



Whales of Southern California

2011 FIELD REPORT

Background Information

Lead PI: Lei Lani Stelle

Report completed by: Lei Lani Stelle

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Department of Biology

Dear Volunteers,

We are in the midst of another exciting gray whale migration. 2011 was a game-changing year as researchers followed “Flex”, a member of the Western Pacific gray whale population, who defied sacrosanct knowledge of gray whale biology by promptly traveling across the Pacific to join the Eastern Pacific population on their southwards migration. Since then, researchers have discovered that at least 12 individuals from the highly endangered Western population have migrated along our coast and may even interbreed with the Eastern animals. Although we were not directly involved in the tagging efforts, our research efforts to help establish a photo-ID catalogue of grays during their migration (which was previously considered by many experts to be too difficult and unnecessary) is contributing to the ability to track the mixing of these populations.

It is too early to tell what these discoveries mean for the gray whale but it is leading to renewed interest in a species that was considered by many to be thoroughly understood. With the enthusiastic help of all of you, we made great progress on our research goals to assess human impacts on the gray whales traveling through the waters of Southern California. Chandler Weeks completed her senior thesis on the effects of vessel disturbance, and fortunately did not detect any significant differences in breathing patterns of whales in the presence of boats. Unfortunately, we do know that some whales are harmed by boats as Laura Conner examined over 1600 photographs of individual whales and found evidence that at least 11 of these whales have been hit by boats. And these are the ones that survived the collisions! Laura also found evidence that 1.2% survived entanglement in fishing gear. We observed this problem directly as two gray whales were recently rescued from fishing net entanglements in our local waters. Volunteers helped Laura examine a massive dataset representing nearly 10% of the entire gray whale population, which is an incredible sample size, and we are working on publishing this analysis.

These projects are continuing and we expect to fine-tune our analyses to improve our ability to detect disturbances. As you all learned, field work can be exhilarating, tiring, tedious, and wet...but always rewarding. We could not have achieved all that we did in our inaugural

season without your assistance. Your keen observations, meticulous records, careful data entry, and most importantly, your enthusiastic interest, were essential to develop a project that is providing great insight into the risks faced by gray whales. This project is still in its early stages but we are already seeing results and expect to continue these efforts as a long-term project. We are now expanding the project to examine all the marine mammals that utilize the waters of Southern California. This upcoming summer will be our first summer season based out of So Cal and we look forward to investigating similar questions of human impacts on other species such as Blue whales, Humpbacks, Bottlenose and Risso's dolphins. In addition, we are developing a new citizen science mobile app that we will share with all of you soon, and hope you will utilize it to continue your research contributions to this project.

Thank you for all of your hard work, your understanding and flexibility, and the support for our project, Earthwatch, and of course, the gray whales!

Take care,

A handwritten signature in black ink, appearing to read "Lei Lani". The signature is written in a cursive, flowing style with some loops and flourishes.

Lei Lani

https://fs22.formsite.com//EarthwatchResearch/files/f-0-17-6415678_m3pAd3u4_Signature.pdf

SECTION ONE: Scientific research achievements

Top highlight from the past season

The most encouraging finding was that based on a preliminary analysis we did not observe any significant differences in the respiration patterns of gray whales when in the presence of vessels. This suggests that the majority of boats are maintaining their distance and following the whale watch guidelines. Unfortunately, we know that this is not always the case and have observed boats getting much too close and changing the behavior of the whales. We also have photographic evidence of injuries sustained by whales who have been hit by boats. Our goal is to increase our sample size so that we can conduct more complex analyses to detect any such disturbances.

Reporting against research objectives

The objective of this project is to examine human impacts on gray whales by expanding our study of gray whales from British Columbia to their migratory route past the Palos Verdes Peninsula. Earthwatch volunteers contributed to the research over three weekends during February, March, and April, 2011. We observed seven different species of marine mammals, including 8 sightings of 13 gray whales (Table 1). We were able to record locations, respiration patterns, swim paths, and take photographs for identification and to evaluate injuries.

Table 1: Marine Mammal Sightings during three 2011 Earthwatch expeditions: 2/19-20, 3/12-13, 4/9-10.

