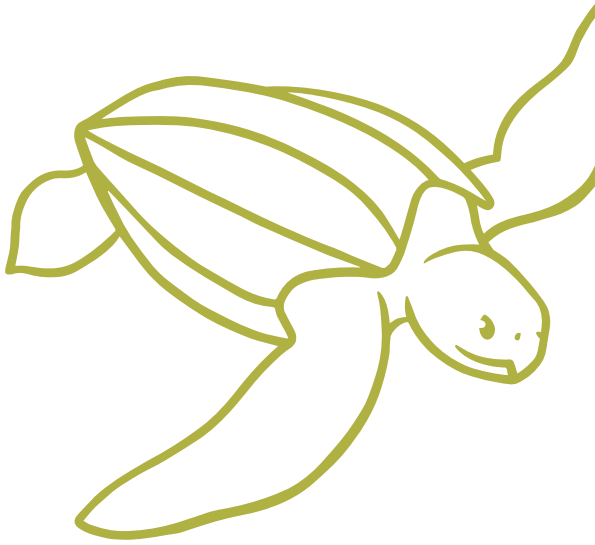
UPWELL

2020 Impact Report

Contents



Upwell's mission is to protect endangered sea turtles by reducing threats at sea.

Sea turtles spend the vast majority of their lives in the ocean, but most conservation efforts remain focused solely on nesting beaches. Beyond the beach, sea turtles face a myriad of anthropogenic threats in their marine environments, including fisheries bycatch, ship strikes, pollution, climate change and other detrimental human activities. There is an urgent and unmet conservation need to protect marine turtles where they spend most of their lives: in the ocean. By better understanding how sea turtles use different marine habitats at different stages of their lives, we can create targeted solutions to address threats they face at sea.

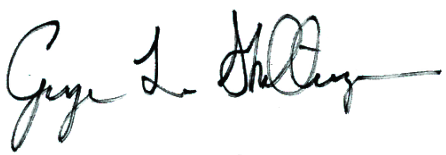
Letter from Upwell's Director

Despite the challenges imposed by COVID-19, Upwell's work continued to advance on many fronts, and 2020 was a productive year. The threats to turtles at sea persist, and the need for conservation of endangered sea turtles does not pause during a pandemic. Having worked as an international team for years, we are well-poised to work remotely as the pandemic continues. Some of our field projects have been postponed until shelter-in-place orders are lifted, but in many cases, we were able to continue work in coordination with partners at field locations to spur progress toward conservation goals.

We have used extra time at our desks to accelerate our publication efforts in collaboration with coauthors and partner organizations. Some of the highlights of this year include five new peer-reviewed publications and the completion of the first-ever juvenile satellite leatherback tracking project in Florida using custom micro-satellite tags.

We are pleased to update you on the progress made possible by our dedicated network of donors, volunteers and partners around the world. On behalf of the entire team at Upwell, I thank you all for your support.

Best regards,



George Shillinger, PhD

Upwell Team

Dr. George Shillinger
Executive Director

Dr. Kristin Reed
Operations Director

Kayla Horner
Administrative and Research Manager

Liz Gregg
Development and Communications Coordinator

Dr. Heather Harris
Wildlife Veterinarian

Dr. Sean Williamson
Researcher

Aimee Doyle
Researcher

Stephanie Rousso
Researcher

Anna Ortega
Researcher

Nicole Barbour
Researcher

Tony Candela
Researcher

Board of Directors

Thomas Jorde, JD
William Sullivan
Rodney Berens
Dr. George Shillinger

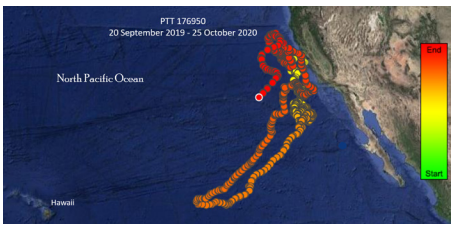
FILLING DATA GAPS

Monitoring West Pacific leatherbacks in the California Current

A satellite-linked transmitter on a leatherback off the California coast sent its final signal on October 25, 2020. Our team deployed the satellite tag on this female West Pacific leatherback encountered in foraging habitat off Half Moon Bay, California. Remarkably, the tag continued to transmit this turtle's location for more than a year. The data revealed how the turtle departed coastal foraging grounds in late fall, traveled into tropical latitudes for the winter and spring months, and returned to the California Current by the summer solstice.

