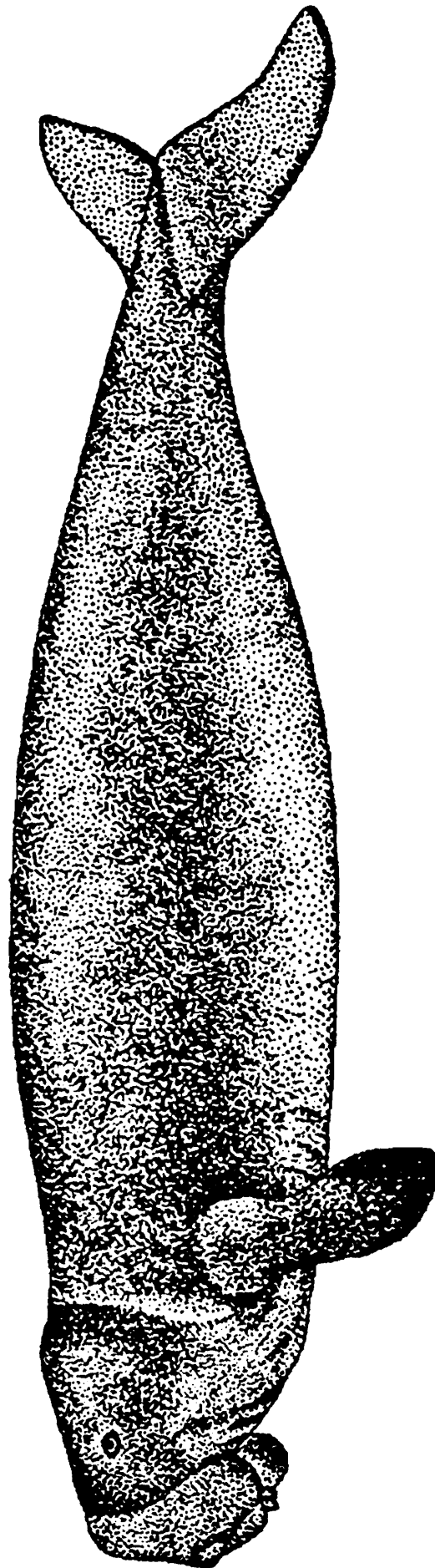
Forelimb : Flipper-like, more long than broad.

Tail fluke : Horizontally flattened and deeply notched.

Teeth : A pair of tusk-like incisors, in adult males ; 3/3 functional cheek-teeth on each side.

Body colour : Brownish grey above, whitish below.

Sexual dimorphism : In males, the incisors are projected out like a tusk, but in females these are small and do not protrude out.



Sea - Cow
Dugong dugon

Intraspecific variation : None. Gohar (1959) considered the Red Sea population as a distinct subspecies, *Dugong dugon tabernaculi*, which is said to be marginally smaller. However, this has not been widely accepted.

FOOD

Feeds on marine algae, grasses, etc., which grow in shallow waters.

DISTRIBUTION

The shores of the Indian Ocean from East Africa to Australia about 15° lat. on each side of the Equator. Never ranging far into the sea. Within the Indian limits, the dugong has been reported from the Gulf of Kutch, Konkan coast, Malabar coast, Tuticorin, Dhaneskodi Is, Rameshwaram, Krusadi Is, Pambam Is, and Andaman and Nicobar Is. (Mani 1960; Jones 1981; Chandrasekhra Rao, 1990; Frazier & Mundkur, 1991;).

