



EARTHWATCH[®]

FINDING SOLUTIONS FOR A
SUSTAINABLE FUTURE INSTITUTE



Bahamas Marine Mammal Research Organisation

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17 November, 2008

Dear Earthwatch Volunteers,

We are writing to express our sincere gratitude for your assistance with the Dolphins and Whales of Abaco Island Project during 2008. Thanks to all your hard work, the project has completed another successful field season, furthering our understanding of marine mammals in The Bahamas, and contributing towards their conservation.

The big news from Abaco is that on October 1st, we both joined the academic world (again) to begin PhD studies at the University of St. Andrews. Diane will investigate spatial processes in the population ecology of beaked whales while Charlotte will be examining vocalizations of beaked whales and possibly dwarf and pygmy sperm whales as well. The long-term dataset from Abaco will form an integral part of each of these studies.

On behalf of all of the BMMRO staff, we thank each of you again and wish you the very best. Please come and visit if you are in Abaco again.

With warm regards,

Diane Claridge & Charlotte Dunn



EARTHWATCH INSTITUTE ANNUAL FIELD REPORT

Project Title: Dolphins and Whales of Abaco Island

Principal Investigator (s): Diane Claridge ¹, Charlotte Dunn¹

Position/Affiliations:

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Research Site(s):

Coastal and pelagic waters off the south-western side of Great Abaco Island, including the northern portion of the Great Bahama Canyon, north-eastern Bahamas (26.0°N, 77.4°W)

Local Management Status of the Research Site(s):

Primary site: southern end of Great Abaco Island is an IBA site

Scientific names of primary species being studied:

Tursiops truncatus, Atlantic bottlenose dolphin

Stenella frontalis, Atlantic spotted dolphin

Mesoplodon densirostris, Blainville's beaked whale (dense-beaked whale)

Ziphius cavirostris, Cuvier's beaked whale (goose-beaked whale)

Kogia sima, dwarf sperm whale

Physeter macrocephalus, sperm whale

Date this report was completed: 18 November 2008

Key Research Objectives:

Long-term research objectives are:

- To investigate marine mammal species' occurrence, distribution and the abundance around The Bahamas to contribute towards management and conservation directives in the wider Caribbean region.
- To investigate the ecology of coastal Atlantic bottlenose dolphins on Little Bahama Bank, and monitor population trends to contribute towards future management of this population.
- To investigate the ecology of Blainville's beaked whales to aid in the conservation of beaked whale species in The Bahamas and elsewhere around the world.

The specific research objectives addressed this field season were:

- To conduct vessel surveys to search for marine mammals around Great Abaco Island, including random line transects, in order to assess species' distribution and habitat requirements.
- To photo-identify marine mammal species, with particular emphasis on bottlenose dolphins, Blainville's beaked whales and sperm whales, to provide sufficient data for the statistical assessment of occupancy patterns, abundance and social organization.
- To collect skin and faecal samples from marine mammal species, focussing on Blainville's beaked whales and sperm whales, to investigate population and social structuring using molecular genetic techniques, and to identify prey species.

Data Collection and Results

During the 2008 Earthwatch field season, thirty-two vessel surveys were conducted in the waters off Great Abaco Island, in the northern Bahamas. Marine mammals were found on 22 surveys, or 69% of all surveys. Six different marine mammal species were encountered over 50 sightings, and photographs were taken to confirm species identification and to identify individuals for 44 of these sightings. The majority of sightings (66%) were in the coastal or inshore ecotype of Atlantic bottlenose dolphins (*Tursiops truncatus*) found on the shallow carbonate banks. Other frequently encountered species included Atlantic spotted dolphins (*Stenella frontalis*) (9% of sightings). Only one faecal sample was collected opportunistically; this occurred during an encounter with sperm whales (*Physeter macrocephalus*).

