



2022 RESEARCH REPORT



NMFS/MMPA Permit #21321

1. BACKGROUND

Pacific Whale Foundation (PWF) conducts applied research throughout the Pacific Ocean which directly supports conservation and management initiatives. Since 1980, PWF researchers have published over 100 peer-reviewed publications, reports, and books that have been used to advance our knowledge on cetacean ecology and inform better management of species. The long-term goal of PWF’s research program is to identify and assess major threats to cetaceans around the world and develop science-based solutions to mitigate these issues. Our headquarters are located on Maui, Hawai’i with established satellite offices in East Australia and Ecuador and funded research projects in Chile and Japan.

This report is a summary of our research activities in 2022, with a recap of some recently published work and preliminary results from our latest projects. The goal of this report is to provide an overview of the research being conducted by PWF to encourage dialogue and opportunities for collaboration and share our impact with our community of donors and supporters.

2. YEAR IN REVIEW

This year, we focused on growth and building capacity for the future. We added five new staff positions, bringing us to 13 full-time employees in Hawai’i, Australia, and Ecuador, and we are delighted to have welcomed Dr. Barbara Galletti from Chile as an affiliated researcher.

2.1 MONITORING CETACEANS IN THE PACIFIC OCEAN

PWF conducts dedicated surveys from research vessels to collect photo-identification (photo-ID), behavioural observations, aerial photogrammetry, biological samples, and more. To increase our sample size and geographic coverage, we also obtain ID photos from platforms of opportunity, such as whale watching boats, and through photos donated to us by the public.

Table 1. An overview of the survey effort conducted by PWF in 2022 including the number of dedicated research trips, the distances that were covered, and the number of surveys conducted on board platforms of opportunity.

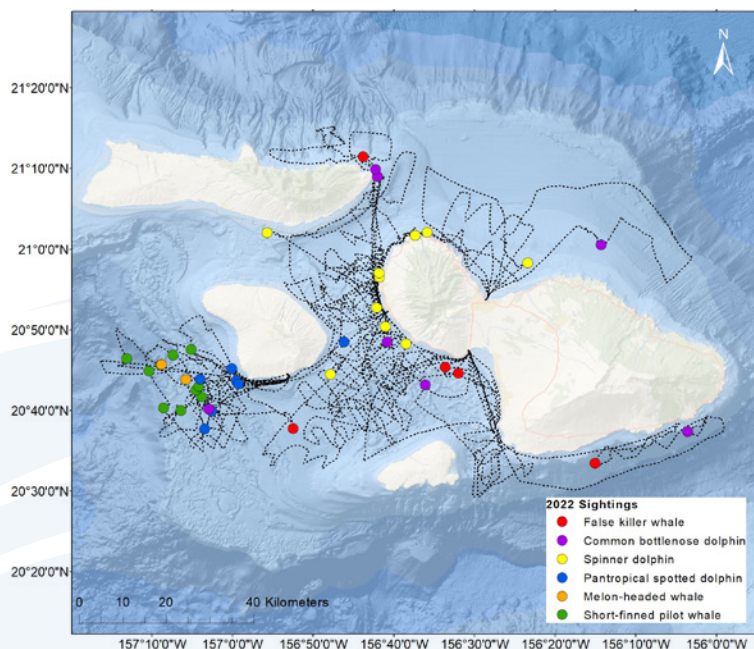
Region	Survey Period	Research Vessel Surveys	Research Vessel Survey Distance (km)	Platform of Opportunity Surveys
Australia	Year round	30	3,794	9
Ecuador	Year round	58	8,567	148
Hawai’i	Year round	56	5,812	4
Japan	Jan - Mar	0	0	20
Chile	Jan - Feb	8	529	0

Photo-ID forms the basis of our long-term monitoring studies. Studying humpback whales has been the foundation of PWF's research since we were founded in 1980. In the years since, we have expanded our research focus to include many other cetacean species (Table 2), however, our humpback monitoring project is our most comprehensive and long running project. Our priorities and research focus depends on the conservation needs of each study site.

Table 2. Current photo-identification holdings at Pacific Whale Foundation. This table includes the species common name, the year the first data were collected, the number of individuals in the catalogue and the locations where data were collected.

Country	Species Common Name	Year of First Entry	Number of Individuals	Regions
Australia	Australian humpback dolphin	2013	35	Hervey Bay, Port Douglas, Eden
	Common bottlenose dolphin	2013	26	
	Humpback whale	1984	6,901	
	Indo-Pacific bottlenose dolphin	2013	127	
Ecuador	Common bottlenose dolphin (inshore)	2021	48	Machalilla National Park Cantagallo Marine Reserve
	Common bottlenose dolphins (offshore)	2021	180	
	Humpback whale	2001	5,205	
	Bryde's whale	2007	48	
USA	Common bottlenose dolphin	1996	301	Maui Nui, Oahu, Big Island, Kauai, Ni'ihau
	False killer whale	1998	142	
	Humpback whale	1981	5,078	
	Melon-headed whale	1999	178	
	Pantropical spotted dolphin	1997	399	
	Pygmy killer whale	1988	42	
	Rough-toothed dolphin	2002	31	
	Short-finned pilot whale	1996	331	
Spinner dolphin	1996	758		

2.2 CONSERVATION OF OCEANIC DOLPHINS



Maui Nui, Hawai'i

This year, our research team committed 20 survey days to study whales and dolphins on the windward side of Maui. This was one of the first dedicated survey efforts for windward waters in Maui Nui and we were able to successfully survey areas spanning from north of Moloka'i to Hana, east Maui (Figure 1). Many of the dolphins we encountered were unknown to our existing photo-ID catalogs, including 25 individual false killer whales from the main Hawaiian Islands insular population.

