

RESPIRATION PATTERNS OF FIN WHALES OFF ISCHIA, ARCHIPELAGO CAMPANO, MEDITERRANEAN SEA.

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Abstract:

The observation of this research were carried out during the summer of 1997 and 1998. The surveys were realised on board of the long sail boat "Barbarian". The routes were chosen to optimise the sights and were determined daily on the basis of previous sightings. The respiratory cycles of 15 solitary whales was recorded during a total of 19 hours and 26 minutes of observation (mean of 39 minutes per whale). All data were recorded for the longest time possible, until visual contact with the whales was lost either due to the distance becoming too great or poor weather conditions. The basis of this study was to see if there was any correlation between the respiratory patterns and the kind of behaviour of the fin whale. The study of respiratory patterns of fin whale could be a useful method to investigate the disturbing effect caused by approaching vessels. Fin whales spent 25% of their time at the surface (sum of surfacing times) and 75% diving. A significant difference in surfacing time was found for the two kinds of behaviour "curious" and "indifferent" of the fin whales (Student t-test, $p < 0.01$). The outcome of our research indicates that the whale respiratory patterns vary according to a number of external stimuli, including the influence of the proximity of vessels and the trophical behaviour. The novelty of our research brings to light that there are two kinds of behaviour of the fin whale towards the vessels: "positive" and "negative".

Key words: fin whale, respiration patterns, Tyrrhenian sea, behaviour.

INTRODUCTION: The fin whale (*Balaenoptera physalus*) is an oceanic cetacean, which is found in every ocean of the World. It is the most common large cetacean inhabiting the Mediterranean sea (Jefferson, T.A. *et al.*, 1993; Leatherwood, S. *et al.*, 1983). Previous surveys carried out in the Archipelago Campano area (Mussi *et al.* 1997, 1998, 1999) pointed out that the sightings of fin whale are generally higher during summer months. A similar situation happens in the Liguro-Provençal basin, where the population of fin whale congregates during the summer (Aguilar, A. 1985; Zanardelli, M. *et al.*, 1992; Relini, G. *et al.*, 1992; Jahoda, M. *et al.*, 1993; Nortarbartolo di Sciara, G. *et al.*, 1993; Forcada, J. *et al.*, 1993).

The area of study of our research is that part of the Tyrrhenian sea embracing the islands of Ischia, Procida and the mainland coast, surveying particularly the submarine canyon of Cuma (Pennetta *et al.* 1998). This area, of about 35 square miles, is smaller than the Ligurian one.

The breathing behaviour of whales seems to be influenced by the presence/absence of boats. The study of respiration patterns of fin whale could be a useful method to investigate the disturbing effect caused by approaching vessels (Jahoda, M. *et al.* 1993, 1996; Notarbartolo di Sciara, G. *et al.* 1996).

In the summer we observed that the level of boat traffic in the studied area is high as a consequence of the proximity of the land and the increase of tourism.

METHODS: The Archipelago Campano has been the object of a long-term study (1991-1999) on cetaceans (Mussi *et al.* 1997, 1998, 1999). The observation of this research were carried out during the summer of 1997 and 1998. The surveys were realised on board of the 15 m. long sail-boat "Barbarian", fully equipped for high-sea navigation. The routes were chosen to optimise the sights and were determined daily on the basis of previous sightings. No trip was performed in conditions greater than Sea State 5 (Beaufort). The survey covered an area of about 35 square miles.

All data were recorded for the longest time possible, until visual contact with the whales was lost either due to the distance becoming too great, or poor weather conditions. To avoid potential

ambiguities due to contiguous surfacing of indistinguishable individuals, respiration times were recorded only from lone whales.

The observers collected the data in seconds, using digital stopwatches. Observations consisted of uninterrupted bouts, from sunrise to sunset, in fine weather condition. The observation period consists of continuous breathing and diving cycles, from the first time the whale is observed until it disappears.

A diving time is defined as an interval between two breaths lasting longer than 36 seconds (Jahoda, M. et al. 1993).

A surfacing time is defined as the time the fin whale swims on the surface.

The surfacing rate is defined as the number of surfacings per whale in an hour.

A cycle is defined as a diving followed by a surfacing time (Jahoda, M. et al. 1993).

Only complete diving-surfacing cycles were considered for the analysis (Jahoda, M. et al. 1993).

For each record of the surfacing rate the observation period was at least of 30 minutes (Friis, L.W. et al., 1992).

Respiration patterns were related to different behavioural states.

"Indifference" and "Investigating" were chosen to point out the different attitude of the fin whale.

We say that a fin whale is indifferent if it is observed at a distance of more than 100 meters from the boat: the whale isn't affected at all from the presence of vessels and continues swimming with a speed of 1-3 Kn.

We say that a fin whale is investigating if it is observed at a distance of less than 100 meters from the boat: the whale shows interest for the vessels and swims milling with a speed < 1 Kn.

We characterised four different behavioural categories: indifferent diving (INDD), indifferent surfacing (INDS), investigating diving (INVD), investigating surfacing (INVS).

