



Revista de Biología Marina y
Oceanografía

ISSN: 0717-3326

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Universidad de Valparaíso
Chile

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Revista de Biología Marina y Oceanografía, vol. 50, núm. 2, agosto, 2015, pp. 383-389
Universidad de Valparaíso
Viña del Mar, Chile

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RESEARCH NOTE

Presence of fin whales (*Balaenoptera physalus*) in Mejillones Bay, a major seaport area in northern Chile

Presencia de ballenas de aleta (*Balaenoptera physalus*) en bahía Mejillones,
un puerto principal en el norte de Chile

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Abstract. In this paper we report the apparently seasonal presence of fin whales in Mejillones Bay (23°S), in northern Chile. We compiled a total of 19 sightings representing 95 whales, including 2 mother-calf pairs, between July and October 2006-2014. We observed groups of 1-10 individuals (mean 5 ± 2.7 ind.) principally in nearshore waters, 30-1000 m off the southwestern tip of Mejillones Bay in austral winter/spring. Fin whales came close to, and potentially overlapped with, the main port access routes of large cargo vessels. Information from real-time monitoring of whale presence relayed to Port Authorities is suggested as to avoid collisions.

Key words: *Balaenoptera physalus*, neritic waters, upwelling center, seasonality

INTRODUCTION

The fin whale, *Balaenoptera physalus* (Linnaeus, 1758) is categorized as 'Endangered' by the International Union for the Conservation of Nature (IUCN Red List of Threatened Species)¹ and is listed on the respective Appendices I of both CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora)² and CMS (Convention on the Conservation of Migratory Species). In Chile, this species is categorized as 'Critically Endangered' according to the Ministry of Environment (Supreme Decree 41/2011)³. These listings reflect the fin whale's highly vulnerable status due to continuing low global population levels following low post-whaling recovery rates, requiring an international ban in commercial trade (Aguilar 2009). Such delicate status calls for more surveys and an improved reporting effort in order to understand the current population trends and potential new threats to this species. This is particular true for regions such as the Southeast Pacific where research on baleen whales is still limited.

In Chile's exclusive economic zone (E.E.Z.), fin whales have been sighted principally in the oceanic realm (Clarke 1962, Aguayo *et al.* 1998a, b; Acevedo *et al.* 2012), while several individuals have also been recorded in neritic

waters surrounding three coastal islands at ~29°S (Capella *et al.* 1999, Pérez *et al.* 2006). Apart from these few observations, no further information is published regarding fin whale distribution in Chilean waters during post-ban years. Recently, one of us (A.S.P.) noted the recurrent presence of fin whales in Mejillones Bay (23°S, Antofagasta Region), a location that supports dense maritime traffic of large cargo vessels due to the mining industry, Chile's main economic activity. According to a global assessment by the Ship Strike Working Group of the International Whaling Commission (IWC), fin whales suffer the highest mortality rate of all cetaceans due to vessel strikes, with the highest number of dead whales stuck on the bow of vessels (Van Waerebeek & Leaper 2008). The reason why this species is particularly prone to collision remains unclear, but some authors suggest that collisions occur mainly with juvenile individuals which spend more time at the surface and possibly have not yet acquired the necessary experience for avoiding vessels (Panigada *et al.* 2006). Therefore, it is important to document the presence of this species in areas where the potential for collision is evident. In this study, we report the recurrent, apparently seasonal presence of fin whales in Mejillones Bay. For this aim, we compiled own sightings together with other sources of authenticated information.

