

## Observations of Longman's Beaked Whale (*Indopacetus pacificus*) in the Western Indian Ocean

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### Abstract

Seventeen new sightings, and a total of 32 records, of the little-known Longman's beaked whale, (*Indopacetus pacificus*) (also called tropical bottlenose whale or Indo-pacific beaked whale) are reported from the western Indian Ocean. Field identification features are reviewed, and the possibilities of confusion with other beaked whales are noted. Mean group size for the western Indian Ocean sightings was 7.2 individuals ( $n = 22$ ,  $SD = 10.9$ , range = 1 to 40). This is smaller than previously published estimates from the Pacific, reflecting a relatively large number of new sightings of individuals and small groups, which, in turn, reflect the recent description of the external appearance of this species. Recorded dive times were either short (mean = 14 min, range = 11 to 18 min,  $n = 5$ ) or long (mean = 26 min, range = 20 to 33 min,  $n = 19$ ). Longman's beaked whales appear to be widely distributed in the warmer ( $> 27^{\circ}$  C) waters of the western Indian Ocean, but most sightings were over or adjacent to deep slopes (depths 250 to 2,000+ m). Mean sighting rates were much higher in the western Indian Ocean (1 sighting per 31 sea days for visual surveys) and particularly around the Maldives (1 sighting per 21 sea days) than have been reported from the Pacific (1 sighting per 200 sea days). Longman's beaked whales may therefore be more common in the western Indian Ocean than in the Pacific, although survey methodologies used in the two oceans were not identical. Widespread gillnet fisheries may pose a potential threat to this species in the Indian Ocean.

**Key Words:** Longman's beaked whale, tropical bottlenose whale, *Indopacetus pacificus*, Maldives, western Indian Ocean

### Introduction

Longman's beaked whale (*Indopacetus pacificus*) (Longman, 1926) was long regarded as the least-known of all living whales. Until recently, it was known only from two beach-cast skulls (Longman, 1926; Azzaroli, 1968; Moore, 1972). Mörzer Bruyns (1971) reported two sightings, which he identified as *I. pacificus* from the north-west Indian Ocean, but his observations were not widely recognized at the time. External appearance of this species remained unknown until Pitman et al. (1999) compiled data on 44 sightings of "tropical bottlenose whales" from the Indian and Pacific Oceans (including several initially identified as southern bottlenose whales, *Hyperoodon planifrons*), concluding that these were probably *I. pacificus*. More recently, Dalebout et al. (2003) presented genetic and morphological information from the two original skulls plus four additional strandings, proving that the tropical bottlenose whale and Longman's beaked whale were one and the same.

Despite the advances in understanding of *I. pacificus* reported by Pitman et al. (1999) and Dalebout et al. (2003), our knowledge of this species remains fragmentary. A spate of new sightings in the western Indian Ocean offers some new insights. The aim of this paper is to report these new sightings, review published records, and to summarize information on Longman's beaked whales in the western Indian Ocean.

### Materials and Methods

All known records of *Indopacetus pacificus* from the western Indian Ocean have been compiled (Table

1). We define the western Indian Ocean here as the area north of 40° S and west of 80° E, but including the waters off the east coast of Sri Lanka. We follow Pitman et al. (1999) in considering animals originally identified as bottlenose whales (*Hyperoodon* sp. or *H. planifrons*) in tropical waters to have been *I. pacificus*. We note an apparent discrepancy between the position of one sighting by Mörzer Bruyns (1971; Chart 9, ca 06° 00' N, 50° 00' E) and the position published by Pitman et al. (1999; 12° 30' N, 54° 00' E); we use the former here. We also note that Pitman et al. (1999) compiled data on 44 sightings, not 45, which is the total they reported, perhaps as a result of the accidental inclusion of one sighting (3 July 1986) twice in their Table 1. Dayaratne & Joseph (1993) reported on a study of cetacean catches off Sri Lanka, carried out from September 1991 to September 1992. Among 2,791 cetaceans sampled, three were originally identified as southern bottlenose whales. These Sri Lankan records were not included in earlier reviews.

