PACIFIC WHALE FOUNDATION

2023 RESEARCH IMPACT REPORT

NMFS/MMPA Permit #21321

REFLECTING ON 2023: A YEAR OF CHALLENGES AND TRIUMPHS

As we bid farewell to 2023, we find ourselves reflecting on a year marked by both challenges and triumphs. It has been a journey of resilience, and we are proud to share our experiences with you.

We cannot discuss this year without first mentioning the profound and heartbreaking challenge we faced in August as devastating wildfires swept through Maui, leaving over 20 of our colleagues without homes. The impact of this tragedy touched our organization deeply, and our hearts continue to go out to those affected by the fires in Lāhainā and Kula. The strength and support demonstrated by our PWF and PacWhale community during this difficult time have been a testament to our unity and compassion. We stand together, ready to assist and rebuild.

On a brighter note, 2023 also brought exciting developments in our mission to protect the ocean through science and advocacy. At the start of this year, we proudly welcomed two new research vessels in Hawaiʻi: Kaiao and Ocean Insight. These state-of-the-art vessels represent a significant step forward in our commitment to advancing marine research and environmental conservation in Hawaiʻi. We look forward to the valuable discoveries and insights they will undoubtedly bring us in the years to come.

Our commitment to expanding our impact was further demonstrated by our growth in Australia. In addition to our ongoing efforts in Hervey Bay, Queensland, we expanded our presence to include field research in Eden, New South Wales. This expansion reflects our dedication to understanding humpback whale migration dynamics in a changing climate, ensuring that our work has a far-reaching impact.

Venturing beyond the shores of Australia, our team also made strides in South America, collecting valuable data on the Critically Endangered population of Chile-Peru southern right whales. Our efforts in Chile and Ecuador to collect biological samples on stranded animals contributes crucial information to the scientific understanding of this highly vulnerable population and underscores our global commitment toward the conservation of whale and dolphin populations.

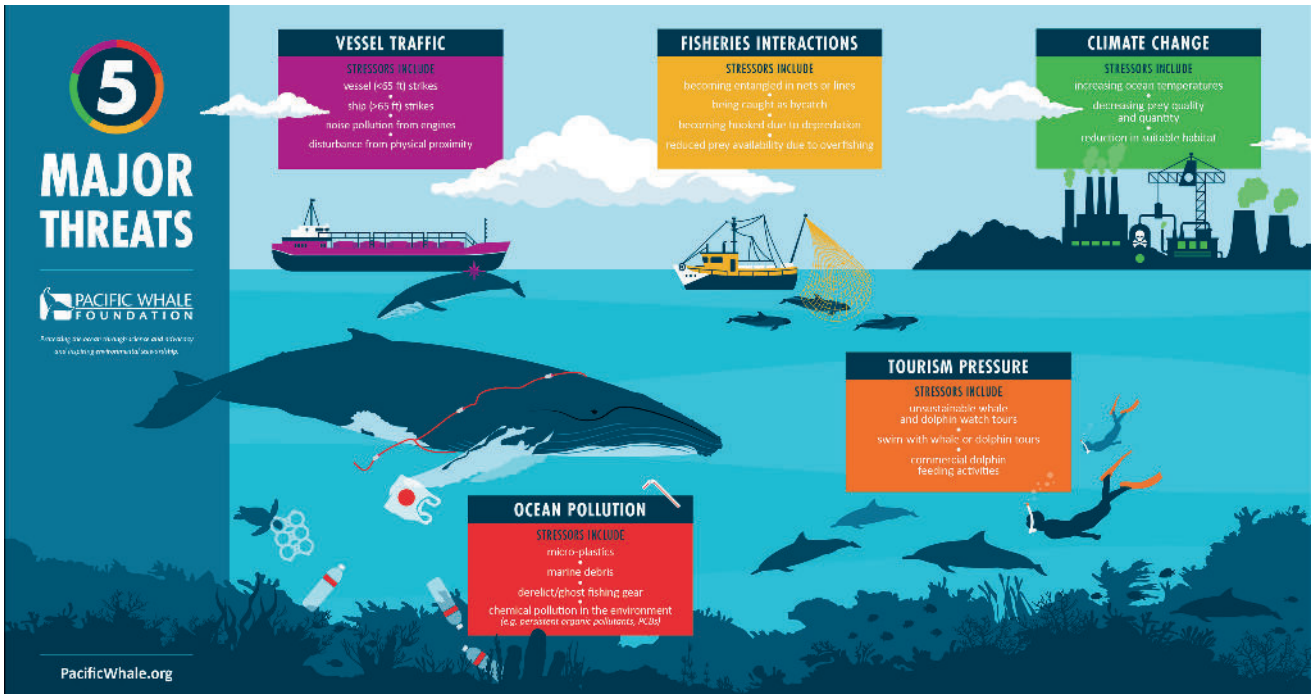
As we reflect on the highs and lows of 2023, we will carry forward the strength gained and the bonds forged. Together, we look ahead to a future where our collective efforts continue to make a positive impact on the ocean environment that we are so passionate about.