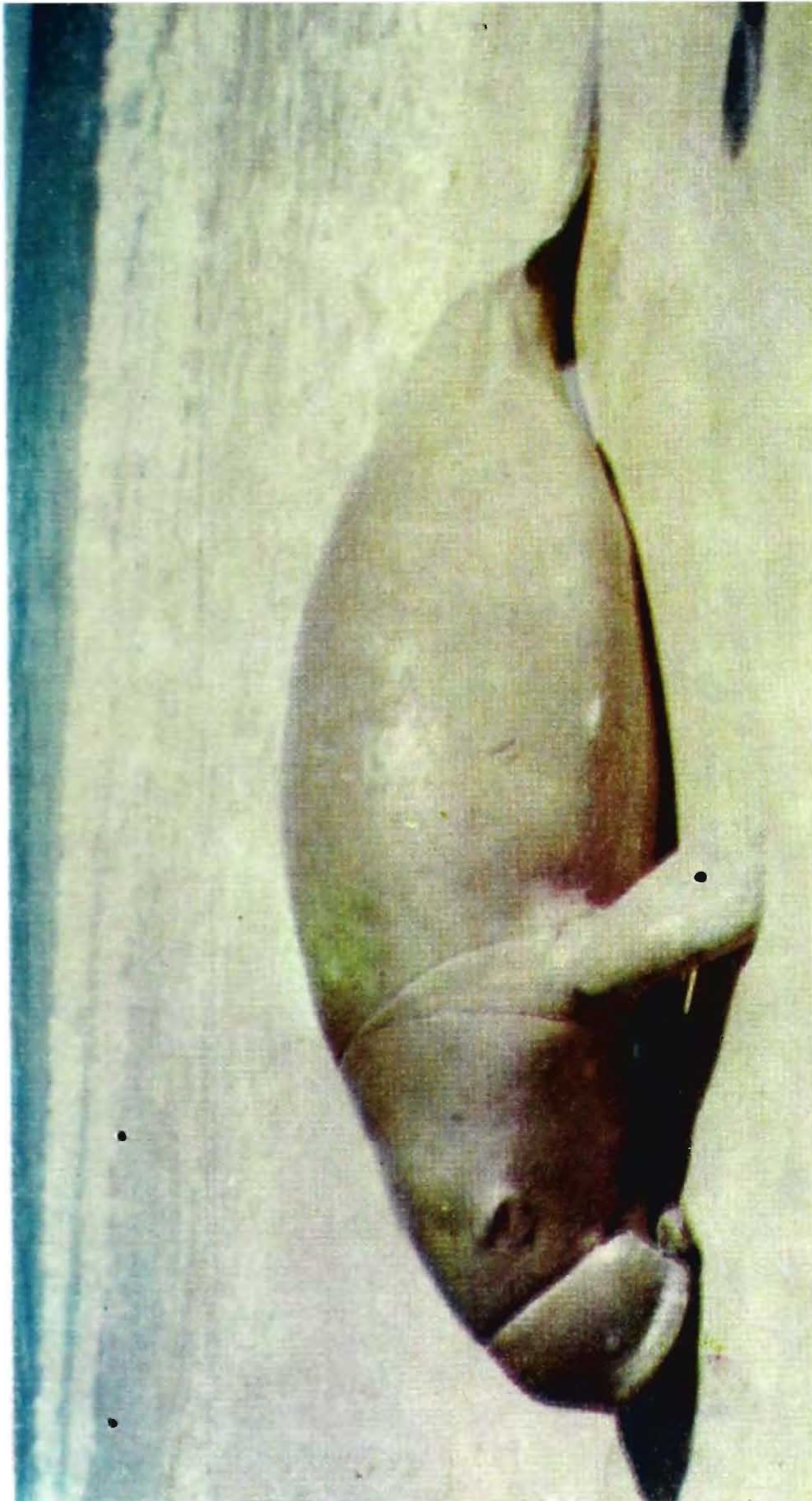
POPULATION

Wild : No data on Indian population is available. About 1000-2000 dugongs are estimated to be present in the northeast region of Australia, and roughly 30,000 in the whole of Indo-Pacific.

Captivity : None at present.

COMMERCIAL VALUE

The dugong is hunted for its flesh, hide, fat, oil, bones and tusks. A dugong weighing 200-300 kg yields 25-56 litres of oil. The tusks are used to make ivory artifacts (Nowak and Paradiso, 1983). The powdered bones are used in native medicines for treating various ailments.



Sea - Cow
Dugong dugon

THREATS

Hunting pressure appears to be the main cause of depletion in its number. They are so scarce now that only occasionally a specimen is caught (Jones, 1976 and 1981; Sailas & Fernando, 1988) in the Indian waters.

Trade data : Not known

SIMILAR SPECIES

None.

POPULATION STATUS

Legally protected from killing under Schedule I of Indian Wild life (Protection) Act and from international trade under Appendix I of CITES.

ACKNOWLEDGEMENT

The authors are thankful to Shri Arun Ghosh, Sr. Artist (retired), Zoological Survey of India, Calcutta, who has drawn the illustrations in this handbook.