¹<www.iucnredlist.org/details/2478/0>

²<www.cites.org/eng/app/appendices.php>

³<www.mma.gob.cl/clasificacionespecies/index2.htm>

MATERIALS AND METHODS

Fin whales were sighted in areas surrounding Punta Rieles and Punta Angamos, at the southwestern end of Mejillones Bay ($23^{\circ}02.512'S$, $70^{\circ}30.076'W$) (Fig. 1) from 2006 to 2014. The first two sightings occurred circumstantially in 2006 when one of us (A.S.P.) was visiting Punta Rieles for SCUBA diving. No systematic survey effort was conducted between 2007 and 2010; however we compiled opportunistic sighting records of fin whales undertaken by members of the public who regularly visited Punta Rieles and Mejillones Bay, including marine scientists, divers, fishermen, tour operators amongst other locals. Information from such sources was included for analysis only when sightings were positively confirmed as fin whales by photographic evidence, either still or film. During 2011-2014, the area was monitored by A.S.P. twice per month between September and November, after incidental records suggested these to be the months of highest frequency of occurrence. Visual search effort, aided by 7 x 50 binoculars, was performed from the top of the ~100 m rocky cliff at Punta Rieles, for 1-3 hours starting at 11:00 h. The size and composition of the group was determined using the following criteria; single, pair, trio or groups of more than three individuals which generally consisted of relatively large animals following a fairly synchronized breathing and swimming pattern. When whales were located nearshore, observers descended to the shoreline to obtain the closest possible photographs.

RESULTS AND DISCUSSION

A total of 19 confirmed fin whale sightings were gathered for the study period, representing a combined 95 whales (the sum of best estimates). Group size ranged 1-10 individuals (mean, 5; $SD \pm 2.7$; $N=19$), including 2 mother-calf pairs (Table 1). Fin whales were sighted mainly in September and October. The earliest documented record occurred circumstantially in October 2006 (Table 1) while the latest sighting occurred on 6 September 2014. Fin whales were spotted principally in the nearshore area between Punta Angamos ($23^{\circ}1.636'S$; $70^{\circ}30.388'W$) and Punta Rieles ($23^{\circ}2.804'S$; $70^{\circ}29.982'W$) at estimated distances from shore of 30-1000 m. Inside the study area (Fig. 1) fin whales changed direction frequently in an apparent random fashion while moving close to shore. After ca. 30-120 min the whales left the area consistently by swimming northwards towards open waters. All individuals were positively identified as fin whales by a diagnostic combination of large size, dark grey dorsal coloration, and a prominent dorsal fin that rises at a shallow angle from the rear of the back (Fig. 2). On 16 July 2010, underwater video further confirmed the identity of the species by its asymmetrical coloration, showing a pale lower jaw on the right side and a dark jaw on the left side.

