Comprehensive Stranding Investigations for High Priority Species

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ABSTRACT

This project provides support for comprehensive stranding investigations in order to obtain increased baseline information about the health of marine mammals. Such support is essential when considering the Pacific Islands region (PIR) where unique geographical challenges exist. The PIR is comprised of isolated islands, spanning over 7 million square miles across the North, South and Western Pacific basins and includes the Hawai'i Range Complex and the Mariana Islands Range Complex. All cetacean stranding response and investigative efforts for the PIR are centralized at a dedicated stranding facility that houses the University of Hawai'i (UH) Health and Stranding Lab, which plays a critical role as the only organization in the region to conduct cause of death investigations when dolphins and whales strand. This requires mounting an immediate response to each newly reported stranding event that occurs and conducting extensive necropsy examinations, including histopathology, disease surveillance, and tissue sampling in support of numerous research efforts aimed at better understanding Hawaiian cetaceans. In addition to this project facilitating advanced diagnostics in-house at the Health and Stranding Lab, we also report on progress towards increasing our knowledge of diet and trophic position of endangered main Hawaiian Islands insular false killer whales and on characterizing marine debris ingestion by abundance and mass in stranded short-finned pilot whales.

SUMMARY OF STRANDING CASES DURING CALENDAR YEAR 2021

Stranding response, necropsy and cause of death investigative summaries were provided for 24 stranding events that occurred in calendar year 2021. In each of these cases, samples were collected, a unique specimen identification number was assigned and the tracking of sample status began at the University of Hawai'i (UH) Health and Stranding Lab. When a cetacean stranding occurs in or around the main Hawaiian Islands or in the greater Pacific Islands, the Health and Stranding Lab responds and coordinates necropsy sampling and cause of death investigations. In some cases, a verified or unverified stranding report may not result in the death of an animal and/or the collection of a biological sample. In these types of stranding response scenarios, a case number is not assigned, and the event is not documented with a unique specimen identification number that is tracked in the Health and Stranding Lab records. Therefore, while we have reported on a total of 24 stranding cases during the calendar year 2021, additional responses were mounted in association with reports of strandings of live animals, cetacean carcasses where it was not possible to obtain a biological sample as well as in some cases mistaken identity, or in cases when other marine species strand such as sharks.

During the 2021 calendar year, the UH Health and Stranding lab coordinated or conducted stranding responses, necropsy and sample collections over a wide geographical range that includes

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
16-03-2022	Monitoring report	2000 to 2021

4. TITLE AND SUBTITLE
COMPREHENSIVE STRANDING INVESTIGATIONS FOR HIGH PRIORITY SPECIES

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
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5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

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8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Commander, U.S.Pacific Fleet, 250 Makalapa Dr. Pearl Harbor, HI

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSORING/MONITORING AGENCY REPORT NUMBER

12. DISTRIBUTION AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited

13. SUPPLEMENTARY NOTES

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15. SUBJECT TERMS					
Marine mammals, strandings, necropsy, DNA, disease, Mariane Islands Range Complex, Hawaii Range Complex					
16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
			UU	5	Department of the Navy
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			**19b. TELEPONE NUMBER (*Include area code)***
Unclassified	Unclassified	Unclassified			808-471-6391

four of the main Hawaiian Islands (Hawai'i, O'ahu, Maui, and Kaua'i), the northwestern Hawaiian Islands (Pearl and Hermes atoll), as well as the US Island territories of Guam and American Samoa, and the unincorporated US territory, Wake Island. These responses resulted in sample collections and specimen tracking at the UH Health and Stranding Lab from a confirmed total of nine different cetacean species including the sperm whale (2), humpback whale (2), striped dolphin (3), spinner dolphin (3), pantropical spotted dolphin (1), Fraser's dolphin (5), false killer whale (1), Cuvier's beaked whale (2), and the pygmy sperm whale (1). Specimens represented various reproductive stages including newborn calves, juveniles, sexually mature males and females and pregnant and lactating females.

An interesting stranding occurred in December of 2021 and involved three Fraser's dolphins on the island of O'ahu. The UH Health and Stranding Lab coordinated an initial beach response, assessment, carcass recovery and subsequent necropsy for each of the animals. An Uncommon Stranding Event is defined as two or more individuals of any cetacean species found alive or dead within a two day period and within 10 miles of one another. This event meets the criteria of an Uncommon Stranding Event with three individuals of the same cetacean species stranding within two days of one another and within a two mile distance. Beginning on December 5th, 2021, at 6:50 am a sub-adult male Fraser's dolphin was reported stranded near Diamond Head Beach in Honolulu, Hawai'i. The individual was brought to the UH Health and Stranding Lab for examination and the necropsy and extensive sample collections began by 10:00 am and continued into the early evening. The following morning, December 6th, 2021, at 7:26 am, and just over 24 hours after the first report of a Fraser's dolphin stranding, an additional adult male Fraser's dolphin was reported floating in the water at Queens Beach, Waikiki, less than two miles from the initial stranding location (Figure 1). The second Fraser's dolphin in this series was recovered following a cultural protocol using the UH Health and Stranding Lab truck and while the truck was enroute to the laboratory at Marine Corps Base Hawaii, another report of a floating dead dolphin was received. The third stranding in these series was reported at 10:55 am and was an adult female Fraser's dolphin floating dead near Tongg's beach in the Waikiki area, less than 1.5 miles from the first sub-adult male in this stranding series, and less than 1 mile from the second adult male.

