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Marine Mammal Institute

2017

Another Successful Year...and More to Come

A message from Marine Mammal Institute Director Bruce Mate

Marine Mammal Institute (MMI) faculty, staff, and students have done such a great job this year that I must remind myself that their "usual" performance standard is exceptional! Students that you have read about in previous newsletters have been graduating and moving into responsible positions. The collective research contributions of MMI colleagues have revealed important aspects of behavior, distribution, and the history of exploitation of marine mammals that get extrapolated into strong conservation and management advice.

A few of the subjects studied this year at MMI include gray whale observations off Oregon; blue whales in New Zealand in an area of mineral extraction; tagging of blue, fin, and humpback whales off California and Hawaii looking to better understand the impacts of Naval operations; sperm whale behavior after the Deepwater Horizon spill; using genetic material from the bones of dead Antarctic whales harvested a century ago to understand the consequences of a 95% harvest; rare dolphins in the South Pacific and the Falkland Islands; responses to Naval sonar activities; harbor seals along the Oregon coast in low oxygen areas; and a variety of marine birds (Leigh Torres and her team also study birds). You'll read about more in this year's newsletter. The research requires patience and diligence, which sets a professional pattern of meaningful science careers. Indeed, MMI's "business as usual" still amazes me.

Above: A gray whale rises to the water's surface in a kelp patch near the GEMM Lab research vessel, off Newport, Oregon. Drone image captured by Todd Chandler under NOAA/NMFS permit #16111.

Oregon State University

Guiding MMI's future

Whether in business or academics, it is essential to have succession plans and it is time to initiate the MMI leadership plan. Yes, I am going to retire from the director position while I am still in good health and can facilitate a smooth transition for a new director. I will continue half-time to help raise MMI funds for greater programmatic stability and additional research grants. Mary Lou and I plan relaxing travel to national parks and will continue to offer some natural history trips, like the Baja Gray Whale Expedition (which still has a few spaces left for 26 February to 6 March 2018) and others that may interest you as well.

I am pleased to tell you that the College of Agricultural Sciences (CAS) is doubling its support of the MMI Director position, so that with MMI funds, the new Director will only need to support 25% of their time with research grant funding. The position is being advertised internationally and will attract talented people.

Supporting new faculty

CAS is also stepping up its support of new and existing MMI faculty positions. We also hope to see some added support for those faculty who want to teach, perhaps with Marine Studies teaching funds for undergraduate and graduate courses to be taught at the Hatfield Marine Science Center. If all goes as hoped, MMI faculty will have 75% of their annual appointment supported on tenure-track and 25% self-generated from grant funding. This model will make MMI positions similar to campus appointments, more attractive to the world's top talent, and more stable for a full career development path. Two of our faculty have moved to other institutions in the last two years due to more secure funding formulas. We will be advertising to replace these positions early in 2018.

Supporting marine conservation

I sincerely hope that you will continue to support the new MMI leadership. You know where my passions lie, but it is often difficult to "read" someone else's interests. In mid-December, Larry and Dena Brown called. For 10 years, Larry has contributed communication headsets from his business that allow the whale "tagger" at the boat's bow to tell the boat driver about the whale's underwater position without turning around to yell directions and thus lose visual contact with the whale.

Marine Mammal Institute Director Bruce Mate on the Baja Gray Whale Expedition. Photo courtesy of Betsy Hartley.

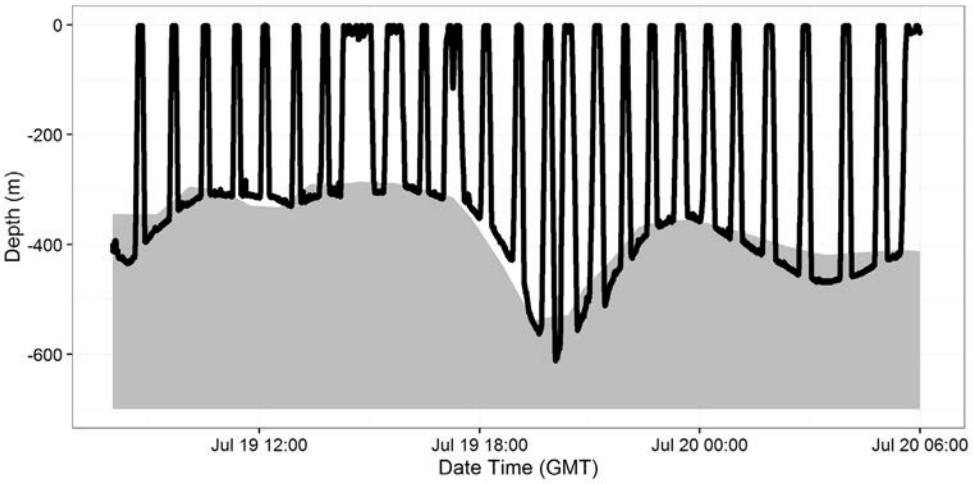
I had never asked the Browns if they had other interests in helping MMI meet our goals, but fortunately they read the MMI newsletter and knew we still didn't have any MMI scholarships despite a very good leveraging situation with the graduate school to create such endowments. The Browns called to offer a very generous gift to start one of those endowments. After talking and sending them details about the opportunity, they called back to more than double their original gift. What a joy! Their gift was completed within two weeks and is now the very first endowed graduate fellowship for MMI, which will fund one student each year — in perpetuity! WOW, we are so grateful!

