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CAMPOS BASIN (RJ-BRAZIL) AS AN IMPORTANT AREA FOR HUMPBACK WHALE MIGRATION: SIGHTINGS DURING SEISMIC SURVEY

Erber, C.; Cordeiro A.; Danielski M.; Fortes R., Freitas R.HA.; Tosi C.; Daffener G.; Ribeiro C.; Ramos R.

The Campos Basin is located in Southeastern Brazil, it is an area of intense activity of the oil industry and with great importance for seismic data research. Brazilian environmental legislation requires the Project of Monitoring of Marine Biota (cetaceans and sea-turtles) throughout the process of seismic survey. This work aims to report the records of Humpback Whales (*Megaptera novaeangliae*) sightings in the Campos Basin, during seismic surveys carried out by the PGS Brazil. The activity of seismic prospecting began on September 04th and ended on December 16th of 2008, resulting in 1,151 h (102 days) of monitoring. The observation effort was performed during daytime, with two on-board observers, using reticules binoculars and digital photographic cameras. During monitoring, 216 humpback whales were recorded in 279 sightings of cetaceans. Seismic activity was stopped 21 times due to the presence of humpback whales in the Security Area (500m distance of the seismic sources). The data here reported confirm past observation that the Campos Basin is an important area of the migration route of the *Megaptera novaeangliae* in the South Atlantic Ocean and plays an important role in the conservation of the specie. Such data may useful for National Conservation Agencies and private entrepreneurs to better preserve the Humpback Whale in Brazil.

KEYWORD: Environmental Monitoring, *Megaptera novaeangliae*, Seismic Vessel.

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Erber, C.[1]; Cordeiro A.; Danielski M.; Fortes R., Freitas R.H.A.[2]; Tosi C.; Daffener G.; Ribeiro C.; Ramos R.[3]

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ABSTRACT

The Campos Basin is located in Southeastern Brazil. It is an area of intense activity of the oil industry, very important for seismic data research. Brazilian environmental legislation requires the Project of Monitoring of Marine Biota (cetaceans and sea-turtles) throughout the process of seismic survey. This paper presents the sightings of Humpback Whales (*Megaptera novaeangliae*) recorded in the Campos Basin, during seismic surveys carried out by PGS Brazil. The activity of seismic prospecting began on September 04th and ended on December 16th of 2008, resulting in 1,151 hours (102 days) of monitoring. Observation was performed during daytime, with two on-board observers, using reticules binoculars and digital photographic cameras. During monitoring, 216 humpback whales were recorded in 279 sightings of cetaceans. Seismic activity was stopped 21 times due to the presence of humpback whales in the Security Area (500m distance of the seismic sources). The data here reported confirm past observation that the Campos Basin is an important area of the migration route of the *Megaptera novaeangliae* in the South Atlantic Ocean and plays an important role in the conservation of the specie. Such data may useful for National Conservation Agencies and private entrepreneurs to better preserve the Humpback Whale in Brazil.

KEYWORD: Environmental Monitoring, *Megaptera novaeangliae* , Seismic Vessel.

INTRODUCTION

The Brazilian environmental legislation requires a Project of Monitoring of Marine Biota (cetaceans and sea-turtles) throughout the process of seismic survey (IBAMA, 2005). Knowing the natural behavior of cetaceans and observing changes in such behavior enables the assessment of the effects of sound pollution on the life of the animals (BAPTISTA & GAUNT, 1997) and mitigation of the effects observed during seismic activities.

The Campos Bay is the area in which PGS has carried out most of its seismic research. The humpback whale is found in Brazilian waters during Austral winter and spring seasons, when it migrates towards the Abrolhos Islands, their main mating and procreation area in the West part of the Southern Atlantic Ocean. Throughout the migration period (July to December) this species lives mainly on waters of the continental shelf and slope. During the period of humpback whale migration the rate of encounters of cetaceans may rise up to the three times (EVEREST, 2005).

This paper reports the sightings of humpback whales during the seismic activities performed in the Campos Bay, in Southeast Brazil, where the oil exploration is intensive and which is part of the migration route of the species in Brazil, analyzing the movement and behavior of humpback whales as regards the sound coming from the seismic ships.

