

Past and recent sperm whales sightings in the Azores based on catches and whale watching information

N. VIEIRA¹ AND C. BRITO^{1,2}

¹Escola de Mar, Rua Actriz Virgínia 17 C, 1900-026 Lisboa, Portugal, ²CHAM, Centro de História de Além-Mar, Faculdade de Ciências Sociais e Humanas, Universidade Nova de Lisboa, Avenida de Berna, 26 C, 1069-061 Lisboa, Portugal

*The sperm whale, *Physeter macrocephalus*, was the most captured great whale in the Azores Archipelago by land-based whaling and nowadays is the most appealing species for whale watching, one of the archipelago's principal sources of tourism. Our objective was to compare number of sightings during whaling and whale watching activities. Our main question to address the possible impact of past whaling in recent whale watching is: does a present-day eco-tourist sight more or fewer sperm whales than a whaler could sight in the past? For that, a compilation of data resulting both from past whaling records and recent whale watching records was conducted. We obtained a total of 727 independent sightings of sperm whales during a total of 280 different days of sperm whaling between 1947 and 1973. A total of 1767 sperm whale sightings were made during 1133 days of whale watching activities, between 1997 and 2008. The sperm whale sighting per unit of effort average was significantly higher in the past (35.68) than in the present (12.06). In the Azores, captures over the decades greatly decreased the number of sperm whales in the region and twenty years after the end of sperm whaling a reduced number of recent sightings were found.*

Keywords: sperm whales, land-based whaling, whale-watching, historical SPUE, recent SPUE

Submitted 14 June 2008; accepted 31 January 2009

INTRODUCTION

Sperm whale (*Physeter macrocephalus*) is a very common species in the North Atlantic Ocean and has been one of the main targets of the Yankee whaling era of the 1800s and of the factory ship whaling of the 20th Century worldwide (Reeves & Smith, 2006). In the Azores Archipelago dedicated sperm whaling started with the arrival of American ships trying to capture sperm whales in their offshore journeys since 1851 (Clarke, 1954; Reeves & Smith, 2006) and ended definitively in 1987, after long decades of traditional land-based Portuguese whaling in the archipelago. Land-based whaling in the Azores was always conducted with open-boats and employing hand-held harpoons and lances, and was only possible on the abundant and relatively slow swimming sperm whales (Bannister *et al.*, 2008). Establishment of protective and conservationist legislation occurred in the 1980s and the official end of Portuguese whaling occurred in 1984.

Whale watching by definition is the human activity of encountering cetaceans in their natural environment (Hoyt, 2002). It can be for scientific, educational or recreational purposes but, in the Azores, most whale watching activities refer to a commercial enterprise. In the late 1980s, whale watching began to spread rapidly across the world and the Azores was no exception. In this Atlantic archipelago, as in almost all the rest of the world, whale watching and whaling did not

occur at the same time (Hoyt, 2002). In fact, the rise of whale watching enterprises since the end of land-based Azorean whaling, but basically since the 1990s, came from the employment needs of former whalers and lookouts and from the continuous attempt to keep on using a valuable natural resource in a lucrative way of life by local people. Even though we are not conducting typical whale watching research, such as referring to impacts of the activity on cetaceans (e.g. Parsons *et al.*, 2006), we considered that information obtained by skippers and biologists on board these trips may be extremely useful to understand the temporal occurrence of several cetacean species and to compare it with past records.

In our research we intended to compile data both from whaling and whale-watching trips, to describe number of captures, strikes without captures and sightings, and to evaluate these past and recent sightings using common comparable available information from the two different periods. The impact of cetacean hunting on the number of whales for whale watching depends on the species and age/sex groups targeted by whalers, the proportion of animals removed relative to the target population, and the geographical and temporal overlap of hunted versus watched whales (Hoyt & Hvenegaard, 2002). But generally, fewer whales due to cetacean hunting do mean fewer cetaceans for other uses such as whale watching. Considering this, some questions arise regarding the Azores case: Is presently an eco-tourist seeing fewer sperm whales than a whaler could kill in the past? Is it to be expected twenty years after the end of whaling that the number of sperm whales sighted is still lower than the number sighted during whaling years?

