

## Rapid Communication

## A long and deep step in range expansion of an alien marine mammal in the Mediterranean: First record of the Indian Ocean humpback dolphin *Sousa plumbea* (G. Cuvier, 1829) in the Greek Seas

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### Abstract

On 7 November 2017 a solitary Indian Ocean humpback dolphin, *Sousa plumbea* (G. Cuvier, 1829), was sighted in Karavolas Bay, near the port of Heraklion, Crete, Greece. On 14, 16 and 17 November 2017 another humpback dolphin sighting, likely the same individual, was recorded 100 km further west in Souda Bay, Crete. North Crete is the third area where this Lessepsian species was sighted in the Mediterranean Sea after records in Israel in 2001 and in SE Turkey in 2016. To reach the north coast of Crete, the dolphin crossed deep offshore waters that are theoretically incompatible with its typical coastal and shallow habitat. The distance travelled by this dolphin (1000–2330 km depending on the path followed) is the largest movement recorded for this species. Our observations show the potential of humpback dolphins to reach the shallow and coastal waters of the Cyclades in the Aegean Sea, where native populations of the vulnerable common bottlenose dolphin (*Tursiops truncatus*) and the endangered short-beaked common dolphin (*Delphinus delphis*) occur.

**Key words:** Lessepsian, alien species, movement, migration, cetacean, Mediterranean Sea, Crete

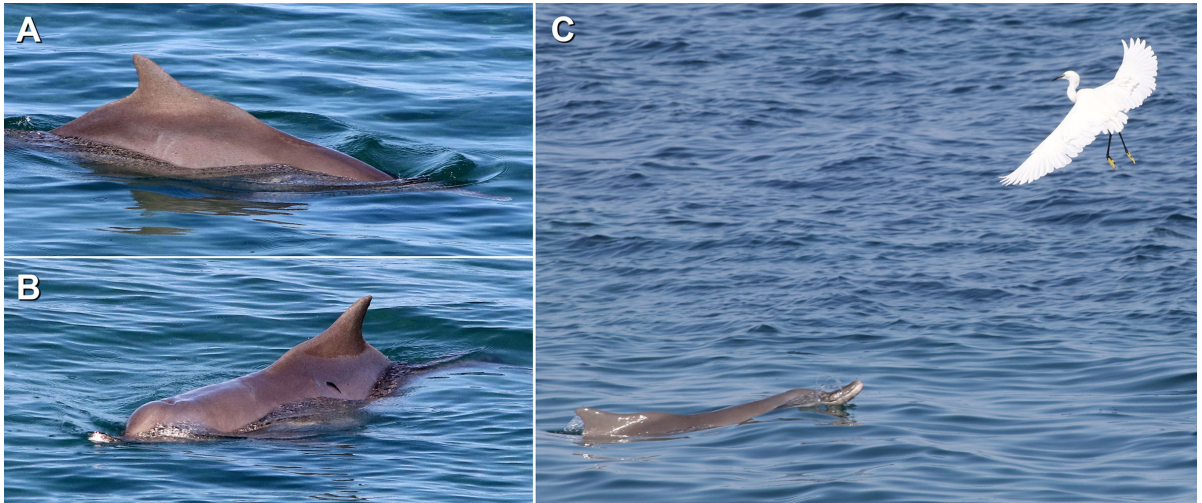
### Introduction

Since the opening of the Suez Canal in 1869, a continuously growing number of species (almost 450 species out of 820 alien species in the Mediterranean) that inhabit the Red Sea have been recorded as alien in the Mediterranean Sea (Zenetos et al. 2012, 2017). Although a humpback dolphin sighting was reported by Marchessaux (1980) at the entrance of Port Said harbor in Egypt, no Lessepsian marine mammal species had been recorded in the Mediterranean Sea *per se* until 2000. In that year, consecutive sightings of a single humpback dolphin (cited as *Sousa* sp.) were reported in three locations along the coasts of Israel (Kerem et al. 2001). Recently, in February and April 2016, two to four humpback dolphins at a time (cited as likely *Sousa plumbea*) were recorded by underwater cameras while feeding on fish escaping from an experimental demersal trawl in two separate hauls in shallow waters of Mersin Bay, Turkey (Ozbilgin et al. 2018). Here we report the first

