

Association between the sessile barnacle *Xenobalanus globicipitis* (Coronulidae) and the bottlenose dolphin *Tursiops truncatus* (Delphinidae) from the Bay of Bengal, India, with a summary of previous records from cetaceans

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Several instances of association between cetaceans and cirripeds have been reported in the literature. Among the barnacles, *Coronula* spp., *Conchoderma* spp., and *Xenobalanus* sp. have been reported from various species of cetaceans of both temperate and tropical waters (Mackintosh and Wheeler 1929, Mackintosh 1942). Devaraj and Bennet (1974) reported a single specimen of *Xenobalanus globicipitis* found attached to the fluke of a finless black porpoise *Neophocaena phocaenoides* caught off Karwar, west coast of India. This type of phoretic partnership (i.e., transportation by one promotes well-being of the other) between 14 specimens of a sessile barnacle *Xenobalanus globicipitis* and a host, the bottlenose dolphin *Tursiops truncatus*, is recorded here from the Bay of Bengal on the east coast of India. This is the first record of the bottlenose dolphin as a host for *Xenobalanus globicipitis* from the central and northern Indian Ocean.

Five spinner dolphins *Stenella longirostris* (Gray 1828) (113.0–177.5 cm TL) and six bottlenose dolphins *Tursiops truncatus* (Montagu 1821) (95.3–367.5 cm TL), were collected from the Bay of Bengal, off Porto Novo (11°29'N; 79°46'E), southeast coast of India, between 15 March 1982 and 1 September 1987.

These specimens were entangled accidentally in bottom-set gillnets (called *Motha Valai*, in Tamil vernacular) set mainly for sharks. The net is made of thick (no. 7-12) nylon thread (monofilament). The stretched mesh size is 10–12 cm, and there are about 120 meshes from the head to the foot rope; hence the net is about 12 m deep. Total length of the net is about 800 m (~ one-half mile). Fishing operations, which were carried out mostly at night, were confined to the upper continental shelf, up to 4 km from the coast, to depths of 18–22 m. The dolphins became entangled in the nets both day and night.