Thank you for your commitment to our shared mission. Here's to a new year filled with progress and continued success!

1. BACKGROUND

The 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 2023, 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

We are happy to report on a productive year with some highlights including our response to the Maui wildfires, new research vessels, expanding our survey areas in Australia, and documenting the northernmost extent of a critically endangered population.

MAUI WILDFIRE RESPONSE

Following the devastating August 8 Maui wildfires, PWF mobilized to monitor and assess potential impacts to the adjacent coastal ecosystems, including the whales and dolphins inhabiting these waters. We quickly turned our focus to designing and implementing vessel and shore-based marine debris and cetacean surveys. Our historic pre-wildfire whale and dolphin databases, as well as our long-running beach debris surveys, are critical for comparisons with post-wildfire data that we are continuing to collect as the catastrophic wildfires are expected to have near and long-term impacts. Our findings will help in determining how to best protect these species and the healthy ocean they depend on for their survival.

Figure 1. The aftermath of the wildfire in Lāhainā, Maui as viewed from a drone (UAS) during one of our vessel-based surveys for marine debris. The burned vessel on the left is Ocean Legacy, a PacWhale Eco-Adventures (the social enterprise owned by PWF) vessel.

WELCOME TO KAIAO AND OCEAN INSIGHT

This year the Hawai‘i research team welcomed two new vessels. Our new primary research vessel, Kaiao, meaning to dawn or to enlighten in ‘Ōlelo Hawai‘i, manifests our continued appreciation of Hawai‘i’s rich cultural landscape and speaks to our Research program’s planned expansion throughout the Hawaiian Islands. The name, Kaiao, was given to the vessel by Roxane Keli‘ikipikāneokolohaka who has been working with PWF to better integrate Hawaiian culture into our research efforts. We deeply appreciate the significance and weight inherent in Hawaiian names, as they are given with intention and responsibility. It is a profound honour for us to collaborate with the Hawaiian community in naming our new research vessel. This collaboration signifies our commitment to honouring not only the physical environment where we operate but also the diverse array of species that we study. Moving forward, we are dedicated to upholding the cultural and environmental legacy embedded in this name, fostering a profound connection between our research endeavours and the Hawaiian culture.

Kaiao is a 9-m motorized catamaran that has an elevated viewing platform designed to increase our detections of cetaceans and has a bow pulpit useful for tagging of cetaceans. Ocean Insight, a 6-m rigid-hulled inflatable boat (RHIB) with a bow pulpit, joined us on Maui as well. These vessels have been instrumental in our team surveying new areas and achieving the first-ever CATS tagging of a false killer whale (see below).

Figure 2. Conducting our first humpback whale survey aboard R/V Kaiao in March 2023.

Figure 3. R/V Ocean Insight, PWF’s primary tagging vessel.

AUSTRALIA EXPANSION TO EDEN, NSW

This year, we expanded the focus of our East Australian humpback whale health assessment to Eden, NSW. PWF has historically collected data in Eden, but not since 2014, so it was exciting to get back to the area. Eden is recognized as an important area for migrating whales, as humpbacks have been observed opportunistically feeding there on their way to Antarctica. Over two weeks, our team measured the body condition of 69 whales, including 32 mother-calf pairs. This information will help us learn more about the overall health of the population and give us an insight into the energetic demands of migration.

Figure 4. Humpback whale flukes in Eden, NSW, Australia.

EXPANDING OUR CAPACITY IN LATIN AMERICA

This year, we warmly welcomed Barbara Galletti Vernazzani from Chile as a full-fledged member of our team. PWF has provided funding to Barbara's research in Chile through her nonprofit Centro de Conservación Cetacea for the past 20 years, and this year she joined our organization as an affiliated Research Associate.