Figure 1. Map showing research survey effort (dashed lines) and associated sightings for the Maui Nui region in 2022.

The team also completed their second season of CATs tag deployments in collaboration with the Marine Mammal Research Program, University of Hawai'i at Manoa. Equipped with sensors to measure orientation, direction, and rotation of tagged animals, as well as a pressure sensor, GPS, video camera, and a hydrophone, CATs tags give us better insights into what whales and dolphins are doing throughout the day and below the surface. During this year's field effort, we were able to field test new deep-rated CATs tags that were developed specifically for Pacific Whale Foundation and the Marine Mammal Research Program for deep-diving dolphins. We successfully deployed this tag to an adult male short-finned pilot whale for 50 hours, well beyond what we expected (Figure 2). These data are being processed and will provide a wealth of information on this species.



Figure 2. The short-finned pilot whale that was tagged with a suction cup CATs tag in November 2022 that resulted in a 50 hour deployment. (Research activities conducted under NMFS/MMPA research permit #21321 and #21476.)

The highlight from this year was watching two false killer whales pursue a mahi-mahi within a few feet of our research vessel. In addition to seeing the mahi-mahi flung several feet into the air, we also observed the fish attempting to seek protection under the research vessel (Figure 3).

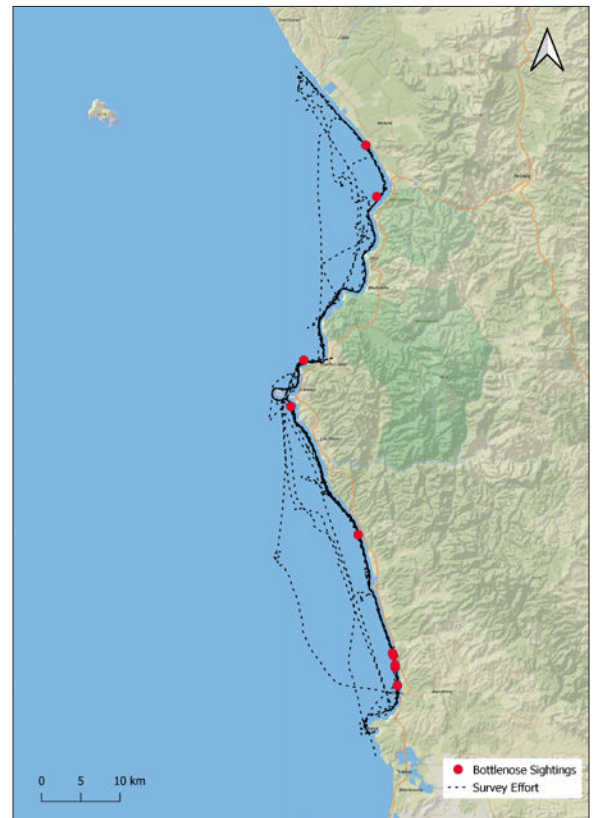


Figure 3. A false killer whale pursuing a mahi-mahi, that is attempting to take shelter under the research vessel, Ocean Protector. (Research activities conducted under NMFS/MMPA research permit #21321.)

Puerto Lopez, Ecuador

This year PWF research in Ecuador was expanded to include common bottlenose dolphins inhabiting the central and northern coast in Ecuador. Little is known about the populations here and it is highly likely that human activity is impacting them. There are two 'ecotypes' recognised in Ecuador; a widely-distributed oceanic group and a coastal ecotype that are thought to be less abundant and restricted to the shallower beach and estuarine waters. Our Ecuador research team conducted 21 dedicated surveys in 2022 encountering eight groups of common bottlenose dolphins (Figure 4). The long-term goal of this work is to assess the degree of human impact on dolphins in this area and advise environmental authorities on conservation strategies.

Figure 4. (right) Map showing dedicated dolphin survey effort and associated sightings for the Ecuador region in 2022.



Hervey Bay, Australia

PWF also expanded their scope in Australia and completed pilot surveys to estimate the abundance of commonly encountered dolphin species in Hervey Bay using distance sampling techniques. Australian humpback dolphins and Indo-Pacific bottlenose dolphins are regularly encountered in Hervey Bay, but no abundance estimates or description of their distribution and habitat use has been published. In 2022, we recorded 55 encounters with Indo-Pacific bottlenose dolphins, 15 encounters with Australian humpback dolphins, and seven encounters with common bottlenose dolphins (Figure 5). The team will work with expert consultants at the University of St Andrews to assess results from this year's pilot surveys and adjust the survey design, if needed, for 2023.