REFERENCES

- Anderson, J. 1879. Anatomical and zoological researches ; comprising an account of the two expeditions to western Yunnan. Quaritch, London, 2 volumes.
- Anderson, R. C. 1990. Report of a pygmy killer whale from Maldivian waters with notes on other whales. *Rasain*, 10 : 148-156.
- Arnold, P., Marsh, H. and Heinsohn, G. 1987. The occurrence of two forms of minke whales in east Australian waters with a description of external characters and skeleton of the diminutive or dwarf form. *Sci. Rep. Whales Res. Inst.*, Tokyo, 38 : 1-46.
- Best, P.B. 1977. Two allopatric forms of Bryde's whale off South Africa. *Rep. intern. Whal. Commn.* (Special issue 1): 10-38.
- Blanford, W. T 1891. *The fauna of British India, including Ceylon and Burma. Mammalia*. Part II. Taylor and Francis, London.
- Blyth, E. 1859. On the great rorqual of the Indian Ocean. *J. Asiat. Soc. Bengal*, 28 : 481-498.
- Borchers, D. L., Butterworth, D.S. and Kasamatsu, F. 1990. Southern Hemisphere whale abundance estimates south of 30°S derived from IWC/IDCR survey and Japanese scouting vessel data. IWC/SC/42/SH Mi 18, 42 pp.
- Buckland, S.T and Anganuzzi, A.A. 1988. Estimated trends in abundance of dolphins associated with tuna in the eastern tropical Pacific. *Rep. intern. Whal. Commn.*, 38 : 411-437.
- Butterworth, D.S. and De Decker, J. B. 1989. Estimates of abundance for Antarctic blue, fin, sei sperm, humpback, killer and pilot whales from 1978-79 to 1985-86 in IWC/IDCR sighting survey cruises. IWC/SC/41/020, 73 pp.
- Caldwell, D. K. and Caldwell, M.C. 1972. *The world of the bottlenose dolphin*. J.B. Lippincott Co., Philadelphia and New York. 157 pp.
- Caldwell, D.K. and Caldwell, M.C. 1989. Pygmy sperm whale, *Kogia*

- breviceps* (de Blainville, 1838) and dwarf sperm whale, *Kogia simus* (Owen, 1866). pp 235-260. In : Ridgway, S.H. and Harrison, R.J. (Eds), *Handbook of Marine Mammals*. Vol. 4. *River dolphins and larger toothed whales*. Academic Press, London.
- Chandrasekhara Rao, G. 1990. Present status of the Sea-cow, *Dugong dugon* (Muller) in Bay Islands. *J. Andaman Sci. Ass.*, 6 : 185-189.
- CMC, 1987 Tabulation of all trade in cetaceans reported by CITES Parties for the years 1976-85. IUCN Conservation Monitoring Centre, Cambridge.
- Chen, P., Liu, P., Liu, R., Lin, K. and Pilleri, G. 1980. The distribution, ecology, behaviour and protection of the dolphins in the middle reach of Chang Jiang river. *Oceanologia et Limnologia Sinica*, 11 : 73-84 (in chinese).
- Cummings, W.C. 1985. Bryde's Whale, *Balaenoptera edeni*. pp. 137-154. In : Ridgway. S. H. and Harrison, R.J. (Eds.), *Handbook of Marine Mammals*. Vol. 3. *The sirenians and baleen whales*. Academic Press. London.
- Daniel, J. C. 1963. Stranding of blue whale, *Balaenoptera musculus* Linnaeus near Surat, Gujarat, with notes on earlier literature. *J. Bombay nat. Hist. Soc.*, 60 : 252-259.
- Dey, S.C., Lal Mohan, R.S. and Roy, S. 1992. Studies on the Ganges River Dolphin, *Platanista gangetica* of the river Brahmaputra, with a note on its population status. *Seminar on Conservation of River Dolphins of the Indian subcontinent*, 1992 (Abstract).
- de_Silva, P.H.D.H. 1987 Cetaceans (whales, dolphins and porpoises) recorded off Sri Lanka coast, India from the Arabian Sea and Gulf, Gulf of Aden and from the Red Sea. *J. Bombay nat. Hist. Soc.*, 84 ; 505-525.
- Dhandapani, P. 1992. Status of Irrawaddy River Dolphin, *Orcaella brevirostris* in Chilka lake. *J. Mar. biol. Ass. India*, 34 : 90-93.
- Evans, P.G. H. 1989. *The Natural History of Whales and Dolphins*. Christopher Helm, London. 343 pp.
- Frazier, J.G and Mundkur, T 1991. Dugong, *Dugong dugon* (Müller)