We also identified two parameters: indifferent surfacing rate (INDSR) and investigating surfacing rate (INVSR).

RESULTS: During the whole period of research 159 diving/surfacing cycles were timed from fifteen lone whales for a total of 19 hrs. 26 min of net observation, corresponding at a mean of 39 minutes per whale.

Fin whales spent 25.01 % of their time at the surface (sum of surfacing times) and 74,98% diving (Figure 1).

Temporal distribution in the dive-surfacing cycle

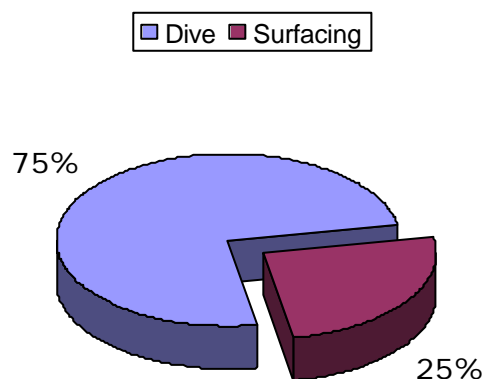


Figure 1

The value of diving/surfacing medium times are respectively 283,57 sec. diving (Std. Err. 11,007) and 110,08 sec. surfacing (Std. Err. 7,082).

A significant difference in surfacing time was found for the two kinds of behaviour "investigating" and "indifferent" of the fin whales (Student t-test, $p < 0,01$) (Figures 2-3-4).