The field work conducted during 2008 has contributed towards achieving the long-term research objectives of the study in numerous ways. Completing another annual census will allow us to further understand the marine mammal fauna inhabiting the waters around Great Abaco Island and the northern Bahamas. This important baseline data will allow us to monitor changes in species occurrence and distribution as Abaco experiences increasing human activity, including increased coastal development of large-scale tourist resorts. Each field season contributes data to the largest dataset for marine mammals in the region, allowing us to monitor change on a much larger scale as well.

SUMMARY OF 2008 RESULTS

During the 2008 field season, the research team surveyed 2,458 km (1,329 nautical miles) in the waters off Great Abaco Island, in the northern Bahamas. Thirty-two vessel surveys were conducted in the study area (shown by the shaded area in Figure 1). During these surveys, team members spent over 230 hours searching for marine mammals.

Vessel surveys were conducted in two different ways: opportunistic surveys, which allow us to maximise our encounter rate and photo-identification efforts by returning to areas known to be frequented by whales or dolphins; and random-line transects, which allow us to gather non-biased data on species' distribution. The majority of surveys during the 2008 field season were opportunistic vessel surveys. These non-random surveys increase our chances of both finding and photographing individuals, which is essential in order to obtain sufficient photographic data for the statistical assessment of population size and structuring and to monitor life history parameters such as calving rates. We also completed 11 random-line transects in the study area during 2008, allowing us to build on our distribution dataset for cetaceans in the area with 7 sightings of four different species. These data also allow us to estimate densities of frequently sighted species relative to habitat and to monitor temporal changes in relative abundance.

During the 2008 Earthwatch field season, there were 50 sightings of marine mammals, including six different species and totalling 423 animals. Atlantic bottlenose dolphins (*Tursiops truncatus*) and spotted dolphins (*Stenella frontalis*) were the most frequently sighted species. A summary of data collected during marine mammal sightings during 2008 is listed in Table 1.