If you are thinking about some aspect of MMI's research, education, or outreach mission that you would like to help with an outright gift, estate planning, or a long-term endowment, please call or write to begin a conversation that will positively affect the lives of students and improve marine conservation. MMI will continue to keep you posted as we further evolve the institute that develops people, science, and an improved future. If you are interested in more details about MMI research, please send your email address to me at **bruce.mate@oregonstate.edu** to receive occasional updates. You may also download specific reprints of scientific papers by going to the Publications tab on the MMI website, **mmi.oregonstate.edu**.

New Insights into the Diving Behavior of Sperm Whales

Ladd Irvine MSc, Daniel Palacios PhD, and Bruce Mate PhD
Whale Telemetry Group

New research from the Whale Telemetry Group examined sperm whale diving behavior over periods up to 35 days. The work used Advanced Dive Behavior tags, a data logger developed by the Whale Telemetry Group in collaboration with Wildlife Computers, which can record dive depth every second while collecting GPS locations. The relatively long attachment duration of the tags allowed for a detailed categorization of different dive types, where they occurred, and how the proportion of each dive type changed over time and from whale to whale.



A 17-hr portion of a dive profile from an Advanced Dive Behavior–tagged sperm whale in the Gulf of California (black line). The gray area shows the depth of the seafloor at the location of each dive. The dive profile appears to show the whale following the contour of the bottom during 17 consecutive deep dives.

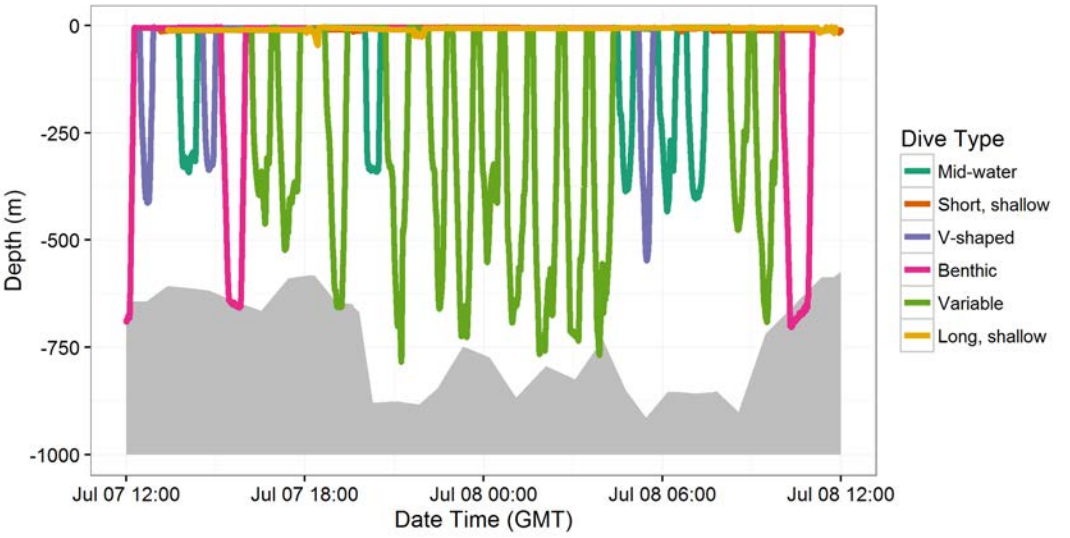
The sperm whales were tagged in the central Gulf of California, Mexico, near Isla San Pedro Martir. In that region, sperm whales are known to feed on Humboldt squid, a cousin of the giant squid, which can grow to a length exceeding six feet. During the tracking period, tagged whales spent almost 30% of their time at the surface. Gulf of California sperm whales form large, stable, social groups, so much of that time is likely related to social activity between whales. Dives were usually from 300 to 400 m deep, but the deepest recorded dive was 1501 m (a mile deep!) and the longest recorded dive was 77 minutes in duration!