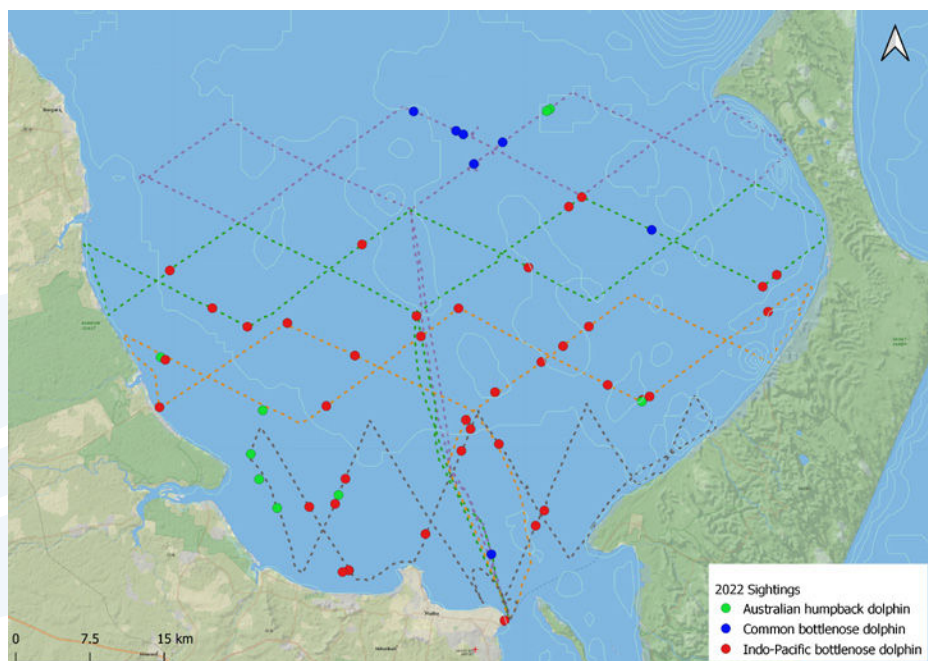


Figure 5. Map showing line transect surveys (dashed lines) and associated sightings of dolphins encountered in Hervey Bay, Australia during 2022.

2.3 BODY CONDITION AND HEALTH OF HUMPBACK WHALES

Body condition of humpback whales in Hawai'i and Australia

PWF has been using drones to study the body condition of cetaceans since 2018. From 2019-2022 we worked in collaboration with Martin van Aswegen and Dr. Lars Bejder (Marine Mammal Research Program, University of Hawai'i at Manoa) and Dr. Adam Pack (University of Hawai'i at Hilo) to collect a comprehensive suite of morphometric and health data on individual humpback whales. In 2022, the final year of the larger collaborative effort, we collected drone measurements of 466 individuals and biopsy samples from 154 individuals from Maui Nui. The team was also able to provide drone support for an entangled whale that was freed of all gear by responders from the Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS) entanglement response team (Figure 6).



Figure 6. An entangled humpback whale which was freed by the Hawaiian Islands Large Whale Entanglement Response Network team. PWF provided drone support for this entanglement response. (Entanglement response conducted under MMHSRP permit #18786-06.)

PWF also began collecting data for a new five-year project assessing the health and status of humpback whales in Hervey Bay, Australia. This year, we collected drone measurements of 250 individuals in Hervey Bay, including 82 mom-calf pairs (Figure 7). As a known stop-over for humpback whales during the southern migration, Hervey Bay offers a unique opportunity to look at energy exchange between mothers with a dependant calf that is approximately 2-3 months old. Previous studies have been conducted in the calving grounds, primarily on calves that are less than 2 months old, so this work will fill some gaps in understanding of humpback whale growth and development in their first year of life.

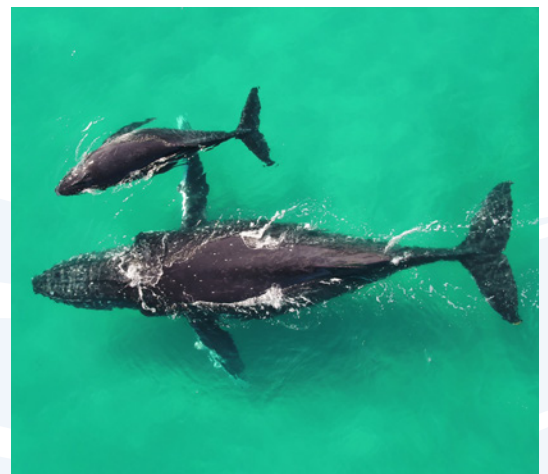


Figure 7. (right) A drone image of a mother and calf humpback whale in Hervey Bay, Australia used to measure the length and width of both mother and calf.

2.4 IMPACTS OF HUMAN ACTIVITY ON CETACEANS

Under our Global Impact Plan, we focus our research efforts on studying five major threats to cetaceans, which are Bycatch, Vessel Traffic, Ocean Pollution, Tourism Pressure and Climate Change (Figure 8).

