Profiling Sperm Whales

Cetacean Conservation and Genomics Laboratory (CCGL)

Scott Baker PhD, Professor; Kelly Lizewski; and Debbie Steel MS

A growing number of large-scale, long-term studies of whales and other marine megafauna (such as sharks and turtles) have collected records linked through individual identification photographs to genetic samples and telemetry tracks. DNA profiles and photo-identification records are increasingly used for defining populations for management purposes and for estimating abundance and trends using capture-recapture models.

The skin and blubber biopsy samples collected for genetic analyses are also used for a growing number of ecological markers (for example, stable isotopes and fatty acids) and environmental contaminants (like persistent organic pollutants and heavy metals). Together, these datasets provide the potential for long-term monitoring of cetacean populations, especially those exposed to human disturbance.

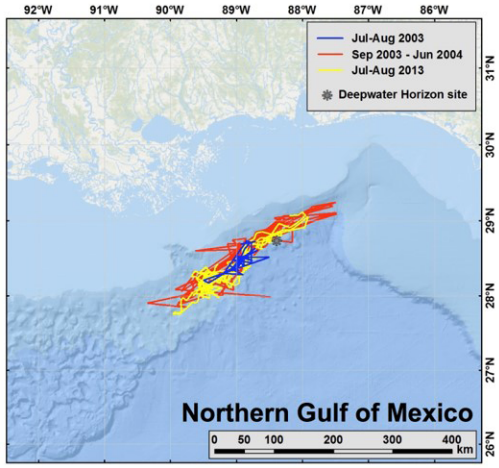
Sperm whales in the Gulf of Mexico have been the subject of several such studies over the last two decades, including collections of both fluke photographs for individual identification and biopsy samples for genetic analyses. It is a population of concern given its genetic isolation and exposure to industrial development and disasters, including the *Deepwater Horizon*, considered to be the largest marine oil spill in history.

The Whale Habitat Ecology and Telemetry Laboratory (WHET Lab) has been an active contributor to these studies, collecting both fluke photographs and biopsy samples, while focusing on satellite tagging and tracking of individual whales.

With this as a starting point, we in the Cetacean Conservation and Genomic Laboratory have identified and contacted other dataholders from past studies and secured their agreement to coordinate and integrate data using the open-source software platform, *Flukebook* (**wildme.org**).

Above: Sperm whales in the Gulf of Mexico are at risk of impact from increasing industrial development. Photo by Craig Hayslip.

		Year	Sex	mt DNA	Microsatellites													
					EV1		EV5		EV94		SW13		SW19		FCB1		GATA417	
1	SWSS1081406	2001	F	X	123	133	155	159	202	202	160	160	124	132	121	125	182	182
	OSU11GMX05	2011	F	X	123	133	155	159	202	202	160	160	124	132	121	125	182	182
2	SWSS2082304	2002	F	X	123	123	155	155	206	220	162	166	97	128	121	131	170	182
	OSU11GMX06	2011	F	X	123	123	155	155	206	220	162	166	97	128	121	131	170	182
3	SWSS1081801	2001	F	Y	123	123	159	167	212	226	162	164	122	128	121	129	182	186
	SWSS3070501	2003	F	NA	123	123	159	167	212	226	162	164	122	128	121	129	182	186
	OSU13GMX01	2013	F	Y	123	123	NA	NA	212	226	162	164	122	128	121	129	182	186
4	SWSS2070702	2002	F	X	123	123	155	155	202	204	162	170	97	166	121	121	170	182
	OSU11GMX14	2011	F	X	123	123	155	155	NA	NA	162	170	97	97	121	121	170	182



DNA profiles, photo-identification and satellite telemetry tracks of the female, SWSS3070501, tagged in 2003 (361 days total) and again in 2013 (42 days total)

We are now working with the software developers to enhance current functionality for both automated matching of fluke photographs and processing of genomic markers for individual identification and population analyses. Last year, we facilitated a virtual workshop among primary data holders to discuss the need for archiving and integrated software solutions to the long-term study of this population. This project is intended as a demonstration of developing standards for other long-term studies of cetacean populations relevant to the Bureau of Ocean Energy Management (BOEM).

The preliminary results of this synthesis have been promising. As part of her PhD at OSU, Alana Alexander, now at the University of Otago, used a standard DNA profile developed by Dan Engelhaupt for samples collected during the Sperm Whale Seismic Study (SWSS) from 2000 to 2005. These profiles included sequences of mitochondrial DNA (mtDNA haplotypes) for identification of maternal lineages, microsatellite genotypes for individual identification, and a molecular marker for sex. Alana was first able to compare the frequencies of mtDNA haplotypes from the SWSS project and the OSU WHET Lab to her worldwide survey, confirming the isolation and very low diversity of the sperm whales in the Gulf of Mexico. Such low diversity is characteristic of sperm whales in other inland seas, such as the Mediterranean.

We were then able to compare the DNA profiles from SWSS with those from biopsy samples collected by the WHET Lab from 2011 to 2013. From an initial comparison, four matching DNA profiles were found between SWSS and the OSU project. One female was first sampled during SWSS in 2001 and tracked by satellite telemetry in 2003 and again in 2013. A review of associated records showed that she was also photo-identified in 2003 and 2013, but the 2001 encounter was only identified from the DNA profile.

With this initial success at integrating DNA profiles, photo-identification, and satellite telemetry, we feel that we are just scratching the surface of the information available for this population.

With funding from BOEM, through the Cooperative Ecosystem Studies Units, we will work with our collaborators over the next year to preserve these invaluable records and to make them accessible for long-term monitoring of this vulnerable population. ***MMI***

AN UNCERTAIN FUTURE FOR NEW ZEALAND'S MĀUI DOLPHINS

Debbie Steel and Scott Baker

The New Zealand endemic Māui dolphin is thought to be the rarest dolphin in the world. In an ongoing effort to improve estimates of trends in this critically endangered subspecies, the CCGL has been working with the New Zealand Department of Conservation and Dr. Rochelle Constantine at the University of Auckland to estimate abundance using DNA profiling for individual identification (see 2020 newsletter).

Earlier this year, a team of rangers and researchers collected 34 small biopsy samples during boat-based surveys off the west coast of New Zealand's North Island. This field effort completes the second year of the most recent two-year survey, following up from previously conducted surveys. DNA profiling of the 34 biopsy samples identified 24 individuals, 13 of which had also been sampled during the 2020 survey.

Using this recapture information, we estimate that only 54 individuals over one year of age were alive at some point during the two survey years. This is lower than the estimate of 63 individuals from the previous survey in 2015–16 but about the same as the estimate of 55 individuals from the 2010–11 survey. We had hoped the ongoing surveys would provide evidence for a trend of recovery. Instead, the low and variable numbers suggest Māui dolphins face an increasingly uncertain future.

Photo of a Māui dolphin courtesy of New Zealand Department of Conservation and the University of Auckland.

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