Species	Number of Sightings	Number of Animals
Gray Whale	8	13
Fin Whale	1	1
Common Dolphin	11	~440
Pacific White-sided Dolphin	1	3
California Sea Lion	17	~37
Harbor Seal	4	~20
Northern Elephant Seal	1	1

We made substantial progress on the two primary objectives which contributed to the senior thesis projects of students, Chandler Weeks (Objective 1) and Laura Conner (Objective 2). Both students began their projects during the summer of 2010 in British Columbia, with assistance from Earthwatch volunteers. Findings reported here encompass both study areas.

Objective 1: Assess if vessels disturb gray whales by measuring energetics data.

Behavioral data was collected on gray whales to determine if whale-watching boats were a disturbance during the summer in British Columbia, Canada and during the winter off the Palos Verdes Peninsula, CA, USA. Noncompliance by boaters to existing regulations could result in animals experiencing high stress levels, injury, and even death. Observations of gray whales were made (a) by using a theodolite from shore and (b) following individual animals from a boat. Advantages of the theodolite are that positional data, swim speeds and swimming direction of the whales can be recorded whereas close behavior and individual identification are easier to observe from a boat. Data collected on diving patterns (average dive duration, numbers of blows per surfacing, and the interval between blows) were not significantly different when comparing behavior with and without whale-watching boats present (Figure 1).

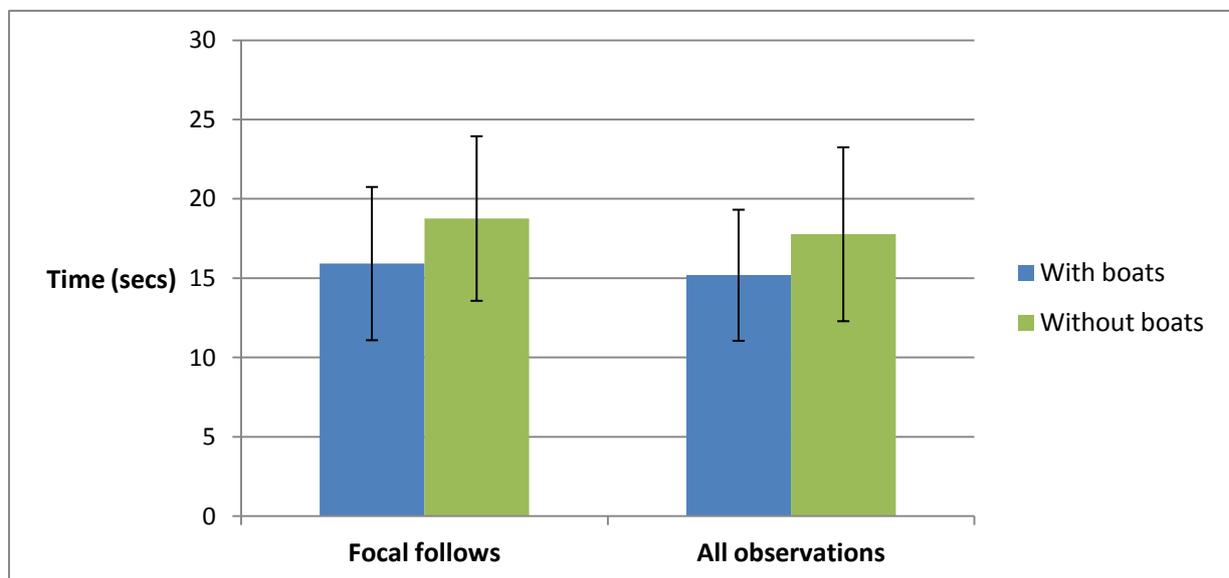


Figure 1a. Average blow interval when whales are in the presence and absence of boats. Focal follows (n=10) are instances where data was available for both with and without whale-watching boats for one whale. All observations include focal follows as well as instances where one whale was observed for a substantial amount of time either with (n=14) or without (n=16) whale-watching boats in the area. Both focal follows (p-value= 0.058) and all observations (p-value= 0.153) were not statistically significant when comparing blow intervals with and without whale-watching boats.