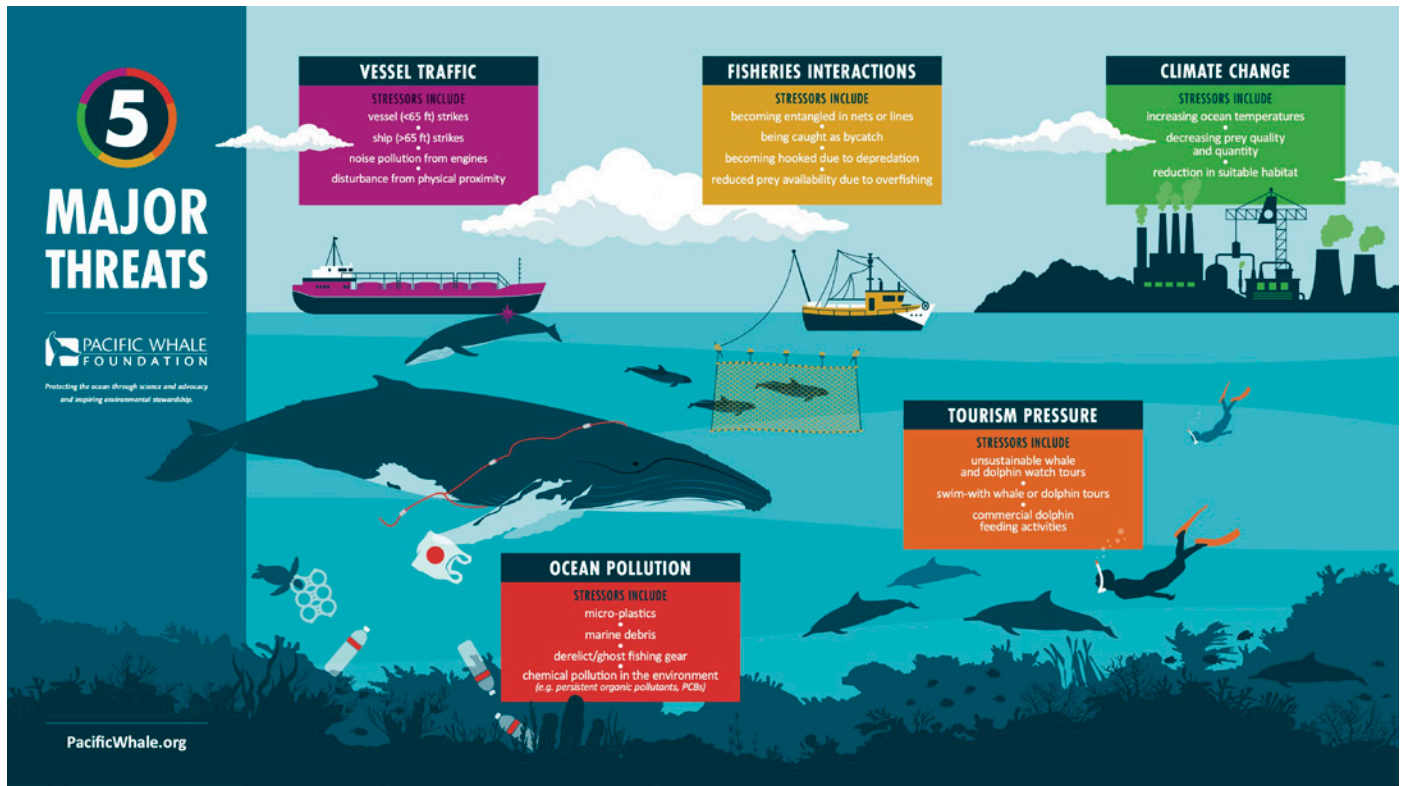
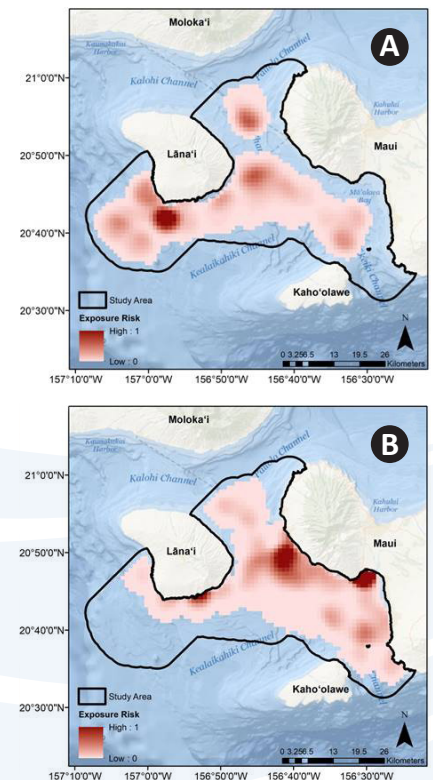


Figure 8. Infographic showing the five major threats that Pacific Whale Foundation studies in order to assess the impacts of human activity on cetaceans.

VESSEL TRAFFIC

This year we published a paper mapping the exposure of pantropical spotted dolphins and common bottlenose dolphins to different categories of vessel traffic in Maui Nui, Hawai'i, which can be downloaded [here](#) (Olson et al., 2022). The paper examined the risk of vessel traffic exposure to pantropical spotted and bottlenose dolphins by quantifying the overlap of dolphin and vessel distribution. This is an important first step in understanding the geographic extent of vessel traffic as a potential threat in Maui Nui. The results found that both bottlenose and spotted dolphins were subject to high amounts of vessel traffic throughout their observed distribution, with the amount and type of vessel exposure varying between species. This work highlights the importance of considering different vessel types and species when evaluating potential vessel-related impacts to dolphins (Figure 9).

