

TOURISM CHARACTERIZATION AND PRELIMINARY ANALYSES OF WHALE WATCHING ON HUMPBACK WHALES (*MEGAPTERA NOVAEANGLIAE*) AROUND ABROLHOS ARCHIPELAGO, SOUTHEASTERN BAHIA, BRAZIL.

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ABSTRACT

Abrolhos Bank is the only known wintering ground for humpback whales in the Southwestern Atlantic Ocean. Up to this moment the whale watching activity and the Abrolhos National Marine Park tourism are intimately connected. From 1988 to 1995 there was a high increment on the number of tourists. From 1995 up to now tourism has shown signs of stabilization, probably due to National Park management and carrying capacity. An on going study aiming to analyze the humpback whale's behavioral responses to whale watching is being undertaken by the Brazilian Humpback Whale Project. From a land-based station whale groups are tracked using a theodolite. Within two seasons 60 whale/vessel interactions were recorded, totaling 90 hours 13 minutes of focal group observation. Trawlers comprise 43% of all boats present in the interactions studied.

It is believed that the absence of a larger city nearby, the lack of tourism infrastructure, the deficiency of specific marketing strategy and weather conditions during winter, limits the development of a whale watching industry as a separately tourism. Local government and tourism operators should invest on towns and tourism improvement in order to receive positive feedbacks from the ecotourism. Regardless the lack of tourism infrastructure, whale watching industry has a great development potential in the near future due to the logistical feasibility of whale watching operation; southern Bahia State coast has recently received the title of "the whale coast" what may propitiate greater influx of tourists and the media that every year announce the arrival of humpback whales on the main TV Brazilian channel. The important aspect of the slow growth of the whale watching industry is that researches will have time to study this humpback population in many aspects, enabling an appropriate development of this activity in the region. Hopefully the development of this industry contributes more effectively for improving socioeconomic aspects in the region.

Keywords: Brazilian humpback whale, *Megaptera novaeangliae*, whale watching, ecotourism, Abrolhos Archipelago.

INTRODUCTION

Humpback whales (*Megaptera novaeangliae*) migrate from high-latitude summer feeding grounds to mating and calving areas in tropical waters in winter (Kellogg 1929; Dawbin 1966). The waters of Abrolhos Bank, off Southeastern Bahia State, Brazil, is the only known breeding ground for the humpback whales in the Southwestern Atlantic Ocean (IBAMA, 1997). Humpbacks stay in Abrolhos waters approximately from July to November (Engel, 1996).

Part of the Abrolhos region became a Marine National Park in 1983. Tourism has been gradually increasing due to the Park's popularity for scuba diving activities and more recently because of the presence of humpback whales. From 1988 to 1995 there was a high increment on the number of tourists; in 1988, about 800 people visited Abrolhos and in 1995, about 14,000. From 1995 up to now tourism has shown signs of stabilization, probably due to National Park management and carrying capacity regulations which allows

for 30 vessels to operate tourism in Abrolhos. From these 30, following IBAMA's ordinances n° 09/96 and n° 72/98, which limit numbers of boats and tourists inside the National Park area, 15 boats with 15 people maximum are allowed at the same time. IBAMA - Instituto Brasileiro do Meio Ambiente is the Brazilian Governmental Institution for the Environment.

Recreational succession (IFAW, 1997) is observed in Abrolhos; there has been a change on tourists and vessel types along the years. Traditional vessels, as sailboats, schooners, wooden trawlers, which take approximately 4 to 5 hours to arrive in the Archipelago and overnight in Abrolhos, are becoming less frequent than speed boats that can make daily trips taking less than 2 hours to arrive (IBAMA, 1997).

Whale watching is one of the most rapidly growing tourism activities worldwide. This non-lethal use of cetaceans can bring economic benefits to local communities, including ex-whaling ones and propitiate scientific research, development of educational campaigns and the conservation of the marine environment and the animals themselves (IFAW, Tethys Research Institute and Europe Conservation, 1995; IWC 1998). Ecotourism activities and developments can have both positive and negative social impacts on the local community (IFAW, 1997).

The whale watching activity, if not conducted within the appropriated rules, can bring many impacts to whales. Impacts are not necessarily negative and can be neutral, positive or unknown (Watkins, 1986; IFAW, Tethys Research Institute and Europe Conservation, 1995). There are various parameters that can be used to measure the impacts of whale watching on cetaceans. Behavioral, physiological and acoustic parameters can be measured in a short timescale and productivity, physical condition of individuals, distribution and behavioral habituation and tolerance as a long term effect (IFAW, Tethys Research Institute and Europe Conservation, 1995). Reactions by whales to human activities, such as whale watching operations, vary with different species and over time.