Corresponding author:

N. Vieira

Email: info@escolademar.pt

We compared the occurrence of *P. macrocephalus* in seven years of the 20th Century hunted by several whaling companies and the last twelve years of observation of this species by an ecotourism company, using a measure of sighting per unit of effort (SPUE). In more detail, our objectives were: (1) to show historical sperm whale sightings, considering number of captures and strikes without capture; (2) to show recent sperm whales sightings based on whale watching information; and (3) to compare past and present SPUEs and the two human activities directly related to the sperm whales presence.

MATERIALS AND METHODS

We analysed historical land-based whaling data in different islands of the Azores Archipelago, for different years of the 20th Century. We considered only the bulletins of GAPB (Grémio dos Armadores da Pesca da Baleia), a Portuguese whalers association. These files are property of the Historical Archive of General Direction of Fisheries and Aquaculture (Ministry of Agriculture, Rural Development and Fisheries, Lisbon, Portugal). GAPB bulletins support data such as number of trips, captures number and date, cetaceans' length and gender and other biological parameters, which are not available in regular fishing statistics. We focused on available hand written data sheets for a total of seven years separated in time. The company Aliança Calhetense, Lda was used for the years 1947 (annual summary), 1948 (12 mensal bulletins) and 1949 (12 mensal bulletins), and the companies União das Armações Baleeiras das Flores e Corvo Parceria dos Armadores Baleeiros do Sul do Pico, Reis Martins/Companhia Baleeira Faialense, Armações Baleeiras Reunidas, União dos Armadores Baleeiros de S. Miguel and Armação Baleeira Terceirense were used for 1968. For 1969 the first four companies mentioned for 1968 also had information, as well as Armação B. Maria Lucinda e Espírito Santo, Armação Baleeira Mota Soares and Companhia Baleeira Graciosa. For 1972 all the companies named except Armação B. Maria Lucinda e Espírito Santo and Armação Baleeira Terceirense were used. For the year 1973 only the company Parceria dos Armadores Baleeiros do Sul do Pico was used.

We used whaling data as a source of information about the occurrence of sperm whales during these periods. We considered as a sighting both effective captures as well as strikes to the animals that did not result in a capture. In both cases information was extracted from the original logbooks and transferred into a digital worksheet. We counted the days with captured sperm whales, and numbers of catches were considered as an independent sighting. We assumed that in the days with strikes but no captures at least one whale was sighted (the one struck), and each was considered as an independent sighting.

Recent data, from the end of the 20th Century and beginning of the 21st Century, was obtained from whale watching datasheets for Pico Island, from one whale watching operator in Pico Island, 'Espaço Talassa'. Available information, between the years 1997 and 2008, consisted in number of boat surveys per day, number of days with sightings and number of sightings between the months of April and October.

For the analysis we defined SPUE as number sightings/number days in a given month/number of years of a period (past and present). Kruskal–Wallis ANOVA analysis was conducted in STATISTICA.

RESULTS

Description of past and recent sperm whale sightings

We obtained a total of 727 independent sightings of sperm whales, during a total of 280 different days of past sperm whaling between 1947 and 1973 (Figure 1). A total of 1767 sperm whale sightings were made during 1133 days of recent whale watching activities, between 1997 and 2008 (Figure 2). Sighted sperm whales in the past (both capture and struck and lost whales) are more irregular over the years than the recent sightings.

Comparison of past and recent sperm whale SPUE

To calculate SPUEs we excluded the year 1947 for which there was no information on the number of days at sea as well as no data about the struck but lost sperm whales. We used 191 days during whaling activities with 593 sightings (3.1 sperm whales sighted per day) and 1130 days during whale watching activities with 1767 sightings (1.6 sperm whales sighted per day).

Results showed a statistically significant dependence of obtained SPUE considering the two periods, whaling/past and whale watching/recent, Kruskal–Wallis ANOVA $H(1, N = 120) = 61.96$ ($P = 0.000$). Sperm whale SPUE average

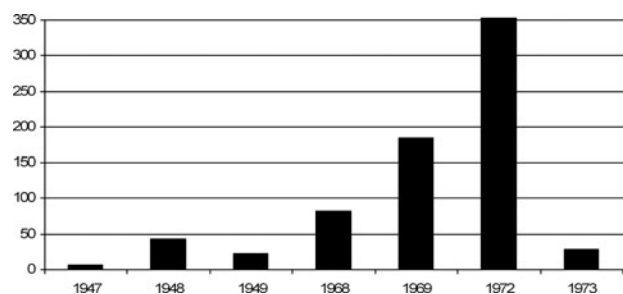


Fig. 1. Distribution of number of sighted sperm whales ($N = 727$) throughout the land-based Azorean whaling years considered in the present study.