Figure 9. (right) Map showing the risk from all vessel traffic to (A) spotted dolphins and (B) bottlenose dolphins from 2014 – 2017 within the Maui Nui region, Hawai'i.



On December 1, we were called to assess a report received of a sick whale observed from a whale watching vessel in Maui, Hawai'i. The whale in question was determined to be likely suffering from blunt force injuries likely caused by a vessel strike that occurred prior to its arrival in Hawai'i (Figure 10). The whale suffered from severe spinal trauma causing it to lose the ability to swim using its tail. In conjunction with the HIHWNMS/NOAA Fisheries Marine Mammal Health and Stranding Response Program, we collected various data, including aerial imagery and a biopsy sample, to assess the whale's health and injuries. We also collected an ID photo and determined the whale to be "Moon", previously sighted in northern British Columbia, Canada.



Figure 10. A drone image of an injured humpback whale sighted on December 1, 2022 in Maui Nui, Hawai'i.

CLIMATE CHANGE

Working with graduate students at the University of Hawai'i, we co-authored a paper that looked at sea surface temperature projections and the potential impact on humpback whale breeding grounds (Von Hammerstein et al., 2022), which can be downloaded [here](#). The paper used high-resolution sea surface temperature (SST) projections to predict the impacts of a climate change and warming oceans on humpback whale breeding areas. Humpback whale breeding and calving grounds generally occur within areas where the water temperature ranges between 21 and 28°C and previous research found that greater encounter rates of humpbacks occurred at the lower end of this temperature range. With the potential for rising global SSTs due to climate change, a shift in humpback whale distribution is possible. This study compared SST projections associated with two different greenhouse gas emission scenarios based on social, economic and technological trends to determine the impacts on humpback whale breeding grounds. In a scenario where no change to the current global trends occurred, the results predicted that by the end of the 21st century, 35% of humpback whale breeding areas will experience SSTs above the preferred range of temperatures. While in a scenario where there is rapid economic growth in carbon-intensive industries, 67% of breeding areas, including Hawai'i, will exceed the preferred SST range during the same timeframe. These projections highlight the importance of reducing global greenhouse gas emissions to minimize further increase in SST in key humpback whale areas (Figure 11).



Figure 11. (right) A breaching humpback whale captured in Hervey Bay, Australia.

OCEAN POLLUTION

This year we joined a new large-scale collaborative project tracking levels of persistent organic pollutants in the southern hemisphere. To contribute to these efforts, the Ecuador team (Figure 12) collected 81 biopsies and 22 sloughed skin samples. This data will contribute to the Humpback Whale Sentinel Programme, which is investigating parameters of adiposity, diet and fecundity on an annual basis in five distinct breeding stocks of southern hemisphere humpback whales on their respective breeding grounds.



Figure 12. (right) Members of the research team in Ecuador.

In Hawai'i, the COVID-19 pandemic and resulting shutdown in tourism provided the research team with a unique opportunity to investigate how reduced tourism and beach use on Maui affected marine debris accumulation. From May 2020 – May 2021 we conducted weekly beach surveys at two locations in South Maui; the same sites which had also been surveyed in 2017 (Figure 13). This allowed us to make comparisons between years as well as between pandemic “lockdown” levels because of the phased re-opening for visitors. After accounting for potential impacts of environmental parameters (e.g., wind, wave, and tides), the lockdown level and day were found to significantly influence debris accumulation. Specifically, as restrictions on beach use were relaxed, and beach users on island correspondingly increased, so did the amounts of debris. These findings will contribute to a broader understanding of where marine debris accumulates and inform related conservation policy.

Figure 13. (below) Map showing the location of the two survey sites on Maui with inserts showing the topographic details and locations of the 100 m transects. Site 1: Kama'ole Beach; Site 2: Ulua Beach.

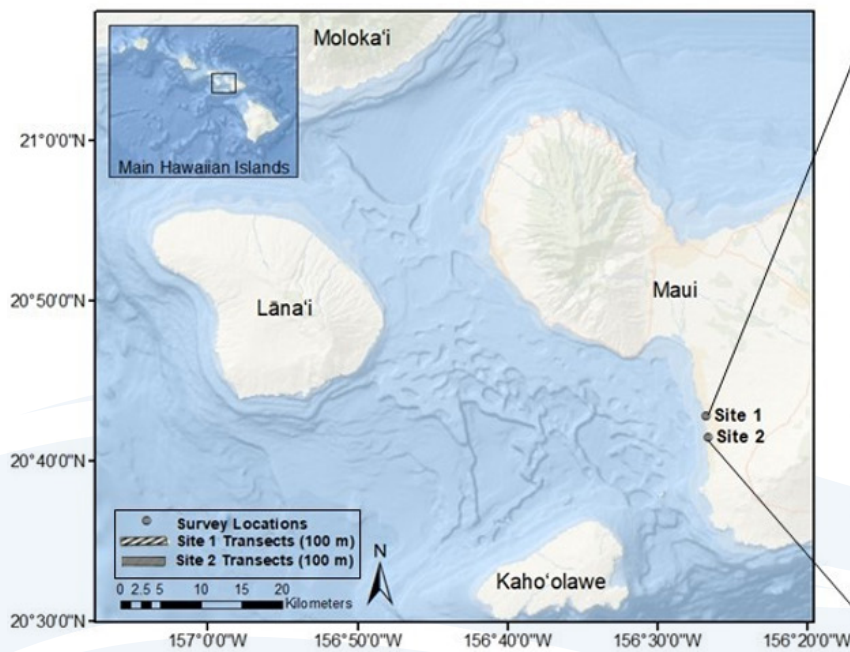




Figure 14. Researchers in Japan studying the impacts of tourism on humpback whale behaviour.