Studies from many places in the world suggest short and long term reactions on humpback populations in the presence of vessels. Short term reaction would be alteration on respiration, diving and swimming patterns, besides exhibition of aerial behavior (breaching, head lunging) correlated with vessel numbers, proximity, speed and direction changes, depending on the categories of whales (Baker *et al.* 1982, 1983; Bauer 1986, Bauer & Herman 1989). Longer-term reactions were suggested by Glockner-Ferrari & Ferrari, 1985, 1990; Salden, 1988, such as mother and calf pairs becoming proportionately less frequent close to shore when recreational boating was increasing. However, Hawaii's humpback population seems to be increasing despite exposure to human activities (Bauer *et al.* 1993) and remain using Cape Cod - Massachusetts, USA as a feeding ground and return annually, despite exposure to many kinds of vessels (Clapham *et al.* 1993).

The whale watching industry is well developed in some places in the world, as in Maui (Hawaii) where it has the capacity available to handle 15,000 passengers a week (Forestell & Kaufman, 1995). Some years ago whale watching in Maui was just like in Abrolhos nowadays; the principal activity would be diving and whale watching was opportunistic. As the same authors describe, this is called "Discovery Phase".

The *Projeto Baleia Jubarte* (Humpback Whale Project), concerned about the potential disturbances the development of the whale watching industry in the region may cause to this population of humpbacks almost unknown worldwide, has been studying the interactions between whales and boats aiming to generate information to suggest, implement and adjust IBAMA's ordinance n° 117/96 about whale watching (Appendix 1), specially for the Abrolhos region.

MATERIAL AND METHODS

Study Area

Abrolhos Archipelago consists of 5 islands, located 36 nautical miles away from Caravelas City, South of Bahia State. Abrolhos bank is on an enlargement of the Brazilian continental shelf with an extensive coral reef formation. The study area consists of 5 nautical miles around the land based observatory (*Ponto Fixo-PF*), which is 36 meters above the sea level, in the Western part of Santa Bárbara Island, geographic coordinates: 17°57'S, 38°42'W. The average depth in the study area is 15 meters. The average temperature of the water during the year is 25,4°C, varying between 23°C in August and 27°C in January.

Study Period

The field work during humpback season in the Abrolhos region is from 1st July to 30th November; daily activities depend on weather. No data collection is undertaken on rainy days, or with wind speed

greater than 5 Beaufort scale (17-21 knots). Within 2 seasons (1998 and 1999), data collection was possible on 205 days.

Equipment

Humpback whale groups were observed and tracked in the presence and absence of vessels with a theodolite. This instrument allows taking the exact location of the whale and its movements and therefore study its behavior without any interference of the observer.

The equipment used in this study are an electric-digital Sokkia DT 5 theodolite with magnification of 30X and Offshore Tasco 7X50 binoculars to search whale pods and observe the interactions. VHF handheld radio is used to allow communication between observers and tourist vessels' captains and the crew of the research vessel *Tomara* and *Benedito*, collecting humpback data on photo-identification and biopsy. A TurboMeter wind speed meter is used for measuring the wind. In the 1998 and 1999 seasons the data was written in a standard datasheet. There's also a sheet with all behaviors abbreviated, which guarantees better dynamics when recording whale behaviors.

The Aardvark software will be used to edit and analyze the data. Aardvark is a program designed to take location data in form of theodolite angles, translates it into geographic coordinates and plot the track of whales groups and vessel movements.

A zodiac powered with a 15Hp engine is used for reaching tourists' and private vessels. During the humpback seasons all tourist arriving at the archipelago receive brochures and an informative talk about the local environment, about the biology of humpback whales and an explanation of the whale watching ordinance by the Project team and Park rangers.

The following definitions are used by the data collecting team and are hereby used:

Focal animal or group continuous sampling: as described by Mann (1999): Continuous sampling is a systematic record of frequencies or durations for a specified set of behaviors.

Behavioral events and state, as described by Altman, 1974: events are instantaneous and states have appreciable durations.

Interaction: when a focal group being observed is approached by a vessel. An interaction is made of 3 parts: before, during and after the boat approach. The behavior observed before the vessel approach will be used as a control to assess the changing or not of the whale behavior during and or after the interaction.

Collecting data

Three observers alternate roles: theodolite operator (main observer), data recorder and binoculars observer. The theodolite operator observes the whale pod, telling to the data recorder all behavioral events and states (Altman, 1974) and most of the respective theodolite readings (fixes). He/she also takes vessel fixes when it is approaching a group of whales. The data recorder writes down all the information together with the exact time it occurs. And the binoculars observer is a second observer who notes some behavior that might escape the attention of the theodolite operator and alerts the team about other boats or other whale pods in the vicinity, as the range of view of the binoculars is broader.