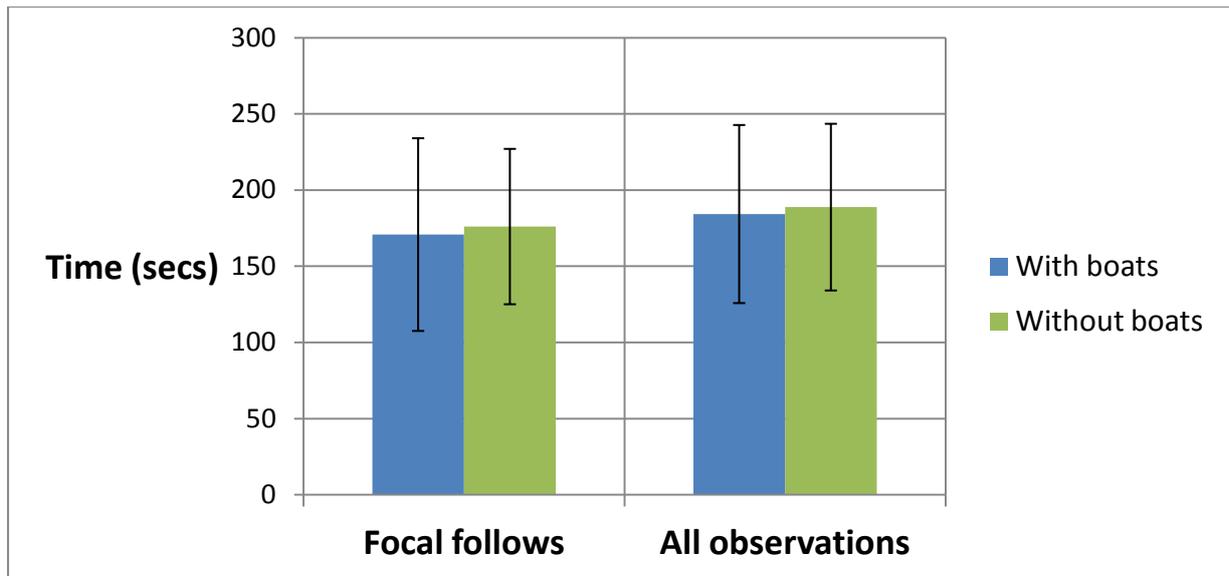


Figure 1b. Average dive duration in the presence and absence of whale-watching boats. Dive times were not significantly different based on both focal follows (p-value = 0.703) and all observations (p-value= 0.829).

This implies that there is no effect of whale-watching on the behavior of gray whales and current regulations may be adequate. It is important to note though that these are preliminary conclusions based on a limited sample size. For example, the interval between respirations within a surfacing were shorter in the presence of boats; this relationship was nearly significant ($p = 0.058$) and may be supported with additional observations. Also, in both study areas the animals were exposed to a near constant level of noise and vessels in close proximity, so that the observed behaviors may reflect a baseline level of stress. Fortunately we did not observe any obvious disturbance of the animals but we know that whales have been harassed and injured by boaters so it is very important to continue monitoring the impacts of vessels on gray whales near these busy ports.

Objective 2: Examine anthropogenic injuries in gray whales from photographs This study used photographs collected for identification of the whales to examine which body regions are susceptible to both natural and anthropogenic injury and determine the most common types of injury to the whales. Photos of 1662 whales were collected from calving grounds in Baja California, Mexico (588 whales), feeding grounds of the Pacific Coast Feeding Aggregation (377 whales), and along the migratory corridor between Southern California, and Northern Alaska (697 whales). Photographs were entered into catalogs for photo ID, and then visually analyzed to determine the body regions and injuries observed. Types of injuries included: scar, wound, rake mark (from attack by Orcas), entanglement, and fluke

(injury on tail that does not fall into another category). Our results indicate scars, rake marks, and fluke injuries represented the most common types of injuries, each occurring in 33%, 7% and 11% of the whales respectively (Table 2).

Table 2: Types and numbers of injuries found on gray whales. Total number of individuals was 1662; ¹fluke photos obtained for 324 individuals.