All the recorded dives were grouped into similar types based on descriptive characteristics like dive depth, duration, distance to the sea floor, etc. resulting in a total of six identified dive types: two "shallow" types (<30 m depth) and four "deep" types (>290 m). Shallow dive types of short and long duration occurred when the whales dove to depths <30 m for an average of 2.3 and 11.0 minutes, respectively. Both dive types are likely related to resting or socializing behavior. The four "deep" dive types (V-shaped, mid-water, benthic, and variable) are likely related to foraging and represented almost 75% of all dives made by the tagged whales.

Mid-water dives were the most common type made by tagged whales and were an average depth of 340 m deep with a general U-shaped profile. Other research has indicated sperm whales may preferentially feed on Humboldt squid in the Oxygen Minimum Zone, a region of low dissolved oxygen in the water column that starts at a depth of approximately 250–300 m. The squid are able to function and even feed in this low oxygen environment, but it may make them more sluggish and therefore easier for sperm whales to catch. Dives classified as mid-water in this paper appear to represent this behavior, while V-shaped dives — where whales descended to an average depth of 290 m, then quickly returned to the surface — are likely exploratory dives where the whale is searching for prey.

Tagged whales dove to, and in some cases appeared to follow, the seafloor (benthic dives) across multiple consecutive dives. This is especially interesting because sperm whales have been reported diving to the seafloor, but it wasn't known to be a common occurrence. Almost 22% of the dives made by one tagged whale were benthic dives, which suggests that it is not only more common than previously believed but that the whales are likely foraging along the seafloor during those dives. It is unclear whether the whales were looking for their usual prey (Humboldt squid), which just happened to be on the sea floor, or whether they were looking for a different type of prey. Sperm whales in other parts of the world will eat large, bottom-dwelling fish like black cod off fishermen's longline gear, so it is possible that the benthic dives represent the whales looking for an alternative to their usual prey.

During the study, three whales from the same social group were tagged and tracked as they moved together (never more than 1 km from each other) for 2.5 days. This is the first time multiple sperm whales from the same social group were tracked for an extended period of time. While their surface movements were very synchronous, their diving behavior was very different, with whales staggering both the start time and depth of their dives. This was somewhat surprising because other highly social marine mammals (e.g., dolphins) have been shown to dive together and feed cooperatively, working together to herd and concentrate prey before feeding. Members of sperm whale social groups that have young calves are known to take turns staying at the surface with them while others dive, in what is presumed to be a form of "babysitting." Two calves were present in the social group when these whales were tagged, so it is possible the staggered diving is the result of the tagged whales staying with calves at the surface.



A 24-hr portion of a sperm whale depth profile collected by an ADB tag. Dives are colored to correspond to one of six identified dive types. The seafloor depth nearest to each dive location is represented by a gray polygon.

The ability to differentiate between different dive types and infer their behavior (feeding, resting/socializing) allowed for the creation of a sperm whale "activity budget," which documents the proportion of time an animal allocates to different activities. How an animal spends its time is one of the more basic measures an ecologist can use to better understand the behavior of an animal. For example, if a population spends all its time foraging, that might indicate it is food-limited and potentially at risk. Our finding that sperm whales in the Gulf of California spend about 30% of their time at the surface resting and socializing suggests that this population had plentiful food resources during the study. Such information has been poorly understood for sperm whales and typically based off of the ability to monitor individuals for less than a day. Thus, the results of this study are a major step forward in the understanding of basic sperm whale ecology that will have applications to populations in other parts of the world.

Irvine, L., Palacios, D.M., Urbán, J., Mate, B., 2017. Sperm whale dive behavior characteristics derived from intermediate-duration archival tag data. Ecology and Evolution 258, 291–16. doi:10.1002/ece3.3322