TOURISM PRESSURE

The Okinawa Churashima Foundation Research Center began collaborating with Pacific Whale Foundation this year to study the impacts of whale watch and swim-with-whale tourism in Okinawa, Japan (Figure 14). In recent years, whale watching tourism has become increasingly popular in Japan, with some areas starting to offer swim-with-whale tours. Research in Australia and elsewhere suggest that an expanding and unregulated tourism industry, especially swim-with-whale tourism, leads to short-term behavioural changes and potential long-term impacts. Our collaborative work in Japan seeks to study and evaluate the potential effects of this form tourism on humpback whales.

3. COMING IN 2023

In addition to continuing to grow our international presence, the Hawai'i research team will receive a new custom-built research vessel to support their data collection needs (Figure 15). Some of the new features include:

- an elevated viewing platform
- a drone launching/landing platform
- an extended bow platform to be used for tag deployments, biopsy collection, and photo-ID
- an interior workstation to process biological samples
- a semi-enclosed helm to provide protection from the elements
- additional fuel capacity to allow for extended survey range

The vessel is scheduled to arrive in January, 2023 – just in time for Hawai'i's whale season.

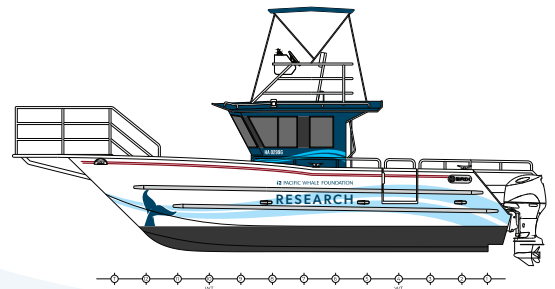


Figure 15. Construction in progress of the new research vessel for Hawai'i (left) and the new graphics (above).

4. 2022 RESEARCH OUTPUTS

Download all Pacific Whale Foundation papers for free [here](#).

Peer-reviewed articles

Olson, G.L., Stack, S.H., Machernis, A.F., Sullivan, F.A., and Currie, J.J. (2022) Mapping the exposure of pantropical spotted dolphins and common bottlenose dolphins to different categories of vessel traffic in Maui Nui, Hawai'i. *Aquatic Mammals* 48(2), 167-181. <https://doi.org/10.1578/AM.48.2.2022.167>.

von Hammerstein, H., Setter, R. O., van Aswegen, M., Currie, J. J., and Stack, S. H. (2022) High-resolution projections of global sea surface temperatures reveal critical warming in humpback whale breeding grounds. *Frontiers in Marine Science*, 668. <https://doi.org/10.3389/fmars.2022.837772>.

Castro C., Gomez W. & J. Castrillon (2022) Whale Watching Tourism as a Driving Force for Socio-Economic Development in Puerto Lopez, Machalilla National Park in Ecuador. *Mammalia aequatorialis*, 4.

Book chapters

Stack, Stephanie H. and Jens J. Currie (2022). "Realising the Potential of Platforms of Opportunity: Re-thinking Scientific Data Collection" In: *Advancing Public and Industry Participation in Coastal and Marine Sciences*: 43.

Technical reports

Harnish, A.E., Baird, R.W., Currie, J.J., Stack, S.H., Cullins, T., Opritou, L., Gorgone, A.M., Kirkpatrick, J.B. (2022) Residency and movement patterns of common bottlenose dolphins (*Tursiops truncatus*) off Oahu and Maui Nui carry implications for current stock boundaries. Document PSRG-2022-15 presented to the Pacific Scientific Review Group, March 22-24, 2022, Olympia, WA.

PWF supported graduate research

Badhuge, H. Migratory patterns and interchange between breeding grounds by humpback whales (*Megaptera novaeangliae*) visiting Hervey Bay. Master's Research Project. Southern Cross University, NSW, Australia (PWF data analyzed).

Raffipiy, W.M. Furthering the scientific and local communities' understanding of anthropogenic impacts on cetacean species to better conserve critical marine mammal species in Hawai'i. Master's Research Project. University of Hawai'i at Hilo, HI, USA

Conference presentations

24th Biennial Conference on the Biology of Marine Mammals in Palm Beach, Florida.

J. Currie, M. van Aswegen, S. Stack, K. West, F. Vivier and L. Bejder. Rapid weight loss in free ranging pygmy killer whales: implications for anthropogenic disturbance of odontocetes. The 24th Biennial Conference on the Biology of Marine Mammals, Palm Beach, FL, USA: 1-5 August.

S. Stack, K. Sprogis, G. Olson, F. Sullivan, A. Machernis, and J. Currie. The behavioural impacts of commercial swimming with whale tours on humpback whales in Hervey Bay, Australia. The 24th Biennial Conference on the Biology of Marine Mammals, Palm Beach, FL, USA: 1-5 August.