Injury Type	Number Injured			Total	Percent
	Breeding Ground	PCFA	Migrating		
Scar	130	186	244	560	33.7%
Rake	23	51	42	116	6.98%
Wound	3	5	3	11	0.66%
Fluke	7	22	7	36	11.1% ¹
Entanglement	0	3	1	4	1.23% ¹
None	427	145	408	980	59.0%
Total	588	377	697	1662	-
Percent Injured by Location	27.4%	61.5%	41.5%	41%	-

It is estimated that about 2% of the whales had injuries from anthropogenic sources; 1.23% had evidence of entanglement, and 0.66% had suffered wounds that appear to be from collisions with ships. Interestingly, whales that belong to the Pacific Coast Feeding Aggregation appear to have more injuries than those observed during the migration or in the breeding grounds. These results represent a minimum injury level for the whales as fatalities are not accounted for, and not all regions of the whale's body can be examined. Yet, nearly 9% of the Eastern Pacific population of gray whales was examined in this study (1662 whales out of a population of about 19,000) and this large sample size provides unusual insight into the threats faced by this species. It is important to have such baseline data in order to make informed decisions about the risks faced by gray whales so that effective management strategies can be applied to the stock.

Changes to research plan or objectives

While focusing our efforts on gray whales during their migration, we also recorded other marine mammals that were observed. We have now expanded our focus to investigate all

marine mammal species, with the common goal of assessing human impacts on these animals. This new approach will begin in the summer of 2012 and we expect to continue into the future, including during the winter weekend trips (although grays will still be an emphasis). In addition, I am currently working to develop a new citizen science effort called "whale mAPP", a mobile platform which will allow the general public, trained volunteers, and researchers, to contribute marine mammal sightings to an online, freely accessible database. Once a prototype is available, Earthwatch volunteers will be involved in the testing and use of the program for data entry and analysis. This will also provide a wonderful way for alumni to continue involvement in the project after their trips.

SECTION TWO: Impacts

Partnerships

- PI is an Associate Professor at the University of Redlands.
- UR has been very supportive of our research efforts and students have been key members of the team.

- Our 2011 research contributed to the senior thesis projects of five students. Coastal Ecosystems Research Foundation initiated the original research in British Columbia, which has expanded into this project in Southern California. Three students spent their summer in BC working with CERF and EW, and two of these projects continued during our winter study.
- Cabrillo Aquarium has provided support for our research by allowing us use of their facilities, especially the library where we do data entry and analysis, and Diane Alps, Program Coordinator, has been an active contributor to our research efforts.
- Voyager Expeditions, in Redondo Beach, California is a commercial whale watch company that has been incredibly supportive of our research.
- We are currently collaborating with Cascadia Research Collective on the injury study, and are co-authoring the publication that we are preparing for submission.

Contributions to conventions, agendas, policies, management plans

- **International**

I recently participated in an international meeting of gray whale experts hosted by the Gray Whale Coalition. The meeting was held March 31st-April 1, 2012 in San Francisco, CA and included researchers from the US, Canada, Mexico, and Russia. This was a small meeting (by invitation only) with the goal of sharing results from research efforts throughout the gray whale distribution to assess the current population status.

- **National or regional**

I served on a panel focused on “Data Integration: Marine Mammals and their Ecosystems at the Pacific Life Foundation’s Southern California Marine Mammal Workshop, in Newport, CA, Feb 3-4, 2012.

- **Local**

Our research is conducted off of local whale watch vessels and often the boat captains will announce our presence so we happily answer questions about our research goals and share our knowledge with the general public.

Developing Environmental Leaders

The University of Redlands students who assist on this project have benefitted greatly, both in terms of the additional research effort, but also by gaining experience working in a professional research setting. Volunteers often commented on the poise and maturity of my students. They took on significant responsibilities and leadership roles which greatly

increased their confidence. These students have since graduated and some are working, others traveling and gaining more research experience, and some are pursuing graduate education in marine related fields.