Previously unreported sightings of *I. pacificus* were recorded during four separate surveys in the western Indian Ocean:

1. A cetacean survey of the Maldives using liveaboard whale watching vessels from 1998 to 2004 (RCA)—Only sightings identified as definite *I. pacificus* (either at the time or subsequently from photos and field notes) are included. Several other sightings of possible *I. pacificus* are not included here.
2. The western Indian Ocean component of a circumglobal survey of sperm whales (*Physeter macrocephalus*) by Ocean Alliance on the *R.V. Odyssey* during the period May 2002 to April 2004 (RC, PTM & CJ)
3. Cetacean surveys around the Union of the Comoros and Mayotte, with most survey effort in waters < 200-m deep, during August 2002 to August 2005 (JK & OB)
4. A cetacean survey of the tropical western Indian Ocean carried out from a platform of opportunity (POO, cruise ship) in January and February 2002 to 2004 (RCA and Susan G. Anderson)

Animals seen during these surveys were considered to be *I. pacificus* if they showed appropriate head shape, colouration, size, and dorsal fin characteristics (as detailed in the “Discussion” section), either at the time or subsequently from photographs. In one of our sightings (No. 21, as listed in Table 1), the animals were seen in silhouette, and colouration was not noted.

## Results

Seventeen new sightings of *Indopacetus pacificus* are reported here, for a total of 32 records from the

western Indian Ocean (Table 1). Positions of all records are shown in Figure 1. Rough estimates of sighting rates are given in Table 2, which includes comparative data from the Pacific (Miyashita, 1993; Wade & Gerrodette, 1993; Pitman et al., 1999). (Data from the Comoros & Mayotte survey are not included in Table 2 because that survey was mostly conducted in shallow coastal waters.)

Mean group size from our new sightings data was 4.2 individuals ( $n = 17$ ,  $SD = 5.2$ , range = 1 to 20). For all western Indian Ocean sightings together, mean group size was 7.2 individuals ( $n = 22$ ,  $SD = 10.9$ , range = 1 to 40).

Dive times were recorded for 24 dives (from 12 separate encounters) and averaged 23 min (range 11 to 33 min). Nineteen dives by ten individuals, pairs, or threes averaged 26 min (range 20 to 33 min). Another five dives (by two groups of 3 and ca 20) averaged 14 min (range 11 to 18 min). A presumed mother and calf pair (the mother estimated to be about 6-m long and the calf just half that length) dived together on three dives of 23- to 25-min duration.

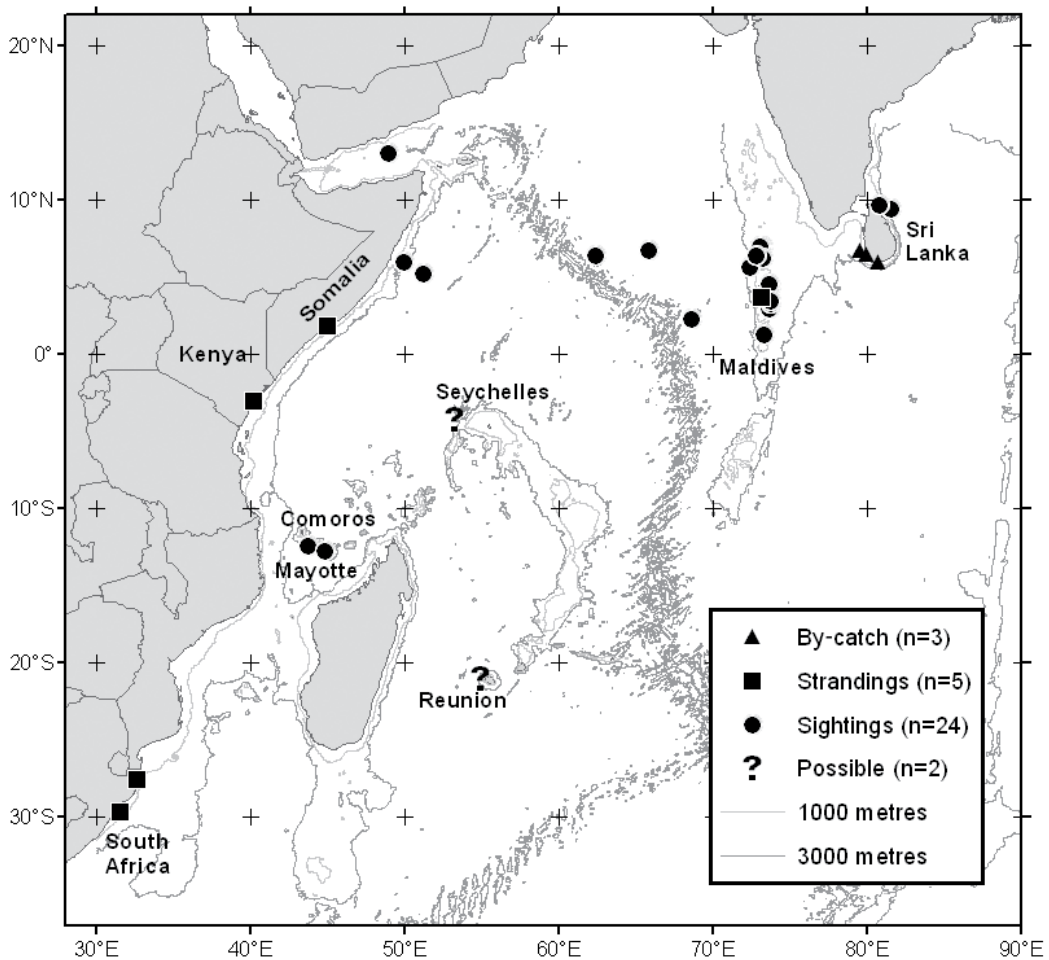
Sea surface temperature (SST) was recorded for only one sighting: 28.9° C in the Maldives. SST varied relatively little in these tropical waters, however, and so rough estimates can be approximated for other sightings—for example, SST in the Maldives is generally within the range 27° C to 30° C, while SST in the Comoros in August is usually about 27° C, and it was about 28° C near Mayotte in June 2005.