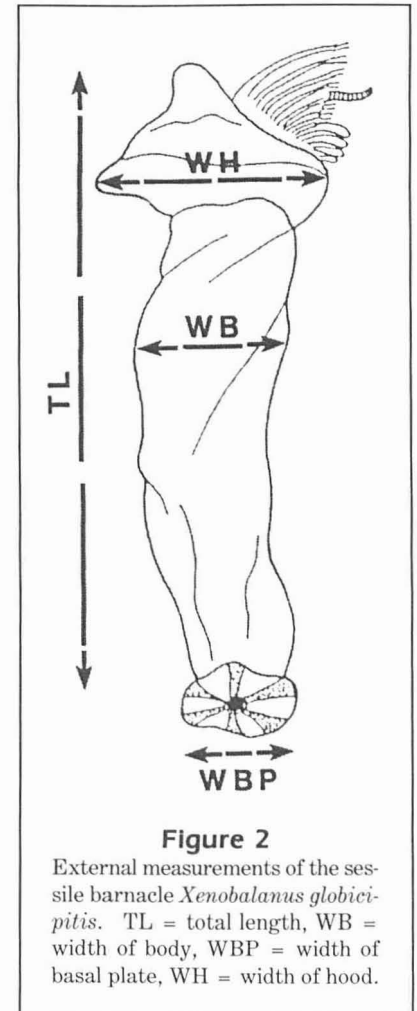
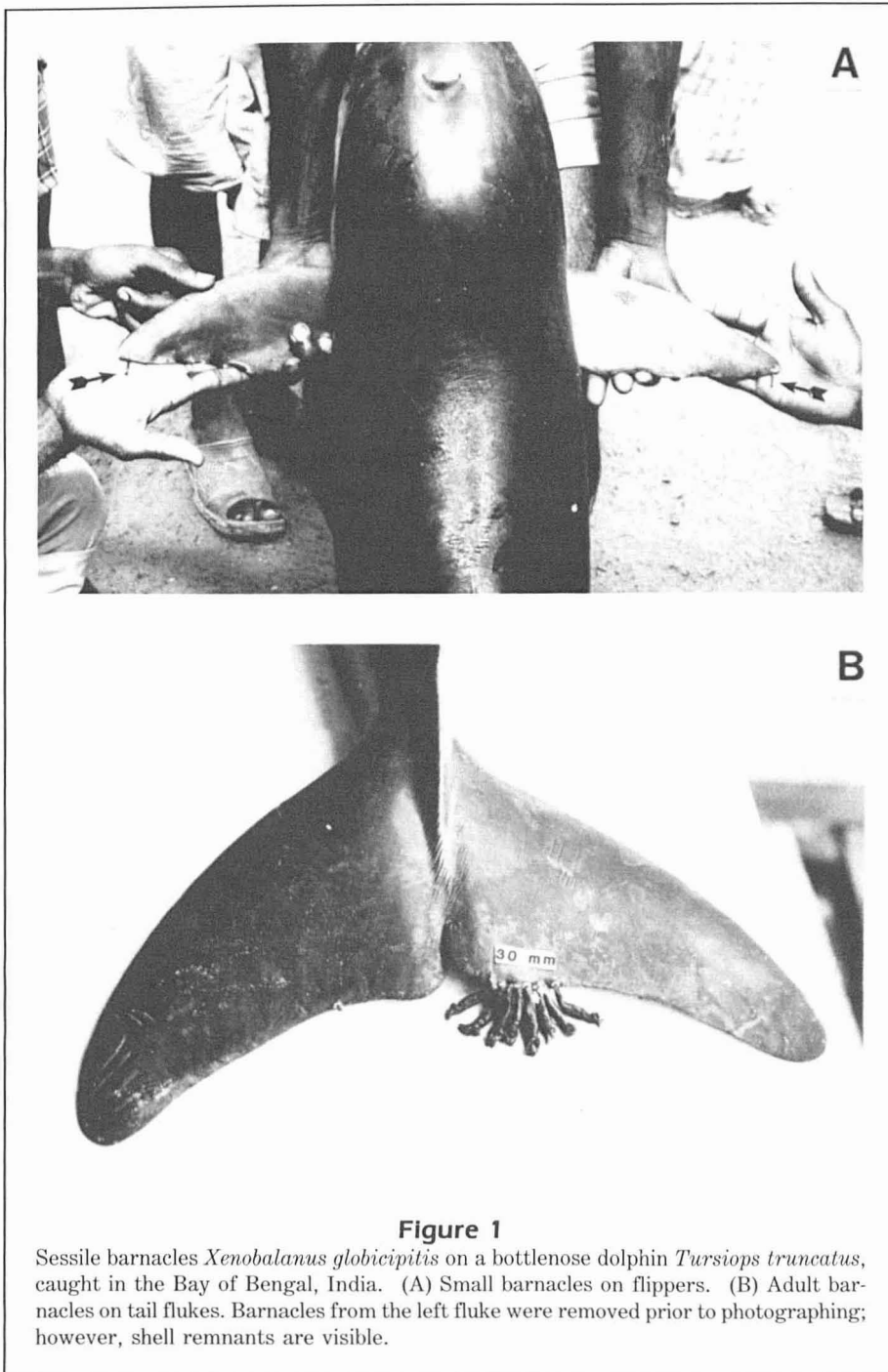
All entangled dolphins were examined for external and internal parasites (several dolphins had internal parasites). No barnacles were found on the spinner dolphins. One small bottlenose dolphin (148 cm male) caught on 28 January 1985 had numerous *Xenobalanus globicipitis* attached (Fig. 1A, B). None of the four larger (>150 cm) bottlenose dolphins had any barnacles. All barnacles were collected (four from the left fluke, eight from the right fluke, and one from each flipper) and preserved in formalin. The barnacles were still alive after more than 12 hours out of water. Measurements to the nearest millimeter (Fig. 2) are given in Table 1.

In the sessile barnacles, extreme reduction of plates is found in *Xenobalanus*. The shell is thin, small, white, irregularly star-shaped, and vestigial, containing only the basal parts of the animal. Connected to this thin, star-shaped shell is a cylindrical, smooth, flexible, peduncle-like body (Fig. 3). At the distal end of this greatly elongated pseudo-peduncle is a reflexed hood, which bears two stumpy outpushings or 'horns,' but terga and scuta are absent. Cirri, mouth, a probosciform penis, and associated organs project from the reflexed hood. The wall plates of this barnacle are embedded in the skin of the dolphin, with feeding appendages (cirri) and associated organs suspended by the long fleshy stalk. The body of *X. globicipitis* was dark-brown in live specimens, with a lighter colored hood; the penis was whitish.