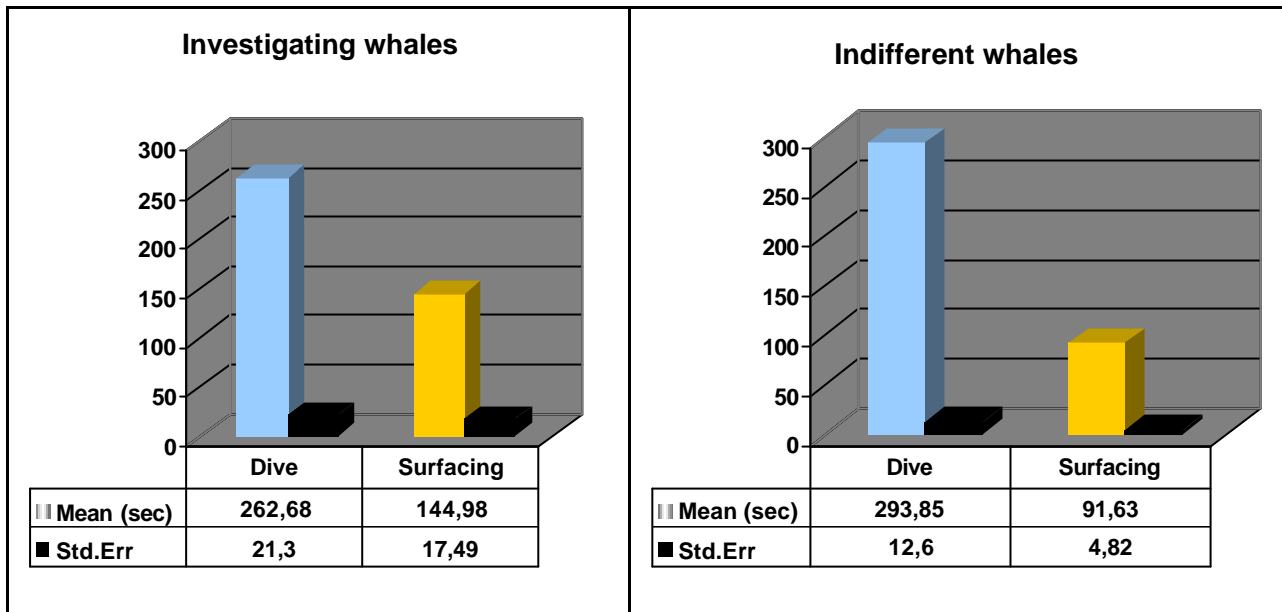


Figure 2, 3

Dive-surfacing lengths in different behavioural states

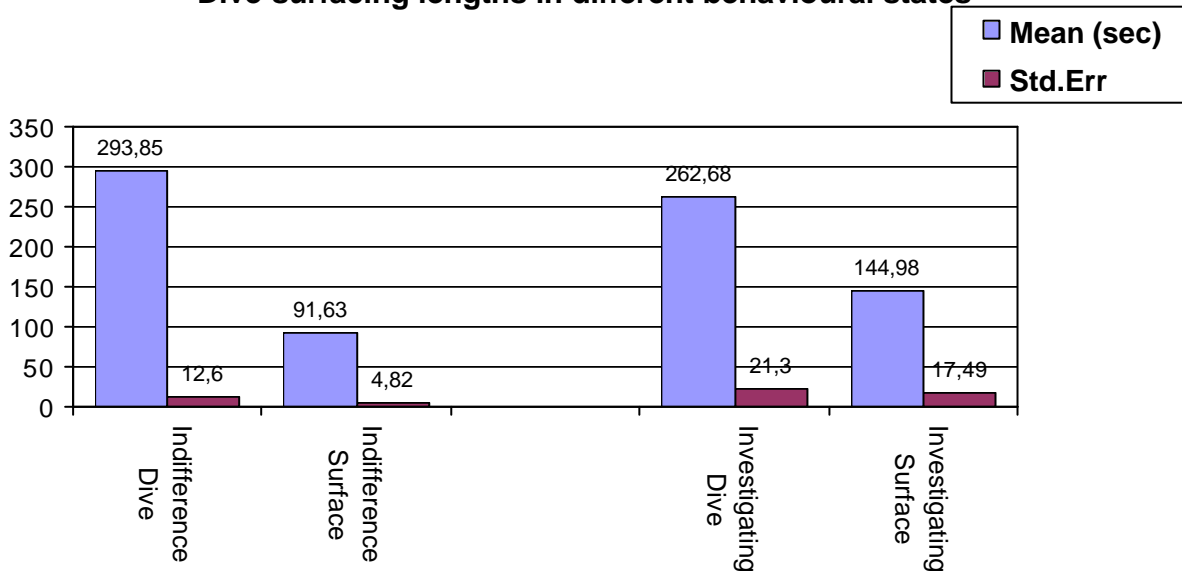


Figure 4

On the contrary no difference emerges from diving time analysis nor from the values of the two parameters INDSR/INVSr (Student t-test, $p > 0,05$).

The surfacing rate changes with the tropical behaviour during the day: during our observation the surfacing rate was higher at daybreak than during daytime showing a little increment at sunset (Figure 5).

Surfacing rates during the day

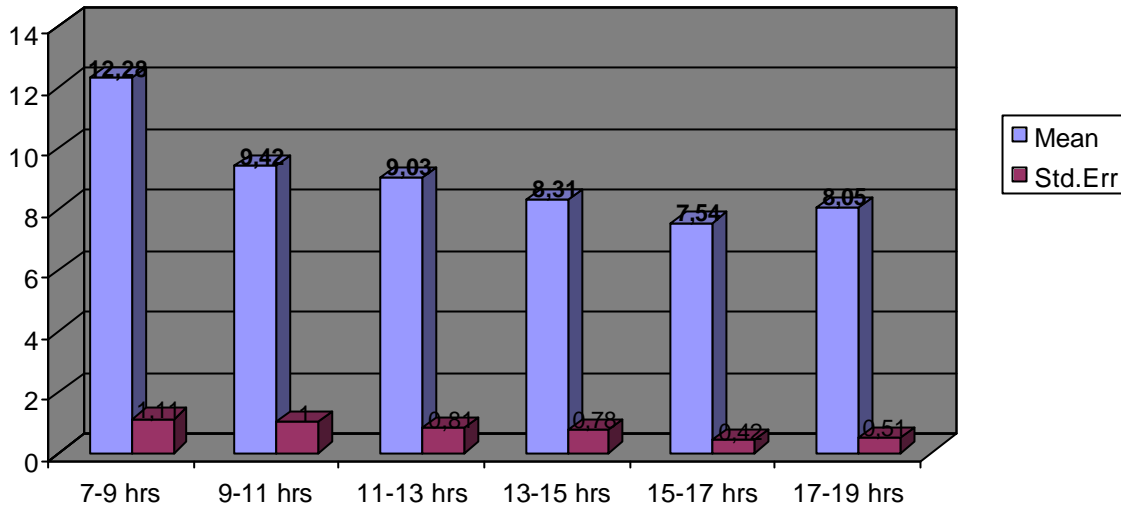


Figure 5

The direct study of the whale's behaviour with the observation of convoluted courses, circle swimming, bubble production and defecation episodes suggested a foraging activity during this hours. (Mussi *et al.*, 1999).

CONCLUSIONS: The outcome of our research indicates that the whale respiration patterns vary according to a number of external stimuli, including the influence of the proximity of vessels and the trophical behaviour.

The surfacing rate could depend on the area of observation, the day-time and is related to the behaviour of the fin whale. This specie, in this area, has a high level of "curiosity" towards the boats, this takes the animals to get close to them, staying more time on the surface than the "indifferent" one.

This kind of influenced behaviour could be considered "positive" because it increases the surfacing time. The whales spend more time at the surface than those observed by other researchers working in the Italian seas. In that case the presence of vessels could be considered "negative" because diminishes the surface time and increases the swimming speed (Nortarbartolo di Sciarra, G. *et al.*, 1996). A negative influence was observed as well by other researchers studying the *Balaena mysticetus* in the Beaufort Sea (Richardson, W.J. *et al.*, 1985).

The novelty that our research brings to light is that there are two kinds of behaviour of the fin whale towards the vessels: "positive" and "negative".

We observed that the whales spent much more time on the surface at daybreak (Figure 5), which is probably associated with the vertical nyctemerial migrations of preyed euphausiaceans (Friis, W.L. *et al.*, 1992; Relini, G. *et al.*, 1992; Mussi *et al.*, 1999).

In future researches the study of "indifferent" whales should be recorded from longer distances to obtain more objective results in order to compare the different levels of human's influence.

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