## Other Sightings

In addition to the records listed above, we know of three other sightings of beaked whales in the western Indian Ocean that are relevant here.

Keller et al. (1982) saw and photographed four beaked whales during an aerial survey off the Seychelles (at 4° 03' S, 56° 70' E). They estimated three adults to be about 4.5-m long and one juvenile to be about 2.5-m long, and provisionally identified them as Gray's beaked whale (*Mesoplodon grayi*) or *I. pacificus*. That tentative identification was made from an aerial photograph by James Mead, who now considers the animals to be best regarded as an unidentified beaked whale (James Mead, pers. comm.).

During the same aerial survey in the Seychelles, Keller et al. (1982) also saw “two light grey whales, one estimated to be [about 6- to 7.5-m long] and the other [about 3.5- to 4.5-m] long, . . . breaching at 04° 12' S, 53° 15' E. They had elongated beaks and broad flukes with a flat posterior margin, all features characteristic of beaked whales” (p. 511). If sizes were estimated accurately, those animals may well have been *I. pacificus*.



**Figure 1.** Map of the western Indian Ocean showing locations of all known records (sightings, strandings, and fishery by-catch) of *Indopacetus pacificus*

A sighting off Réunion (approx. 21° S, 55° E) was reported as *H. planifrons* (Anonymous, 1991). It seems possible that this sighting may have been of *I. pacificus*. SST off Réunion averaged 24° C to 26° C, which is within the range recorded for *I. pacificus* (Pitman et al., 1999); however, the sighting, even though within the tropics, was sufficiently far south that confusion with *H. planifrons* cannot be excluded. Although *H. planifrons* is known mostly from waters south of 30° S, it does occur further north—the holotype, for example, being discovered on Australia's Indian Ocean coast in 20° S (Flower, 1882; Mead, 1989). Further observations in the southern subtropics, and from the Mascarene Islands in particular, will be required to resolve this issue.

## Discussion

### Field Identification

Accurate identification is a prerequisite for any meaningful biological study. *Indopacetus pacificus* is a moderately distinctive beaked whale, and under good conditions, identification should be straightforward (except in southern latitudes where *Hyperoodon planifrons* might also occur). Under less than ideal conditions, however, identification is difficult. This is especially the case since details of external appearance only recently have become available (Pitman et al., 1999).

**Head Shape**—The bulbous melon and distinct beak distinguish this species from other known beaked whales in the tropical western Indian Ocean, although, in some individuals (presumably females and juveniles), the melon is not particularly bulbous. In addition, animals surfacing

Table 1. Records of 32 *Indopacetus pacificus* in the western Indian Ocean (from 1955 to 2005)