Closer and smaller pods, preferentially mother/calf groups, due to calves' vulnerability are chosen for focal group or focal animal continuous sampling (Mann, 1999). Focal groups might turn out to be an interaction observation: when tourists' boats leave the Archipelago to whale watch and the research vessels *Tomara* or *Benedito* is in the vicinity of Archipelago. we suggest them to approach the pod being observed as focal. The focal session or interaction ends when:

- The pod exceeds the boundaries of the study area;
- The pod under observation affiliates with others, making it impossible for observers to distinguish the groups;
- The whales get out of sight (behind an island);
- Visibility conditions and weather become precarious (glare, haze, heavy sea state, strong wind) therefore rendering the observers unable to secure observation and the definition of behavioral events;
- There is necessity of providing environmental information for tourists when tourist boats arrive in Abrolhos;

Weather conditions, visibility and tide are measured indirectly with theodolite's vertical angles, and sky covering (ranging from 0/8 to 8/8) wind direction and speed, glare and haze are recorded in the beginning of a focal or interaction observation, or every hour when observation exceeds this time.

Tourism vessels

Forty-seven percent (n=14) of the vessels that operate tourism in Abrolhos nowadays are speedboats. Trawlers (wooden fishing boats that were adapted for tourism purposes), make up 20% (6) of the vessels. Schooners account for 16% (5), catamarans 6,7% (2) and a 27 feet long sailboat 3,3% (1). All vessels use diesel as fuel. The largest vessel is a 23 meters long schooner which uses two 250Hp engines. Among the trawlers, the largest one is 14 meters powered by a 300Hp engine. The largest catamaran is 16 meters and is powered by two 110Hp. Engines.

Abrolhos visitation

Vessels and number of tourists that arrive in Abrolhos Archipelago, have been recorded by Park employees everyday on a standard datasheet since 1988. Every month these data are digitized in an Excel worksheet. Visitation number were statistically analyzed in order to evaluate the evolution of tourism frequency along the 12 years period (1988 to 1999), table 1. Regression analysis were used to compare tourism flow during and out of the humpback season, respectively the months of July to November and December to June.

RESULTS

Table 1: Numbers of visitors at Abrolhos National Park per month, from 1988 to 1999.

Within these 2 years of data collection 219 humpback whale pods were observed as focal groups, totaling 361 hours 39 minutes of observation. In one hundred-seventy-four observations (71 mother/calf groups, 35 mother/calf/1 escort, 31 dyads, 23 singles, 10 trio or more adults, and 4 groups of mother/calf/2or more escorts, groups weren't approached by any boats (total time of 261 hours 26 minutes). This data will be used for behavioral studies of Abrolhos' humpbacks. Forty five focal groups' observations became interactions observations, summing 90 hours 13 minutes. Table 2 shows total time, number and type of whale groups and vessels. Nine whale groups observed had been approached by two or three vessels in different instances. Taking into account these cases, 60 interactions were observed.

Table 2: Number and frequency of humpback whale groups' interactions with different types of vessels and total time for each group category.

Trawlers approached whales in 43% (n=26). The research vessels *Tomara* and *Benedito* are also trawlers, adding up to the higher frequency observed comparing to other types of vessels. From 26 interactions observed, 65% (17) were with the research boats *Tomara* or *Benedito*. Seventeen percent (10) of the interactions were made by schooners. Speedboats were observed interacting with whales in 13% (8). Zodiacs and catamarans made up 10% of all observations each (6 each) and the sailboat 7% (4) of all interactions studied. Table 2.

Mother/calf pairs was observed in 41,7% (25) of all interactions, and mother/calf/escort groups in 18,3% (11). See Table 2 for frequency and number of other group's types.

The shortest interaction observed lasted 25 minutes and the longest 9 hours. From the 45 groups approached the average time of interactions was 2 hours.

The result of the regression analysis, comparing the period out season (December to June) and during season (July to November), graphic 1, were the equations:

$$y=908,54 x - 79534,6 \text{ out season}$$

$$y=541,472 x - 47802,2 \text{ during the season}$$

Graphic 1: Abrolhos visitation during and out the whale season.