- in the Gulf of Kutch, Gujarat. *J. Bombay nat. Hist. Soc.*, 87 : 368-379.
- Gambell, R. 1985. Sei Whale, *Balaenoptera borealis* and Fin Whale, *Balaenoptera physalus*, pp. 155-192. In : Ridgway, S. H. and Harrison, R.J. (Eds.), *Handbook of Marine Mammals*. Vol. 3. *The sirenians and baleen whales*. Academic Press, London.
- Ghosh, M. 1992 On the capture of a Gangetic Dolphin *Platanista gangetica* Roxburgh (Mammalia : Cetacea : Platanistidae) in Duduya river, northern West Bengal. *J. Bombay nat. Hist. Soc.*, 88 : 195-199.
- Gilpatrick, J.W., Perrin, W.F., Leatherwood, S. and Shiroma, L. 1987. Summary of the distribution records of the spinner dolphin, *Stenella longirostris*, and the pantropical spotted dolphin, *Stenella attenuata* from the Western Pacific, Indian Ocean and Red Sea. NOAA Tech. Memo. (NOAA-TM-NMFS-SWFC-89) : 42 pp.
- Gohar, H.A.F. 1959. The Red Sea Dugong. *Publ. mar. biol. Stn. Al Gharadgua, Egypt*, 9 : 3-50.
- Haque, A.K.M.A. 1976. Comments on the abundance and distribution of the Ganges Susu, *Platanista gangetica* and the effects of the Farakka Barrage on its population. FAO/ACMRR/MM/SC/132.
- Heyning, J.E. 1989. Cuvier's beaked whale, *Ziphius cavirostris* G. Cuvier, 1823, pp. 289-308. In : Ridgway, S. H. and Harrison, R.J (Eds) *Handbook of Marine Mammals*. Vol. 4. *River dolphins and the larger toothed whales*. Academic Press, London.
- Heyning, J.E. and Dahlheim, M.E. 1988. *Orcinus orca*. Mammalian Species 304 : 9 pp.
- Horwood, J. E. 1987. *The Sei Whale : Population, Biology, Ecology and Management*. Croom Helm, London. 375 pp.
- Ichihara, T. 1966. The pygmy blue whale, *Balaenoptera musculus brevicauda*, a new species from the Antarctic, pp 79-113. In : Norris, K.S. (Ed.), *Whales, dolphins and porpoises*. Univ. of California Press, Los Angeles.

- IUCN 1987 *Directory of Afrotropical protected areas*. Gland. 1034 pp.
- IWC, 1984. Report of the subcommittee on small cetaceans. *Rep. intn. Whal. Commn.*, 34 : 144-160.
- IWC, 1988. Report of the workshop on individual recognition and estimation of cetaceans population-parameters. IWC/SC/40/Rep I.
- IWC, 1989. Report of the subcommittee on small cetaceans. *Rep. intn. Whal. Comm.* 39 : 117-129.
- IWC, 1991. Report of the subcommittee on Southern Hemisphere minke whales. *Rep. intn. Whal. Comm.* 41.
- James, D.B. 1984. Capture of a false killer whale, *Pseudorca crassidens* at Port Blair, Andamans. *Marine Fish. Inf. serv.*, 55 : 17
- Jones, S. 1959. On a pair of captive dugong [*Dugong dugon* (Erxleben)]. *J. Mar. biol. Ass. India*, 1 : 198-202.
- Jones, S. 1976. The present status of the dugong, *Dugong dugon*, in the Indo-Pacific and problems of its conservation. FAO/ACHRR/MM/SC/26, 47 pp.
- Jones, S. 1981. Distribution and status of the dugong, *Dugong dugon* (Müller) in the Indian region. The Dugong. *Proc. Sem. James Cook Univ.*, 1979 : 43-54.
- Jones, S. 1982. The present status of the Ganges Susu, *Platanista gangetica* (Roxburgh), with comments on the Indus Susu, *P. Minor* Owen. *Mammals in the seas*, FAO Fisheries Ser., 5(IV) : 97-116.
- Kasuya, T 1972. Some information on the growth of the Gangetic Dolphin with a comment on the Indus Dolphin. *Sci. Rep. Whales Res. Inst.*, Tokyo, 24 : 87-108.
- Kasuya, T. 1985. Effect of exploitation on reproductive parameters of the spotted and striped dolphins off the Pacific coast of Japan. *Sci. Rep. Whales Res. Inst.*, Tokyo., 36 : 107-138.
- Kasuya, T and Haque, A.K.M.A. 1972. Some information on distribution and seasonal movement of the Ganges dolphin. *Sci. Rep. Whales Res. Inst.*, Tokyo, 24 : 109-115.