Actions or activities that enhance natural and/or social capital

Conservation of Taxa

- 1) Grey whale, *Eschrichtius robustus*.
- 2) Significance - ecosystem sentinel, wide-ranging coastal migrant provides insight into human disturbances. Culturally significant as considered a "local" species by people in many countries (e.g. Mexico, US, Canada, Russia)
- 3) Conservation status: Blue-listed (British Columbia), Special Concern (COSEWIC Canada), Least Concern (IUCN).
- 4) first great whale to be removed from the Endangered Species List. The question remains though if the population has reached pre-exploitation levels though as the historical population size is debated and the current population estimates are being revised.
- 5) Our impact is in assessing the risks to the population. Our photo-ID catalogue is also contributing to our understanding of stock structure, habitat use, and population size estimates.

Conservation of Habitats

New Marine Protected Areas have been recently established in our study area. As we have been collecting information on habitat use by marine mammal species, this will be useful baseline data to compare with future sightings to help assess the impact of MPAs on marine mammals.

Conservation of Cultural Heritage

Impacting Local Livelihoods

We contribute to the economy of the local community, especially our base in San Pedro, as we stay in a local hotel, eat at local restaurants, and conduct our research from whale watch vessels in the surrounding areas.

Dissemination of research results

Scientific peer-reviewed publications

Grey literature and other dissemination

CONFERENCE PRESENTATIONS:

Stelle, L.L., "Data Integration: Marine Mammals and their Ecosystems. Citizen Science Whale mAPP" (talk and panel participant) *Pacific Life Foundation's Southern California Marine Mammal Workshop*, Newport, CA, Feb 3-4, 2012.

Conner*, L.M., Stelle, L.L., Najera-Hillman, E., Megill, W.M., Calambokidis, J. "Using Photo-ID to Examine Injuries in Eastern Pacific Gray Whales (*Eschrichtius robustus*)" (poster) *Society for Marine Mammalogy 19th Biennial Conference*, Tampa, Florida, Nov. 27-Dec. 2, 2011

Yerkes, M.* , and Stelle, L.L. "The Effects of Whale Watching and Vessel Traffic on Gray Whale (*Eschrichtius robustus*) Behavior" (poster) *Southern California Conference for Undergraduate Research*, Mt. San Antonio College, Nov. 19, 2011.

Stelle, L.L "GIS: A tool for undergraduate student research projects in marine ecology" (talk) *34th Applied Geography Conference*, Redlands, California, Oct. 19-Oct. 21, 2011

Conner, L.** , and Stelle, L.L. "Gray Whale Injuries and Photo-ID: from Baja to B.C." (talk) *Southern California Conference for Undergraduate Research, Pepperdine University*, Nov. 20, 2010

Stelle, L.L., Connor, L.* , Weeks, C.* , Megill, W.M. "Assessing Potential Threats to Gray Whales along their Migratory Path" (poster) *American Cetacean Society, 12th International Conference – Whales 2010: Inspiring a New Decade of Conservation*, Monterey, California, Nov. 12-14, 2010

* undergraduate students involved in the Earthwatch project

INVITED SEMINARS:

American Cetacean Society, Scripps Institution of Oceanography, San Diego, California, June 2011.

"Gray Whales Energetics and Anthropogenic Impacts" Channel Islands National Marine Sanctuary Whale-watch Docent Training Program, Ventura, California, February 2011.

"Gray Whales Energetics and Anthropogenic Impacts" Cabrillo Aquarium Whale-watch Naturalist Training Program, San Pedro, California, January 2011.

"Gray Whales: Feeding, Breeding, and Migratory Energetics"

MEDIA COVERAGE:

OchTamale, Spring/Summer 2011, University of Redlands Alumni Magazine “Biology Professor to Study Human Impacts on Whales”

OUTREACH:

Redlands East Valley High School, Mentone, California, December, 2011 “Gray Whales and Human Impacts” – class presentation to science club

Crossroads Elementary School, Santa Monica, California, April, 2011 Science Day – led activities on mapping and ocean acidification. Invited by Earthwatch board member.

SECTION THREE: Anything else

Acknowledgements

University of Redlands University of Redlands Science Center Summer Research Program
Coastal Ecosystems Research Foundation Cabrillo Marine Aquarium Diane Alps
Bernardo Alps Voyager Expeditions 22nd street Landing whale watch Cascadia Research
Collective