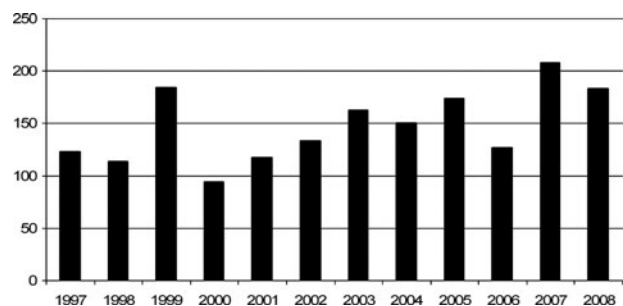


Fig. 2. Distribution of number of sighted sperm whales ($N = 1767$) throughout the considered years of a whale watching activity in the Azores.

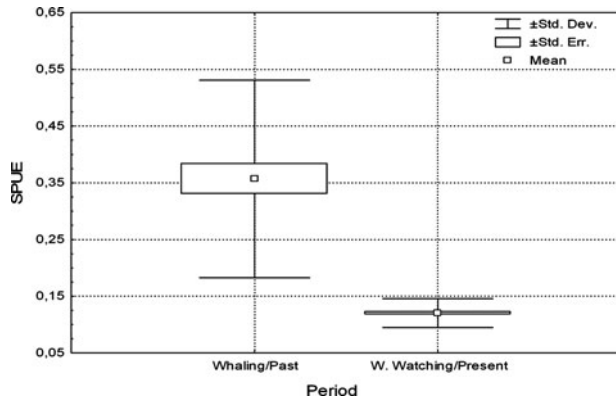


Fig. 3. Box and whisker plot of past (whaling) and recent (whale watching) sperm whales SPUE. Past SPUE is significantly higher than present SPUE and the plot shows no overlap between the two.

is significantly higher in the past (35.68) than in the present (12.06) (Figure 3).

DISCUSSION

During whaling years here reported, 674 independent sightings of sperm whales occurred while in more recent years there were a total of 1767 sperm whale sightings. This is due to the fact that there were many more days of whale watching than whaling days, from our sources of information. It is important to remember that only a very small sample of whaling years are here considered from a total of 89 years of Azorean land-based whaling (Brito, 2007). Also, total number of whaling sightings, for the referred years between 1947 and 1973, is certainly underestimated, as we can only be certain of the 600 captured whales; more individuals may have been sighted than those captured. We are also assuming that during days with struck but lost whales at least one animal was sighted when more could have been observed.

Sperm whale sightings per unit of effort in the past are significantly higher than in recent years, indicating that presently we are sighting fewer sperm whales than in the past. Again, if our past SPUE is underestimated this would only reinforce these results, as hunting loss was a feature of this whaling operation, and therefore the total number of whales actually 'sighted' was certainly larger than referred (Smith *et al.*, 2008). Also because SPUE is a measure of sightings per unit of time worked by a catcher vessel as well as by a watcher vessel it may be subject to various errors arising from differences between activities (Danner *et al.*, 2006). It should be noted that the way of spotting sperm whales in both cases is the same (lookouts from high points on land by very experienced watchers scanning the sea during the complete day) so the chance of sighting sperm whale in the past or in present days is quite similar. Number of days at sea for whaling or whale watching resulted directly from land observations and consequently effort is comparable between the two periods. It seems clear that a decrease in number of sightings occurred between the two periods, which may be indicative of a non-recovery of the local population. Nevertheless, boat traffic, water pollution, over-fishing and many other anthropogenic effects may also explain a possible abandonment of the area by sperm whales.