For the past three years, Upwell has partnered with the National Oceanic and Atmospheric Administration (NOAA) on monitoring leatherbacks to mitigate fisheries interactions. The data we collect improves our understanding of how West Pacific leatherbacks use marine habitats along the US West Coast and the timing of their seasonal arrival and departure. We use this data to advance targeted actions to protect this critically endangered sea turtle population from risks they face at sea.

At the leading edge of conservation technology, Upwell began tests of unmanned aerial systems as leatherback monitoring tools with potential to enhance coverage and reduce cost. Upwell researchers also worked with a team in Germany on development of a customized suction-cup camera tag for examining leatherback foraging behaviors. Our team plans to deploy the camera on leatherbacks foraging in two critical habitat zones: one from Central to Northern California and another along the Pacific Northwest coastline.



13 months of satellite tracking capturing 4,652 GPS datapoints

"Our monitoring efforts with Upwell on leatherback occurrence and distribution provide data that would otherwise be impossible for fishermen and fisheries management agencies to obtain. The West Pacific leatherback population declined steeply over the past three decades. Our partnership with Upwell has improved our knowledge of leatherback turtles in our waters and helped us collect the data we need to aid managers in developing solutions to reverse the decline of this ancient mariner."

— Scott Benson, Research Fishery Biologist - NOAA Marine Mammal & Turtle Division

FILLING DATA GAPS

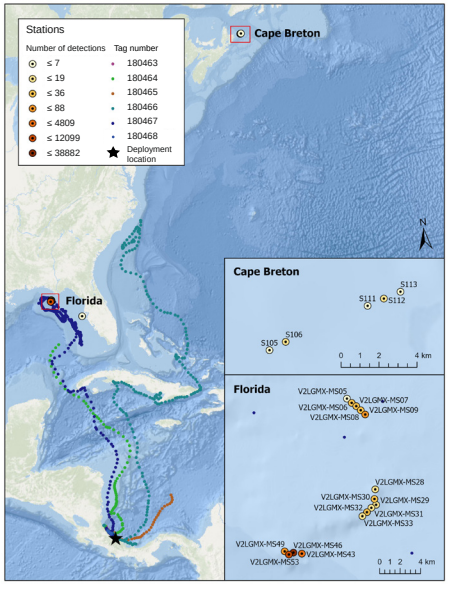
Novel use of acoustic tracking technology on the Eastern Seaboard

56,193 acoustic detections from 3 leatherbacks off the coast of Florida

In March 2020, Upwell's Executive Director Dr. George Shillinger received unusual news. A West Atlantic leatherback turtle he had outfitted with an acoustic tag in Pacuare, Costa Rica had passed an acoustic receiver off the coast of St. Petersburg, Florida. Scientists servicing acoustic receivers are accustomed to recording transmissions from passing goliath groupers and sharks, but not leatherback sea turtles.

Acoustic receivers pick up coded signals identifying a tagged animal when it passes within range (up to 1200 meters, but more typically between 500-850 meters). In recent years, use of acoustic tags has expanded to include species with larger ranges. This is because acoustic arrays were traditionally maintained by geographically distinct operators with independent systems for storing the data. However, efforts to standardize systems, make acoustic data more accessible, and link projects with differing objectives are opening new opportunities for tracking highly migratory species using acoustic technology.