F. Sullivan, S. Stack, J. Breman, R. Martelles, and J. Currie. Presenting Whale & Dolphin Tracker – An App for Data Collection and Engaging with Community Scientists. The 24th Biennial Conference on the Biology of Marine Mammals, Palm Beach, FL, USA: 1-5 August.

A. Machernis, S. Stack, G. Olson, F. Sullivan, and J. Currie. Trouble in Paradise? Expanded Photo Analysis Techniques Reveal High Rates of Fishery-Related Scarring on Bottlenose and Pantropical Spotted Dolphins in Maui Nui, Hawai'i. The 24th Biennial Conference on the Biology of Marine Mammals, Palm Beach, FL, USA: 1-5 August.

G. Olson, S. Stack, A. Machernis, F. Sullivan, and J. Currie. Mapping Reveals High Degree of Overlap Between Vessel Traffic and the Occurrence of Two Dolphin Species in Maui Nui, Hawai'i. The 24th Biennial Conference on the Biology of Marine Mammals, Palm Beach, FL, USA: 1-5 August.

R. Finn, E. Lyman, L. Bejder, J. Currie, M. van Aswegen, J. Moore, S. Stack, T. Cheeseman, M. Lammers, S. Wilkin, and T. R. Spradlin. Entanglement Scar Analysis of Humpback Whales, *Megaptera novaeangliae*, in Hawaiian Waters (2013 – 2021): A Comparison of Surface, Aerial, and Underwater-Obtained Imagery. The 24th Biennial Conference on the Biology of Marine Mammals, Palm Beach, FL, USA: 1-5 August.

E. Lyman, M. Lammers, A. Pack, A. Bradford, D. Schofield, J. Currie, S. Stack, J. Rossa, and A. Tom. Variability in Collisions Between Vessels and Humpback Whales (*Megaptera novaeangliae*) in Hawaiian Waters (1979 – 2021). The 24th Biennial Conference on the Biology of Marine Mammals, Palm Beach, FL, USA: 1-5 August.

S. Atkinson, A. Pack, H. Pearson, V. Melica, K. Mashburn, M. Lammers, J. Moran, S. Teerlink, L. Bejder, J. Currie, S. Stack, A. Szabo, K. Cates, and M. van Aswegen. Seasonally stressed? Varying metabolic biomarkers in humpback whales (*Megaptera novaeangliae*) in Alaska and Hawaii. The 24th Biennial Conference on the Biology of Marine Mammals, Palm Beach, FL, USA: 1-5 August.

M. van Aswegen, A. Szabo, J. Currie, S. Stack, A. Pack, T. Cheeseman, S. Atkinson, and L. Bejder. The ups and downs of humpback whale motherhood: quantifying the cost of maternal investment and calf growth on their Hawaiian breeding grounds and Southeast Alaskan foraging grounds. The 24th Biennial Conference on the Biology of Marine Mammals, Palm Beach, FL, USA: 1-5 August.

F. Vivier, R. Wells, M. Hill, K. Yano, A. Bradford, A. Pacini, J. Ferguson, E. Leunissen, C. Booth, J. Rocho-Levine, J. Currie and L. Bejder. Sensitivity and precision of unoccupied aerial system photogrammetry to assess the age structure of delphinid populations. The 24th Biennial Conference on the Biology of Marine Mammals, Palm Beach, FL, USA: 1-5 August.

T. Cheeseman, K. Audley, A. Frisch, N. Ransome, J. Urban, P. Martínez Loustalot, J. Jacobsen, E. Quintana-Rizzo, J. De Weerd, D.M. Palacios, C. Hayslip, J. Calambokidis, K. Flynn, P. Clapham, C. McMillan, J. Hildering, J. Wray, N. Doe, C. Birdsall, K. Dracott, J.D. Darling, J.K. Byington, T. Shaw, M. Mallison, J.K. Ford, T. Doniol-Valcroze, J. Neilson, J. Straley, S. Teerlink, J. Cedarleaf, A. Szabo, F. Sharpe, J. Moran, H. Pearson, O. von Ziegesar, B. Witteveen, D. Zwiefelhofer, C. Matkin, R. Cartwright, S. Stack, J. Currie, M. Jones, E. Lyman, R. Finn, C. Gabriele, A. Pack, B. Goodwin, K. Yano, L. Bejder, M. van Aswegen, M. Hill, J. Marie Acebes, O. Filatova, O. Titova, E. Mamaev, G. Donovan, J. Moore, J. Barlow, M. Olio, H. Newell, and K. Southerland. A Happy Collaboration: Basin-scale, High-throughput, AI-assisted Photo-ID Matching for North Pacific Humpback Whales. The 24th Biennial Conference on the Biology of Marine Mammals, Palm Beach, FL, USA: 1-5 August.

D. Mello, M. Marcondes, K.R. Groch, C. Castro, and C. de Oliveira. Determination of Total Body Length from Two Populations of Humpback Whale at Breeding Grounds in the South Hemisphere. The 24th Biennial Conference on the Biology of Marine Mammals, Palm Beach, FL, USA: 1-5 August.

E. Gless, S. Mahaffy, G. Olson, S. Stack, J. Currie and R. Baird. Photo-identification of pantropical spotted dolphins in Hawaiian waters reveal long-term re-sightings, supporting the existence of island-associated resident populations. The 24th Biennial Conference on the Biology of Marine Mammals, Palm Beach, FL, USA: 1-5 August.