REU intern measures whether whales drift with the ocean's currents

Ryan Case

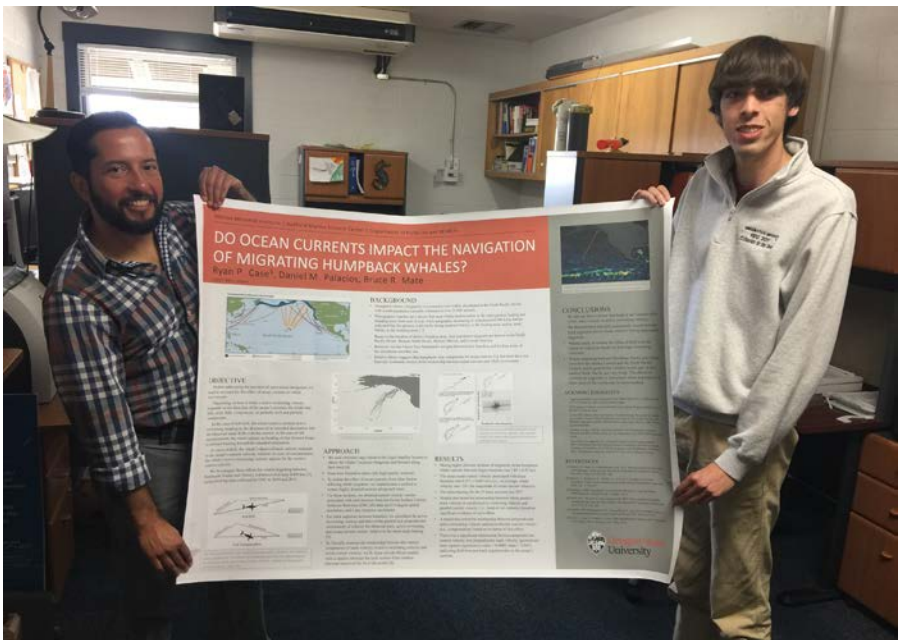
This summer I got the incredible opportunity to work as an undergraduate intern with Dr. Daniel Palacios in the Whale Telemetry Group (WTG). I am a computer science major and math minor at the University of Oregon. I got to work with the WTG through the National Science Foundation–funded Research Experience for Undergraduates (REU) program. I applied for this program because I had an urge to apply my computer programming and math skills to interesting problems in the sciences.

I began the summer with an interest in how humpback whales are able to navigate during their seasonal migrations. Some populations migrate through the open ocean, where there are no obvious visual cues. How are humpbacks able to find their way along these long migration routes? It is possible that they use the sun's position, the stars in the night sky, or even the earth's magnetic field to help orient themselves. With the aid of the WTG's humpback satellite locations, I wanted to use computational methods to see if humpback movement is consistent with any of these hypotheses about how whales navigate.

Science doesn't always take you where you expect it to. I realized that to understand how humpbacks were navigating, I would first need to know if the whales drift with the ocean's currents during migration and account for this appropriately. Addressing this question allowed me to use my programming

skills and taught me a lot about how to practically apply statistical methods.

Before this program I had very little experience with whales, or even the broader field of ocean sciences. By the end of the summer I felt like I had a solid footing in the field. I learned so much, both about humpback whales and about how to formulate a scientific question and implement an answer to that question. Throughout the summer I learned how to work with the satellite locations, and how to find and process environmental data like geomagnetism and ocean current speeds at these locations. To cap the experience off, I even got the chance to help the WTG on one of their trips to tag humpback whales off of the Oregon Coast. In my future research I plan to return to the question of how humpbacks navigate, now that I have a solid understanding of how the they are affected by the currents.



Dr. Daniel Palacios, left, and REU intern Ryan Case, right, show off their poster describing the results of Ryan's summer research project, "Do Ocean Currents Impact the Navigation of Migrating Humpback Whales?"

Put a Whale on Your Tail!

Oregonians may now purchase vouchers for a new license plate featuring a gray whale and her calf, with proceeds going to support the Oregon State University Marine Mammal Institute.

The voucher can be purchased for $40 through the Marine Mammal Institute at **www.whaleplate.com**. Once 3,000 vouchers have been sold, the Oregon Department of Motor Vehicles will begin manufacturing the plates. The OSU Marine Mammal Institute will receive $35 for each pair of license plates sold. Funds raised will directly support whale research, graduate student education and public outreach.

The gray whale and calf image featured on the "Coastal Playground" plate was created by well-known wildlife illustrator Pieter Folkens.

How to Get Your Plates

It's easy to reserve your Oregon gray whale license plates:

- Go to **www.whaleplate.com** to purchase a voucher online for yourself — or as a gift for someone else!
- Once 3,000 vouchers are sold, the Oregon DMV will begin the plate production process, which takes several months.
- Hold onto your voucher! The MMI will notify you when it is time to exchange your voucher for your new whale plates at the DMV.

*Additional DMV registration and plate fees apply. Please read the FAQ at **www.whaleplate.com** for details.*

Dolphins on Opposite Sides of the World

Scott Baker, PhD, Cetacean Conservation and Genomics Laboratory

A new look at the critically endangered Māui dolphins of New Zealand

The advent of Unmanned Aerial Vehicle (UAV, or drones) is changing the way we view wildlife. Like our colleague Leigh Torres, we are finding new applications for this technology, particularly in our efforts to better describe the abundance and distribution of the critically endangered Māui dolphins (see "Using DNA to Count the World's Rarest Dolphin," in the 2016 MMI newsletter).