HUMAN IMPACTS ON SOUTHER RIGHT WHALES IN CHILE-ECUADOR

The Chile-Peru southern right whale population is Critically Endangered, and recovery requires the elimination of human-caused mortalities. Unfortunately, two calf deaths were documented by our team during 2023. In June, a 9-m southern right whale calf stranded dead near Melinka, in southern Chile, with evidence of severe fishing gear entanglement and propeller cuts. In August, a 6-m male southern right whale calf stranded at Tongorachi Beach, Muisne, Ecuador. The calf exhibited multiple injuries, including fishing net marks on the tail and a deep hole on its dorsal flank. The Ecuador calf stranding represented the northernmost record for this species and the second consecutive year that this species has been recorded in Ecuadorian waters.

Figure 5. Stranded southern right whale calf in Ecuador.

Figure 6. Stranded southern right whale calf in Chile showing fishing gear entanglement.

2.1 REGIONAL HIGHLIGHTS

Maui Nui, Hawaiʻi

The Hawaiʻi region research team completed 51 field days to assess the impacts of the 5 major threats to local populations of whales and dolphins in the waters surrounding the islands of Maui, Kahoʻolawe, Lānaʻi and Molokaʻi. The team had a total of 62 odontocete encounters, involving approximately 1,711 individuals, including bottlenose dolphins, spinner dolphins, pantropical spotted dolphins, short-finned pilot whales, melon-headed whales, false killer whales, sperm whales, and pygmy sperm whales. During whale season, they encountered 302 groups of humpback whales resulting in the identification of 732 individuals. We also collected 43 biological samples, comprising sloughed skin, biopsy, and faecal samples collected from various cetacean species, including humpback whales, sperm whales, bottlenose dolphins, and short-finned pilot whales.

Figure 7. A new species for many team members on board, we encountered ~18 sperm whales south of Maui which included calves, subadults, and adults.

After the August 8, 2023 wildfires in Lāhainā, 68 beach surveys at two beaches close to the burn area were conducted from September to October, with support from conservation staff, to determine the amount and spread of fire-related debris. Over 1,500 items of debris were removed and documented, mainly plastics, with minimal fire-related debris found. With special permissions from the Coast Guard, weekly boat-based surveys were also conducted off the coast of Lāhainā to determine any potential impacts to marine life. These surveys included drone flights to monitor reef impacts, health assessments of whales and dolphins, and documentation of dead or injured marine life. These vessel and drone surveys documented 87 debris items and 6 different wildlife species and will provide a baseline to monitor future changes to the coastal areas and reefs near the fire impact zone.

In October 2023, we received funds from NOAA to carry out a line-transect survey to determine the abundance of spinner dolphins in Maui Nui. This project is in collaboration with the Marine Mammal Research Program (MMRP) and will contribute to the larger population assessment of spinner dolphins throughout the Main Hawaiian Islands. The collected data will offer updated information on the abundance and distribution of spinner dolphins in Maui Nui. The team has conducted five surveys to date, covering 67 out of 656 transect lines.

Figure 8. Team members photograph a pod of spinner dolphins from the bow pulpit of Kaiao.

Now entering our third year of collaboration with MMRP, we are actively advancing the use of suction-cup CATS tags for the study of deep-diving odontocetes. The primary focus is on gathering crucial information related to energetics, foraging rates, and targeted prey species. Our team utilized four specially designed deep-rated CATS tags, developed for PWF and MMRP. In a groundbreaking achievement, we successfully conducted the first-ever CATS tagging of a false killer whale in February, replicating this feat in November.

Figure 9. The second CATS tag is successfully placed on a false killer whale in November 2023.

Across both deployments, we retrieved over 16 hours of invaluable data, providing detailed insights into the precise movements, behaviours, and feeding events of the animals. This data is instrumental in enhancing our understanding of the daily energy requirements of false killer whales in Hawaiʻi. Ultimately, this information will play a key role in formulating effective strategies for potential population recovery, contributing significantly to ongoing conservation efforts.

Puerto Lopez, Ecuador

We completed 63 research trips to develop a comprehensive understanding of coastal dolphins and humpback whales. Notably, 836 humpback whales were identified through photo-ID, and 113 biopsy samples were collected. Additional encounters included 23 Bryde's whales, of which 11 were biopsied. We had 25 spotted dolphin and oceanic bottlenose dolphin encounters, and one with coastal bottlenose dolphins. We also had an incredibly rare blue whale sighting at Isla de la Plata. During these surveys, several animals were observed with vessel interaction scars.