- Kasuya, T and Kureha, K. 1979. The population of finless porpoise in the inland sea of Japan. *Sci. Rep. Whales Res. Inst.*, Tokyo, 31: 1-44.
- Kasuya, T., Miyashita, T and Kasamatsu, F. 1988. Segregation of two forms of short finned pilot whales off the Pacific coast of Japan. *Sci. Rep. Whales Res. Inst.*, 39 : 77-90.
- Kasuya, T and Nishiwaki, M. 1971. First record of *Mesoplodon densirostris* from Taiwan. *Sci. Rep. Whales Res. Inst.*, 24 : 43-56.
- Kasamatsu, F. and Oshumi, S. 1985. Preliminary estimation of the summer abundance of sperm whales in waters adjacent to Japan, using sighting data. *Rep. intern. Whal. Commn.*, 35 : 217-221.
- Khan, M.K. and Niazi, M.S. 1989. Distribution and population status of the Indus dolphin. In : Perrin, W.F., Brownell, R.L., Zhou Kaiya and Liu Lian kang (Eds.). *Biology and Conservation of the River Dolphins*. IUCN (SSC) Occ. pap. No. 3 : 77-80.
- Klinowska, M. (Ed) 1991. *Dolphins, Porpoises and Whales of the World. The IUCN Red Data Book*. Gland, Switzerland and Cambridge.
- Kruse, S. L., Leatherwood, S., Prematunga, W.P., Mendes, C. and Gamage, A. 1987. Records of Risso's dolphin in the Indian Ocean 1881-86. IWC/SC/39/SM3.
- Lal Mohan, R.S. 1988. Observations on the by-catch of dolphin in the gill-nets off Calicut coast, India, pp. 78-83. In : Silas E. G. (Ed.). *Proc. Symp. Endangered Marine Animals*, Cochin, India. Marine Biological Association, India.
- Lal Mohan, R.S. 1992. Conservation of river dolphins of the Indian subcontinent. *Species*, 19 : 47-48.
- Lal Mohan, R.S., Dey, S.C. and Bairai, S.P. 1998. On a resident population of the ganges river dolphin, *Platanista gangetica*, in the Kulsi river, Assam, a tributary of Brahmaputra. *J. Bombay nat. Hist. Soc.*, 95(1) : 1-7.
- Laws, R.M. 1959. The foetal growth rates of whales with special reference to the fin whale *Balaenoptera physalus* Linn. *Disc. Rep.*, 29 : 281-308.

- Leatherwood, S., Peters, C.B., Santerre, R., Santerre, M. and Clarke, J.T 1984. Observations of cetaceans in the northern Indian Ocean Sanctuary, November 1980—May 1983. *Rep. intn. Whal. Commn.*, 34 : 509-520.
- Leatherwood, S., Prematunga, W.P., Girton, P., McBreathy, D., Illangakoon, A. and McDonald, D. 1987 Records of the Blackfish (killer, false killer, pilot, pygmy killer and melon-headed whales) in the Indian Ocean Cetacean Sanctuary, 1772-1986. IWC/SC/39/SM 4.
- Leatherwood, S. and Reeves, R.R. (Eds.) 1990. *The Bottlenose Dolphin*. Academic Press, San Diego. 653 pp.
- Leatherwood, S. and Reeves, R.R. 1991. Marine mammal research and conservation in Sri Lanka 1985-86. 2nd ed. Nairobi : *UN Environmental Programme. Marine Mammals Tech. Rep.* 1, 138 pp.
- Lydekker, R. 1903. On two dolphins from Madras. *J. Bombay nat. Hist. Soc.* 15 : 408-414.
- Lydekker, R. 1903. Notes on the Trivandrum cetaceans. *J. Bombay nat. Hist. Soc.*, 15 : 40-41.
- Lydekker, R. 1909. On an Indian dolphin and porpoise, *Proc. zool. Soc. Lond.* (1908) : 802-806.
- Mani, S. B. 1960. Occurrence of the Sea Cow, *Helicore dugong* (Erxl.), off the Saurashtra coast. *J. Bombay nat. Hist. Soc.*, 57 : 216-217
- Marsh, H., Lloze, R., Heinsohn, G.E. and Kasuya, T 1989. Irrawaddy dolphin, *Orcaella brevirostris* (Gray, 1866), pp. 101-118. In : Ridgway, S.H. and Harrison, R.J. (Eds.). *Handbook of Marine Mammals*. Vol. 4. *River dolphins and the larger toothed whales*. Academic Press, London.
- Mc Breathy, D.A., Message, M.A. and King, G.A. 1986. Observations on small cetaceans in the north-east Atlantic Ocean and the Mediterranean Sea, 1978-1982. In : *Research in Dolphins*, M.M. Bryden and R.J. Harrison (Eds). Clarendon Press, Oxford.
- Mead, J.G. 1984 Survey of reproductive data of the beaked whales (Ziphiidae). *Rep. intn. Whal. Commn.* (Special issue 6) : 91-96.