Māui dolphins *(Cephalorhynchus hectori maui)* are concentrated during summer months in near-shore waters along the west coast of New Zealand's North Island. The population is thought to have suffered a severe decline due to fisheries-related mortality. Previously, we developed a collaborative research partnership with the University of Auckland and the Department of Conservation to estimate the abundance of Māui using "DNA profiling" for individual identification. For this objective, vessel surveys, dedicated to the collection of biopsy samples, were conducted in the known range of Māui dolphins during the austral summers of 2010 and 2011 and again in 2015 and 2016. The results of the 2015–16 surveys have now been reported to DOC, providing an updated estimate of about 63 individuals. When compared with the previous estimate of 55 in 2010-11, this small increase in the estimated abundance is encouraging but confirms the precariously small size of this population.

An encounter with Māui dolphins as viewed by an Unmanned Aerial Vehicle (UAV, or drone) off the west coast of the North Island of New Zealand. Courtesy of the Harbers Family Foundation and Steve Hathaway.

Although the primary objective of our previous surveys was the collection of biopsy samples, we have also collected photographs for individual identification using natural markings (photo-identification). Unlike DNA profiling, however, not all Māui dolphins can be individually identified by natural markings. Many dolphins lack any conspicuous nicks or scars on the trailing edges of their dorsal fins. Now, with improvements in digital photography, the potential to identify more individuals has increased. To take advantage of these improvements, we have developed a partnership with Renee and Brigitte Harbers of the Harbers Family Foundation, a non-profit committed to the visual arts in service of conservation (https://www.harbersfoundation.org/harbers-foundation/).

With support from the Foundation, we completed 11 surveys of Māui dolphin habitat in February. The primary objective was to extend the photo-identification effort using professional-quality cameras. As previously, these photographs will be compared for matches to the "distinctively marked" individuals in the public catalog held by the University of Auckland and integrated into an update of the catalog. We will also use the photographs to identify a minimum number of recognizably marked individuals. This approach does not require that markings are sufficient for identification between years ("recapture"), only that a minimum census of individuals can be documented for a given survey period.

In keeping with the broader objective of using advances in digital technology for improved monitoring of Māui dolphins, we also worked with local filmmaker, Steve Hathaway, to collect high-definition (HD) video using a small UAV. The specific objectives of the drone filming were to improve estimates of group size and to better understand the use of the surf-break habitat.

We are now sorting through thousands of digital images from the still cameras and several hours of HD video from the drone. The initial results are very exciting. We have already resighted a number of the distinctively marked individuals from the existing catalog, and the drone video is giving us a new insight into the group size and behavior around the boat. Over the next few months, we will continue to sift through the new images adding to our long-term monitoring of this rarest of dolphins.

A first look at dolphins of the kelp in the Falkland Islands

Halfway around the world from New Zealand, the Falkland Islands, located 300 miles (480 km) east of Argentina's southern Patagonian coast, at a latitude of about 52°S, are home to two species of inshore dolphins, the Commerson's *(Cephalorhynchus commersonii),* a close relative of New Zealand's Hector's and Māui dolphins, and Peale's *(Lagenorhynchus australis)* dolphins. The islands are an unusual habitat for a community of small dolphins, given their high latitude and distance from con-specific populations on the South American continent. Yet, both species appear to be island residents and are observed year-round foraging in the dense kelp forests within a few hundred meters of shore. The apparent preference for foraging in the kelp forests suggests an ecological specialization not observed in continental populations of Commerson's dolphins.

Together with the geographic isolation of the Falkland Islands, the potential for ecological specialization provides a "natural experiment" in understanding the evolutionary trajectory of dolphin populations as they differentiate into subspecies and then diverge into species. Two subspecies of Commerson's are recognized: *C. c. commersonii* along the Argentine coastline of South America and *C. c. kerguelenensis* in the Kerguelen Islands in the Indian Ocean. The population found around the Falkland Islands is currently assumed to represent *C. c. commersonii,* but there has been no collection of genetic samples or survey of morphological evidence to consider an alternate subspecies classification. There are no published descriptions of the genetic structure of Peale's dolphins from the Falkland Islands or from the South American continent, but this species is more pelagic in distribution and thus more likely to remain connected across its range.

Commerson's dolphins foraging and socializing in the near-shore kelp forests of the Falkland Islands.

The Falkland Islands are also unusual in having no history of inshore fisheries. Consequently, there is no history of fisheries-related mortality (bycatch) that threatens coastal dolphins in other parts of the world (for example, Hector's and Māui dolphins around New Zealand). The Commerson's and Peale's dolphins around the Falklands have also been spared the destructive hunting experienced by populations in the Strait of Magellan and around Tierra del Fuego, where the dolphin meat is used as bait in crab traps. Recent vessel-based and aerial surveys have confirmed an abundance of both species in the inshore waters. Although there are no known threats to dolphins around the Falkland Islands currently, this could change with planned development of inshore aquaculture, a deep-water port, and potential near-shore transhipment of oil from newly discovered offshore petroleum fields.