Date	Location	Latitude	Longitude	Original identification	School size	Comments	Source
1955	Danane, Somalia	01° 52' N	45° 02' E	<i>I. pacificus</i>	[1]*	Stranding (skull)	Azzaroli, 1968
ca 1968	Kenya	ca. 03° 00' S	40° 30' E	<i>I. pacificus</i>	[1]*	Stranding (skull)	Dalebout et al., 2003
Pre-1971	Gulf of Aden	ca. 13° 00' N	49° 00' E	<i>I. pacificus</i> ?	NA	ca 6-7 m?	Mörzer Bruyns, 1971
Pre-1971	Socotra area	ca. 06° 00' N	50° 00' E	<i>I. pacificus</i> ?	NA	ca 6-7 m?	Mörzer Bruyns, 1971
7 November 1976	Natal, South Africa	29° 39' S	31° 36' E	<i>H. planifrons</i>	[1]*	Stranding	Dalebout et al., 2003
11 April 1983	Sri Lanka	09° 28' N	81° 34' E	<i>H. planifrons</i> ?	40		Alling, 1986
23 April 1983	Sri Lanka	09° 43' N	80° 52' E	<i>H. planifrons</i> ?	2		Alling, 1986
1991-1992	Beruwela, Sri Lanka	[06° 30' N	80° 00' E]*	<i>H. planifrons</i>	[1]*	Fisheries by-catch	Dayaratne & Joseph, 1993
1991-1992	Beruwela, Sri Lanka	[06° 30' N	80° 00' E]*	<i>H. planifrons</i>	[1]*	Fisheries by-catch	Dayaratne & Joseph, 1993
1991-1992	Southern Sri Lanka	[06° 00' N	80° 45' E]*	<i>H. planifrons</i>	[1]*	Fisheries by-catch	Dayaratne & Joseph, 1993
5 August 1992	Natal, South Africa	27° 34' S	32° 41' E	<i>H. planifrons</i>	[1]*	Stranding	Dalebout et al., 2003
30 April 1995	Western Indian Ocean	06° 46' N	65° 51' E	<i>I. pacificus</i> ?	2		Ballance & Pitman, 1998
1 May 1995	Western Indian Ocean	06° 25' N	62° 26' E	<i>I. pacificus</i> ?	35		Ballance & Pitman, 1998
3 May 1995	Western Indian Ocean	05° 14' N	51° 18' E	<i>I. pacificus</i> ?	8		Ballance & Pitman, 1998
17 January 2000	Vaavu Atoll, Maldives	03° 26' N	73° 26' E	<i>I. pacificus</i>	[1]*	Stranding	Dalebout et al., 2003
04 May 2000	Meemu Atoll, Maldives	02° 59' N	73° 40' E	<i>I. pacificus</i>	ca 20	Stranding ca 6-7.5 m, with pilot whales and bottlenose dolphins	RCA
21 March 2001	Southern Maldives	01° 19' N	73° 22' E	<i>I. pacificus</i> ?	2	ca 6 m	RCA
06 April 2001	Vaavu Atoll, Maldives	03° 16' N	73° 45' E	<i>I. pacificus</i> ?	2	ca 6 m	RCA
01 April 2002	Haa Alifu Atoll, Maldives	06° 58' N	73° 18' E	<i>I. pacificus</i> ?	2	ca 6 m	RCA
24 August 2002	Moheli, Comoros	12° 26' S	43° 49' E	<i>I. pacificus</i>	15	ca 7-8 m (one calf ca 4 m), with pilot whales, bottlenose and spinner dolphins	JK & OB
7 February 2003	Western Indian Ocean	02° 15' N	68° 42' E	Bottlenose whale	2	ca 6-7 m	Susan Anderson & RCA
11 February 2003	Raa Atoll, Maldives	05° 37' N	72° 29' E	Beaked whale	5	4 adults (ca 6-7 m) and one calf; SST 28.9° C	<i>Odyssey</i>
29 March 2003	North Malé Atoll, Maldives	04° 25' N	73° 45' E	<i>I. pacificus</i> ?	2	ca 6-7.5 m	RCA
2 April 2003	Vaavu Atoll, Maldives	03° 44' N	73° 29' E	<i>I. pacificus</i>	5	Adult (ca 6 m) and calf (ca 3 m)	RCA
21 April 2003	Haa Alifu Atoll, Maldives	06° 59' N	73° 08' E	<i>I. pacificus</i>	3	ca 7+ m; one breach	RCA
22 April 2003	Shaviyani Atoll, Maldives	06° 15' N	73° 18' E	<i>I. pacificus</i> ?	3	ca 6-7 m	RCA
8 November 2003	Shaviyani Atoll, Maldives	06° 26' N	72° 51' E	<i>I. pacificus</i>	1	ca 6-7 m	RCA
17 March 2004	Vaavu Atoll, Maldives	03° 40' N	73° 36' E	<i>I. pacificus</i> ?	3	ca 6 m+	RCA
20 November 2004	South Malé Atoll, Maldives	03° 57' N	73° 36' E	<i>I. pacificus</i>	2	ca 7+ m	RCA
12 April 2005	North Malé Atoll, Maldives	04° 35' N	73° 41' E	<i>I. pacificus</i>	1	ca 6-7 m	RCA
14 April 2005	Vaavu Atoll, Maldives	03° 30' N	73° 41' E	<i>I. pacificus</i>	3	ca 5-6 m	RCA
3 June 2005	Mayotte	12° 45' S	44° 54' E	<i>I. pacificus</i>	1	ca 7-8 m	JK