DISCUSSION

The tourism flow outside the humpback season is higher comparing to the season period. The annual visitation increases independent of the whale season. During summer months: December, January and February, the Abrolhos Park holds the higher visitor frequencies compared to other months. Besides being

summer school vacations and Carnival, during this period underwater visibility is much better comparing to winter, improving scuba-diving and snorkeling activities; moreover weather conditions are almost all the time perfect for navigating. During winter time (whale season), the month of July has high visitor frequency due to winter school vacations, and the months of September and October have, nowadays, larger visitor frequency rates. We believe the reasons for this are related to 2 national holidays, one in each of the mentioned months, and the presence of the whales. In the last two years not only during the holidays in September and October, but during the entire months, the Park had high visitation frequency, almost reaching the maximum visitor capacity allowed, except for the days with poor weather condition. Since 1996 overnight trips to Abrolhos in September and October have been sold out at least a couple of months in advance.

As mentioned before, poor weather (basically high wind speed) has been strongly restrictive for tourism during winter months, therefore slowing down tourism growth rate during whale season. This certainly has resulted in decreasing numbers of visitors during the month of September in 1999.

The success of tourism in the region also depends on the social and economic state of Brazil, as all around the world tourism is the first thing to decline in times of recession and economic slumps (IFAW, 1997). As economy fluctuations are fairly common in Brazil and tourism during winter and spring is basically domestic, Abrolhos tourism influx always experience oscillations.

Due to the Park's carrying capacity regulations, it is expected that in the future the visitation in Abrolhos will be more homogeneous, better distributed along the year. As the trips will be sold out during the peak visitation periods, people willing to visit Abrolhos won't have any other alternative unless, booking the trip for other period.

The methodology being used for studying the interactions between whales and vessels, although theodolite tracking analysis has not been done yet, has shown to be adequate for the study area. For the 2000 season equipment improvement is planned which will lead to better dynamics in collecting data and therefore analyzing it: the theodolite will be linked to the computer. The Aardvark program, developed by Harold Mills (Cornell University Bioacoustics Research Program) will be used to collect, edit and analyze data. This program has been used in other cetacean studies as those undertaken in 1996 and 1997, to investigate the effects of the low-frequency ATOC transmissions on the behavior of Humpback whales. Woods Hole and the Cornell Bioacoustics Research Program also used it concerning the impact of Sounds from the U.S. Navy's Low frequency Active (LFA) sonar system on Gray whales in California in January 1998 and Hawaiian humpback whales in 1998.

The environmental information given to all boat occupants that arrive in Abrolhos Archipelago is an important activity developed by the Project, arising the tourists' awareness about the whale watching rules and environmental consciousness.

Up to this moment, during humpback whale season, the whale watching activity and the National Park tourism are intimately connected. Visitors go to Abrolhos Archipelago due to scuba-diving, snorkeling activities and to whale watch. Whale watching industry alone hasn't developed yet. And we believe the reasons are basically the lack of big cities or State capitals in the vicinity of Abrolhos Bank, (the closest larger city is about 300 kilometers) and the lack of tourism infrastructure in the region. The deficiency of a specific marketing strategy by tourism operations in the region also limits the development of the whale watching industry.

The Southern Bahia State coast near Abrolhos Bank (which encompasses 3 main towns: Caravelas, Nova Visoça and Alcobaça) do not offer so far an appropriate infrastructure to tourism; there isn't a variety of shops, good restaurants, banks for changing money, and airfare to these towns is extremely expensive. Most of all the tourists that go to Abrolhos do not spend the night, or even have meals at the towns. People arrive, depart to the Park and when they come back, leave right away. Besides, the weather can be extremely rough during winter time (whale season) becoming restrictive for the existing type of tourist vessels to navigate safely. In order to receive positive feedbacks from ecotourism and whale watching, the local government and tourism operators, should invest on towns and tourism quality improvement.

Regardless of the lack of infrastructure, which probably will delay the process of development of whale watching industry independent of the Park tourism, the whale watching industry has a great development potential in the near future. Abrolhos nowadays is known not only because of the Park itself but also due to presence of the whales. Every beginning of season, the humpbacks arrival become news at the main TV news program in Brazil. Recently the Southern Bahia State coast near Abrolhos Bank had received the title of "The Whale Coast" by the Bahia government, what may propitiate a greater influx of tourists. Besides, whale watching boats would not necessarily navigate all the way to Abrolhos Archipelago to see

whales, as they can be sighted already at 8 to 10 nautical miles away from the continent, thus adding to the logistical feasibility of the operation.'

The linkage of Park and whale watching tourism and the slow growth of the whale watching industry have positive aspects though, first because whale watching tourism nowadays falls into Abrolhos Park's regulations for carrying capacity and second researchers will have time to study the population in many aspects and the whales' responses to boats before whale watching becomes an intense activity in the area. There will be enough time to enable an appropriate (controlled, conscious, structured, and educated) development of this activity. The local community will be aware of the importance of a sustainable whale watching development.