Although belonging to the sessile group of the Cirripedia, this barnacle closely resembles stalked barnacles, especially *Conchoderma auritum* which is also found on cetaceans though never attached directly to the skin of its host. *Xenobalanus globicipitis* is always attached directly to the skin of its host (Pilsbry 1916, Barnard 1924). The resemblance is superficial, and is likely adaptive to being dragged through the water by the host. The closest affinities with *Xenobalanus* are the genera *Coronula*, *Platylepas*, and *Tubicinella* (Darwin 1854, Pope 1958).

The barnacles are found only around the rear margins of flippers and flukes. It is hypothesized that those that settle elsewhere are more easily swept off. A single immature barnacle (15 mm TL) was found attached to each flipper of the dolphin (Fig. 1A). All 12 mature barnacles (30–39 mm TL) (Table 1) were aggregated at the rear margin of the flukes (Fig. 1B). Pilsbry

Manuscript accepted 19 December 1991.
Fishery Bulletin, U.S. 90:197–202 (1992).



were from the central Atlantic coast of the United States (True 1891, Mead and Potter 1990), Gibraltar (Dollfus 1968, Pilleri 1970), and the east coast of South Africa (Barnard 1924, Ross 1984).

Based on a review of the literature, Rappé and Waerebeek (1988) suggested that *X. globicipitis* is an inhabitant of tropical and warm-temperate waters.

(1916) reported that these barnacles grow in close groups. This aggregation permits cross-fertilization, which is common in hermaphroditic crustaceans (Barnes 1986).

Xenobalanus globicipitis occurs on about 19 species of cetaceans, from the small harbor porpoise *Phocoena phocoena* to the large blue whale *Balaenoptera musculus* (Table 2). The present record is the seventh report from a bottlenose dolphin. Six previous reports

They reported that occurrence of this species in the northeast Atlantic and Mediterranean is erratic, possibly related to sporadic incursions from adjacent tropical warm-temperate waters. Their information was based on only 23 reported localities. Our study shows 87 localities (Table 2) reported for *X. globicipitis*: 28 (32.2%) are located north of 40°N; 27 (31.0%) between 35° and 40°N; and 32 (36.8%) between 30°N and 30°S. From this it is clear that *X. globicipitis* is

Table 1

External measurements of the sessile barnacle *Xenobalanus globicipitis* collected from a bottlenose dolphin *Tursiops truncatus* (♂; 148 cm TL), entangled in a gillnet off Porto Novo, southeast coast of India, 28 January 1985

Attachment area	Specimen no.	TL	WH	WB	WBP
----- (mm) -----					
Left fluke	1	37	11	7	5
	2	37	10	6	5
	3	37	11	6	5
	4	32	9	6	5
Right fluke	5	35	11	7	5
	6	30	11	7	5
	7	39	12	7	5
	8	35	12	7	5
	9	30	10	7	5
	10	34	11	8	8
	11	37	10	6	4
	12	30	9	6	5
Left flipper	13	15	5	3	3
Right flipper	14	15	4	3	3

Total length (TL): Basal plate to highest point of hood
 Width of body (WB): Maximum width of elongated body
 Width of basal plate (WBP): Maximum width of basal plate
 Width of hood (WH): Maximum width of hood