METHODOLOGY

The CAMPOS SW Block is located in the Southwest area of the Campos Bay, in the Rio de Janeiro State, Brazil. The block lies between latitudes 22°02’56,4”S and 22°56’56,4”S and longitudes 040º24’10,8”W and 041º06’54,0”W. Monitoring the Marine Biota was performed on board of the seismic ship Ramform Valiant, counting with eventual additional information about the presence of animals in the area coming from support vessels.

The main objective of the Monitoring of the Marine Biota Project is to mitigate the impacts of seismic sources on the marine biota, stopping the seismic activity when marine mammals and sea turtles come near the active seismic source – a distance of 500 meters from the source, called the Security Area.

A team of three persons was in charge of the observation. Observers hold University degrees, most often on biology and receive special training for the job. Monitoring is

performed by two persons, on a rotating basis, every day during the whole period in which there is daylight visibility.

Reticular binoculars BUSHNELL (7x50) were used. Sightings were recorded on SONY Digital Video Camera Recorders Model DCR-SR85 (Hybrid Mega Pixel HDD). Observation points are located at 22 meters above the water level and they allow for vision angles varying between 180º and 225º for each of the two observers. Sightings and behavior were recorded on the spreadsheets prescribed by the IBAMA (CGPEG). Quantification of the identification of *Megaptera novaenglie* is restricted to sightings adhering to a "definitive" certainty criterion, using identification guides (JEFFERSON et al., 1993; REEVES et al., 2002). The proportion between sightings with air guns on and off was compared using Goodman's test (GOODMAN, 1965).

RESULTS AND DISCUSSION

Sampling started at September 4th, 2008 and finished at December 16th – a total of 102 days and 1151 hours of observation. 279 sightings were made from the seismic ship, of which 77.4% (N=216) of *Megaptera novaenglie*, 21.5% (N=60) of other cetaceans and 1.1% (N=03) of sea turtles. Within the universe of 276 observed cetacean groups, 10 were mixed, formed by two or three species. The humpback whale was present in seven mixed groups, with the following species: *Peponocephala electra, Stenella frontalis and Balenoptera acutostrata*, besides some non-identified cetaceans and dolphins (Delphinidae). Humpback whales were observed at depths varying between 68 and 2087 m but the majority of sightings (92,6% of the total for humpback whales) was concentrated at the depth of up to 500 m.

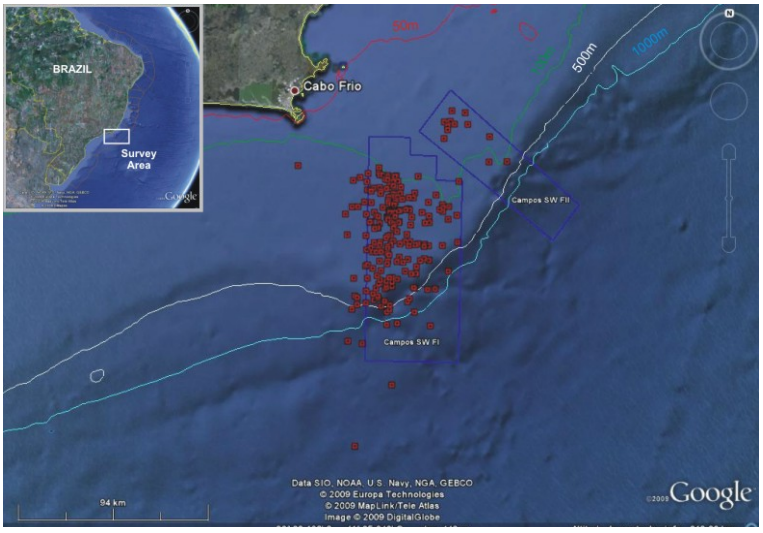
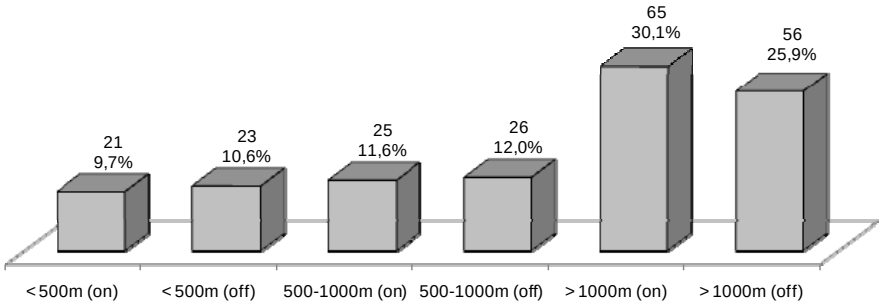


