

A feeding aggregation of Omura's whale, *Balaenoptera omurai*, off Nosy Be, Mozambique Channel

Pierre Laboute, Philippe Borsa*

Institut de recherche pour le développement (IRD),
Anse Vata, BPA5, 98848 Noumea,
New Caledonia

* Corresponding author:
philippe.borsa@ird.fr
philippeborsa@gmail.com

Abstract

A feeding aggregation of Omura's whales, *Balaenoptera omurai*, was documented off Nosy Be Island at the northeastern entrance of the Mozambique Channel in November 1994. Underwater photographs of live individuals illustrated sub-surface skimming as the main feeding behaviour, with small crustaceans, small jellyfish and other gelatinous micronecton identified as prey. A precise description of the whales' pigmentation patterns completes previous descriptions from the recent literature.

Keywords: Omura's whale, feeding aggregation, Mozambique Channel

Introduction

The recently discovered Omura's whale, *Balaenoptera omurai* Wada, Oishi and Yamada 2003, has been reported mainly from the tropical waters of the Atlantic, Indian and western-Pacific Oceans (Fig. 1). The osteology of the skull has been described in detail from a number of specimens from the Indian and Pacific Oceans (Wada *et al.*, 2003; Yamada *et al.*, 2006a; 2006b; 2008). DNA markers have been used to ascertain identification in a number of captured, stranded (Sasaki *et al.*, 2006; Jung *et al.*, 2016; Ottewell *et al.*, 2016; Ranjbar *et al.*, 2016; Cypriano-Souza *et al.*, 2017; Xu *et al.*, 2017), as well as live Omura's whales (Kahn and Pet 2002; Cerchio *et al.*, 2015). Cerchio *et al.* (2015) have reported regular sightings of Omura's whales (whose identity was validated by mitochondrial DNA sequence) along the northwestern coast of Madagascar, mainly off the Ampasindava Peninsula and also north of Nosy Be Island from 2007-2014. A series of diapositives of a previously unidentified balaenopterid whale taken off Nosy Be twenty years ago by one of us (PL), were recently resurrected. The present note is a brief account of the observations made on these whales, now identified as Omura's whales, which were part of a feeding aggregation of up to 12 individuals. Some of their external morphological features and their pigmentation patterns

are described, and details are provided on their feeding behaviour, thus adding to the knowledge of the external aspect and behaviour of Omura's whale.

Methods

From July 1991 to December 1995, and again in June-August 1998 and June-August 2000 one of us (PL) undertook field work along the reef plateau west of Nosy Be island (northern Mozambique Channel), using a 5-meter outboard motorboat for daily to weekly outings at sea. No outing occurred from January to February. Rorquals of moderately large size, from approximately 8 m to approximately 12 m, were observed on almost every occasion, from June to September, every year and occasionally in October and November. Aggregations of whales, with up to a dozen individuals within a radius of less than 500 m, were sighted on 06 November 1994 at around 10h00 local time. The coordinates were 13°26'S, 48°05'E. The bottom depth was between 40 m and 80 m, sloping gently westwards towards the shallower reef plateau. On that occasion, the boat was stopped and PL free dived amid the whale aggregation for about one hour to take underwater pictures. Three of the pictures are presented here (Fig. 2) to illustrate the whales' external morphological features, pigmentation patterns, and feeding behaviour.