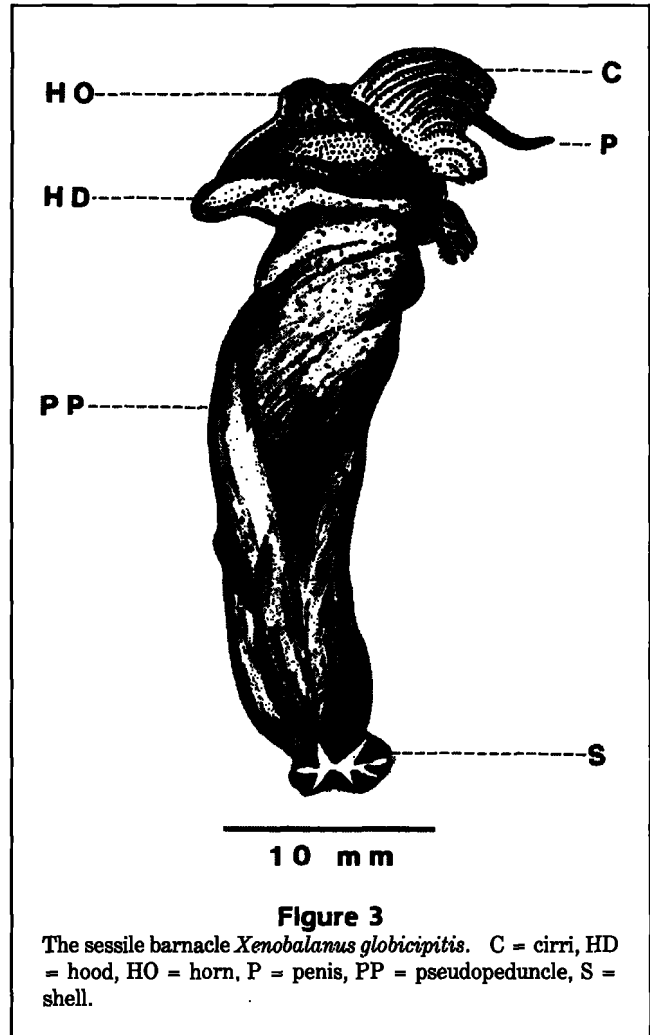


Figure 3

The sessile barnacle *Xenobalanus globicipitis*. C = cirri, HD = hood, HO = horn, P = penis, PP = pseudopoduncle, S = shell.

a cosmopolitan species, occurring in temperate, warm-temperate, and tropical waters. In relation to the distribution of *X. globicipitis*, the bottlenose dolphin is distributed widely in temperate and tropical oceans. It is common from at least the north coast of Argentina to northern Norway (Kenney 1990).

Table 2

Distribution and reported hosts of the sessile barnacle *Xenobalanus globicipitis*. Identification of host species names are updated.

Host	Reported by	Year	Locality	Host	Reported by	Year	Locality
Order: Cetacea				<i>Balaenoptera musculus</i>			
Suborder: Mysticeti				(Blue whale)			
Family: Balaenopteridae				(continued)			
<i>Balaenoptera borealis</i> (Sei whale)	Broch	1924	Farøe Is., Greenland; Ingoy, Norway		Nilsson-Cantell	1930	Saldanha Bay, S. Afr.
	Cornwall	1927	Vancouver		Mackintosh	1942	South Africa
	Nilsson-Cantell	1921	Farøe Is.		Cornwall	1955a	Pacific Canada
	Matthews	1938	Saldanha Bay		Pike (in Cornwall)	1955b	No locality
	Mackintosh	1942	Saldanha Bay		Boxshall (in Rappé and Waerebeek)		Shetland Is., Scotland
	Heldt	1950	Tunis	<i>Balaenoptera physalus</i> (Fin whale)	Calman	1920	Shetland Is.
	Boxshall (in Rappé and Waerebeek)		Finnmark, Norway		Barnard	1924	North Atlantic
<i>Balaenoptera musculus</i> (Blue whale)	Barnard	1924	Saldanha Bay		Barnard	1924	Antarctic
	Mackintosh and Wheeler	1929	South Africa		Mackintosh and Wheeler	1929	South Africa
					Nilsson-Cantell	1930	S. Shetland Is.
					Nilsson-Cantell	1930	Saldanha Bay
					Mackintosh	1942	South Africa
					Raga and Sanpera	1986	Galicia, Spain

Table 2 (continued)

