

# THE OCEAN ALLIANCE

*Voyage of the Odyssey*

**Cruise Report No. 2**

27 April - 5 May 2000



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Dirección General de Intereses Marítimos de la Armada Nacional

Charles Darwin Research Station

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## **Introduction**

The Ocean Alliance continued with its research activities on cetaceans in waters of the Galápagos Marine Reserve with a second cruise aboard the research vessel *Odyssey*. The objective of this cruise was to collect biopsy samples, identification photographs and acoustic recordings from sperm whales (*Physeter macrocephalus*) for:

1. Toxicology studies. Collaborators: John Stegeman and Michael Moore, Woods Hole Oceanographic Institution.
2. Genetic studies. Collaborators: Sarah Mesnick, Southwest Fisheries Science Center, and Bill Amos, Cambridge University.
3. Photo-identification studies. Collaborator: Hal Whitehead, Dalhousie University.
4. Acoustic studies. Collaborators: Chris Clark, Cornell University, and Jonathan Gordon and Douglas Gillespie, International Fund for Animal Welfare (IFAW).

In addition, the Ocean Alliance runs a media, education, and communication program from aboard the R/V *Odyssey* called “A Voice from the Sea”. The mission of this program is to bring the results of the scientific projects to the general public via a network-based, interactive web site, with the ultimate objective of educating the public and increasing marine conservation awareness worldwide.

Dr. Roger Payne and Iain Kerr, president and vice-president of the Ocean Alliance, respectively, oversaw all activities during this cruise. Dr. Payne’s views on the philosophy of the biopsy work being conducted by the Ocean Alliance in the Galápagos are enclosed at the end of this report as an appendix. Maryuri Yépez Revelo, of the Marine Biology Division at Charles Darwin Research Station in San Cristóbal, was the Ecuadorian national representative on board. Her role was to act as an observer, as part of the permit agreement with the Galápagos National Park. The research activities by the Ocean Alliance are being conducted under authorization from the Galápagos National Park (Proyecto No. PC-32-00 of 11 February 2000, with Alcance a la autorización original of 13 March 2000) and from the Dirección General de la Marina Mercante y del Litoral (Autógrafo: Acuerdo No. 018/00 of 27 March 2000).

## **Methods**

The second cruise took place between 27 April and 5 May 2000 aboard the R/V *Odyssey*. The *Odyssey* is a 28-m ketch outfitted for open-ocean research with cetaceans. Searching for sperm whales was conducted visually and acoustically. Once sperm whales were sighted, the vessel was carefully maneuvered in their vicinity in order to gain a close approach for biopsy and photo-identification procedures.

Visual effort. A visual watch is maintained during daylight hours (0600-1800 h) from an observation platform located 5.6 m above the water level or from a crow’s nest located 19.1 m above the water level. Observers search the area 180° forward of the vessel to the horizon with naked eyes and aided with 7x binoculars [maximum sighting distances to the horizon from these platforms are 4.56 n.mi. (8.45 km) and 8.42 n.mi. (15.61 km),

respectively]. Travel speed is normally 6-8 knots, with variations due to currents and other factors. All marine mammal sightings are recorded in the computerized database Logger 2000 v. 2.03 (developed by D. Gillespie for IFAW), including their bearing and distance to the vessel. NMEA data are automatically recorded in the database for every entry, including GPS position, local time and GMT, and vessel course and speed. Sightings within one nautical mile from the vessel's track are regularly approached to obtain species identification and to estimate school size. Sea-surface temperature and weather conditions related to sightability (sea state, swell, meteorological conditions) and navigation data are also entered in the database every hour along the track.