- Mead, J.G. 1989. Beaked whales of the genus *Mesoplodon*, pp. 349-430. In : Ridgway, S.H. and Harrison, R.J. (Eds.), *Handbook of Marine Mammals*, Vol. 4. *Rivx dolphins and the larger toothed whales*. Academic Press, London.
- Mead, J.G., Heyning, J.E. and Brownell, R.L. 1988. Distribution and exploitation of beaked whales in Northern Hemisphere. IWC/SC/40/SM21.
- Mitchell, E.D. (Ed.) 1975. Review of the biology and fisheries for smaller cetaceans Report of the meeting on smaller cetaceans, International Whaling Commission. *J. Fish. Res. Board Can.* 32(7) : 875-1240.
- Mitchell, E.D. (Ed.) 1975. Propoise, dolphin and small fisheries of the world IUCN Monograph No. 3. Morges, Switzerland.
- Miyazaki, N. and Wada, S. 1978. Fraser's dolphin in the western North Pacific. *Sci. Rep. Whales Res.Inst.*, Tokyo, 30 : 231-244.
- Miyazaki, N. and Perrin, W.F. (in press). Rough-toothed dolphin, *Steno bredanensis* (Lesson 1828). In : Ridgway, S.H. and Harrison, R.J. (Eds.). *Handbook of Marine Mammals*. Vol.5. Academic Press, London.
- Moses, S. T 1948. Notes on two whales stranded in Baroda State. *Proc. Indian Sci. Congr.*, 34 : 188.
- Murray, J.A. 1984,. A contribution to the knowledge of the marine fauna of Kurrachee. *Ann. Mag. nat. Hist.*, 13 : 348-352.
- Nagorsen, D. 1985. *Kogia sinus*. Mamalian Species 239 : 6 pp.
- Nishiwaki, M. 1959. Humpback whales in Ryukyuan waters. *Sci. Rep. Whales Res. Inst.*, Tokyo, 14 : 49-85.
- Nishiwaki, M. 1963. Taxonomic consideration on genera of Delphinidae. *Sci. Rep. Whales Res. Inst.*, Tokyo, 17 : 93-103.
- Nishiwaki, M., Kasuya, T., Tobayama, T. and Nakajima, M. 1965. *Feressa attenuata* captured in the Pacific coast of Japan in 1963. *Sci. Rep. Whales Res. Inst.*, 20 : 95-100.
- Nishiwaki, M. and Kenneth, S. N. 1966. A new genus,, *Peponocephala* for Odontoceti cetacean species *Electra electra*. *Sci. Rep. Whales Res. Inst.*, Tokyo, 20 : 95-100.