In January, I flew to the Falkland Islands via Santiago, Chile, to join a team of researchers from the South Atlantic Environmental Research Institute (SAERI, http://south-atlantic-research.org/). SAERI's mission is to support and conduct world-class scientific research by its local staff and through international collaboration. A recent pan-American symposium on science in the South Atlantic that I attended reviewed research opportunities for SAERI and management needs for the Falkland Islands, including the genetic monitoring of the Commerson's and Peale's dolphins. The need for basic research on these species is also recognized in the *Falkland Islands Species Action Plan for Cetaceans* by the Environmental Planning Department of the Falklands and by the International Union for the Conservation of Nature (IUCN), which considers both species "Data Deficient."

With funding from the Waitt Foundation/National Geographic Society and the UK Darwin+ Award, our objectives were to survey coastal waters and collect genetic samples from the two species. We were an eclectic crew, including one Italian, one Colombian, and one local, but all committed to a better understanding of the marine biodiversity of this poorly studied region of the world.

Now back in the Cetacean Conservation and Genomic Laboratory, we are using these samples to provide the first description of the genetic diversity and population structure of Commerson's and Peale's dolphin from the Falkland Islands. The research is a natural extension of our previous research on the evolutionary origins of Commerson's, in relation to the Māui and Hector's dolphins, and the local community structure of coastal dolphins around the Southern Hemisphere.

Putting Our Science to Work for Conservation and Education

Leigh Torres, PhD, Geospatial Ecology of Marine Megafauna Laboratory (GEMM Lab)

Documentation and impact of a new blue whale population

It's not every day that a new blue whale population is documented. Yet, the GEMM Lab has done just this. Over four years, Dr. Leigh Torres has a led a multidisciplinary and highly collaborative study in New Zealand, which has led to not only the documentation of a new foraging ground, but a whole new population of blue whales.

Based on this research and recent analysis, we now know that these blue whales are genetically distinct from other blue whale populations, are present year-round in New Zealand waters, and use the South Taranaki Bight (STB; the region between the North and South islands) for foraging, breeding, and nursing.

These findings have gone straight from discovery to management. The same day the research vessel docked in Wellington after a three-week research survey, Dr. Torres testified at a NZ Environmental Protection Authority (EPA) hearing regarding a seabed mining permit application in the STB. The GEMM Lab's research was pivotal in the EPA's deliberations, and Dr. Torres testified repeatedly on recent findings and their implications.

A drone piloted by GEMM Lab's Todd Chandler captures the moment a blue whale in New Zealand begins a surface lunge feeding event and its krill prey try to leap away.

The discovery of this NZ blue whale population also caught the attention of the New Zealand people and politicians. In August 2017, the NZ Green Party proposed a marine mammal sanctuary in the STB to protect blue whales from on-going oil and gas exploration and extraction, seabed mining, and vessel traffic. The reach of the GEMM Lab's pioneering research on blue whales in NZ has also been global, as their drone video of a lunge-feeding blue whale went viral, with over two million views. (See the OSU press release at http://bit.ly/2oKGMAh.)

A blue whale surfaces in front of an offshore oil and gas production and processing vessel in the South Taranaki Bight, New Zealand. Photo captured by Dawn Barlow.

The GEMM Lab plans to expand their research on NZ blue whales to an assessment of impacts by industrial activities on their behavior, energetics, and health. This work will continue to influence management decisions and ecological understanding of whales around the world.

The master's thesis of OSU MMI graduate student Dawn Barlow focuses on this project. This research is conducted collaboratively with Cornell University's Bioacoustics Research Program and MMI's Cetacean Conservation and Genomics Laboratory and is supported by the Aotearoa Foundation, New Zealand Department of Conservation, MMI, and others.

Inspiring the next generation of marine scientists

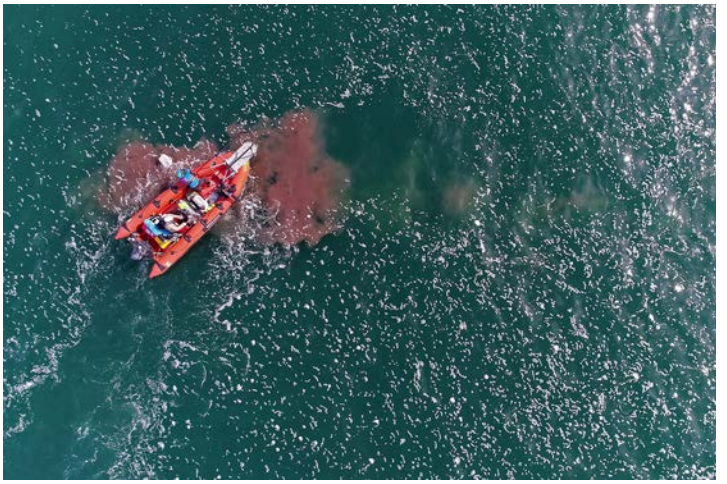
How do we get communities engaged and young students interested in marine research? The GEMM Lab tackled this issue head on this summer by incorporating two local high school students into our ongoing research program on gray whale ecology in Port Orford, Oregon. The project also gave an OSU undergrad the opportunity to participate in research and gain leadership experience by training the high school interns.