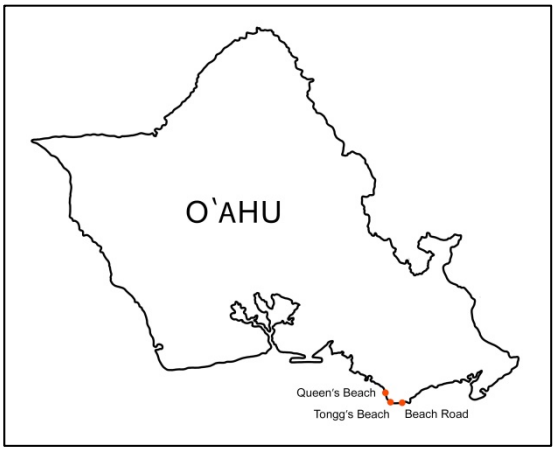

Figure 1. Island of O'ahu and locations of the three Fraser's dolphin strandings that occurred over a two day period in December, 2021.

The necropsies of the three stranded Fraser's dolphins were conducted in succession at the Health and Stranding Lab. Necropsy findings included evidence of trauma and severe hemorrhage in the first two of the three individuals examined. The first individual stranded in this series had fractured jaws and extensive internal hemorrhage in close proximity to the fractured jaws, indicating that this was a severe pre-mortem injury. Additionally, the first Fraser's dolphin in the stranding series had a fractured ear with accompanying hemorrhage as well as gas bubbles noted in the lung, diaphragm, kidneys and other organs. The second Fraser's dolphin in the series had a fracture in the back of the skull and the occipital condyle showed signs of both a chronic bone condition, as well as severe and fresh

hemorrhaging associated with the break in the occipital bone. Associated hemorrhage in the brain was also noted and consistent with the signs of trauma to the back of the head. Additionally, extensive hemorrhaging associated with multiple internal organs and a ruptured portal vein were noted in the abdominal region of this individual and microbubbles were noted in the left lung. The third individual had two large shark bites in the abdominal area that limited the examination of organs in this body region. However, signs of congestion were apparent in both lungs. The third animal in this series was lactating at the time of death and had distended uterine tissue, suggesting a recent birth but no calf was sighted in the area when the floating carcass was recovered. A full investigation into factors that may have contributed to the cause of this Uncommon Stranding Event is underway.

FALSE KILLER WHALE COMPOUND SPECIFIC AMINO ACID STABLE ISOTOPE ANALYSIS

As part of this project, samples archived by the UH Health and Stranding Lab were analyzed for Compound Specific Isotope Analysis of Amino Acids CSIA-AAs at the Biogeochemical Stable Isotope facility at the University of Hawai'i. These samples represented 6 false killer whales that stranded or were bycaught in the Hawaiian Islands between 2010 and 2019. These included 3 adult females, 2 adult males and 1 subadult male. The body mass index (BMI) values ranged from 0.0028423 in an adult female to 0.0037415 in an adult male. BMI was calculated as mass/length^2. Additionally, qualitative body condition in the 6 animals was recorded at the time of necropsy and spanned emaciated to robust classification. δ15N values were estimated for a minimum of 12 separate amino acids (AAs) in each sample. Using four equations available from the scientific literature and used for other marine species, the trophic position of each sampled individual was calculated based on the CSIA-AA results. As protein is consumed and metabolized, δ14N is excreted as waste and animal tissue is enriched with δ15N at a steady rate that varies between species or groups, a measure of the δ15N load in the AAs from the tissue of a consumer allows for the trophic position (TP) to be calculated. TP refers to the level at which a species falls on the food web, primary consumers, or herbivores are TP 1, and TP 5 are apex predators, or species at the highest consumer level. All 14 AAs were successfully analyzed in only one individual, KW2010019. Calculated values using trophic enrichment factors recommended for marine mammal TP estimation placed the false killer whale between Trophic position (TP) 4.08 and 4.63, with an outlier of TP level 6.57, giving an average value of 4.82. These values fall into agreement with other species studies which place other odontocete species between TP 4.0 and 5.0 and 6.57 is interpreted as an outlier as the highest previously estimated TP of a marine mammal is 5.0. A trophic level of 4 or more is high as it indicates that an animal is consuming other predators rather than prey lower on the food web.