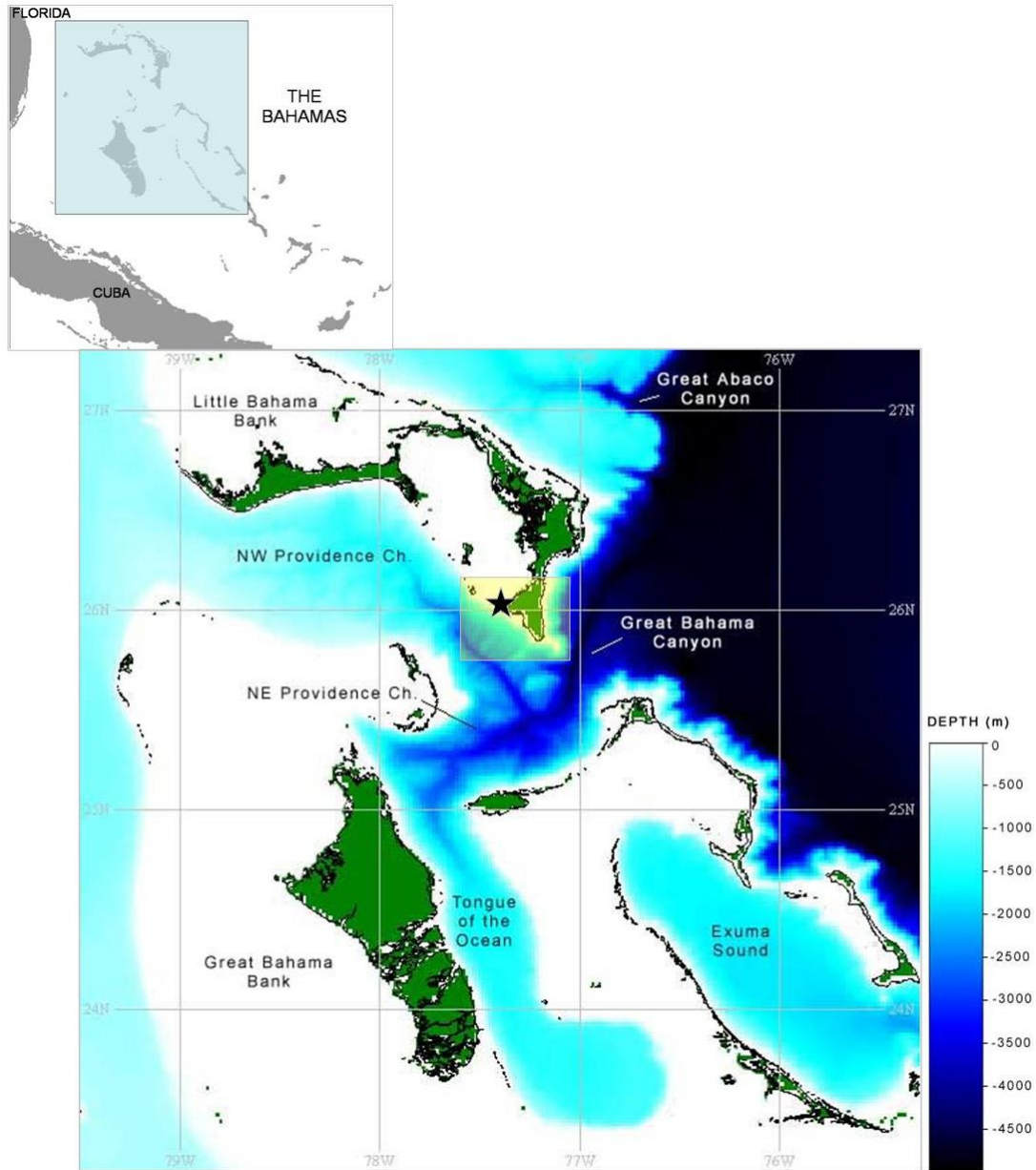


Figure 1. Map of the northern Bahamas showing the study area (shaded box) off the southwest coast of Abaco Island. The star denotes the location of the Bahamas Marine Mammal Research Organisation in Sandy Point from which the field work was based. Bathymetry data clearly show how the study area encompasses contrasting habitats, including the shallow regions of Little Bahama Bank in the northern part and the deep waters of the Great Bahama Canyon in the southern portion.

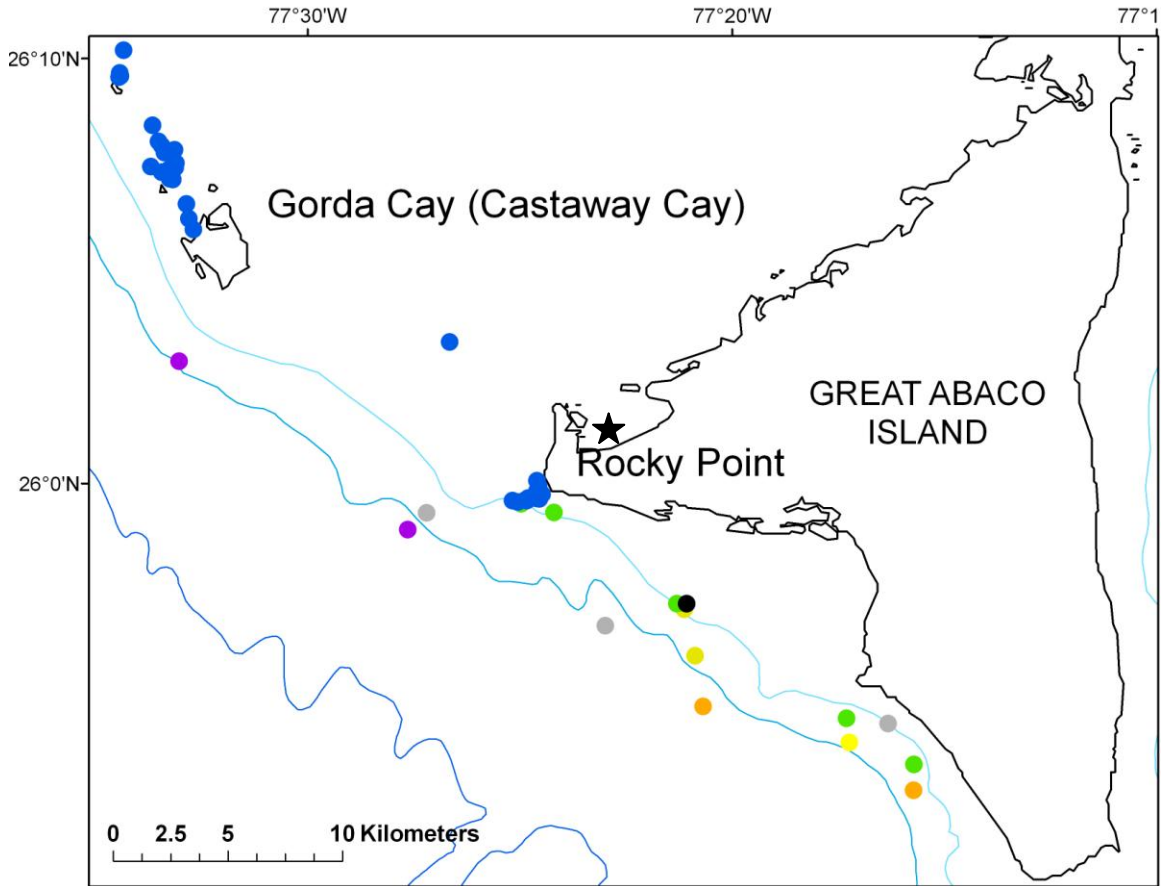
Table 1. Summary of data gathered during the 2008 Earthwatch field season.