We completed 19 beach cleanups, preventing over 730 kg of waste from potentially entering the ocean. We recorded more than 57,000 items of debris, with plastics constituting the majority of items. Specifically, in areas frequented by humans, we identified 3,100 plastic bags, 3,000 straws, and 1,400 disposable food containers. Interestingly, single-use plastics was also the dominant waste item in locations lacking human presence.

In October, we assisted with the deployment of 12 satellite tags. This tag data will form part of a Southern Hemisphere-wide modelling effort under the “Whales and Climate” Programme, with PWF offering field support to deploy the tags. By late November, one whale remained near Chile's Juan Fernandez Archipelago. Seven whales moved south, some along the coast, others toward Antarctica. One whale surprised us by traveling further north, rather than south. Understanding these paths is crucial to understand the impact climate change has on whale distribution.

In 2023, we presented at 15 workshops, engaging with 716 participants. We conducted six training courses for teachers, fishermen, and park rangers, delivered 30 environmental talks to over 1,000 students, and distributed 1,020 of our environmental education books to children in Puerto Lopez, emphasizing Ecuador's whale and dolphin threats.

Figure 10. A child reading about humpback whales after PWF donated copies of our environmental education book to groups in Puerto Lopez.

Figure 11. The team in Ecuador collecting a biopsy sample from a humpback whale near Puerto Lopez.

Hervey Bay and Eden, Australia

2023 was the third year of our East Australia humpback whale health assessment project. Over 28 survey days, our team recorded body condition images from 345 individuals including 159 mother-calf pairs. This brings our total to 619 measurements since 2021. This season, one highly distinctive humpback whale, 'Clipper' and her calf were encountered on two separate occasions, 20 days apart. Body condition measurements showed that over the 20 days, Clipper lost approximately 10% of her body volume while her calf gained nearly 18%. These repeat measurements give us a great insight into the energetic demands of motherhood for humpback whales and are crucial for understanding the impacts that climate change and other anthropogenic threats have on cetacean populations.

Our UAS images are also used to assess the degree of scarring related to entanglement in fishing gear and vessel interactions in cetaceans. Using data from 2022, a preliminary assessment of the humpback whales in Hervey Bay found that between 14-24% of individuals showed evidence of previous entanglement and between 2-4% had scars from a vessel collision. This important information was presented at the Australian Marine Sciences Associate (AMSA) conference.

We had a busy year presenting our work in Australia this year, including two talks at the AMSA conference and a talk at the Eco Summit 2023 conference. We also gave talks at the Hervey Bay Whale Watch Industry meeting, the Hervey Bay Whale Festival's Creating Waves event and were invited to give a series of talks on Lady Elliot Island as part of their educational programme.

Figure 12. One of our team getting the all-important fluke photograph used to identify an individual humpback whale.

Figure 13. The distinctive tail fluke of the East Australian humpback whale known as 'Clipper'.

Figure 14. A humpback whale in Hervey Bay, Australia showing the telltale signs of a previous vessel collision. The consecutive line markings along the body are made by a vessels propellor.

Chiloe Island, Chile

The Alfaguara Project completed its 20th field season this year. This project is focused on the conservation of blue whales off Isla de Chiloe, southern Chile.

Weather conditions were exceptional during this season, as well as the whales' proximity to the coast. This allowed us to conduct 20 marine surveys covering 1,200 km and recording more than 200 animals. Species sighted included blue whales, humpback whales, fin whales and southern right whales as well as Peale's and Chilean dolphins. Feeding behaviour and defecation was frequently observed.

We also encountered the largest aggregation of Critically Endangered southern right whales recorded since the end of commercial whaling, further highlighting the importance of these waters, not only for blue whales, but for other whale species.

Preliminary results from the project were presented to the Scientific Committee 69A meeting of the International Whaling Commission (IWC) and important recommendations for the conservation of these species were adopted.

Furthermore, we were also able to complete the 6-year review of the Conservation Management Plan (CMP) for southern right whales and the new 2023 CMP updated version was adopted by the Governments of Chile and Peru.

Our long-term blue whale photo-identification datasets and the international collaborative efforts led under the IWC Southern Hemisphere Blue Whale Catalogue are being used to model abundance estimates using novel multimark-recapture models. These models are being tested for the first time with Chilean blue whales and would then be applied to the New Zealand and Australian blue whale populations.