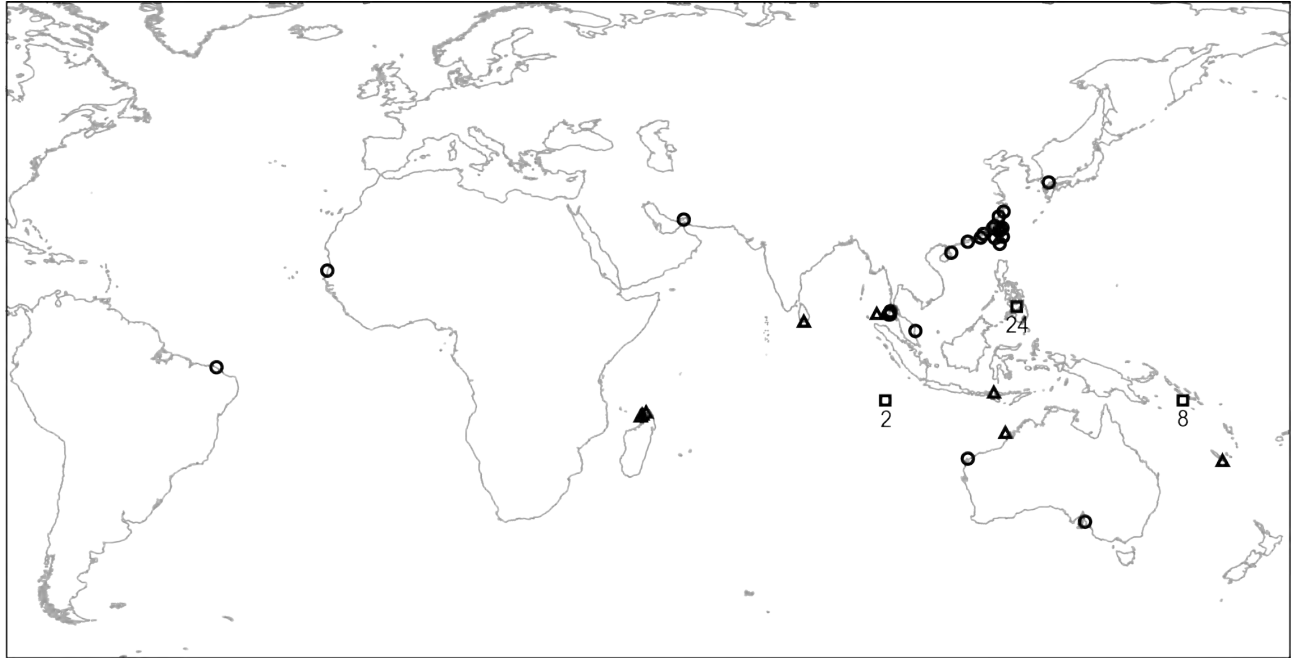


Figure 1. Point-map distribution of Omura's whale as obtained from sightings (Kahn and Pet, 2002; Yamada, 2009; Krajewsky, 2012; Cerchio *et al.*, 2015, and references therein; de Vos, 2017; present report) symbolized by triangles; strandings (Wada *et al.*, 2003; Yamada *et al.*, 2006b; Ponnampalam, 2012; Jung *et al.*, 2016; Ottewell *et al.*, 2016; Ranjbar *et al.*, 2016; Cypriano-Souza *et al.*, 2017; Xu *et al.*, 2017, and references therein; also including three presumably stranded specimens reported from Thailand, and six from Taiwan, by Yamada *et al.* (2006a)] symbolized by circles; and captures (Wada *et al.*, 2003; Yamada *et al.*, 2008) symbolized by squares, with number of specimens reported.

Results and Discussion

Seen from above, the maxilla had a slightly pointed ogival shape (Fig. 2A). The rostrum bore a single median ridge, and two or three subtle lateral grooves were visible, parallel to the median ridge each side of it (Fig. 2A). The dorsal fin was relatively small, falcate and recurved, its tip pointing backwards (Fig. 2C). The pigmentation of the right mandible was light (Fig. 2B) while that of the left mandible was dark (Fig. 2C). Asymmetry in pigmentation was also visible on the inner part of the lip, which was dark on the right and light on the left (Fig. 2A, C). A series of three parallel, S-shaped dark chevrons connecting the eye and the posterior edge of the mouth to the nuchal region was visible on the right side (Fig. 2B), apparently not matched by symmetrical chevrons on the left side (Fig. 2B, C). A lighter-grey, Z-shaped chevron connecting the axil to the anterior part of the back below the shoulders was visible on the right side (Fig. 2B) and a symmetrical, S-shaped chevron was visible on the left side (Fig. 2B, C). The flipper's anterior edge was light-pigmented, contrasting with the darker pigmentation of the flipper's dorsal side (Fig. 2A-C).