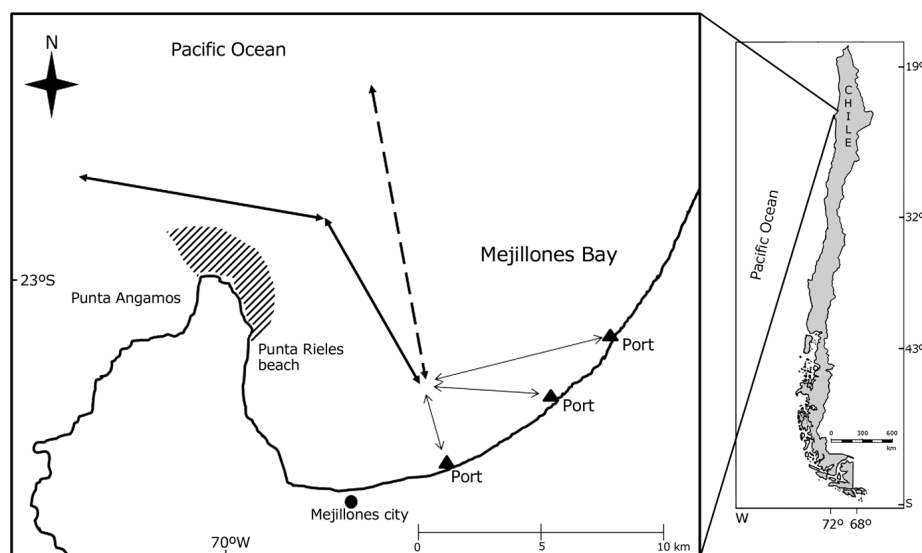


Figure 1. Map of Mejillones Bay in northern Chile. The hatched area represents the location of the sightings of fin whales. The main routes (2) used by large cargo vessels are depicted by continuous and dashed bold lines. Thin arrows represent the routes into the 3 main bay ports / Mapa de la bahía Mejillones en el norte de Chile. El área achurada representa la zona de avistamientos de ballenas de aletas. Las principales rutas (2) que toman los barcos cargueros de gran calaje se muestran con flechas continuas y punteadas. Las flechas más delgadas representan las rutas a seguir hacia los 3 puertos principales

Table 1. Fin whale sighting records (n= 19) at Mejillones Bay, northern Chile, ordered chronologically. The hour indicates the approximate time of the start of the sighting / Registros de ballena de aleta (n= 19) en bahía Mejillones, norte de Chile, ordenados cronológicamente. La hora indica el tiempo aproximado del inicio del avistamiento

Location	Sighting Hour	Number of whales	Source	Comments
Punta Rieles	12:00	1	A.S.P.	A single fin whale surfaced at ~20 m distance from the shoreline and kept swimming in northward direction towards the center of Mejillones Bay. The whale was visible during 20 min.
Punta Rieles	16:00	9	A.S.P.	Three subgroups of fin whales, ca. 100 m from each other, were spotted from the top of the rocky cliff and observed for 30 min. Subgroups consisted of two mother-calf pairs, a trio and a pair. Whales were swimming from the center of the bay towards the Punta Rieles area, crossing ship routes.
Punta Rieles	13:00	6	Fernando Valenzuela*	Sighting occurred when snorkeling close to the beach. A whale was filmed during 3.5 minutes (film available from the senior author). After snorkeling 6 fin whales were counted from the beach. [*Marine scientist from Universidad de Antofagasta].
Punta Rieles	12:00	4	Christian Guerra**	Sighting occurred during navigation from Punta Angamos to Mejillones port. Species identification was confirmed from photographs. [** Marine ecologist from Universidad de Antofagasta].
Punta Rieles	18:00	6	Pilar Irribarren***	Two groups of fin whales were observed after a camping day at Punta Rieles beach. A first group of three whales appeared close to the shore moving randomly. After 45 min, a second group, also of three whales, was sighted simultaneously but towards Punta Angamos. Observation ended after 10 min when whales left the area. Species identification was confirmed from photographs. [*** Marine scientist from Universidad de Antofagasta].
Punta Rieles	12:00	2	Diego Cuello†	Whales were sighted in the area during zooplankton sampling from a boat. Species identity was confirmed from photographs. Both whales were swimming with no particular direction for ca. 30 min before heading offshore towards the bay entrance. †Marine scientist from Universidad de Antofagasta.
Punta Angamos	11:00	3	A.S.P.	A group of whales was observed for 40 min and photographed from the top of the rocky cliff at Punta Angamos before they headed to offshore waters. Observation effort continued until 13:00 but no further whales were noticed.
Punta Angamos	10:00	4	A.S.P.	A group of whales was sighted and photographed from the rocky cliff at Punta Angamos. The group was swimming from the inside of the bay towards the southern head of Mejillones Peninsula. Whales were observed during 30 min. Observation continued until 13:00 but no further whales were recorded.
Punta Rieles	9:00	5	Luis Maldonado††	Two groups of three and two whales respectively were sighted during navigation along the Punta Rieles beach. Observation lasted 10 min as the boat headed to Mejillones port. Photographs confirmed the species. †† Mejillones fisherman.
Punta Rieles	11:30	2	Ricardo Rodríguez‡	A pair of fin whales was observed for 30 min during an excursion to the beach. Whales were swimming ca. 50m from shore with no particular direction. 30 min. [‡ Professional photographer].