Figure 1 – Campos Bay Map and sightings of humpack whales (red points)

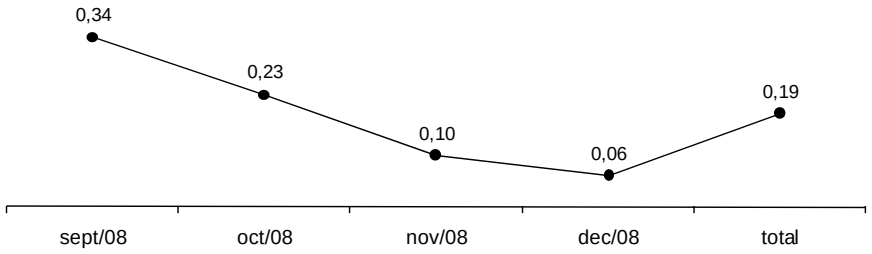
Sighting of humpback whale were made in the same proportion with the seismic sources turned off (105 sightings) and turned on (111 sightings) (Goodman's test $z_{calc} = 0.58 < z_{crit} = 1.96$), which indicates that the animals stayed in the area during the period of seismic research by the ship irrespective of the *status* of the sound sources. Interaction between the seismic activity and the humpback whale was observed: in 9.7% of sightings (21 out of 216) it was necessary to stop the seismic activity because humpback whales had come to less than 500 meters of the sound sources (Graph 1)



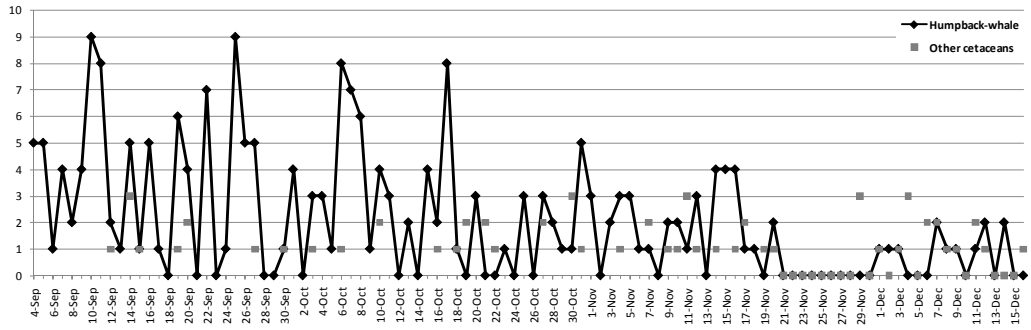
Graph 1 - Humpback whales Sightings according status of the sound sources

The sightings rate (groups/hour) of the humpback whale was 0.19n/hour, which corresponds to a group, been sighted every 5 hours of observation (with an average of 11 monitoring hours per day) (Graph 2). The sightings rate was greatest during the month of September (0.34), with a group every three hours of observation and declined in the following months – 0.23 in October, 0.10 in November and 0.06 in December, corresponding, approximately, to a group sighting every 4 hours and a half, every 10 hours and every 16 hours, for each successive month, respectively. Graph 3 shows the reduction in the number of observed groups: in September the maximum number of observed groups was 9 per day. In the following month the maximum number of groups observed was 8 and this indicator declined to 4 in November and 2 in December.

The change in the sightings rate and in the maximum number of groups observed can be ascribed to the presence of the humpback whales, which, as explained above, are migrating during this time of the year.