The whales were observed feeding on a large swarm of zooplankton and micronekton that included small crustaceans, small jellyfish and other gelatinous

organisms. The main mode of feeding was by skim-ming, with the animal gliding at shallow depth (less than 5 m below surface), mouth slightly gaping, allowing the flow of filtered seawater to escape laterally along the gaping rear extremity of the mandible (Fig. 2A, C). Lunge feeding was also observed occasionally, when the rorqual opened its mouth wide and gulped large quantities of gelatinous micronekton. On one occasion, a whale was observed defecating; the animal stood immobile in an upright position below the surface, allowing the plume of faeces to sink.

The whales documented in the present report were identified as Omura's whales on the basis of their external morphology and pigmentation, including the markedly recurved dorsal fin, the ogival shape of the rostrum, the single median ridge, and the asymmetry in pigmentation patterns (Wada *et al.*, 2003; Cerchio *et al.*, 2015; Ottewell *et al.*, 2016). Pigmentation patterns were very similar between the whales photographed by PL in 1994 (present report) and those photographed in the same area 18-20 years later (Cerchio *et al.*, 2015). In particular, two individuals presented in Figure 3 of Cerchio *et al.* (2015) exhibited a series of three parallel, dark-grey chevrons similar to that photographed in Fig. 2B. Sample monomorphism in the control-region sequences ($N = 11$) reported by Cerchio