Host	Reported by	Year	Locality	Host	Reported by	Year	Locality
Suborder: Odontoceti				<i>Globicephala melas</i>			
Family: Delphinidae				(Long-finned pilot whale)			
<i>Delphinus delphis</i>	Hoek	1883	Atlantic		Steenstrup	1852	Farøe Is.
(Common dolphin)	Gruvel	1905	South Africa		Hoek	1883	Farøe Is.
	Gruvel	1920	South Africa		Weltner	1897	Farøe Is.
	Richard	1936	Oran, Algeria		Gruvel	1912	Monaco
	Stubbings	1965	Gorée, Senegal		Pilsbry	1916	Chesapeake Bay
	Pilleri	1970	W. Mediterranean		Gruvel	1920	Gibraltar
	Rappé	1988	Belgium		Nilsson-Cantell	1921	Farøe Is.
<i>Grampus griseus</i>	Gruvel	1920	Azores		Richard	1936	Gibraltar
(Risso's dolphin)	Richard	1936	Azores		Zullo	1963	Woods Hole
	Richard	1936	Azores		Pilleri and	1969	Spanish coast,
	Pilleri and	1969	Barcelona, Spain		Knuckey		Medit. Sea
	Gühr				Kinze (in		Farøe Is.
	Ross	1984	SE coast, S. Afr.		Rappé and		
					Waerebeek)		
<i>Sotalia</i> sp.	Siciliano et al.	1988	Rio de Janeiro, Brazil		Raga et. al.	1983	Farøe Is.
(Tucuxi)					Pilsbry	1916	New England
<i>Stenella attenuata</i>	Ross	1984	Mpelane, S. Afr.	<i>Globicephalus</i> sp.	Barnard	1924	North Atlantic
(Spotted dolphin)					Richard	1936	Mid-Atlantic
					Richard	1936	Baléares, Spain
<i>Stenella</i>	Raga et. al.	1982	Spanish coast, Medit. Sea	<i>Orcinus orca</i>	Gruvel	1920	Mediterranean
<i>coeruleoalba</i>				(Killer whale)	Richard	1936	Monaco
(Striped dolphin)	Raga et. al.	1983	Spanish coast, Medit. Sea		Richard	1936	Gibraltar
	Ross	1984	SE coast, S. Afr.	<i>Pseudorca</i>	Gruvel	1912	Monaco
	Raga and	1985	W. Mediterranean	<i>crassidens</i>	Gruvel	1920	Miguel, Azores
	Carbonell			(False killer whale)	Richard	1936	Miguel, Azores
	Boxshall (in		Mallorca		Pilleri	1967	Spanish coast, Medit. Sea
	Rappé and						
	Waerebeek)						
<i>Stenella euphrosync</i>	Pilleri	1970	Str. of Gibraltar	Family: Phocoenidae			
(Euphrosyne dolphin)				<i>Neophocaena</i>	Devaraj and	1974	Karwar, India
<i>Tursiops truncatus</i>	True	1891	N. Carolina	<i>phocaenoides</i>	Bennet		
(Bottlenose dolphin)	Dollfus	1968	Gibraltar	(Finless black porpoise)			
	Pilleri	1970	Gibraltar	<i>Phocoena phocoena</i>	Stubbings	1965	Hann, Senegal
	Present study	1985	Porto Novo, India	(Harbor porpoise)			
	Mead and	1990	Central Atlantic coast, USA	Family: Ziphiidae			
	Potter			<i>Mesoplodon mirus</i>	Ross	1984	SE coast, S. Afr.
	Ross	1984	Natal, S. Africa	(True's Beaked whale)			
	Barnard	1924	Natal, S. Africa	<i>Ziphius cavirostris</i>	Bane and	1980	North Carolina
Unidentified delphinid	Pope	1958	Heron I., Queensl.	(Goosebeaked whale [or] Cuvier's Beaked whale)	Zullo		
	Relini	1979	Ligurian Sea				
<i>Feresa attenuata</i>	Stubbings	1965	Yenn, Senegal	Unidentified whale	Broch	1924	Greenland
(Pygmy killer whale)					Nilsson-Cantell	1930	W. Afr. (14°45'N; 18°34'W)
<i>Globicephala macrorhynchus</i>	Spivey	1977	Florida, Atlantic coast	Unknown host	Nilsson-Cantell	1978	Bay of Biscay
(Short-finned pilot whale)							

Acknowledgments

Bruce B. Collette, Director, NMFS Systematics Laboratory, provided laboratory facilities and reviewed the

manuscript, and the Fish Division, USNM, provided computer facilities. R. Natarajan and the authorities of Annamalai University, Tamil Nadu, India, provided facilities for this work. The senior author is grateful

to CSIR, New Delhi, for a Senior Research Fellowship for the Marine Mammal Project. William A. Newman verified the identification of *X. globicipitis*. Drafts of the manuscript were read by James G. Mead, William F. Perrin, and Austin B. Williams.

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