Graph 2 - Sightings Rate (group/hour) of humpback whales in Campos SW Block



Graph 3 – Number of sightings of humpback whales and other cetaceans in Campos SW Block per day of monitoring

The seasonal presence of humpback whales may increase the sightings rate up to three times, as shown by the monitoring performed in PGS seismic ships. The highest rate was found in the Campos Bay, in the Humpback Whale Field – 1.16 - over the period of 07/24/2005 to 9/5/2005, in which a group was sighted each day of monitoring, corresponding to a sighting every 9 hours of observation (EVEREST, 2005). Humpback whales predominated in that area and period, accounting for 42.1% of sightings. Non identified whales accounted for 21% of sightings.

Such results indicate a rise in the sightings rate during the period of migration of humpback whales for reproductive purposes, which may also reflect an increase in the population of humpback whales. The characteristics of sightings in Campos Bay SW, with whales dispersed over the area of activity may indicate an occupation of the Campos Bay. Whales may be occupying this area instead of using it as migration route only. This result may indicate that the number of whales and the area occupied has increased over the years, with former areas of concentration on the Western South Atlantic being once more occupied. The number of recordings of the humpback whale

(*Megaptera novaenglie*) is due to the position of the Block in the migratory route during the reproductive period of the species (July-November – site IBJ). Such data strengthen the knowledge about such routes along the Brazilian coast and they may be used in conservation activities (Projeto Baleia por Satelite – The Whale Project by Satellite). Even accounting for the possibility of double counting due to the dislocation of the seismic ship along parallel lines during the day and the long time it takes to cover the same area, the number of sightings shows the use of the by the species. The number of sightings was greater during the months of September and October (Table 1), indicating a concentration of the population stock which is migrating to Abrolhos (Bahia)

Other authors provide additional evidence of *Megaptera novaenglie* sightings in the Campos Basin from seismic ships. SOUZA *et al.* (2007) reports that 98.78% of 327 sightings were of *Megaptera novaenglie* in shallow waters during the reproductive season of 2006. ANZARINI *et al.* (2008) registered as humpback sightings 28% of the 180 sightings performed in areas of 200 and 4000 meters of depth, between Espírito Santo and Santa Catarina. Earlier studies report yearly sightings of *Megaptera novaenglie* in the Campos Basin since 2002 (RAMOS et al., 2002, RAMOS et al., 2004, DAFFERNER et al. 2005, OLIVEIRA et al., 2005). It is worth stressing that the CAMPOS SW phase I and II Block is not included in the temporarily restricted area for seismic activity, which ranges from the Barra do Riacho (North of ES) to Mangue Seco (North of BA).

Looking at the behavior of humpback whales, the most frequently observed are: Blow (37%), Tail Display (12%) and Breach (22%) – the same frequency ranking recorded by SOUZA *et al.* (2007). In both studies, the blowing (Figure 2) is the most frequently observed because it is the main indicator of the presence of whales. Tail display (Figure 3) is often observed in humpback whales which are reproducing in the Abrolhos Islands and it becomes more frequent as the season advances. Breach (full and partial body display) (Figure 4) is common at times of reproduction because they are behavioral answers to the presence of vessels, learning behavior of calf and communication between individuals (SIMÕES-LOPES, 2005)

Figure 2 – Blow

Figure 3 - Tail Display

Figure 4 – Breach with head slap

CONCLUSIONS

The main objective of Monitoring of the Marine Biota Project is to enforce the mitigation measures, stopping the seismic activity if marine mammals and sea turtles come too near the sound sources. Nonetheless the observation of some species in specific areas and their behavior is relevant to provide information about the

environmental sensitivity of the area as well as to help in the conservation of species which coexist with intensive oil industry activity. Such information may help to evaluate possible concentration areas of cetaceans and to effectively mitigate the impacts deriving from the interaction of such animals with the above-mentioned activity.

The recovery of the humpback whale population in an ancient reproduction area may lead to an increase in the sightings rate along the migratory route. On the other hand, such data indicate that the rise in the sightings rate of whales with seismic ships does not seem to negatively interfere with the migration of whales since whales have reached their reproduction areas and it is estimated that their population is growing. The data provided by this paper widen the knowledge of the presence of the humpback whale in the Campos Basin and they strengthen the perception of the importance of such area as a migratory route during the reproductive period in Western South Atlantic

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