<i>Common name</i>	<i>Scientific name</i>	<i>No. sightings</i>	<i>No. of animals seen</i>	<i>No. sightings during transects</i>	<i>No. Faecal, semen or sloughed skin samples</i>
Blainville's beaked whale	<i>Mesoplodon densirostris</i>	1	2	1	0
Sperm whale	<i>Physeter macrocephalus</i>	2	7	0	1
Dwarf sperm whale	<i>Kogia sima</i>	2	5	1	0
Pygmy sperm whale	<i>Kogia breviceps</i>	2	8	1	0
Atlantic bottlenose dolphin – coastal ecotype	<i>Tursiops truncatus</i>	34	319	2	0
Atlantic spotted dolphin	<i>Stenella frontalis</i>	5	78	0	0
Unknown <i>Kogia</i>	<i>Kogia sp.</i>	2	2	0	0
Unknown cetacean	-	3	3	2	0

During encounters, team members collected 41.1 hours of observation, environmental and habitat use data. A large proportion of sightings occurred at Rocky Point as shown in Figure 2, which is a known feeding site for Atlantic bottlenose dolphins. The close proximity of this site to the research centre in Sandy Point allows us to visit this area more frequently than other areas.

Significance/Benefits of Research

The significance of this research project reaches many levels. Locally, the study is helping to monitor the impacts of environmental changes to local marine mammal populations. Coastal development is increasing at an alarming rate on Great Abaco Island, and this growth is projected to continue, as more large-scale developments are planned. During 2008 the Government of The Bahamas announced approval of 14 large scale touristic resorts on Abaco Island. With this unprecedented growth come many changes to the marine environment. These include habitat alteration, e.g. from dredging operations; loss of mangroves which are important fish nursery habitats; increased nutrients causing loss of coral cover on reefs; increased vessel traffic with the increasing number of boat slips available at new marinas; increased pressure from over-fishing from more sport-fishermen; and increased marine pollution, e.g. engine oil. As top predators in the marine environment, whales and dolphins will be affected by these changes, particularly the coastal bottlenose dolphin communities. For this reason, BMMRO (Bahamas Marine Mammal Research Organisation) has teamed up with Dr. John Durban and Holly Fearnbach of US NOAA Fisheries (Seattle, WA) to continue efforts to monitor bottlenose dolphin populations around Abaco (for more information see: http://www.bahamaswhales.org/news/news_Oct08.html).