- Nishiwaki , M. and Marsh, H. 1985. Dugong, *Dugong dugon*. Pp. 1-32. In : Ridgway, S.H. and Harrison, R. J. (Eds.), *Handbook of Marine Mammals*. Vol. 3. *The sirenians and baleen whales*. Academic Press, London.
- Norris, K. S. 1961. Standardized methods for measuring and recording data on the smaller cetaceans. *J. Mammal.*, 42(4) : 471-476.
- Norris, K.S. (Ed) 1966. *Whales, dolphins and porpoises*. Univ. California Press. Berkeley.
- Nowak, R.M. and Paradiso, J.L. 1983. Walker's mammals of the World, 4th ed., vol. 2. The Johns Hopkins University Press, Baltimore and London.
- Oshumi, S. 1972. Examination of the recruitment rate of the Antarctic fin whale stock by use of mathematical models. *Rep. int. Whal.Comm.* 22 : 69-90.
- Perrin, W F. 1989. Dolphins, porpoises and whales. An action Plan for the conservation of biological diversity, 1988-1992. IUCN, Gland, Switzerland. 30 pp.
- Perrin, W.F. 1990. Subspecies of *Stenella longirostris*. *Proc. biol. Sci. Wash.*, 103 ; 453-463.
- Perrin, W.F., and Gilpatrick, J.W (in press). Spinner dolphin, *Stenella longirostris* (Gray, 1828). In : Ridgway, S.H. and Harrison, R.J. (Eds.), *Handbook of Marine Mammals*. Vol. 5. Academic Press, London.
- Perrin, W.F. and Kasuya, T (in press). Striped dolphin, *Stenella coeruleoalba* (Meyen 1833). In : Ridgway, S.H. and Harrison, R.J. (Eds.), *Handbook of Marine Mammals*. Vol. 5. Academic Press, London.
- Perrin, W.F., Leatherwood, S. and Collette, A. (in press). Fraser's dolphin, *Lagenodelphis hosei* Fraser, 1957 In : Ridgway, S.H. and Harrison, R.J. (Eds.), *Handbook of Marine Mammals*. Vol. 5. Academic Press, London.
- Perrin, W F., Mitchell, E. E., Mead, J.G., Caldwell, D. K., Caldwell, M.C., Van Bre P.J.H. and Dawbin, W.H. 1987 Revision of the

- spotted dolphins, *Stenella spp.* *Marine Mammal Science*, 3(2) : 99-170.
- Perrin, W.F., Miyazaki, N. and Kasuya, T. 1987. A new spinner dolphin from Thailand. *VII Binneal Conf. Biol. Mar. Mamm.*, December 5-9, 1987 Miami, USA. Abst., 53.
- Perrin, W.F. and Reilly, S. B. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. *Rep. intn. Whal. Commn.*, (Special issue 6) : 97-133.
- Pilleri, G. and Gahr, M. 1972. Contributions to the knowledge of the cetaceans of Pakistan. *Invest. Cetacea*, 4 : 107-162.
- Pilleri, G. and Gahr, M. 1974. Contribution to the knowledge of the cetaceans of southwest and monsoon Asia (Persian Gulf, Indus delta, Malabar, Andaman Sea and Gulf of Siam). *Invest. Cetacea*, 5 : 95-149.
- Pilleri, G. and Gahr, M. 1975. On the taxonomy of the finless black porpoise, *Neophocaena*. *Mammalia*, 39 : 657-673.
- Pilleri, G. and Gahr, M. 1976. Record of *Pseudorca crassidens* off Karachi. *Invest. Cetacea*, 7 : 205-207
- Pilleri, G. *et al.* 1982. Speciation in Platanistoidea. *Invest. Cetacea*, 14 : 15-46.
- Reeves, R. R. and Brownell, R. L. 1989. Susu, *Platanista gangetica* and *Platanista minor*, pp. 69-100. In : Ridgway, S.H. and Harrison, R.J. (Eds.), *Handbook of Marine Mammals*, Vol. 4 *River dolphins and the larger toothed whales*. Academic Press, London.
- Reeves, R. R. and Leatherwood, S. 1984. Live capture of fisheries for cetaceans in USA and Canadian waters 1973-1982. *Rep. intn. Whal. Commn.*, 34 : 497-507.
- Ridgway, S. H. and Harrison, R (Eds.) 1985, 1989. *Handbook of marine mammals*. Vol 3. The sirenians and baleen whales; Vol 4. River dolphins and the larger toothed whales. Academic Press, London.
- Rice, D.W. 1977 *A list of the marine mammals of the world*. 3rd ed. NOAA tech. Rep. NMFS/SSRF 711 : 15 pp.
- Rice, D.W. 1979, Bryde's whale in the equatorial eastern Pacific. *Rep.*