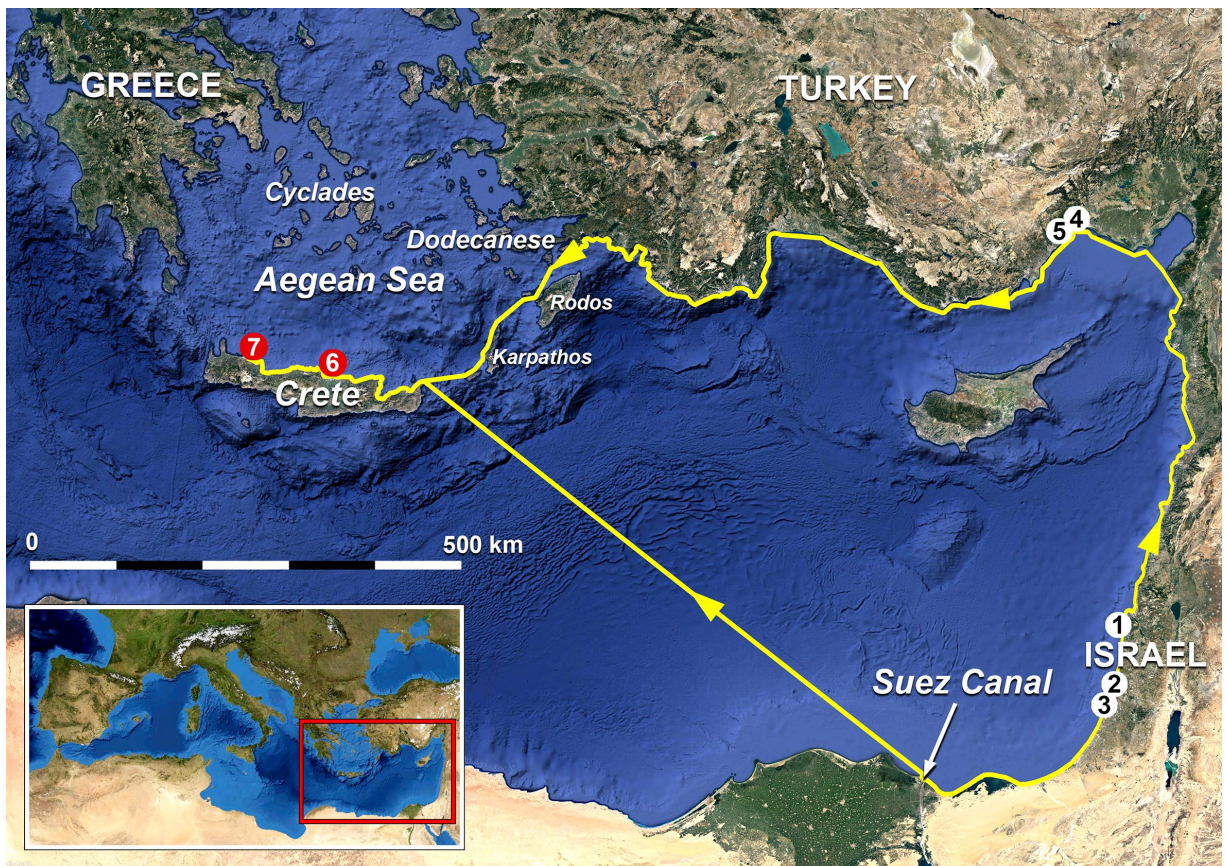
sightings of a humpback dolphin [*Sousa plumbea* (G. Cuvier, 1829)] in the Greek Seas, 845 and 945 km west of the westernmost previous record and discuss the possibility of the establishment of a Mediterranean population with potential to expand into the Aegean Sea.