This value was not surprising as false killer whales are expected to exhibit a high trophic level position. Our preliminary examination of the false killer whale CSIA-AA data provides its first application to false killer whales to our knowledge. Next steps will involve detailed comparison of known diet from stranded individuals and foraging observations of false killer whales to the CSIA-AA data. Trophic position findings will also be compared among individuals and to data available on contaminant burdens in false killer whales. We anticipate that this will ultimately lead to a greater understanding of the dietary patterns of false killer whales in Hawaiian waters, the trophic position of false killer whales, and the relationship to overall population health.

MARINE DEBRIS OPTION

The UH Health and Stranding Lab has removed significant masses of marine debris from the stomachs of three necropsied pilot whales that stranded between 2014 and 2017. To quantify the type and potential source of marine debris ingested by these animals, a standardized methodology protocol involving categorization, counts, measurements and weights of ingested marine debris items was developed. As of the end of calendar year 2021, this protocol has been completed for all of the ingested marine debris found in one of the stranded pilot whales (KW2014009) and is in progress for another (KW2017005). We continue to categorize, count and measure ingested marine debris items recovered from the second individual that continues to be the focus of additional data collection and we will move on to the assessment of the third individual upon its completion. Although data collection is on-going for this individual, we have completed the cleaning and detangling of all of the marine debris ingested by this animal and provide preliminary results below (KW2017005).

To date, 11,060 ingested marine debris items have been categorized, counted and measured from KW2017005, which greatly exceeds the total number of marine debris items ingested by KW2014009 (4,239). An initial examination of the marine debris ingested by KW2017005 indicates that the most common type of marine debris ingested by this individual is monofilament line (4,711), followed by multifilament line (4,642). Monofilament and multifilament line also dominated the type of marine debris ingested by KW2014009, but monofilament line comprised a greater proportion of the marine debris in KW2014009 at 55.1% when compared to 42.6% in KW2017005. Conversely, the proportion of multifilament line was greater in KW2017005 (42%) as compared to 29% in KW2014009. The contribution of sheet plastic to the marine debris composition in both individuals was very similar, with approximately 15% of the marine debris comprising this category in each animal.

The most common size classes of marine debris observed was also similar between the two animals with the 20-100 mm size range measured most frequently (5,895) in KW2017005 and in KW2014009. However, the second most frequently observed size class category in KW2017005 was the 100-200 mm size range (2,390), in contrast to the 5-20 mm range most frequently observed in KW2014009. It is unclear if this difference reflects a true difference in the most frequently observed size class ranges of marine debris ingested by the two pilot whales examined to date, or if this may be an artifact of the unfinished examination of KW2017005. It is possible that larger pieces of marine debris are easier to categorize and count, resulting in a preliminary data analysis that is skewed towards larger size classes in KW2017005. This will be further assessed upon completion of the marine debris categorization, counts and measurements from KW2017005 during the coming months and the subsequent comparison of these findings with the data obtained from KW2014009.

Continued processing of marine debris from the stomachs of pilot whales has included weighing the debris in each size and category class ingested by KW2014009. A drying protocol was developed and conducted to ensure a dry weight was recorded rather than a wet weight that included moisture retained by each of the marine debris items. A total of 561.4 grams of marine debris was present in the stomach of KW2014009. The majority of the mass (72%, 405.4 g) was

composed of multifilament plastic, followed by miscellaneous items (22.7%). The high miscellaneous weight was driven by a single item, a large plastic eel trap which accounted for 118.5 grams. The greatest weight contributing size class was composed of the marine debris items which measured 200 mm or longer (71.7%. 402.5 g).

The combined weight of marine debris in each size and type categories differed in importance compared to counts in individual KW2014009. While multifilament plastic was the largest contributor to weight it was second to monofilament plastic by count and multifilament was the fourth most important category by weight. Additionally, the largest size class contributor by weight was the 200+ class but when considering the contribution by total counts, the 200+ size class was the smallest contributor. The only references to the capacity of the stomach for pilot whales is in the context of reports from the 1980's where the volume of digesta was estimated between 0,6 and 2.2 liters in the case of 3 whales and 20L of digesta in another individual. Observations of the stomach contents by the UH Health and Stranding Lab at the time of necropsy from a minimum of ten stranded pilot whales examined in the Hawaiian islands indicate that the amount of marine debris ingested in the three whales as part of this project far exceeded the maximum amount of ingesta observed in the stomach of any stranded pilot whale.

ACKNOWLEDGEMENTS

Funding for this project was provided by Commander, United States Pacific Fleet. We would also like to acknowledge the Prescott Grant program for support of stranding response, necropsy and the collection of archived and current samples that allow for advanced diagnostics. This work was conducted under NOAA National Marine Fisheries Service Permit #18786. Special thanks goes to Cody Clifton and the volunteers at the Health and Stranding lab for sample collection and preservation, as well as to the numerous stranding volunteers throughout the Hawaiian Islands and Pacific island territories that assisted in the collection of samples during remote stranding events and necropsy.

Suggested citation:

West, K.L., Phipps, J., Hofmann, N., Silva-Krott, I. (2022). *Diseases of Stranded Pacific Island Marine Mammals* (Marine Species Monitoring Program Annual Report). United States Navy.