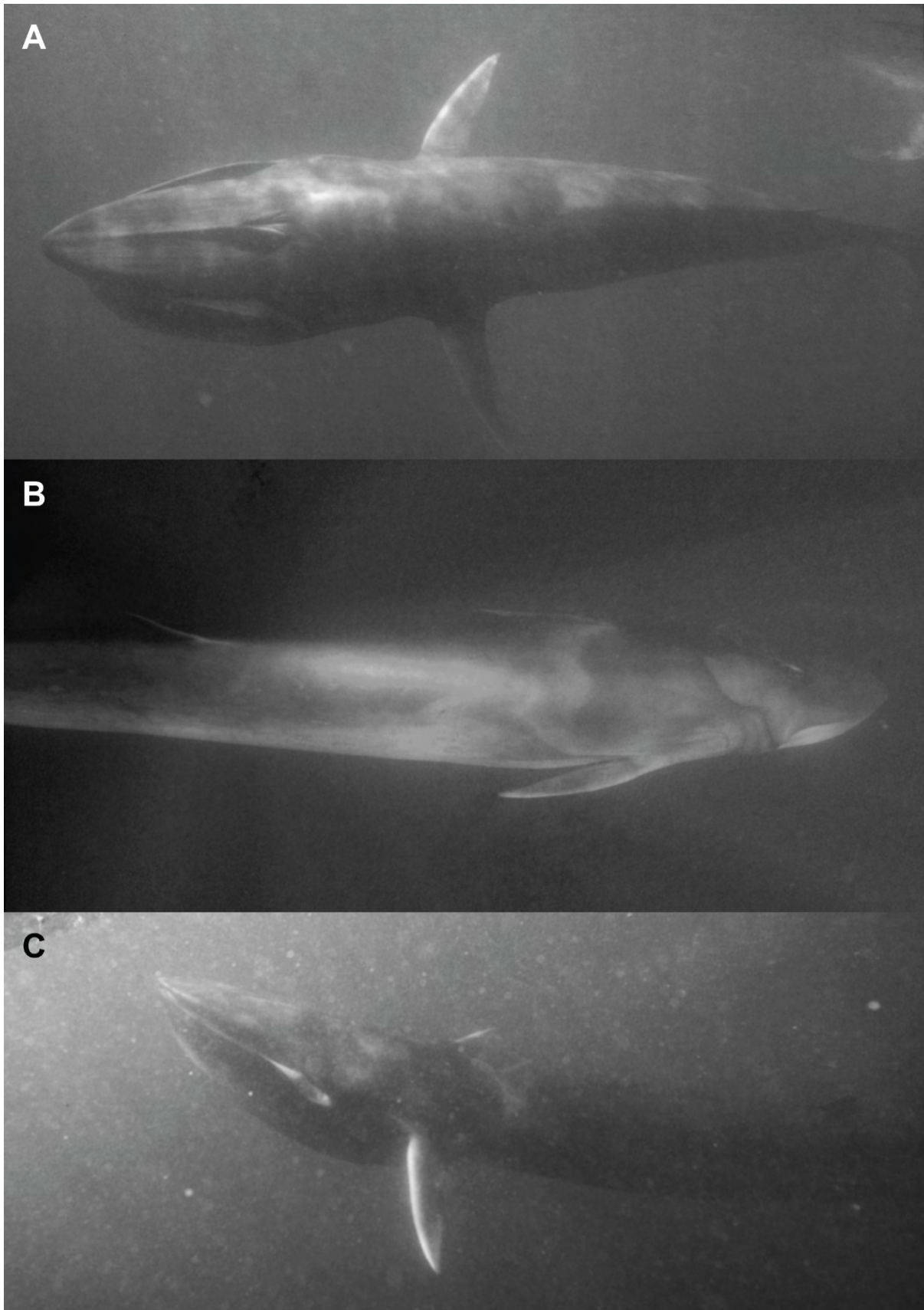


Figure 2. Omura's whales photographed off Nosy Be ($13^{\circ}26'S$, $48^{\circ}05'E$), 06 November 1994. A. Skimming posture of Omura's whale, viewed from above. B. View of the right and dorsal sides of an individual. C. Backlight view of the left side of another individual, also showing a swarm of gelatinous micronecton under the surface.

et al. (2015) indicates a low genetic diversity for the population of Omura's whales off northwestern Madagascar, suggesting a low effective population size. This in turn may explain similarities in pigmentation patterns such as those observed and which at first sight appeared to differ from those of a few individuals from other areas where pigmentation patterns were partly scoreable (Western Australia: Ottewell *et al.*, 2016; Persian Gulf: Ranjbar *et al.*, 2016). However, the skin of the Western Australian specimen had likely undergone post-mortem darkening (Ottewell *et al.*, 2016) and the skin of the Persian Gulf specimen displayed cuts, scratches and abrasions on part of its surface, erasing part of the pigmentation (Ranjbar *et al.*, 2016; these injuries are ascribed to a collision with a ship). The fact that a similar three-dark chevron pattern also characterized an individual documented from off Komodo Island (Kahn and Pet, 2002) and another one from off southern Sri Lanka (de Vos, 2017) suggests that it is, at least, a pattern frequently encountered in Omura's whales from the Indian-Ocean.

The occurrence of medium-sized rorquals including Omura's whales off Nosy Be every winter and spring for five consecutive years (this report) and 20 years later again for three consecutive years (Cerchio *et al.*, 2015) may be either related to seasonal and perhaps year-round suitable trophic conditions, or to suitable conditions for reproduction, or both. Sightings of mother-calf pairs (Cerchio *et al.*, 2015), acoustic records interpreted as courtship vocalizations (Cerchio *et al.*, 2015), and the documentation of feeding behaviour (Cerchio *et al.*, 2015; present study) suggest that the continental shelf waters at the northeastern entrance of the Mozambique Channel harbour a permanent or semi-permanent breeding population of Omura's whale. The interaction of the westward-flowing extension of the South Equatorial Current with the topography of the northeastern entrance of the Mozambique Channel generates large anticyclonic eddies (Schouten *et al.*, 2003). Anticyclonic eddies provoke upwellings which in turn favour high phytoplankton production. Eddies and currents play an important part in the spatial distribution of the chlorophyll in the Mozambique Channel (Quartly and Srokosz, 2003). High chlorophyll concentrations associated with upwellings are found along the coasts of Madagascar and Mozambique, notably at the northwestern and southwestern tips of Madagascar (Zubkov and Quartly, 2003). It is possible that the particular topography of the shelf area off northwestern Madagascar favours the accumulation and retention of

drifting, fast-growing zooplankton and micronecton including small jellyfish and other gelatinous animals, which Omura's whales exploit. Although poorly energetic, this diet may suffice to contribute a part of the energetic requirements of middle-sized rorquals such as Omura's whales in tropical waters, where individual energetic expenditure is less than in colder waters.