### Results

On 7 November 2017, a solitary and apparently healthy humpback dolphin (Figure 1) was sighted in the small Karavolas Bay, less than 1 km west of the port of Heraklion, Crete, Greece (Figure 2). The bay is less than 200 m long and 110 m wide, located at 35°20'30"N, 25°07'44"E. The dolphin stayed roughly one hour in the bay, swimming slowly at a distance of 20–80 meters from the shoreline. After various calls from citizens, a boat of the local port-police authorities approached the dolphin and maneuvered in the bay in an effort to herd it back offshore and “rescue it in case it was disoriented”. On 14, 16 and 17



**Figure 1.** Photos from the first sighting of the Indian Ocean humpback dolphin (*Sousa plumbea*) in Karavolas Bay, Heraklion, Crete, Greece. A: The characteristic hump and coloration of this species from the right side. B: The moderate size of the hump from the left side. A small parasitic fish or ectoparasite is visible below the hump area. C: The long characteristic beak of the species out of the water, while a little egret (*Egretta garzetta*) is closely inspecting the dolphin (photos: Stefanos Rapanis).



**Figure 2.** Location of all sightings of Indian Ocean humpback dolphins (*Sousa plumbea*) in the Mediterranean Sea (GoogleEarth and NASA images for the large and small frames, respectively) and the possible paths (yellow lines) that the reported dolphin may have taken to reach the coast of north Crete. Distances of these paths are given in the text. Sighting locations of this study in Heraklion (6) and Souda Bay (7) are indicated with red dots. Previously reported sighting locations of humpback dolphins in Mersin, Turkey in February and April 2016 (4, 5; Ozbilgin et al. 2018) and Israel in January 2000 (1, 2, 3; Kerem et al. 2001) are indicated with white dots.

November 2017, another humpback dolphin sighting was recorded 130 km west along the north Cretan coast at 35°30'00"N, 24°04'00"E in Souda Bay (Figure 2). Souda Bay is a 16 km long, narrow gulf orientated east-west with its dead end at the west, where the dolphin was spotted daily for a few hours. After its last observation on 17 November, the dolphin was not observed again until at least 12 February 2018.

Photos and videos from sightings in both areas were available, but only those of the first sighting are of good quality. Based on the moderate size of its dorsal hump, the dolphin may be a sub-adult (Koen Van Waerebeek, pers. comm.) and probably not an adult male or calf (Thomas Jefferson, pers. comm.). Several nicks and notches that were present on its dorsal fin further support that this was not a very young individual. A small hanging object below the left side of the dolphin's dorsal fin (Figure 1B) seemed to be a very small remora, a small sea lamprey or, less likely, some other ectoparasite.

Considering that the dolphin originally came from the Red Sea and entered the Mediterranean through the exit of the Suez Canal in Port Said (Egypt), it should have travelled some 2050 km to reach the location of the first sighting. This distance would mean that the dolphin swam only in shallow coastal waters along the SE Mediterranean coastline up to Rodos Island, Greece and took the closest and more coastal path to Crete (Figure 2). This last part, from Rodos Island to Karpathos Island and then to north Crete, includes two crossings over waters of depths ranging between 200 and 1500 m for at least 75 km. The total migration path of the dolphin would be some 2330 km to reach the last sighting position (Figure 2). If the dolphin reached Crete starting from the last known sighting before this publication (i.e. from Mersin, Turkey), i.e., assumed to be one of the individuals of the pod(s) observed there, it would have travelled 1350 km in total (Figure 2). The closest direct path for reaching the second sighting position directly from Port Said would be 1000 km mostly over very deep (2000–3000 m) pelagic Mediterranean waters (Figure 2).

## Discussion

The observations reported here constitute the first record of a humpback dolphin in the Greek Seas according to previous reviews of the Greek cetacean fauna (Frantzis et al. 2003; Frantzis 2009). There is still no definitive diagnostic phenotype definition to externally distinguish between the two candidate humpback dolphin (i.e., the Indian Ocean humpback dolphin (*Sousa plumbea*) and the Atlantic humpback

dolphin [*Sousa teuszii* (Kükenthal, 1892)]) species for this observation. (Koen Van Waerebeek, pers. comm.). However, based on the coloration and dorsal fin shape, this animal is more similar to the Indian Ocean humpback dolphin (Koen Van Waerebeek, pers. comm.), since the Atlantic humpback dolphin is usually darker and most often has a rounded dorsal fin tip (Thomas Jefferson, pers. comm.).