- intn. Whal. Commn.* 29 : 321-324.
- Rice, D. W 1989. Sperm whale, *Physeter macrocephalus*, pp. 177-234. In Ridgway, S. H. and Harrison, R.J. (Eds.), *Handbook of Marine Mammals*. Vol. 4. *River dolphins and the larger toothed whales*. Academic Press, London.
- Roberts, T.J. 1977 *The Mammals of Pakistan*. Ernest Benn, London, 361 pp.
- Ross, G.J.B. 1979. Records of Pygmy and Dwarf sperm whales, genus *Kogia* from South Africa with biological notes and some comparisons. *Ann. Cape. Prov. Mus. (Nat. Hist)*, 11(14) : 259-327
- Ross, G. J.B. 1984. The smaller cetaceans of the southeast coast of South Africa. *Ann. Cape. Prov. Mus. (Nat. Hist)*, 15 : 173-410.
- Ross, G.J.B. and Cockroft, V.G. 1990. Comments on Australian bottlenose dolphins and the taxonomic status of *Tursiops aduncus*, pp. 101-128. In : Leatherwood, S. and Reeves, R. R. (Eds.). *The Bottlenose Dolphin*. Academic Press, San Diego.
- Scott, M.D., Perryman, W.L. and Clark, W.G. 1985. The use of aerial photographs for estimating school sizes of cetaceans. *Inter-American Tropical Tuna Commission Bulletin*, 18 : 381-419
- Sailas, E.G.(Ed.) 1988. *Proceedings of the Symposium on Endangered Marine Animals and Marine Parks*, Cochin, India. Marine Biological Association, Cochin. 506 pp.
- Sailas, E.G. and Fernando, A.B. 1988. The dugong in India : Is it going the way of the Dodo? *Proc. Symp. Endangered Marine Animals and Marine Parks*, Cochin, 1985 : 12-16.
- Shrestha, T.K. 1986. Ecology of Gangetic dolphin, *Platanista gangetica* in the Karnali river, pp. 112-142. In : *Nepal Himalaya : Geo-ecological perspectives*, S.C. Joshi (Ed.). Himalayan Research Group, Nainital. pp.
- Singh, L.A.K. and Sharma, R.K. 1986. Gangetic Dolphin, *Platanista gangetica* : Observations on habits and distribution pattern in National Chambal Sanctuary. *J. Bombay nat. Hist. Soc.*, 82(3) : 648-653.

- Sinha, R.K. 1997 Status and conservation of Ganges River Dolphin in Bharigathi-Hooghly River Systems in India. *Intn. J. Ecol. & Environ. Sci.*, 23 : 343-355
- Stewart, B.S. and Leatherwood, S. 1985. Minke whale, *Balaenoptera acutorostrata*. Pp. 91-136. In : Ridgway, S. H. and Harrison, R. J. (Eds.), *Handbook of Marine Mammals*. Vol. 3. The sirenians and baleen whales. Academic Press, London.
- Sylvestre, J. P. 1983. Review of *Kogia* specimens (Physeteridae ; Koginae) kept alive in captivity. *Invest. Cetacea*, 15 : 201-219.
- Tinker, S. W. 1988. *Whales of the World*. Leiden Brill. 310 pp.
- Tomilin, A. G. 1957. Cetacea : Mammals of the USSR and adjacent countries. Jerusalem. (Original in Russian).
- Van Bree, P.J.H. and Gallagher, M.D. 1978. On the taxonomic status of *Delphinus tropicalis* Van Bree, 1971. *Beaufortia*, 28 : 1-8.
- Venkataramanujam, K. et. al. 1988. On a sei whale, *Balaenoptera borealis* stranded at Tuticorin, East Coast of India. *Invest. Cetacea*, 21 : 247-249.
- Walker, E. 1968. *Mammals of the World*, 2nd ed. Vol. II. John Hopkins Press, Baltimore.
- Wang, P. 1984. Distribution of cetaceans in Chinese waters. *Chinese J. Zool.*, 6 : 52-56 (in chinese).
- Wilson, C.E., Perrin, W.F., Gilpatric, J.W. and Leatherwood, S. 1987. Summary of the worldwide locality records of the striped dolphin, *Stenella coeruleoalba*. NOAA Tech. Memo. (NOAA-TM-NMFS-SWFC-90) : 65 pp.
- Winn, H.E. and Reichley, N.E. 1985. Humpback whale, *Megaptera novaeangliae*, pp. 241-274. In : Ridgway, S.H. and Harrison, R.J. (Eds.), *Handbook of Marine Mammals*. Vol. 3. The sirenians and baleen whales. Academic Press, London.
- Tochem, P.K. and Leatherwood, S. 1985. Blue whale, *Balaenoptera musculus*, pp. 193-240. In : Ridgway, S.H. and Harrison, R.J. (Eds.), *Handbook of Marine Mammals*. Vol. 3. The sirenians and baleen whales. Academic Press, London.