\* The positions given for the three records of Dayaratne & Joseph (1993) are of landing sites not locations of capture; the "school sizes" of strandings and by-catch records are of single, dead individuals.

slowly and not raising their heads right out of the water tend to push up a bow wave, which covers the front of the melon (see Figure 2), making viewing of the head shape difficult.

**Size**—Size of live animals at sea is notoriously difficult to estimate accurately, but *I. pacificus* is an obviously large beaked whale. Most of the individuals reported here were estimated to be approximately 6- to 7-m long, although some were thought to be up to 8-m long (Table 1). Mörzer Bruyns (1971) did not report the lengths of the animals he saw, but did note that they were “very large beaked whales” (p. 137) and of a similar size to Cuvier's beaked whale (*Ziphius cavirostris*) (the length of which he gave as 6.1 to 7 m). These adult sizes are larger than any *Mesoplodon*. Single calves were present in three of our sightings, the smallest of which was estimated to be about 3 m long. Three, presumably juvenile, individuals landed in Sri Lanka were reported to be 2.7- to 3.3-m long (Dayaratne & Joseph, 1993). A neonate stranded in South Africa was 2.91-m long (Dalebout et al., 2003).

**Colouration**—The colour pattern of *I. pacificus* has been well-described by Pitman et al. (1999). We do not repeat that here, but do note several instances of colour variation. First, apparent dorsal colour of live animals varies according to weather conditions. In good sunlight, most animals appear a rich coffee brown colour. Under grey skies, most appear dull grey-brown. Secondly, the dark band behind the blowhole is highly variable and sometimes indistinct (Figure 2). Thirdly, the lower jaw is normally pale brown or grey, but it is sometimes pink. This was noted in one particularly active group and may indicate flushing related to thermoregulation (Perrin, 2002).

**Dorsal Fin**—The dorsal fin is relatively large and erect (Figure 2). It is distinctly larger and taller than the dorsal fins of most, if not all *Mesoplodon* spp., but appears only slightly larger than that of *Z. cavirostris*. The dorsal fin sometimes appears to have a dark leading edge and pale centre.

**Blow**—The blow is low and bushy, and usually visible (also audible if closeby). Pitman et al. (1999) noted one case in which the blow was reported to have been forward-canted. We confirm that this is the case, having specifically noted that the blow is indeed directed slightly forwards in four of our sightings (Figure 2).

**Diving Behaviour**—At the surface, during a terminal roll before a long dive, *I. pacificus* usually arches its back only slightly. In contrast, *Z. cavirostris* normally arches strongly.