Acoustic effort. Sperm whales produce regular audible clicks that can be detected for several miles with specialized underwater acoustic equipment. The *Odyssey* carries an acoustic array that is towed 100 m behind its wake. The array consists of two PVC-encased hydrophone elements (Benthos AQ4, with Benthos AQ201 pre-amplifiers). The elements are suspended inside a 10.5-m Delrin (acetal homopolymer) hose filled with Carnation (non-conductive, low-viscosity) oil. The separation between the two elements is 2.9 m and they are held together by a stabilizing plastic mesh. Depth and temperature sensors for the array are also encased in the hose. This array is connected to the vessel by a Kevlar-shielded cable, 100 m long. Under optimal conditions the maximum listening range may be up to ten nautical miles, provided that the vessel is stationary and all engine noises are shut off. Effective listening range is 3-6 nautical miles depending on ocean conditions and on whether the vessel is underway. Initial processing of incoming data from the array includes amplification of the signal, analog-to-digital conversion, and high-pass filtering. The output signal is connected to high-quality headphones as well as to a pair of stereo speakers located in the pilothouse. The entire acoustic system is powered by an isolated 12-V battery bank also located in the pilothouse.

The output signal is also interfaced with a PC desktop computer with a stereo 16-bit sound card and RS232 data input. Incoming acoustic data from the array is automatically processed in real time by the software Rainbow Click v. 1.03.00 (developed by D. Gillespie for IFAW). The input data is scanned for clicks with different algorithms depending on background noise levels. Rainbow Click analyzes stereo signals using the time difference between arrival of clicks on the two channels to measure a bearing to each click. The bearing calculation assumes that the two hydrophone elements are in line directly behind the vessel. Detected clicks are extracted from the raw data, displayed on the screen and written into a data file for further analysis. Screen display windows include: Bearing/Time, Inter-click Interval/Time, Click Waveform (for the two channels), Power Spectrum (Fast-Fourier Transform), First and Second Level Triggers (scanning algorithms), and Cross-correlation (to compare two sections of a click waveform).

Listening stations are occupied every hour with the vessel fully stopped and the engine turned off. At each station the helm's person on watch dons the headphones and listens for five minutes. Acoustic contacts with cetaceans (or the absence of contacts) are entered in Logger 2000. Sounds from the array are monitored 24 h a day by the helm's person on watch by listening to the speaker set while the vessel is underway. Once sperm whales are detected acoustically, the vessel is maneuvered to derive the bearing of the vocalizing

animals relative to the vessel using the Bearing/Time display window in Rainbow Click. This display window is also used to identify and track individual animals that are vocalizing underwater.

Biopsy sampling. Once sperm whales are located visually at the surface, the vessel is diverted to approach the animals for the collection of biopsy samples. In order to minimize potential disturbance to the whales due to the close approach of a vessel, the *Odyssey* has a platform that projects eight meters over the water from the starboard side of the bow (Fig. 1). This increases the minimum distance between the vessel and the animals during the approach. The platform allows the positioning of the vessel to be almost parallel to a sperm whale for biopsy attempts, instead of taking the biopsy from behind which is the usual way. This increases the comfort zone for the animals as well as the probability of obtaining a successful sample. Biopsies are taken using a compound crossbow with a red dot sight and a 150 lb draw string (Barnett RC-150). The arrows are made of carbon graphite, and have been designed specifically for whale biopsy by Finn Larson. The biopsy tip consists of a circular razor blade 40 mm long by 8 mm in diameter with three internal prongs to retain the skin/blubber sample. A conical float at the tip end adds buoyancy to the arrow after it bounces off the whale and it also acts as a stop collar to prevent the dart from penetrating beyond the external skin/blubber layer of the animals (Fig. 2).

Once collected, the samples are divided up and preserved according to established protocols for six specific experiments:

- Genetics (skin stored in DMSO buffer at room temperature)
- Chemistry/toxicology (blubber stored at  $-20^{\circ}\text{C}$ )
- Stable isotopes (skin stored at  $-20^{\circ}\text{C}$ )
- Stable isotopes (blubber stored at  $-20^{\circ}\text{C}$ )
- Whole slice for dosing/protein studies (stored in formalin at room temperature)
- RNA (2 pieces of skin/blubber interface stored in liquid nitrogen)

Photo-identification. Standard and digital photographs of the dorsal area and the flukes of the animals are collected during each approach. These photographs are used in short term identification of individuals to avoid re-biopsying. They are also used for long-term mark-recapture and social organization studies by H. Whitehead and collaborators.