A. Harnish, R. Baird, J. Currie, S. Stack, T. Cullins, L. Opritoiu, A. Gorgone, and J. Kirkpatrick. Stock Structure, Residency, and Inter-Island Movements of Common Bottlenose Dolphins between O'ahu and Maui Nui. The 24th Biennial Conference on the Biology of Marine Mammals, Palm Beach, FL, USA: 1-5 August.

E. Corsi, R. Baird, A. Harnish, A. Gorgone, J. Currie, S. Stack, and J. Kiszka. Variation in social structure of three different stocks of island-associated bottlenose dolphins (*Tursiops truncatus*) around the main Hawaiian Islands. The 24th Biennial Conference on the Biology of Marine Mammals, Palm Beach, FL, USA: 1-5 August.

19ª Reunião de Trabalho de Especialistas em Mamíferos Aquáticos da América do Sul e 13º Congresso da Sociedade Latino-Americana de Mamíferos Aquáticos.

C. Castro, J. Castrillon, L. Barragán, & F. Felix. Skin marks as indicators of possible inshore bottlenose dolphin threats on the Central Coast of Ecuador. 19ª Reunião de Trabalho de Especialistas em Mamíferos Aquáticos da América do Sul e 13º Congresso da Sociedade Latino-Americana de Mamíferos Aquáticos. Praia do Forte, Brazil: 11-15 September.

I. Avila & C. Castro. Whales with "Pollock coloration type": a new body color style for the G-stock humpback whales? 19ª Reunião de Trabalho de Especialistas em Mamíferos Aquáticos da América do Sul e 13º Congresso da Sociedade Latino-Americana de Mamíferos Aquáticos. Praia do Forte, Brazil: 11-15 September.

L. Barragán, H. Orellana-Vásquez, & C. Castro. Is Humpback Whale (*Megaptera novaeangliae*) song in Ecuador revolutionary or evolutionary? 19ª Reunião de Trabalho de Especialistas em Mamíferos Aquáticos da América do Sul e 13º Congresso da Sociedade Latino-Americana de Mamíferos Aquáticos. Praia do Forte, Brazil: 11-15 September.

D. Djokic, M. Rossi- Santos, R. Sousa-Lima, L. Padovese, J. Baumgarten, M. Gonçalves, J. De Weerd, K. Rasmussen, D. Venturini, M. Marcondes, S. Silva, A. Pacheco, C. Castro, L. May-Collado, E. Duque -Mesa, J. Denking, J. Oña, S. Eliens, J. Patris, & F. Malige. Latin American humpback whale song dynamics. 19ª Reunião de Trabalho de Especialistas em Mamíferos Aquáticos da América do Sul e 13º Congresso da Sociedade Latino-Americana de Mamíferos Aquáticos. Praia do Forte, Brazil: 11-15 September.

5. PARTNERS AND ACKNOWLEDGEMENTS

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Hawai'i

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Dr. David Lusseau, Technical University of Denmark

Ed Lyman, Hawaiian Islands Humpback Whale National Marine Sanctuary

Dr. Elizabeth Madin, Hawai'i Institute of Marine Biology, University of Hawai'i at Manoa

Dr. Kristi West, Hawai'i Institute of Marine Biology, University of Hawai'i at Manoa

Dr. Lars Bejder, Marine Mammal Research Program at the University of Hawai'i

Mark Manuel, NOAA Marine Debris Program

Dr. Robin Baird, Cascadia Research Collective

Ted Cheeseman, Southern Cross University and Happywhale.com

Dr. Roxane Keli'ikipikāneokolohaka, Native Hawaiian Advisor and Educator

Australia

Dr. Susan Bengston-Nash, Griffith University

Dr. Laura Marshall, Centre for Research into Ecological & Environmental Modelling, University of St. Andrews

Dr. Olaf Meynecke, Whales and Climate Programme

Dr. Wally Franklin, The Oceania Project

Ecuador

Dr. Fernando Felix, Museo de Ballenas, Pontificia Universidad Católica del Ecuador

Dr. Koen Van Waerebeek, Peruvian Centre for Cetacean Research (CEPEC)

Dr. Susan Bengston-Nash, Humpback Whale Sentinel Programme, Griffith University

Ted Cheeseman, Southern Cross University and Happywhale.com

Dr. Santiago Burneo, Pontificia Universidad Católica del Ecuador

Dr. Paul Gamboa, Universidad Central del Ecuador

Chile

Elsa Cabrera, Centro de Conservación Cetacea

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The research activities described here are conducted under the appropriate state and federal permits. In Hawai'i, the activities described are authorized under NMFS research permit #21321 issued to PWF, #21476 issued to Dr. Lars Bejder and #19655 issued to Dr. Adam Pack. In Australia, our activities are conducted under a scientific research permit and a marine park permit authorized by the Queensland Department of Environment and Science. In Ecuador, we operate under a research permit issued by Ministerio del Ambiente, Agua y Transición Ecológica.

Drone operators hold additional certifications; in Hawai'i the drone pilots hold FAA Part 107 authorization and in Australia, drone operators hold a CASA remote pilot license and operate under a CASA operating certificate. All images in this document were taken under the relevant permits.

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