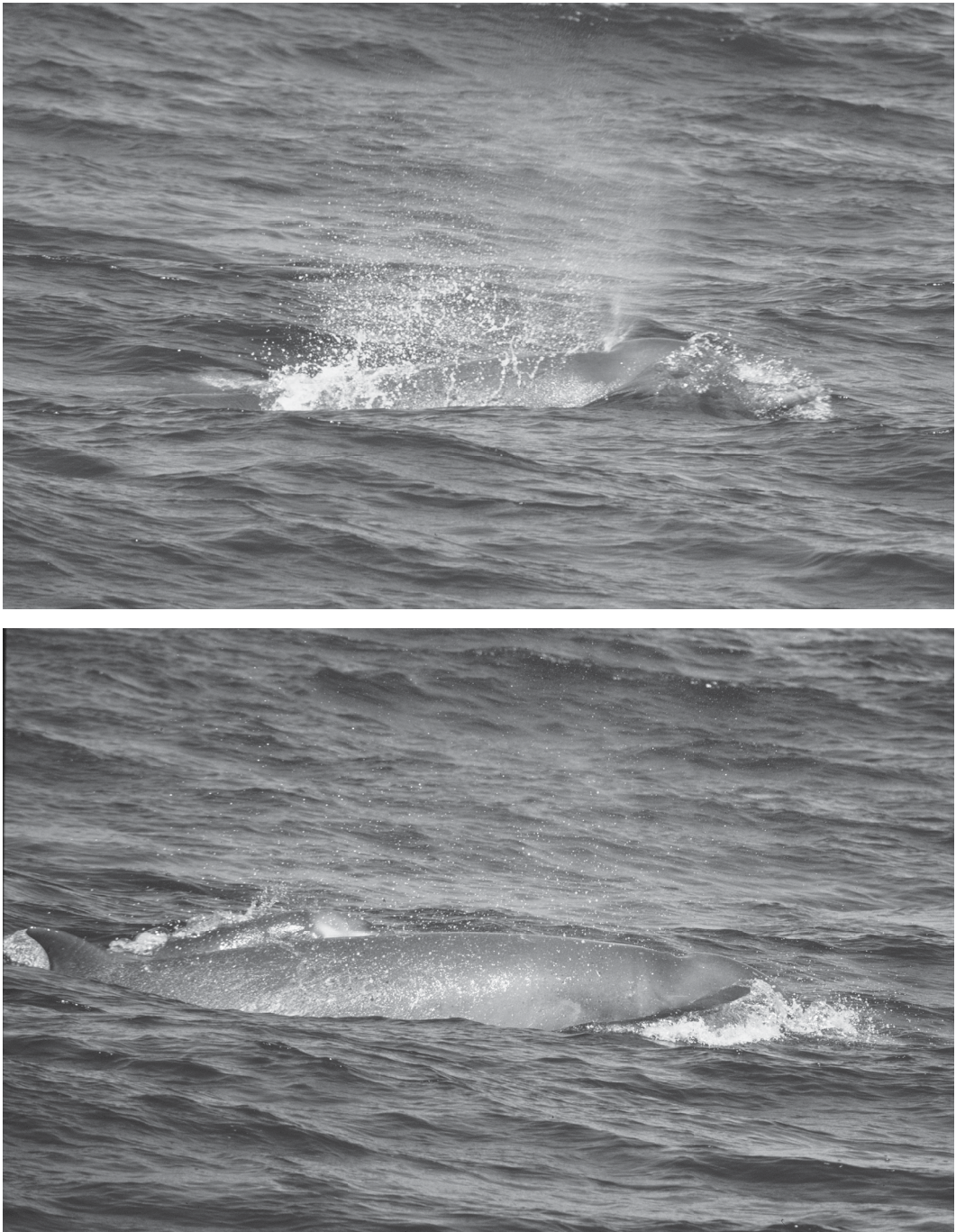
In our experience, if the head is not seen clearly, size and posterior dorsal colouration may lead to confusion with *Z. cavirostris*. Mörzer Bruyns (1971) also reported that these two species are of similar size and shape.

Also, there is the possibility of confusion with Blainville's beaked whale (*M. densirostris*). In one sighting of *M. densirostris* in the Maldives, two apparent female animals showed a pale head contrasting with a darker body, with the two regions being separated in one animal by a thin, dark vertical bar (RCA, pers. obs.). This colouration was very similar to that shown by most *I. pacificus*. In the case of those *M. densirostris*, the pale colouration of the head extended distinctly posterior to the blowhole, whereas in *I. pacificus*, it extends only to the level of the blowhole. Furthermore, in that one case, the two animals were identified as *M. densirostris* by the following features: size (estimated to be about 5 m, not 6 m+), distinctive shape of jawline (subsequently, from photographs), melon shape (sloping, not bulbous), dorsal fin shape (height approximately equal to width, not taller, and leading edge becoming approximately horizontal at apex), and close association with an easily identifiable mature male. We have not noted any other *M. densirostris* with that colouration in the western Indian Ocean; however, a somewhat similar colour pattern was recorded on at least two separate occasions in the Atlantic: (1) on a juvenile in the Canaries (Natacha Aguilar, pers. comm.) and (2) on a mature female in the Bahamas (Colin Macleod, pers. comm.).

#### Group Size

Estimates of mean group size (4.2 individuals for our new sighting data; 7.2 individuals for all western Indian Ocean sightings together) are less than those reported previously. Mean group sizes reported by Pitman et al. (1999) were 8.6 individuals ( $n = 17$ ) from the eastern Pacific, 29.2 individuals from the western Pacific ( $n = 15$ ), and 18.5 individuals for the entire Indo-Pacific ( $n = 41$ ). While we do not discount the possibility of genuine regional differences, we suspect that much inter-sample variability may arise from observer effects. In particular, larger groups are often very active at the surface, often ignore or even approach boats, may spend less time under water, and often lift their heads clear of the water. They are therefore disproportionately likely to be spotted and identified or photographed. In contrast, single animals or pairs are often relatively quiet at the surface, often do not show much of their heads, may spend more time under water, and seem more likely to avoid boats. They are therefore more likely to be either missed or misidentified. As an example, in the Maldives, RCA identified just one sighting of a particularly active group as *I. pacificus* (estimated group size = 20) during 81 d at sea in 1998 to 2000 when inexperienced with this species, but subsequently identified 12 sightings of individuals or small groups (mean group size = 2.4) during