## Results

The cruise track followed by R/V *Odyssey* between 17 April and 5 May 2000 is shown in Figure 3.

Visual effort. Forty-six marine mammal sightings were made, belonging to *Delphinus delphis* (n=4), *Stenella coeruleoalba* (n=1), *Tursiops truncatus* (n=2), *Globicephala macrorhynchus* (n=5), *Grampus griseus* (n=1), *Ziphius cavirostris* (n=1), *Kogia* sp. (n=1), *Arctocephalus galapagoensis* (n=3), *Zalophus californianus* (n=2), *Physeter*

*macrocephalus* (n=9), unidentified dolphins (n=6), unidentified otariids (n=9), unidentified cetaceans (n=2).

Acoustic effort. The array was deployed on 27 April at 1500 h and towed for the entire duration of the cruise. Eighty-eight five-minute listening stations were occupied.

Biopsy sampling. Three biopsies and one piece of skin naturally sloughed were collected during the cruise. Figure 4 shows the locations where the samples were taken.

Photo-identification. Three rolls of 400 ASA color film were shot of individual identification photographs, primarily of biopsied whales. In addition, 30 digital stills were taken of the dorsal area and the flukes of the approached animals. Digital identification photographs of the three animals biopsied are presented in Figure 5.

Education, media, and communication program. Continued connection between the R/V *Odyssey* and the outside world during this cruise was maintained through our web site, <http://www.oceanalliance.org>. The following activities were completed:

- Four audio logs – internet audio updates relating to daily occurrences on the *Odyssey* and the science and research being completed onboard. A daily photo accompanies these logs. Contents of audio logs on this cruise included Frigate Birds, Bioluminescence, Darwin, and Bottlenose Dolphins filmed with the ‘BowCam’.
- Four “Voice from the Sea” audio pieces – weekly narratives by Dr. Roger Payne. On this cruise they included two pieces on the Geology of the Galápagos Islands, Darwin, and Sperm Whales.
- Two video logs – internet video updates related to the science and research completed on the *Odyssey* as well as surrounding events. These included Bottlenose Dolphins and Sperm Whales.
- Four questions of the day – The onboard education coordinator supports Dr. Roger Payne’s “Voice from the Sea” pieces with questions based on his most recent audio piece.

## **Acknowledgements**

The Galápagos National Park and the Dirección General de la Marina Mercante y del Litoral authorized our research activities in the waters of the Galápagos Archipelago. Poly Robayo, Jenni Thompson and Edwin Yáñez of the Charles Darwin Research Station provided invaluable logistic support. The port captains of Santa Cruz and Seymour islands kindly processed our *zarpe* paperwork. TAME airlines provided discounted air travel between the Galápagos and continental Ecuador. We thank the rest of crew of the R/V *Odyssey*: Bob Wallace, Alison Walker and Daniel McBride for ensuring a successful operation.



Figure 1. Platform at the end of extension boom, 8 m from bow.



Figure2. Crossbow and arrow for collecting biopsy samples.

