

Dear Singing Whales of Puerto Rico volunteers,

We would like to thank you again for choosing to spend your free time helping us conduct our research - we hope you all enjoyed helping us as much as we enjoyed working with you! We would like to take this time to provide you with a summary and update you on the progress of our project. As you know, this was our first field season, and much of our time was spent trying out new equipment and problem solving. We would like to thank everyone for being so understanding and flexible during this time.

During team 1, we had our first whale sighting of the project and made our first live recording of a singing whale! Our team 2 volunteers willingly adapted to a constantly changing schedule and helped us build and test our floating hydrophone system (H2). During team 3, we were visited by Chong, who taught us about artificial neural networks, and Rachael, whom we helped with a project that will give us more information about how sounds change underwater with respect to distance.

With all of your help, we were able to make recordings at several locations, including El Faro, Mayaguez Bay, Baja Seco, and Desecheo Island. Altogether, during our two months in Puerto Rico, we logged 42 sightings of humpback whales from El Faro and recorded over 30 hours of whale song! None of this would have been accomplished without all of your hard work.

During our first field season we were able to establish several local connections. We attended and spoke at local meetings of the Surfrider Foundation. Most of you were able to participate in reserve walks/talks led by Leon Richter, coordinator of Surfrider, Rincon. We learned about a local campaign, Salva Tres Palmas, which resulted in the designation of Tres Palmas Beach as a National Marine Reserve. This is now of particular importance, as this area is home to some of the healthiest Elkhorn Coral in the world, which has recently been designated a threatened species under the Endangered Species Act. We hope to stay involved with and perhaps even collaborate with Surfrider in the future, as we share similar conservation goals.

Through our connection with Surfrider, we were able to arrange presentations at a local junior high school, Escuela Jorge Seda Crespo. The students not only learned about humpback whales and our research, but got to see our recording equipment up close and listen to our recordings of singing whales, shrimp, and boats. In future years we hope to set up a school outreach programme so we can educate and involve more students in our project.

We were given the opportunity to write an article about our project for Surfriders' newsletter, which reaches 200 people. Our project was also featured in El Nuevo Dia, the most widely read newspaper in Puerto Rico, complete with a photo of Jennifer and Patchouly watching for whales from El Faro, as well as an interview with Jennifer about the research.

We feel that we are off to a very good start with respect to community education and involvement with our project and we hope to strengthen and expand upon this connection in future seasons. We are proud to say that our first field season was a success, thanks to all your ideas, enthusiasm, and hard work.

Sincerely,

Patchouly Banks – Field Team Leader  
Jennifer Schneider – Principal Investigator  
Dr. Eduardo Mercado III – Principal Investigator

## EARTHWATCH INSTITUTE FIELD REPORT 2006

**Project Title:** Singing Whales of Puerto Rico

**Principal Investigators:** Dr. Eduardo Mercado III<sup>1</sup>, Jennifer N. Schneider<sup>2</sup>

**Position/Affiliations:** Assistant Professor<sup>1</sup>, Graduate Student<sup>2</sup> Department of Psychology, University at Buffalo, The State University of New York

**Research Site(s) (geographic location, include coordinates if known, e.g. Lat/Long):**

Añasco/Rincon, Puerto Rico N 18 W 67

**Local Management Status of the Research Site(s) (e.g. National Park, RAMSAR Site, World Heritage Site, IBA etc.):**

None

**Scientific names of primary species being studied:**

*Megaptera novaeangliae*

**Key Research Objectives:**

- Acoustically locate and monitor singing whales
- Determine the noise environment surrounding whales in Puerto Rico
- Measure the frequency and structure of songs produced in Puerto Rican waters
- Examine the propagation of songs within various environmental conditions
- Determine which song elements propagate farthest, and when important song features are likely to be drowned out by noise pollution

**Data Collection and Results**

a) Give a concise account of the data you have collected during the past field season.

We recorded 42 observations of whales near El Faro lighthouse, determining the best times (early morning and mid-late afternoon) to see whales. From this data we will determine the best location to install a more permanent hydrophone array, based on where whales were observed and their direction of travel. We also made 26 hours of audio recordings of singing humpback whales and four hours of broadcast sounds using “two-ear” or stereo hydrophone arrays. These recordings will be used to identify components of whale song, to compare recordings between two “ears”, and to compare recordings made from various locations.

b) What progress have you made towards achieving your original objectives?

The recordings we collected will allow us to determine the ambient noise levels in Puerto Rico. We have both near and far recordings of both whale song and broadcast noise, allowing us to examine sound propagation. Finally, we have recordings from

hydrophones spaced the equivalent of a whale's ears, allowing us to examine differences in recordings between "ears".

c) Please provide a summary of your results.

Data analysis in progress.

### **Significance/Benefits of Research**

a) What is/are the significance/benefits of your research at the following levels?

- Local: Our research site is in close proximity to Tres Palmas, a small marine reserve. Plans are currently in the works for expanding the reserve and overall management areas. Our research will reinforce the need for a larger management area, as well as help determine the type of management necessary for protecting humpback whales.
- National and international: Our approach to the dangers of noise pollution in the ocean is rather unique, focusing on communication disruption rather than just physical harm to the animals. Publication of our research will help increase public awareness of issues with oceanic noise pollution and encourage new kinds of environmental monitoring and management strategies.

b) How do your findings contribute to issues of sustainability?