SPECIES	
●	Blainville's beaked whale
●	Sperm whale
●	Dwarf sperm whale
●	Pygmy sperm whale
●	<i>Kogia</i> sp.
●	Atlantic bottlenose dolphin
●	Atlantic spotted dolphin
●	Unknown cetacean

Figure 2. Map of the study area showing marine mammal sightings during the 2008 Earthwatch field season. The star shows the location of BMMRO's (Bahamas Marine Mammal Research Organisation) research centre where the field work was based from. The 200 m, 1,000m and 2,000m bathymetry (water body topography) lines are shown in shades of blue. Atlantic bottlenose dolphins (*Tursiops truncatus*) were concentrated at Rocky Point and Gorda Cay. Sperm whales (*Kogia* sp.) were found along the 1 000m isobath (all isobaths shown are in metres.)

Findings from the long-term study of beaked whales (*Mesoplodon densirostris*, Blainville's beaked whale and *Ziphius cavirostris*, Cuvier's beaked whale) off Abaco Island, supported by Earthwatch since 1992, are contributing towards a larger-scale study of beaked whales in the Great Bahama Canyon (location illustrated in Figure 1), known as the Bahamas Beaked whale Ecology Study (BBES). The long-term goal of this project is to collect baseline data to fill critical data gaps on the population ecology of beaked whales in the northern Bahamas, specifically relating to distribution, habitat use, abundance and population structuring. Since 2007, three large-vessel cruises have been carried out to conduct visual and acoustic surveys for beaked whales in the Great Bahama Canyon. When beaked whales were sighted, photo-identification photos were taken and tissue samples obtained by remote biopsy sampling. Photographs of individual beaked whales will be compared to those previously archived in BMMRO's existing photographic catalogues from southwest Abaco Island, which has been primarily collected on Earthwatch teams. These data will contribute towards estimating beaked whale abundance using mark-recapture techniques, examining rates of immigration and emigration and understanding their population structure in the Great Bahama Canyon. For more information on this project, see:

http://www.bahamaswhales.org/research/claridge_beaked_08.pdf

The study is also contributing towards the conservation of marine mammal species throughout The Bahamas through dissemination of information to stakeholders in marine mammal conservation, namely the US Navy and Government of The Bahamas. The project has contributed marine mammal and sea turtle sightings data towards the US Navy's Marine Resources Assessment project. These data will be used by the US Navy's Fleet Forces Command to help mitigate naval activities in The Bahamas operating areas. Data has also been contributed to Environmental Reviews for US Navy Operating Areas in The Bahamas, providing the only data available for marine mammal distribution, abundance and species occurrence in this region.

Internationally, our research has resulted in the only long-term study of marine mammal fauna in the wider Caribbean region. Most importantly, we are contributing data which applies to the Agreement for Specially Protected Areas and Wildlife (SPAW agreement, within the UN Cartagena Convention), which provides protection for all marine mammal species in the region. The Government of The Bahamas has signed but not yet ratified this Convention, and our findings on species diversity and occurrence have shown the need for full participation in this important international agreement.

The findings of this study contribute to issues of sustainability by increasing our understanding of the ecological role of top predators in the marine ecosystems, allowing for the assessment and monitoring of the health of the environment. With the contribution of data collected each year, we are able to more accurately assess species' distribution and determine which habitats are important and may need consideration as protected areas. Furthermore, the photographic data gathered during encounters in 2008 will contribute towards the estimation of abundance and occupancy patterns for bottlenose dolphins and Blainville's beaked whales, and will contribute towards assessing population structuring, social organization and monitoring trends in abundance over time.

By monitoring the status of species, this study is also contributing information which will aid their conservation and help to maintain the marine biodiversity of the region.

Dissemination of Results

Management plans and reports:

Annual Field Report to The Bahamas Department of Fisheries, Nassau, Bahamas.