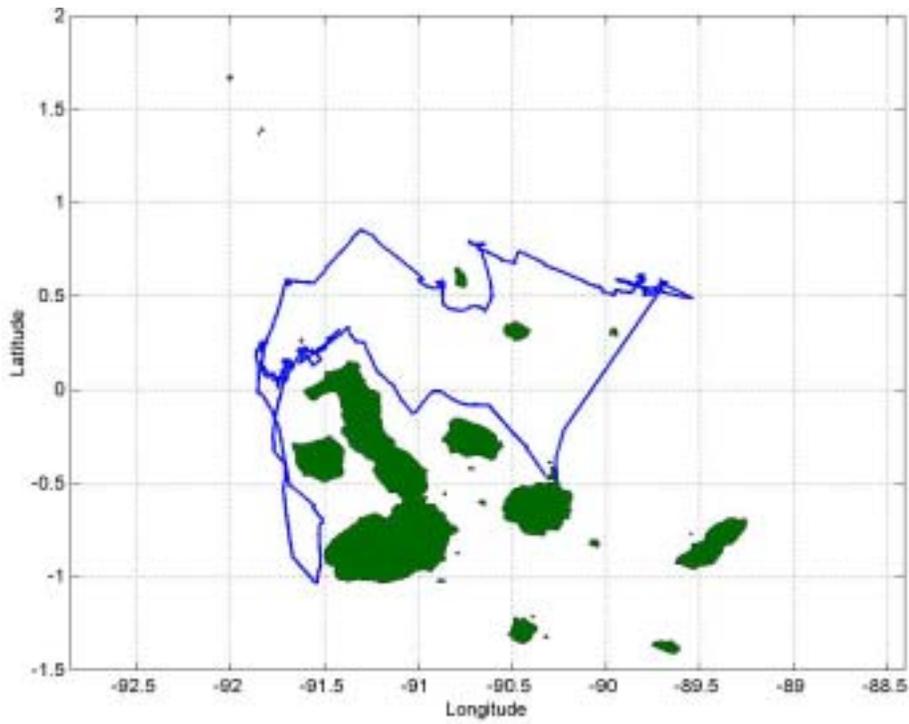


Figure 3. Cruise No. 2 track, 27 April - 5 May 2000.

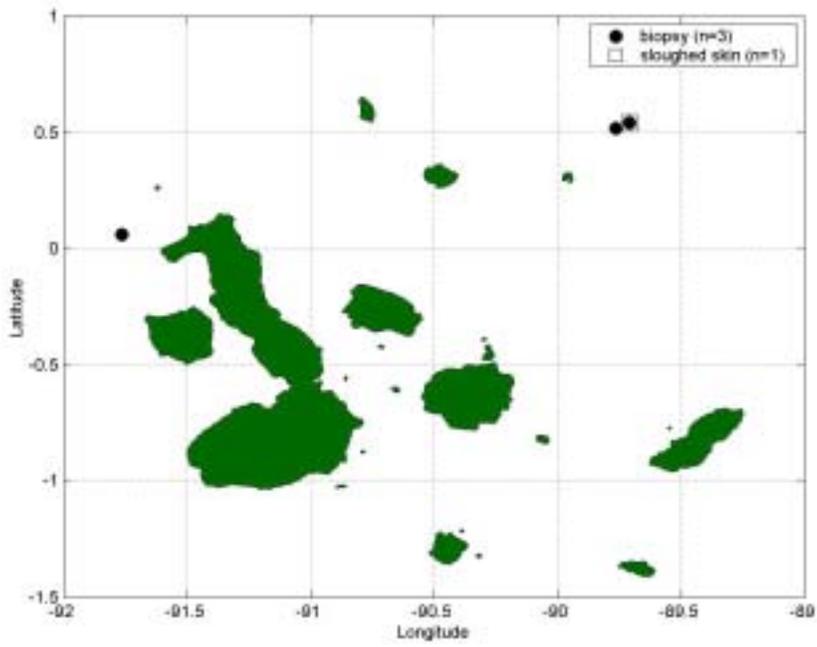


Figure 4. Locations of biopsy and sloughed skin samples collected during Cruise No. 2.



Biopsy No. GP20000501-007.  
Date: 1 May 2000  
Time: 1456 h  
Latitude: 0°03.7'N  
Longitude: 91°45.9'W



Biopsy No. GP20000505-008  
Date: 5 May 2000, Time: 0821 h  
Latitude: 0°31.1'N, Longitude: 89°45.8'W



Biopsy No.  
GP20000505-009  
Date: 1 May 2000  
Time: 1052 h  
Latitude:  
0°32.6'N  
Longitude:  
89°42.6'W

Figure 5. Photos by G. Johnson