**Figure 2.** Two Longman's beaked whales surfacing, Maldives, 11 February 2003 (Photographs from Chris Johnson, Ocean Alliance). Upper photo: Note slight forward projection to blow, melon, and distinct beak partly obscured by water, and indistinct dark bar immediately posterior to blowhole. Lower photo: Note shape and relative size of dorsal fin on nearer animal; pale melon clearly demarcated from dark back on second (apparently smaller) animal.

194 d at sea from 2001 to 2005. In addition, the lack of information on field characteristics prior to the publication of Pitman et al. (1999) inevitably hindered earlier identifications.

#### *Dive Times*

Only two dive times (18 and 25 min) for Longman's beaked whales appear to have been published (Gallo-Reynoso & Figueroa-Carranza, 1995; Pitman et al., 1999). The 24 dive times recorded herein fell into two classes: short (11 to 18 min) and long (20 to 33 min). The significance, if any, of this bimodal distribution is unknown, particularly given the small sample size. Short dives were performed by groups (of 3 and *ca* 20 individuals), which were rather active at the surface; we speculate that they may have been socializing. Long dives were performed by a single, pairs, and a group of three, none of which appeared particularly active at the surface; we speculate that they may have been deep foraging.

Dive times in the northern bottlenose whale (*Hyperoodon ampullatus*) have also been characterised as short ( $\square$  16 min) and long ( $\geq$  25 min), the latter apparently associated with deep foraging (Hooker & Baird, 1999). The longest dive time recorded in that study was 70 min, and northern bottlenose whales are believed to dive for even longer (Mead, 1989; Hooker & Baird, 1999). During our study, the longest dive time recorded for *I. pacificus* was 33 min. It is likely that some longer dive times were missed since surveys in the Maldives (where all the dive times were recorded) were rarely interrupted for more than about 30 min after seeing an animal dive to wait for it to resurface. In addition, the one animal seen off Mayotte was tracked acoustically for 45 min after diving, during which time continuous clicking was recorded (suggesting that it was under water for all of that time), although contact with the animal was lost before it resurfaced.

#### *Distribution Within the Western Indian Ocean*

*I. pacificus* appears to be widely distributed throughout the warm waters of the western Indian Ocean. Although SST was not recorded in most cases, all new sightings reported here were made in areas where SST is generally above 27° C. This is consistent with the findings of Pitman et al. (1999), who noted that most sightings were in waters warmer than 26° C.

Dalebout et al. (2003) noted the stranding of two Longman's beaked whales on the Natal coast of South Africa at 27° S and 29° S. These two records are much further south than any other, but occurred in an area influenced by the warm, southward flowing Agulhas Current. These two strandings occurred in 1976 and 1992, which were both El Niño years.

Most of the 24 sightings occurred in deep water, with three-quarters of the sightings over or near areas with steep bottom topography. These areas included the 13 steep outer atoll slopes of the Maldives (bottom depths not well charted but of the order of 400 to 2,000 m), the two continental slopes off Sri Lanka (250 to 3,500 m), the slope off Mayotte (2,000 m), and off Somalia (exact position uncertain, but apparently near continental slope). In addition, two sightings were in waters of about 2,500 m in the general vicinity of the mid-ocean Carlsberg Ridge. On three occasions in the Maldives, *I. pacificus* were observed travelling parallel to the outer atoll slope, presumably maintaining position over a particular depth. The one sighting from Comoros was unusual in this regard in that it occurred in shelf waters of only 40 to 50 m, some 2 km from the 200-m isobath.

#### *Relative Abundance*

Pitman et al. (1999) noted that *I. pacificus* is a rare species. They presented results from two separate series of oceanic cetacean surveys in the Pacific during which there was an average of only one sighting per 200 d at sea. Sightings have been more frequent within the western Indian Ocean. During our surveys, together with those of Alling (1986) and Ballance & Pitman (1998), there was an average of one sighting per 41 d at sea (Table 2). Sightings were particularly frequent around the Maldives, where they averaged one per 21 d at sea. The lowest sighting rates in the western Indian Ocean were recorded during the Voyage of the *Odyssey*, possibly because that survey focused on acoustic detection of sperm whales and placed less emphasis on visual detection of cetaceans. Excluding the *Odyssey* data, there was an average of one sighting per 31 d at sea in the western Indian Ocean. This is six times the rate recorded from the Pacific. The sighting rate for individuals in the western Indian Ocean (one individual per 4.2 d at sea, excluding *Odyssey* data) was twice that in the Pacific (one individual per 8.2 d at sea).