Human-made noises in breeding areas can have impacts that are not easily identified through playback experiments or behavioral observations. The behavior of a listening whale that cannot detect key components of a distant singer's song because of noise is unlikely to be radically different from that of a listening whale that is too far away from a singer to bother responding to the song. Such missed opportunities for breeding interactions cumulated across many individuals could, however, negatively impact the population. Our research aims to assess the possibility that human-made sounds interfere with humpback whale song function. We will do this by continuously monitoring singing whales in Puerto Rican waters, and clarifying how environmental conditions (including noise levels) affect song transmission and reception.

### **Dissemination of Results**

a) Have you provided details of results from your research to or within:

- Scientific papers
  - Data analysis in progress
- Presentations
  - Rincon Surfrider meeting – 30 local community members with interests in conservation
  - Escuela Jorge Seda Crespo, Rincon, PR – 20 junior high school students
- Popular articles
  - Nueva Dena – March 12, 2006 "Un enigma el canto de las ballenas"
  - Surfrider Newsletter - April 17, 2006 – "Singing Whales of Puerto Rico"

## Volunteer Tasks and Accomplishments

- a) How did the volunteers contribute ideas, skills, expertise and motivations beyond that which you anticipated?

As we were in the initial stages of our project, there was a lot of problem solving – our volunteers were very helpful in suggesting and trying new ideas. They were also very understanding and flexible, as our schedule was not always consistent. They were able to assist us with our equipment – some of our volunteers were very technically savvy or had expertise with certain pieces of equipment (e.g. GPS).

- b) How have volunteers helped you to achieve your research or educational objectives?

**Project Development** Volunteers helped us collect descriptions of 42 whale sightings; record over 30 hours of ambient noise, whale song, and broadcast sounds; enter hours worth of data; construct two hydrophone arrays; and teach one middle school class.

- a) What logistical or scientific challenges have you encountered in the past season and how will you address them during the next field season?

- The noise of the boat hitting the water was interfering with our recordings – we devised a hydrophone system that floats away from the boat in order to gather less noisy recordings.
- Long term recordings – this season we were not able to implement our hydrophone arrays due to equipment limitations. We have now identified better quality equipment, as well as determined possible spots to set up our arrays and plan to use a combination of arrays and live recording next season.

- b) Have you used any additional methods/strategies to meet your research objectives?

While our initial plan involved setting up permanent hydrophone arrays, we had to modify our strategy for this year. Instead, we made recordings from boats: recording for 30 minutes from location, moving one or more kilometres, and recording for another 30 minutes. In this way we recorded the same whale from two locations with two hydrophone arrays. Since we are not recording humpback whale songs at the source, we performed an additional experiment to allow us to examine the propagation of sound in our research environment. We broadcast sounds in the water, and recorded the sounds simultaneously from three locations: near the source, 30 metres from the source, and anywhere from 0.5-2 km from the source.

- c) How will you develop your research in the coming field season?

In the coming field season we will install a permanent hydrophone array, allowing us to record whales at night. We will perform additional, systematic tests of sound propagation using broadcast sounds.

## **Educational Opportunities**

- a) Does your project directly or indirectly involve the following groups in your research topic?
- Local communities – yes
  - Students - yes
  - Early career scientists - yes
  - Other groups – investigators from underrepresented minorities
- b) Please tell us the ways your research helps these groups better understand the conservation of a sustainable environment.

Our interactions with the local community in Rincon help us as students and early career scientists to understand the people in Rincon and their dependence on the ocean. Fishing, tourism, and entertainment (e.g. surfing, snorkelling, etc.) are an essential part of the lives and livelihood of these people. As we learn how the whales, fish and coral reefs contribute to their lives, we are better able to use our research to help them maintain this lifestyle. As we have talked to locals we have found that there are many misconceptions about whales and their behaviour, yet at the same time people take pride in the whales. Through our research we are able to educate them on what is known about the whales and learn how to keep the environment “whale friendly”.

- c) Has your project helped lead to the completion of Masters’ theses, or other educational research findings?

Yes. These initial studies provided opportunities for an undergraduate honours student to conduct an independent research project, and for three graduate students to collect data that they can use in ongoing graduate research projects.

## **Partnerships**

- a) List partnerships or collaborations with other organizations that you have developed or maintained in the past season.

Surfrider Foundation, Rincon Chapter

- b) How have these organizations contributed to your project objectives?

By attending Surfrider meetings, we were able to inform members of the community about our project. It was through Surfrider that we were able to establish a connection with and present our project to a local middle school, furthering our community outreach. Surfrider also connected us with several people who directly helped us collect our data by providing boat time. We were also able to inform our volunteers about the local community through Leon Richter of Surfrider, who gave talks to our group about the Tres Palmas Reserve.

- c) How do you anticipate these organizations will use the results generated by the project, and in what timeframes?

Classroom collaboration and community education (ongoing each field season).  
Expansion of the Tres Palmas Marine Reserve (5-10 years).

### **Acknowledgements**

We would like to send a special thanks to everyone who provided us with boat time, enabling us to make our recordings: Alex Hollins, Capital Water Sports; Francisco (Pochy) Rosario, Light Tackle Adventure; Taino Divers; Jose (Pepe) Alfonso, Makaira Fishing Charters; and especially Gary (Corky) Rogers and Leslie Cruz of Aquatic Exports, who very willingly gave their own time to help us. We would also like to thank Leon Richter, Surfrider Foundation, Rincon Chapter, for all of his invaluable help; Annette Blasini, Surfrider Foundation, Rincon Chapter, for arranging and translating school talks; Danny Rollins, Escuela Jorge Seda Crespo, for allowing us to talk to his classes and for translating; Trini Olivares, at Roberto's Hidden Paradise, for being a wonderful landlady; Itzel Orduna for translating this article for us; and all of our Earthwatch volunteers for their hard work!