References

- Cerchio S, Andrianantenaina B, Lindsay A, Rekdahl M, Andrianarivelo N, Rasoloarijao T (2015) Omura's whales (*Balaenoptera omurai*) off northwest Madagascar: ecology, behaviour and conservation needs. Royal Society Open Science 2: 150301
- Cypriano-Souza AL; Oliveira de Meirelles AC; Carvalho VL; Bonatto SL (2017) Rare or cryptic? The first report of an Omura's whale (*Balaenoptera omurai*) in the South Atlantic Ocean. Marine Mammal Science 33: 80-95
- de Vos A (2017) First record of Omura's whale, *Balaenoptera omurai*, in Sri Lankan waters. Marine Biodiversity Records 10: 18
- Jung J-L, Mullié WC, Van Waerebeek K, Wagne MM, Ould Bilal AS, Ould Sidaty ZA, Toomey L, Méheust E, Marret F (2016) Omura's whale off West Africa: autochthonous population or inter-oceanic vagrant in the Atlantic Ocean? Marine Biology Research 12: 66-75
- Kahn B, Pet J (2002) Rare whale species identified in Komodo National Park, Indonesia. Apex Environmental, Denpasar. 3 pp
- Krajewsky H (2012) Extraordinarily rare whale sighting – Omura's whale (*Balaenoptera omurai*). Marine Education and Research Society, Alert Bay. <https://mersociety.wordpress.com/author/mersociety/>
- Ottewell K, Coughran D, Gall M, Irvine L, Byrne M (2016) A recent stranding of Omura's whale (*Balaenoptera omurai*) in Western Australia. Aquatic Mammals 42: 193-197
- Ponnampalam LS (2012) Opportunistic observations on the distribution of cetaceans in the Malaysian South China, Sulu and Sulawesi Seas and an updated checklist of marine mammals in Malaysia. Raffles Bulletin of Zoology 60: 221-231
- Quartly GD, Srokosz MA (2003) Eddies in the southern Mozambique Channel. Deep-Sea Research Part II, Topical Studies in Oceanography 51: 69-83
- Ranjbar S, Dakhteh MS, Van Waerebeek K (2016) Omura's whale (*Balaenoptera omurai*) stranding on Qeshm Island, Iran: further evidence for a wide (sub) tropical distribution, including the Persian Gulf. Journal of Marine Biology and Oceanography 5: 1-9

- Sasaki T, Nikaido M, Wada S, Yamada TK, Cao Y, Hasegawa M, Okada N (2006) *Balaenoptera omurai* is a newly discovered baleen whale that represents an ancient evolutionary lineage. *Molecular Phylogenetics and Evolution* 41: 40-52
- Schouten MW, de Ruijter WPM, van Leeuwen PJ, Ridderinkhof H (2003) Eddies and variability in the Mozambique Channel. *Deep-Sea Research Part II, Topical Studies in Oceanography* 50: 1987-2003
- Wada S, Oishi M, Yamada TK (2003) A newly discovered species of living baleen whale. *Nature* 426: 278-281
- Xu M, Wang X, Miao X, Wu F, Ma M, Tao C, Zhu Q (2017) Stranding Record of Omura's Whale (*Balaenoptera omurai* Wada, Oishi, and Yamada, 2003) in the Taiwan Strait, China. *Aquatic Mammals* 43: 289-298
- Yamada T (2009) Omura's whale, *Balaenoptera omurai*. In : Ohdachi SD, Ishibashi Y, Iwasa MA, Saitoh T (eds) *The wild mammals of Japan*. Mammalogical Society of Japan, Kyoto. pp 330-331
- Yamada TK, Chou L-S, Chantrapornsyl S, Adulyanukosol K, Chakravarti SK, Oishi M, Wada S, Yao C-J, Kakuda T, Tajima Y, Arai K, Umetani A, Kurihara N (2006a) Middle-sized balaenopterid whale specimens (Cetacea: Balaenopteridae) preserved at several institutions in Taiwan, Thailand, and India. *Memoirs of the National Science Museum, Tokyo* 44: 1-10
- Yamada TK, Kemper C, Tajima Y, Umetani A, Janetzki H, Pemberton D (2006b) Marine mammal collections in Australia. *National Science Museum Monographs* 34: 117-126
- Yamada TK, Kakuda T, Tajima Y (2008) Middle sized balaenopterid whale specimens in the Philippines and Indonesia. *Memoirs of the National Museum of Natural Sciences, Tokyo* 45: 75-83
- Zubkov M, Quartly GD (2003) Ultraplankton distribution in surface waters of the Mozambique Channel – flow cytometry and satellite imagery. *Aquatic Microbial Ecology* 33: 155-161