At the end of the season, we made a presentation on the 20th year results of the Alfaguara Project to the tourist operators, fishermen and local community. In addition, we have been invited as keynote speaker to the 4th Ecosystem Services Partnership Latin America and Caribbean International Conference, organized by the Foundation for Sustainable Development / Ecosystem Services Partnership and participated at the joint IWC-CMS workshop on cetacean and ecosystem functioning.

Figure 15. A Southern Right Whale is taking a dive off Isla de Chiloe in Chile. In 2023, we completed the 20th field season for the Alfaguara Project.

Okinawa, Japan

The Okinawa Churashima Foundation Research Institute (OCF) has been collaborating with PWF since 2021 to study the impacts of whale-watch and swim-with-whale tourism in Okinawa, Japan. Our collaborative work in Japan seeks to study and evaluate the potential effects of this form of tourism on humpback whales. Data collection is ongoing and planned for at least one additional field season.

In 2023, PWF and OCF submitted a report regarding this ongoing collaborative research project to the IWC Scientific Committee sub-committee on Whale Watching. The implementation of this project was received favourably at the meeting, and the IWC gave a recommendation to the Japanese government and local researchers that we should continue to conduct this research project. It was also recommended that the implementation of swim-with-whale tourism should be made carefully and only after proper research has been conducted to assess the impact of tourism on humpback whales.

OCF and a Ministry of the Environment of Japan held a humpback whale symposium in Okinawa (December 2023) so that local tour operators and stakeholders are informed about this project and its goals. We work with tour operators to provide training and discuss best practices for both swim-with-whale and whale-watch tours to reduce the potential impacts on endangered humpback whales. We aim to establish government regulations for both swim-with-whale and whale-watch tours instead of having multiple whale watch associations develop and enforce their own rules. We will begin by developing guidelines in Okinawa and eventually aim to establish national government regulations to be implemented throughout Japan.

Figure 16. Our collaborators from OCF collecting photo-ID data of humpback whales in Okinawa, Japan.

Figure 17. The OCF team collecting data to study the impacts of tourism on humpback whales in Okinawa, Japan.

2.2 SUMMARY OF FIELD EFFORT

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 photographs donated to us by the public.

Table 1. An overview of the survey effort conducted by PWF in 2023 including the number of dedicated research trips and the distances that were covered, and the number of surveys conducted using whale watching tours as platforms of opportunity.

Region	Survey Period	Dedicated Research Vessel surveys	Dedicated Research Vessel survey distance (km)	Opportunistic surveys aboard a commercial platform
Australia	Year round	37	5,738	8
Ecuador	Year round	63	3,209	335
Hawai‘i	Year round	51	5,226	20
Japan	Jan - Mar	N/A	N/A	15
Chile	Jan - Mar	20	1,214	0

2.3 PUBLISHED WORK

Currie, J.J., Sullivan, F.A., Beato, E. Machernis, A.F., Olson, G.L., and Stack, S.H. (2023). The impact of the anthropause caused by the COVID-19 pandemic on beach debris accumulation in Maui, Hawaiʻi. Scientific Reports 13(17729).

This study investigated the repercussions of the "anthropause", the name given to the substantial reduction in human activities caused by the COVID-19 pandemic, on beach debris accumulation at two Maui, Hawaiʻi sites. The objective was to determine how the temporary decline in human presence and associated beach activities, spurred by lockdowns and travel restrictions, affected the coastal environment. Employing systematic beach surveys conducted prior to, during, and post-anthropause, we documented shifts in debris patterns across the COVID-19 pandemic timeline. Our findings showed a notable surge in daily debris accumulation rates on Maui's beaches, escalating from an average of 16 items per 100 meters during the peak lockdown to 43 items per 100 meters as restrictions eased. Plastics emerged as a substantial contributor to beach debris at both sites, underscoring the profound impact of plastic pollution. The study highlights the imperative to address debris from both local and distant sources, advocating for improved waste management practices. Leveraging these data, the study advocates for the implementation of highly effective waste prevention strategies in Hawaiʻi to combat the multifaceted challenges posed by increased beach debris accumulation.

Figure 18. Infographic depicting the evolution of beach usage throughout the COVID-19 pandemic from May 2020 to May 2021, highlighting a substantial 102% increase in visitor arrival rates during this timeframe.