Table 1. Continued / Continuación

	Location	Sighting Hour	Number of whales	Source	Comments
21 August 2013	Punta Rieles	17:00	4	Fernando Berrios ^{††}	A group of fin whales was filmed from the top of the cliff at Punta Angamos. After 15 min of observation whales approached the shore prompting the observer to descend to Punta Rieles beach to obtain a close view. Whales were swimming randomly within the area but after one hour they headed offshore. Whales were filmed during the whole observation period (film is available from the author). [^{††} Marine ecologist from Universidad de Antofagasta].
5 September 2013	Punta Rieles	-	2	Newspaper article	The presence of fin whales in Mejillones Bay called the attention of the local media. Based on two days of whalewatching trips, a newspaper report showed the presence of two fin whales at the Punta Rieles area during the first day. Photographs and the report are available at: http://www.estrellaantofagasta.cl/impresa/2013/09/06/full/8/
6 September 2013	Punta Rieles	-	4	Newspaper article	During the second day four fin whales were observed according to the newspaper report.
1 September 2014	Punta Rieles	10:00	5	Juan Menares ^{†††}	A pair and three individuals were sighted in front of Punta Rieles during an excursion around the Mejillones area [^{†††} Tour operator].
2 September 2014	Punta Rieles	15:00	10	Juan Menares	A trio and seven separate individuals were sighted at the southern end of Punta Rieles during an excursion aimed at watching the local marine fauna.
3 September 2014	In front of Mejillones city	10:00	10	Juan Menares	Ten fin whales were sighted during navigation on an excursion from the Mejillones port.
4 September 2014	Between the three main ports	10:00	9	Juan Menares	A pair close to the shore, another pair offshore and five separate individuals were sighted in the area between the three main ports of Mejillones Bay during an excursion.
5 September 2014	In front of Mejillones city	10:00	3	Juan Menares	Three separate individuals were sighted at the center of the bay during an excursion after 10 min of navigation departing from the Mejillones port.
6 September 2014	Punta Rieles Punta Angamos	12:14	6	A.S.P.	Three pairs of fin whales were sighted and photographed from the cliff top at Punta Angamos. At start one pair was in the inner part of the bay, a second pair was located in the middle of the bay but close to the shore and the third pair was located in front of the observation point at Punta Rieles. All groups of whales moved slowly towards open waters by the end of the observation.