This summer was our third year conducting research in the close-knit, small, rural town of Port Orford, where we tracked

whales from a cliff-top location using a theodolite while simultaneously using a research kayak to collect data on zooplankton prey. We want to extend our research into the community and evaluate this effort. The students were engaged in all aspects of the research, including data collection using theodolites, cameras, computers, GoPros, zooplankton sampling gear, GPS, a time-depth recorder, a secchi disk, and the research kayak. Through this internship, students learned scientific methodology, ecological principals, quantitative data analysis methods, and science communication skills by contributing to the GEMM Lab blog and delivery of a community presentation at the Port Orford Field Station about the project and results. This presentation was a huge success as the students enthusiastically presented to a packed house, demonstrating their passion, knowledge, and bright futures. As part of the program's evaluation, each student was asked, "What impact has this experience had on you?" Their answers demonstrate the success of the program: "Completely changed my view of research in the field. I love it." "It has taught me how to work in the field and on a real research team."

Quince Nye and Nathan Malamud, high school interns in the GEMM Lab summer gray whale research program, deliver their project presentation to the Port Orford community. Photo by Alexa Kownacki.

This project was co-led by recent OSU MMI graduate, Florence Sullivan. This program was funded by Oregon Sea Grant, The Oregon Coast STEM-Hub, MMI, and the Port Orford Field Station.



The GEMM Lab team collects a gray whale fecal sample off the Oregon coast from the R/V *Ruby* using two dip nets.

Identifying the health of whales

Boo! When you are startled by a noise you may have a behavioral reaction (jump) and a physiological reaction (heart racing). Scientists have often studied the behavioral response of whales to disturbance events like noise or vessels, but what about the physiological impacts and, ultimately, the health consequences? The GEMM Lab is pioneering efforts to assess the impacts of disturbance on the health of whales through two innovative methods: analysis of stress hormones in their fecal matter (poop) and quantification of their body condition through drone-based photogrammetry (are they fat and happy?).

Busy and successful field seasons in 2016 and 2017 along the Oregon coast with subsequent data analysis have enabled the GEMM Lab to provide the first description of gray whale hormone variation, determining normal stress and reproductive hormone cycles. Additionally, the GEMM Lab has developed novel and robust photogrammetry methods to accurately and objectively measure a whale's body condition. We are now able to describe the normal, healthy hormone levels and body condition of gray whales, allowing us to detect stressed and unhealthy whales. With this information, we will be able to link disturbance events to whale health in order to determine thresholds of human activities and inform management efforts.

The PhD thesis of OSU MMI graduate student Leila Lemos focuses on this project. This research is conducted collaboratively with the NOAA Pacific Marine Environmental Laboratory (NOAA/PMEL) group and is funded by NOAA's Ocean Acoustics Program.

How They Roll: Feeding Strategies, Pregnancy Rates in Whales

Ari Friedlaender, PhD, Biotelemetry and Behavioral Ecology Laboratory

Feeding strategies in blue whales

Ari Friedlaender

One of the more exciting research findings from our lab this year came from a study of the foraging behavior of blue whales. Lateralized behaviors benefit individuals by increasing task efficiency, providing indirect fitness benefits in foraging and anti-predator behaviors. The conventional lateralization paradigm suggests individuals are left or right lateralized, although the direction of this laterality can vary for different tasks (e.g. foraging or predator inspection/avoidance). By fitting tri-axial movement sensors to blue whales *(Balaenoptera musculus),* and recording the direction and size of rolls during lunge feeding events, we show how these animals differ from such a paradigm. The strength and direction of individuals' lateralization was related to where and how the whales were feeding in the water column. Smaller rolls (≤180˚) predominantly occurred at depth (>70 m), with whales being more likely to rotate clockwise around their longest axis (right lateralized). Larger rolls (>180˚), conversely, occurred more often at shallower depths (<70 m) and were more likely to be performed anti-clockwise (left lateralized). More acrobatic rolls are typically used to target small, less dense krill patches near the water's surface, and we posit that the specialization of lateralized feeding strategies may enhance foraging efficiency in environments with heterogeneous prey distributions. This work is published in the forthcoming issue of *Current Biology*. A.S. Friedlaender, J. E. Herbert-Read, E.L. Hazen, D.E. Cade, J. Calambokidis, B.L. Southall, A.K. Stimpert, and J.A. Goldbogen. In Press. Context dependent lateralized feeding strategies in blue whales. *Current Biology*.