A lack of pristine or baseline knowledge on population structure and habitat use of most cetaceans makes it difficult to determine the exact impacts of whaling on whale watching or present-day sightings. However, reductions in whale populations by whaling certainly decrease the potential number of whales for whale watching (Hoyt & Hvenegaard, 2002). This seems to be the case in the Azores, where continuous captures throughout the decades greatly decreased the number of sperm whales in the region (Brito, 2007). In 1954, the sperm whale stock off the Azores did not appear to be over fished (Clarke, 1956, 1981), but during the 1960s this seemed to be true, at least in some islands of the archipelago (Brito, 2007). Land-based whaling off the Azores officially ended in 1984, but in 1987 several whales were struck and lost and, at least, three individuals were caught (Deimer *et al.*, 1988). In the Azores, captures throughout the decades greatly decreased the number of sperm whales in the region and twenty years after the end of sperm whaling a reduced number of recent sightings were found. However, whale watching is not an activity in decline in the Azores, on the contrary, as this area has high diversity and abundance of several cetacean species this activity is on the increase.

Future research is needed, especially including data regarding sex and size of captured individuals, as well as amounts of obtained oil and amber, in order to characterize catches and compare them to recent data. New studies regarding this matter should also take into consideration seasonal variation in sperm whales presence, population structure, age-class occurrence and habitat use.

ACKNOWLEDGEMENTS

We thank Dr N. Anastácio from Portuguese DGPA for making available the access to the historical fisheries archive in Lisbon and to S. Viallelle from Espaço Talassa in Pico Island (Azores) for the recent information on sperm whale sightings. We would like to acknowledge two anonymous referees for their comments on and improvements to an earlier manuscript. We also acknowledge a grant to C.B. from the Portuguese Foundation for Science and Technology (SFRH/BD/21836/2005).

REFERENCES

- Bannister J.L., Josephson E.A., Reeves R.R. and Smith T.D. (2008) There she blew! Yankee sperm whaling grounds, 1760–1920. In Starkey D.J., Holm P. and Barnard M. (eds) *Oceans past: management insights from the history of marine animal populations*. London: Earthscan Research Editions, pp. 109–132.
- Brito C. (2007) Assessment of catch statistics during the land-based whaling in Portugal. *JMBA2 Biodiversity Records on line* 1–5.
- Clarke R. (1954) Open boat whaling in the Azores: the history and present methods of a relic industry. *Discovery Reports* 26, 281–354.
- Clarke R. (1956) Sperm whale of the Azores. *Discovery Reports* 28, 237–298.
- Clarke R. (1981) Whales and dolphins of the Azores and their exploitation. *Reports of the International Whaling Commission* 31, 607–615.
- Danner E.M., Kauffman M.J. and Brownell Jr R.L. (2006) Industrial whaling in the North Pacific Ocean 1952–1978. In Estes J.A., Demaster D.P., Doak D.F., Williams T.M. and Brownell Jr R.L. (eds)

Whales, whaling, and ocean ecosystems. Berkeley, CA: University of California Press, pp. 134–144.

Deimer P., Gordon J. and Arnbom T. (1988) *Sperm whales killed in the Azores during 1987*. International Whaling Commission, Report SC/40/Sp5, 2.

Hoyt E. (2002) Whale watching. In Perrin W.F., Würsig B. and Thewissen J.G.M. (eds) *Encyclopedia of marine mammals*. San Diego, CA: Academic Press, pp. 1305–1310.

Hoyt E. and Hvenegaard G.T. (2002) A review of whale-watching and whaling with applications for the Caribbean. *Coastal Management* 30, 381–399.

Parsons E., Lück M. and Lewandowski J. (2006) Recent advances in whale-watching research: 2005–2006. *Tourism in Marine Environments* 3, 179–189.

Reeves R.R. and Smith T.D. (2006) A taxonomy of world whaling: operations and eras. In Estes J.A., Demaster D.P., Doak D.F., Williams T.M.

and Brownell Jr R.L. (eds) *Whales, whaling, and ocean ecosystems*. Berkeley, CA: University of California Press, pp. 82–101.

and

Smith T.D., Reeves R.R., Josephson E.A., Lund J.N. and Whitehead H. (2008) Sperm whale catches and encounter rates during the 19th and 20th centuries: an apparent paradox. In Starkey D.J., Holm P. and Barnard M. (eds) *Oceans past: management insights from the history of marine animal populations*. London: Earthscan Research Editions, pp. 149–174.

Correspondence should be addressed to:

N. Vieira

Escola de Mar, Rua Actriz Virgínia 17 C

900-026 Lisboa, Portugal

email: info@escolademar.pt