Castro, C., Engel, M. H., and Martin, A. R. (2023). First humpback whale movement between Ecuador and South Sandwich Islands: redefines the easternmost migration point of breeding stock G Aquatic Mammals, 49(4), 382-387.

This study presents the initial recorded instance of a humpback whale recaptured during migration between the South Sandwich Islands and Ecuador. By comparing PWF's Ecuador catalogue with holdings from the Instituto Baleia Jubarte (Humpback Whale Institute) in Brazil, a humpback whale (PWF-EC_1457) was photographed in both regions. Initially spotted in 2006 near the South Sandwich Islands, this individual was rediscovered in 2008 at Machalilla National Park in Ecuador. The recorded migratory distance of 8,900 to 10,000 km redefines the furthest known eastward migration point of humpback whale Breeding Stock G and supports the hypothesis that there is overlap between feeding areas in Antarctica; highlighting the influence of climate-driven distribution patterns on humpback whale populations.

Figure 19. A humpback whale 'breaches' in Machalilla National Park in Ecuador.

3. COMING SOON

1. Supporting the next generation of researchers

We are excited to continue fostering the next generation of marine researchers by working with an undergraduate Honours student from the University of the Sunshine Coast and a Master's student from the Hawaiʻi Pacific University. Both students are undertaking a research project within our program. These collaborations aim to provide valuable hands-on experience and mentorship to young talent.

2. Advancements in Automated Detection

We are collaborating with Happywhale, the Oceania Project, and a Ph.D. student at the University of New South Wales in the development of an algorithm for the detection of killer whale scars on humpback whale tails. The algorithm promises to streamline the analysis of photographic data, providing a more efficient and accurate method for identifying this type of scar. This innovative project will result in a free algorithm for all photo-ID catalogue holders to use and will be incorporated into Happywhale's image processing.

3. Pioneering Research on Plastics Additive Exposure

In close collaboration with the Center for Marine Debris Research and the Hawaiʻi Pacific University, we aim to comprehensively investigate plastics additive exposure in bottlenose dolphins in Maui Nui. Utilizing cutting-edge techniques, we will analyse blubber samples from bottlenose dolphins for a targeted list of 101 plastics additive chemicals. By correlating plastics additive concentrations with factors such as sex, trace elements, hormones, life history, and body condition we seek to unveil critical insights into the impact of these additives on marine mammal health.

4. 'Go Slow, Whale Below' Campaign in Hawaiʻi

Using nearly a decade of research as the basis for updated whale watching guidelines, we will implement a 'Go Slow, Whale Below' campaign to protect humpback whales in Hawaiʻi state waters. This campaign calls on vessel operators to operate at 15 knots or less during the whale season, slowing down to 6 knots or less when within 400 yards of a whale. Through scientific monitoring, we will assess the campaign's effectiveness in mitigating vessel strikes and disturbance to whales, embodying a bottom-up approach to safeguard the well-being of humpback whales in a critical breeding and calving habitat.

5. The Society for Marine Mammalogy Conference

We are eagerly anticipating participation in the upcoming Society for Marine Mammalogy conference in Perth, Western Australia. This gathering of experts provides an invaluable platform for sharing our findings, exchanging ideas, and fostering international collaboration. The conference will not only showcase our ongoing efforts in Australia and throughout the Pacific but also offer a unique opportunity to learn from and engage with leaders in the field. We hope to see you there!

In summary, the next phase of our research program promises exciting developments, ranging from cutting-edge technological advancements to expanding our reach. We remain committed to the pursuit of knowledge, driven by our passion for understanding and protecting the incredible marine life that inhabits our oceans.

4. 2023 RESEARCH OUTPUTS

***PWF contributors listed in bold**

Peer-reviewed Journal Articles

Currie, J.J., Sullivan, F.A., Beato, E. Machernis, A.F., Olson, G.L., and **Stack, S.H.** (2023) The impact of the anthropause caused by the COVID-19 pandemic on beach debris accumulation in Maui, Hawai'i. Scientific Reports 13(17729). DOI: https://doi.org/10.1038/s41598-023-44944-4.

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Books and Book Chapters

Garduño J., Moreira J., Espinoza E. y **Castro C.** 2023 (Segunda Edición). Viajeros del Oceano. Migramar. Baby Shark. Pacific Whale Foundation. 40pp.

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6. MEET THE TEAM: THE FACES OF PWF RESEARCH

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