Artist's rendering of two lunge feeding strategies from side-on orientation (i.e. X-Z plane); barrel and side rolls. Top schematic shows left-sided barrel roll where whale rotates 360˚ during prey capture. Bottom graphic shows right-sided roll, where whale rotates <180˚. Estimated angle of visual range is shown as white cone. During the left-side roll, the whale's right eye maintains visual contact (or direction) with prey until the lunge occurs.

Logan Pallin successfully defends master's thesis in May

Logan Pallin

I began my master's degree in fall 2015 working with Dr. Ari Friedlaender in the MMI and just recently completed my master's degree in May 2017. While a student in the MMI, I aimed to assess the variation in the population demographics of humpback whales around the Western Antarctic Peninsula (WAP), a region currently experiencing rapid environmental change. Humpback whales that forage along the WAP are recovering from the effects of extensive commercial whaling that took place during the 20th century. During my studies, I worked on an extensive data set of archived biopsy samples from roughly 500 individual humpback whales where I assessed key demographic parameters such as population sex ratios and pregnancy rates. I found some fascinating results: the WAP population of humpbacks was characterized as having a high (63.5%) average proportion of pregnant females combined with an observed high proportion of annually pregnant females (being both pregnant and nursing a calf simultaneously), both of which are being consistent with a population in full recovery from past over-harvest.

As I reflect on my time as a student in the MMI at Oregon State University, I realized I conducted some fascinating research, surrounded by some of the experts in the field. Prior to starting

my degree where I looked at the demographics of humpback whales in the Antarctic, I never thought I would find myself boating around in Antarctic waters, let alone grinding up blubber on a daily basis to look for pregnancy hormones. What stands out to me the most from the past two years has been the MMI, its faculty's never-ending support, and their development of an astounding intellectually stimulating graduate experience and environment. Even after I completed my degree, I had the pleasure of staying on as a research technician for the summer of 2017 working with Dr. Scott Baker and the Cetacean Conservation and Genomics Lab isolating nuclear and mitochondrial DNA from whale snot. I also worked with Dr. Bruce Mate and the Whale Telemetry Group to look at pregnancy within their tagged whales and how this may have related to specific migratory behaviors observed by the tags. All of the research outcomes as well as the great learning experiences would likely not have happened had I not had the support of the MMI faculty and staff. Thanks to everyone!

Graduate student Logan Pallin guides the boat driver to retrieve a recently collected biopsy sample in Antarctic waters. Photo by Drew Spacht.

Leptospirosis Is Taking Its Toll on California Sea Lions

Jim Rice, Coordinator, Oregon Marine Mammal Stranding Network

As the old adage goes, "it's déjà vu all over again." The Oregon Marine Mammal Stranding Network hotline has been very busy since early September. California sea lions *(Zalophus californianus)* are once again appearing on Oregon beaches in poor health, reflecting a renewed cyclical outbreak of leptospirosis, a contagious disease that infects the kidneys and is caused by the spirochete bacterium *Leptospira interrogans*.

Leptospirosis commonly affects California sea lions during the autumn months, and epizootics along the Pacific coast of North America are generally known to occur every 3–5 years (primarily in California). The last outbreak to happen in Oregon occurred in 2009 and 2010. Both of those years were marked by an extraordinary number of California sea lion strandings, most of which were confirmed mortalities. During each of those years, we documented approximately 350 strandings, a more than three-fold increase over the average rate of 110 strandings of that species during non-outbreak years.

Clinical signs of leptospirosis include extreme lethargy, dehydration, weight loss, reluctance to use the hind flippers, vomiting, and muscle tremors. The infection typically results in death by acute renal failure and severe bronchopneumonia.

It is currently believed that some California sea lions function as reservoir hosts for *Leptospira,* with many animals serving as asymptomatic chronic carriers of the organism, shedding it in their urine and maintaining a persistent circulation of the pathogen in the sea lion population. Although it is unclear what factors serve as drivers for specific disease outbreaks, it appears that environmental conditions are thought to play a role. Epidemiological researchers at the University of California, Los Angeles (Drs. Jamie Lloyd-Smith and Katie Prager) are striving to solve this mystery, and tissue samples we collect from stranded Oregon sea lions may help provide them with some answers.

As of this writing, October 18 2017, the Oregon Marine Mammal Stranding Network is receiving reports of between 1 and 5 novel cases of sick or dead sea lions per day. If past outbreaks are predictive, we can expect this trend to continue through the end of the year.

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