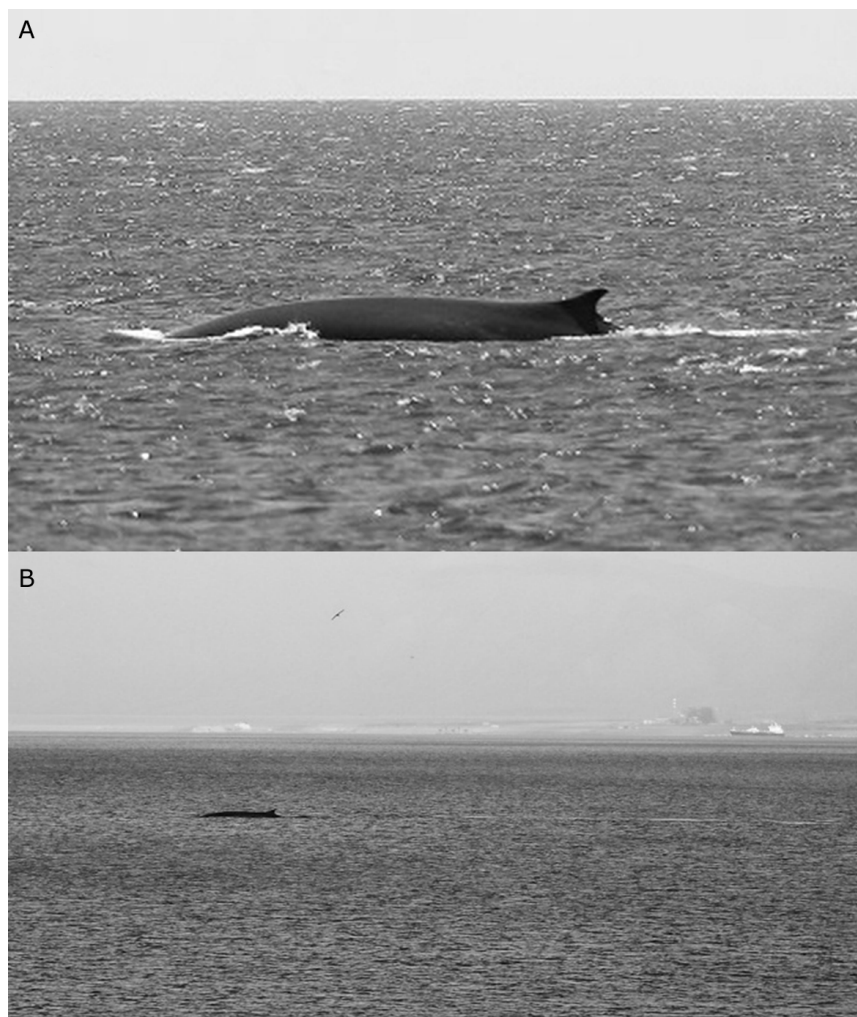


Figure 2. Fin whales in Mejillones Bay, northern Chile. (A) View of the characteristic dorsal fin positioned at a shallow angle towards the rear of the whale's back, on 7 October 2012 (Photo courtesy of Ricardo Rodríguez). (B) View from Punta Rieles beach, a single whale swimming along the shore while in the background a large cargo vessel is loaded at the port (Photo courtesy of Pilar Irribarren) / Ballenas de aleta en la bahía Mejillones, norte de Chile. (A) Vista de la aleta dorsal la cual se posiciona en un ángulo bajo hacia la parte dorsal de la ballena, tomada el 7 de octubre de 2012 (Foto cortesía de Ricardo Rodríguez). (B) Vista desde la playa Punta Rieles, una ballena solitaria se desplaza a lo largo de la costa mientras que en el fondo se aprecia un barco siendo cargado en el puerto (Foto cortesía de Pilar Irribarren)

Whaling and post-whaling data indicated an oceanic distribution of fin whales in Chilean waters (Clarke 1962, Aguayo *et al.* 1998a, b; Acevedo *et al.* 2012). This study constitutes the first report of the apparently seasonal occurrence of fin whales in nearshore waters of at least one coastal site in northern Chile. The species has previously been documented during summer in neritic waters surrounding Chañaral, Damas and Choros Islands

(centered $\sim 29^{\circ}\text{S}$) which are located on the continental shelf relatively close to the coast (5-10 km from the shore), in an area of *ca.* 50 m depth (Capella *et al.* 1999, Pérez *et al.* 2006, Van Waerebeek *et al.* 2007). Our results differ from the latter observations because Mejillones Bay is located on the mainland, 680 km further north and supports intense port activity, while the 3 coastal islands are located within a Marine Protected Area, in a less-populated zone.