Observing the natural tourism development process and the 12 years of existing ecotourism in the region for Abrolhos Park, we noticed few changes. The local community, specially the new generation (probably because of the environmental education on local schools), has become aware of Abrolhos and its wild inhabitants, using them as themes during their cultural events. But so far the traditional culture hasn't weakened. Some fisherman kids are now working in tourism related activities. The government has improved access to the towns, but basic social services, as health care and education remain steady, as described by Place, 1995, as a negative impact from ecotourism. Hopefully the development of whale watching industry contributes more effectively for improving socioeconomic aspects in these towns.

Preliminary Management Recommendations

As speedboats are becoming more frequent in Abrolhos waters, a greater research effort is needed in order to observe more speedboats/whales interactions. Despite the perceived political and/or economic impacts, there is merit in discussing the possibility of regulation boat speed in the region during whale season.

Another important improvement would be the presence of a Humpback Whale Project naturalist on board of every tourism boat for improving environmental information for the tourists, optimizing data collection (photo-id) and help enforce regulations regarding whales/boats interaction.

Also, the use of questionnaires for the tourists within the whale season for detecting the main reason of visiting Abrolhos, whales or the Park itself (diving activities) and characterize the tourism would be useful for management purposes.

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APPENDIX 1

IBAMA ORDINANCE # 117/96, December 26th, 1996:

-To prevent and restrain from intentionally harassment of cetaceans in Brazilian waters:

- a) To get closer than 100 meters to any species of whales (cetaceans Mysticeti, sperm whale, *Physeter macrocephalus* and orca, *Orcinus orca*) with engine on to the nearest animal;
- b) To turn on the engines before checking if the whales are farther than a minimum of 50 meters from the vessel;
- c) To pursue, with engines on, any whale for longer than 30 minutes, even if respecting the above mentioned distances;
- d) To interrupt the direction displacement of any cetaceans species or try to modify or divert their direction;
- e) To drive intentionally into groups of any species of cetaceans, dividing or scattering them;

- f) To produce excessive noise, such as music, percussion of any kind or others, besides those generated by the normal operation of the vessel, closer than 300 meters of any cetaceans;
 - g) To dispose any kind of dregs, substances or material closest to 500 meters of any cetaceans;
- It is forbidden swimming, snorkeling or scuba diving closer than 50 meters of any species of whales

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Table 1: Visitation number at Abrolhos Archipelago from 1988 to 1999.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1988	110	327	116	0	0	0	30	0	0	93	10	185	871
1989	694	754	308	114	63	0	90	57	87	89	81	163	2500
1990	698	661	377	203	46	54	219	45	201	254	154	250	3162
1991	553	382	373	84	96	47	366	84	194	224	175	475	3053
1992	635	458	456	407	212	44	257	232	337	274	182	464	3958
1993	1157	820	414	324	100	123	601	129	439	519	390	590	5606
1994	1387	1426	536	537	209	173	994	357	928	643	551	1028	8969
1995	3544	1698	1476	421	210	286	1217	542	1022	1366	669	1398	13849
1996	4434	2596	881	662	321	103	1267	384	989	912	529	1416	14514
1997	3600	2363	559	432	424	264	1488	916	1351	1165	637	2011	15230
1998	3488	2104	622	517	266	159	789	929	1709	1004	424	1396	13407
1999	3379	2289	633	636	211	207	862	730	1438	1446	614	1310	13755
TOTAL	23679	15878	6751	4337	2158	1480	8200	4405	8695	8189	4416	10686	98874

Table 2:

Number and frequency of humpback whale groups' interactions with different types of vessels and total time for each group category.

WHALES AND BOATS INTERACTIONS 1998 and 1999 seasons									
Humpback Groups	N Groups Approached	Speed Boats	Trawlers	Schooners	Sail Boat	Zodiacs	Catamarans	Total(%)	Total Time
Mother and Calf	19	3	12	4	2	3	1	25 (41.7%)	36h 49m 51s
Mother Calf Escort	8	0	6	4	0	0	1	11 (18.3%)	14h 25m 58s
1 Adult	6	1	3	1	2	0	2	9 (15%)	20h 14m 43s
Dyad	8	2	2	1	0	1	2	8 (13.3%)	14h 00m 52s
Trio	3	0	3	0	0	1	0	4 (6.7%)	3h 52m 04s
4 or + Adults	1	2	0	0	0	1	0	3 (5%)	49m 32s
Total (%)	45	8 (13%)	26 (43%)	10 (17%)	4 (7%)	6 (10%)	6 (10%)	60	90h 13m