More importantly, the Atlantic humpback dolphin has never been reported from the Western Mediterranean, nor from close to the Atlantic side of the Strait of Gibraltar. The northern-most limit of its range, in Dakhla Bay, Western Sahara (Van Waerebeek et al. 2004), is located some 1700 km south of the Strait of Gibraltar. On the contrary, the natural range of the Indian humpback dolphin in the northern Red Sea extends as far north as the tip of the Gulf of Suez, and the Suez Canal seems to constitute favourable habitat for this species (Notarbartolo di Sciara et al. 2017). Therefore, in agreement with the authors of previous reports (Kerem et al. 2012; Ozbilgin et al. 2018), I believe that it is highly unlikely for the humpback dolphins observed in Israel, Turkey and Greece to be anything but Indian Ocean humpback dolphins, who entered into the Mediterranean via the Suez Canal, or are descendants of such dolphins.

Humpback dolphins of all four species (*Sousa* spp.) are restricted to coastal habitats, and the Indian Ocean humpback dolphin is found most often in a narrow strip along the coast almost exclusively in waters of less than 30 m depth (Jefferson and Rosenbaum 2014; Jefferson and Curry 2015). As elsewhere throughout its range in the Red Sea, the species occurs in shallow, nearshore waters most often within the 25-m isobath (Notarbartolo di Sciara et al. 2017). Crossing deep water for long periods of time is very unusual for this genus (Thomas Jefferson, pers. comm.). Trenches with waters depths of 2000 m are much deeper than humpback dolphins would normally occur in and potentially act as a barrier to their dispersal (Jefferson and Rosenbaum 2014). Given this strong preference for shallow coastal waters, it is surprising that the species has reached the northern coasts of Crete.

Although we cannot be absolutely sure that the second sighting in Souda Bay was the same individual, the distance between the two sighting locations (130 km) is close to the species' ability to travel given the time frame (Vermeulen et al. 2017; see below). Therefore, it is unlikely that a second solitary animal reached the coasts of northern Crete at the same time. In a recent study of movement patterns of Indian Ocean humpback dolphins along the South African coasts, Vermeulen et al. (2017) recorded maximum daily movements of 45 km, 50 km

in two days, 90 km in eight days and in cases of distances > 100 km a minimum time span of 24 days. Exchange rates of individuals between the studied locations decreased considerably for distances > 200 km, and the longest distance covered by a single dolphin was 500 km in a time span of three years.

The total distance travelled for the dolphin that reached the Cretan coasts from the Suez Canal directly, through a SE Mediterranean coastal path, or from the closest last record of the humpback dolphin in Mersin, Turkey (1000, 2330 and 1350 km, respectively) is the largest movement recorded so far for this species (Figure 2). It is between two and four times longer than the previous maximum reported by Vermeulen et al. (2017). Such a long distance also over very deep waters by an apparently healthy individual shows the potential of the species to reach the shallow coastal waters of the Cyclades/Dodecanese in the Aegean Sea (Figure 2). This area could provide an appropriate habitat for establishment and expansion for the species.

The observation of a few individuals of humpback dolphins does not necessarily imply that a viable population is already established in the eastern Mediterranean Sea. However, the repeated sightings and their growing distance from the Suez Canal indicate that the potential for a resident population of Indian Ocean humpback dolphin in the eastern Mediterranean Sea is already there. On 6 August 2015, the latest expansion of the Suez Canal opened to shipping, doubling its capacity (Bishop 2016). The wider path for invasive species that has been created can only favour further migration attempts by Indian Ocean humpback dolphins into the Mediterranean Sea.

The exact impact of a possible future population of humpback dolphins on resident population units of common bottlenose dolphins [*Tursiops truncatus* (Montagu, 1821)] and short-beaked common dolphins (*Delphinus delphis* Linnaeus, 1758) cannot be predicted. These two native species are predominantly coastal in the Aegean and Ionian Seas (Frantzis 2009; Giannoulaki et al. 2017) and have been listed as vulnerable and endangered in the Mediterranean Sea, respectively (Bearzi 2003; Bearzi et al. 2012). Both species are threatened by overfishing (Reeves and Notarbartolo di Sciara 2006; Bearzi et al. 2008) and compete for their survival with fisheries (Bearzi 2002; Frantzis 2007). In case of establishment of a humpback dolphin population in their habitat, it seems likely that competition between native and alien species, as well as between all dolphin species and fisheries, would increase together with the risks for native species conservation.

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