Providing field support for the Behaviour Response Study (BRS – 08) (October 2008).
Annual report to the Office of Naval Research (Grant no. N000140711035)

Distribution, abundance and population structuring of beaked whales in the Great Bahama Canyon, northern Bahamas (October, 2008) Annual report to the Office of Naval Research (Grant no. N000140710120).

Presentations - The following presentations were made at the Seventeenth Biennial Conference on the Biology of Marine Mammals, 29 November – 5 December 2007, Cape Town, South Africa (abstracts are available at http://www.bahamaswhales.org/news/news_Jan08.html):

Claridge, D. E and L. S. Hickmott. Estimating calving intervals, weaning age and calf survival of Blainville's beaked whales (*Mesoplodon densirostris*): insights from individual life histories.

DeRuiter, S. L., D. E Claridge, L. S. Hickmott and P. L. Tyack. A noninvasive molecular method for diet determination from toothed whale fecal samples.

Dolman, S. J., D. E. Claridge and J. W. Durban. Monitoring abundance trends of Bahamian odontocetes.

Dunn, C.A., D.E. Claridge and L.T. Pusser. Killer whale (*Orcinus orcas*) occurrence and predation in the Bahamas.

Gordon, J., D. Gillespie, M. Caillat, D.E. Claridge, D. Morretti and I. Boyd. Detection of beaked whales using near surface towed hydrophones: prospects for survey and mitigation.

Hickmott, L. S., M. Johnson, D. E. Claridge and P. T. Madsen. Evidence of adaptive foraging behaviour on schooling prey by Blainville's beaked whale (*Mesoplodon densirostris*)

Popular articles and films:

Claridge, D.E. and O.M. Patterson (2007). Guide to the most common whales and dolphins of Abaco, in "Cruising Guide to the Abacos", White Sound Press, New Smyrna Beach, FL., reprinted 2007.

World Wide Web:

Bahamas Marine Mammal Research Organisation's website: <http://bahamaswhales.org/>.

SECTION II: VOLUNTEERS

Volunteer Tasks and Accomplishments

Volunteers help to make this project a success in numerous ways. These include their enthusiastic help with vessel surveys, data entry, outreach and community service work. To search over 2,458 km in small boats searching for elusive animals such as beaked whales and finding animals during 69% of surveys is no easy feat! Once animals were sighted, volunteers' help in keeping track of animals was an extremely valuable contribution to the field effort.

The data is processed, entered and error-checked on a near real-time basis thanks to an enormous effort from the staff and volunteers. As a result, this Earthwatch field season, data entry for 41.1 hours of observation data gathered during 50 sightings, resulted in database entry of over 3,500 records! In addition, the initial matching of individuals from over 4,000 photographs of bottlenose dolphins was completed.

Additionally, the optional participation of the volunteers in the Sandy Point Environmental Camp (summer teams) helps to teach local children about their environment. Volunteers are able to directly share their recent cetacean experiences with the camp children as well as their enthusiasm and excitement about the natural environment surrounding these children's home. Many of the volunteers are teachers or students interested in marine biology and the interaction that they have with Sandy Point children is vitally important.

As part of our community service work, each Earthwatch team conducted either a beach clean-up or underwater garbage clean-up. This effort resulted in five pickup truckloads of trash removed from the beach and in the coastal waters near Sandy Point during 2008.

Project Development

An ongoing challenge for this project includes the effective dissemination of our results, but we have taken several steps to meet this challenge. The project PIs have joined the academic world (again) as PhD candidates at the University of St Andrews. Having an affiliation with a university will greatly increase opportunities for sharing BMMRO data with other post graduate students to provide the opportunity for data analyses and subsequent publication. During summer 2008, a student from Florida Atlantic University began analyses of BMMRO's spotted dolphin data to contribute towards her Master's degree. The launching of BMMRO's website last year has provided an additional means by which to present our results. All of these efforts will help with our challenge to continuously share our findings to the scientific community and policy makers, and to publish significant findings.

BMMRO's long-term marine mammal dataset which has been collected from Abaco with support from Earthwatch volunteers is providing the basis for the study of beaked whale distribution, abundance and population structuring in the Great Bahama Canyon.