On the basis of these sighting rates, *I. pacificus* appears to be more common in the western Indian Ocean, and around the Maldives in particular, than in the Pacific. It should be noted, however, that survey methodologies in the two oceans were not identical. It is possible that the Pacific surveys underestimated the abundance of *I. pacificus*. Those surveys were conducted largely in deep oceanic waters, while the surveys in the western Indian Ocean included more time in slope waters, where *I. pacificus* appears to be more common. In addition, all of the Pacific surveys were completed prior to the publication of the first paper describing the external appearance of this species (Pitman et al., 1999). On the other hand, the

**Table 2.** Number and rate of sightings of *Indopacetus pacificus* by major ocean area from seven separate investigations (WIO = Western Indian Ocean; ETP = Eastern Tropical Pacific)

Area	Period	Sea days	Sightings	Days / sighting	Individuals	Days / individual	Source
WIO	1982-1984	ca. 185	2	93	42.0	4.4	Alling, 1986
WIO	1995	105	3	35	45.0	2.3	Ballance & Pitman, 1998
Maldives	1998-2005	275	13	21	49.0	5.6	This study (RCA)
WIO	2002-2004	243	1	243	5.0	48.6	This study ( <i>Odyssey</i> : RC, PTM & CJ)
WIO	2002-2004	19	1	19	2.0	9.5	This study (POO: RCA & Susan Anderson)
Subtotal / average (WIO all)	827	20	41	143	5.8		
Subtotal (WIO excluding <i>Odyssey</i> )	584	19	31	138	4.2		
ETP	1986-1990	ca 600	4	150	39.0	15.4	Wade & Gerrodette, 1993; Pitman et al., 1999
Western Pacific	1986-1990	1,200	5	240	181.0	6.6	Miyashita, 1993; Pitman et al., 1999
Subtotal / average (Pacific)	--	1,800	9	200	220.0	8.2	

surveys in the Pacific were conducted by teams of professional observers, on high stable platforms, scanning the waters out to the horizon during all the daylight hours with high-powered binoculars (Robert L. Pitman, pers. comm.), while most observations in the Indian Ocean were made in a less rigorous manner.

#### Association with Other Species

Two groups of Longman's beaked whales were associated with (i.e., seen in relatively close proximity to) other species. One group in the Maldives was associated with short-finned pilot whales (*Globicephala macrorhynchus*) and bottlenose dolphins (*Tursiops truncatus*). Another group in Comoros was associated with these two species and also spinner dolphins (*Stenella longirostris*). Association with short-finned pilot whales and bottlenose dolphins has been noted before (Pitman et al., 1999).

#### Threats

Dayaratne & Joseph (1993) recorded three juvenile "southern bottlenose whales" during a study of cetacean by-catch in Sri Lanka. Two were landed at Beruwela (on the southwest coast), having been caught by gillnet. One was landed on the south coast (at a port between Dondra and Tangalle, inclusive) and was almost certainly caught by gillnet. It should be noted that Sri Lankan boats tend not to land the largest cetaceans caught because of the difficulties of taking them on board and the excessive amount of hold space that they would require for storage. Large cetaceans are

cut free or cut-up and used as longline bait for sharks (Leatherwood & Reeves, 1989; Dayaratne & Joseph, 1993). Therefore, the sizes of the three juveniles landed (2.7 to 3.3 m) are unlikely to have been representative of the total catch. It should also be noted that Sri Lankan fishing boats range widely in the Indian Ocean, presently at least as far as Seychelles (Leslie Joseph, pers. comm.). Even in 1991 and 1992, some boats were travelling hundreds of miles from their home ports (Dayaratne & Joseph, 1993). For this reason, the site of landing does not necessarily indicate anything about location of capture. Currently, there are thousands of vessels of several nations carrying out pelagic gillnetting across large swathes of the northern Indian Ocean, although much of this fishing effort is poorly documented. These vessels are likely to pose some threat to Indian Ocean population(s) of *I. pacificus*, but the extent of this threat is unknown.

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