Our data do not yet allow firm conclusions about the seasonal presence of this species in the area, but some points can be raised. Based on observations of fin whale aggregations ranging 287–314 km off the central coast of Chile (28°–36°S) in October to November 1958, Clarke (1962) assumed that whales were on their way south towards the Antarctic grounds where they are known to feed on Antarctic krill *Euphausia superba*, in summer. Clarke (1962) suggested that fin whales may be feeding to some extent during their spring migration towards the Antarctic, so they may depend on some supply of food which is abundant near the boundary regions on the oceanic side of the upwelling currents adjacent to the continental coastlines. However, fin whales may also enter relatively shallow, neritic areas with localized high productivity. Pérez *et al.* (2006) observed fin whales feeding on the euphausiid *Euphausia mucronata* in the vicinity of the 3 aforementioned coastal islands during the austral summer. Even though we were not able to directly record feeding or the presence of prey in Mejillones Bay, the observed non-directional milling of whales in a circumscribed area was strongly suggestive of feeding behavior. Mejillones Bay and particularly Punta Angamos are located in front of the strongest and most persistent (*i.e.*, year-round) upwelling center in northern Chile (Escribano & Hidalgo 2000, Escribano *et al.* 2010), which supports large populations of *E. mucronata* (Escribano *et al.* 2000, Antezana 2010). As euphausiids constitute the primary prey of fin whales globally (Aguilar 2009) and also in some areas of Chilean waters (Isla Chañaral and Isla Choros-Damas, Marine Protected areas) individuals have been observed feeding on *E. mucronata* (Pérez *et al.* 2006) it appears reasonable to hypothesize that this highly productive micro-habitat may serve as a focal feeding ground for the observed fin whales. On the other hand, their nearshore presence in the Mejillones area in September–November theoretically could also be related to calving or breeding and a need for shelter. In the Southern Hemisphere fin whales breed during the austral winter/spring (Aguilar 2009) which coincides with the timing when fin whales were present in our study area. Accordingly, we recorded 2 mother-calf pairs on 16 October 2006 but none stayed there (Table 1). However, fin whales are not known to regularly approach nearshore areas for calving in contrast to 2 other baleen whale species off western South America, *i.e.*, humpback whale *Megaptera novaeangliae* (Guidino *et al.* 2014) and southern right whale *Eubalaena australis* (Aguayo-Lobo *et al.* 2008). The topographic characteristics of the coast provide possible further explanations (Clarke 1962). The

continental shelf off northern and central Chile is very narrow and the slope is very steep (the shelf break is located at *ca.* 4 km from the shoreline in front of Punta Angamos) so fin whales may approach the coast while still maintaining great water depth below them or nearby. Further research is necessary to understand the ecological and biological processes behind the probably seasonal presence of fin whales in neritic waters of northern Chile.

Considering that fin whale is the species most commonly involved in collision accidents worldwide (Laist *et al.* 2001, Panigada *et al.* 2006, Van Waerebeek & Leaper 2008), the dense shipping traffic within and around Mejillones Bay may represent a significant threat to fin whales visiting the bay. Our observations indicate that the main aggregation area of the whales lies very close (less than 1000 m) to one of the main routes used by large cargo vessels (Fig. 1). Although the normal speed of cargo vessels when maneuvering in the bay (< 10 knots), as reported by Port Authorities (personal communication to A.S.P.) lies within the mostly non-lethal range for whales in case of bow strikes (Van Waerebeek & Leaper 2008), generating awareness about the presence of the whales with port and other maritime authorities will contribute to their safety and mitigate a potential navigational hazard. During our observations whales moved unpredictably in multiple directions around the bay. When approaching or heading out again to the open ocean many of them likely entered directly into the vessels' paths. Also, while we emphasize the risk with large cargo vessels it is worth noting that this bay is also intensively used by semi-industrial and small-scale artisanal fishing boats and fast recreational boats, further enhancing the risk of collisions. Although the current evidence of danger of collisions in Mejillones Bay is circumstantial, the simultaneous occurrence of fin whales and large numbers of vessels suggest the risk may be significant. We strongly recommend the participation of dedicated land-based observers in direct radio contact with Port Authorities to assist with the monitoring for the presence of fin whales, as well as the provision of real-time information and calls for caution to pilots and captains onboard vessels when entering and exiting Mejillones Bay.

ACKNOWLEDGMENTS

We warmly thank all the persons who collaborated with this study by sharing information and their photo and video records. Particularly D. Cuello, F. Valenzuela and C. Guerra provided useful material. We are grateful also to

Under-lieutenant Gerson González of the Capitanía de Puerto de Mejillones, for providing relevant navigational information. Comments by two anonymous reviewers and M.J. Pérez helped us to improve an early version of this manuscript.

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Received 31 January 2015 and accepted 13 May 2015

Associated Editor: María José Pérez Álvarez