Educational Opportunities

This project directly involves many aspects of the public sector, and provides several different educational opportunities. During the summer months, the project ran the Sandy Point Environmental Camp, a 7-week outreach programme for 52 primary school students residing in Sandy Point. By learning about the marine life around Abaco, these students are becoming more sensitive towards protecting their environment. A testimony to the success of this project is shown through the decreasing amount of garbage collected on the beach and in town by each camp over the past 4 years. In 2007, BMMRO's Sandy Point Environmental Camp was used as a template for 2 other locations in Abaco (Marsh Harbour and Cooper's Town), a project lead by Abaco's Friends of the Environment (www.friendsoftheenvironment.org). Friends now leads the Environmental Camp program increasing the number of children that are exposed to environmental education throughout Abaco.

Staff positions were made available for early career scientists, and this year included a student from Imperial University, and a Fisheries Officer who plans to start a similar project to the research conducted by BMMRO in St. Vincent and the Grenadines, her home country. Numerous past student staff members from the Bahamas are now pursuing careers in marine science and environmental education partly as a result of the field experience that they gained by working on this project.

Partnerships

During summer 2008, BMMRO staff once again took part in the Behaviour Response Study (BRS) which is a large, multi-national project in which responses of whales exposed to underwater sounds are measured to identify and mitigate their adverse effects. This work comprised Phase II of a multi-year study which has taken place in the Tongue of the Ocean (*'Tongue of the Ocean' is the name of the deep oceanic trench in the Bahamas that separates the islands of Andros and New Providence. It is one of the two main branches of the Great Bahama Canyon*). The study is led by Dr. Ian Boyd (Sea Mammal Research Unit) as the Chief Scientist and holder of Bahamian research permit, and the Principal Investigator and holder of US permit, Dr. Brandon Southall [National Oceanographic and Atmospheric Administration (NOAA)]. The project is supported by the Office of Naval Research (ONR) and US Department of Defense (NAVSEA PEO IWS and OPNAV N45). Diane Claridge is one of five co-Principal Investigators. Photo-identification data and tissue samples collected during BRS will be contributed towards BMMRO's analysis of population structuring of beaked whales in the Great Bahama Canyon.

Tiffany Adams from Florida Atlantic University and the Wild Dolphin Project came to visit the BMMRO in July of 2008 to collect data for a Master's thesis on the distribution and movements of Atlantic spotted dolphins in the northern Bahamas. Tiffany will be correlating photo-identification data from two separate, long-term projects that cover study sites 160 km apart on opposite ends of Little Bahama Bank to identify individuals travelling between the two sites and examine the implications of those movements. She will also look at similarities and differences between these populations as a whole, and

examine basic population parameters such as group size and sex ratio, as well as patterns of site-fidelity (residency based on re-sightings), natal philopatry (continued residence in the natal home range past the age of independence from parents), and sex-biased dispersal. To learn more about this exciting work, see:

http://www.bahamaswhales.org/news/news_Jul08.html

Acknowledgements

This study would not be possible without the enthusiastic help of our volunteer research staff, student interns and Earthwatch Institute volunteers over the years. This field season, the research staff included team leaders Olivia Patterson and Thomas Brown; research assistants Edward Adderley, Lucine Edwards, Nathalie Ashford-Hodges and Kendria Ferguson; Bahamian high school intern, Gino; and four great teams of Earthwatch volunteers, including a teen team under the excellent supervision of facilitator Gretchen Mills. We wish to acknowledge the contribution of each and every one of you, and thank you for your dedication to conservation and hard work in the field. We also thank the volunteers on the summer teams who helped with the environmental camp.

The Sandy Point Environmental Camp was funded by Friends of the Environment. We also thank the Friends of the Environment for supporting the high school student internship programme. BMMRO is grateful to The Bahamas Department of Fisheries for granting our research permit (Permit No.1 under the Bahamas Marine Mammal Protection Act, 2005) and supporting our duty-exemption status.