Upwell recognized an opportunity to track West Atlantic leatherbacks using acoustic arrays along the Eastern Seaboard. These sea turtles follow persistent migration pathways that often overlap with existing acoustic detection systems. Better yet, the battery life of acoustic tags far exceeds that of satellite tags. Upwell hopes the acoustic tags he deployed on West Atlantic leatherbacks will yield multi-year datasets. Since the initial news, the Florida acoustic array has detected two more of the eight West Atlantic leatherbacks that Upwell's team outfitted with acoustic tags at Pacuare Nature Reserve. Keep an eye out for an upcoming Upwell publication on this groundbreaking use of acoustic technology for tracking long-distance leatherback migrations!



"Upwell's acoustic detection is a great example of international data sharing and collaboration. Just five years ago, we might have never made the connection because data from the different acoustic arrays were stored separately."

— Dr. Robert Ellis, Research Associate - Florida Fish and Wildlife Conservation Commission

FILLING DATA GAPS

First-ever satellite tracking of juvenile leatherbacks

Recorded 380 position datapoints from 18 micro-satellite tagged juvenile leatherbacks using 2 satellite systems

Upwell conducted the first-ever satellite tracking study of juvenile leatherback movements with our project partner Dr. Jeanette Wyneken at Florida Atlantic University (FAU) in September 2020. This research is part of our Lost Years program to better understand how hatchlings disperse from nesting beaches and how juvenile turtles use ocean environments.

Our team worked with Lotek Wireless and FAU to design prototype "micro-satellite tags" to fit the tiny turtles. We then released the eighteen satellite-tagged juvenile turtles in locations consistent with natural dispersal patterns identified in consultation with our oceanographic modeling partners at Mercator Ocean International (MOI) (see p. 12). Using the Sea Turtle Active Movement Model (STAMM) developed by Drs. Philippe Gaspar and Maxime Lalire, we selected sites 25-80 kilometers off the coast of Palm Beach County between Florida and the Bahamas. The satellite tags transmitted location data for the juvenile turtles as they traveled off the Atlantic coast of Florida and into the Gulf Stream, yielding new insights into the earliest life history stage for leatherbacks leaving Florida's nesting beaches.

"It is heartening to see that there is a way forward for this endangered species. There is an awful lot of biology going on between the hatchling and adult stage that we need to understand. We're the first to ever put satellite tags on little leatherbacks; nobody's ever done that before and that is a big deal. We're learning where they go to grow up, what's their nursery area. Currently, none of that is known."

— Dr. Jeanette Wyneken, Professor of Biological Sciences and FAU Marine Lab Director - Gumbo Limbo Environmental Complex


CONCE

Upwell researcher Stephanie Rousso discusses ways to reduce bycatch with fishers in Mexico.

CONSERVATION TECHNOLOGIES

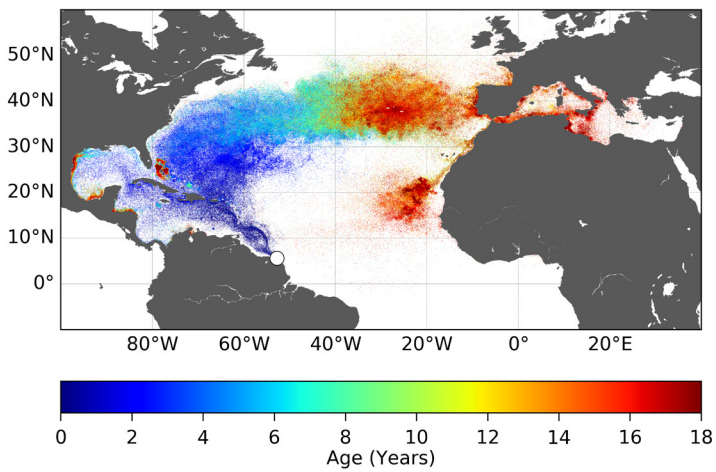
Unraveling the mysteries of the Lost Years

Upwell's exciting partnership with Mercator Ocean International sheds light on leatherback movements during the "lost years"–the 15-25 year period between the day hatchlings first enter the ocean until the turtles reach maturity and migrate back toward natal beaches. Upwell researcher Tony Candela has been unraveling the mysteries of the lost years from his desk in Toulouse, France. He works with Dr. Philippe Gaspar to run hatchling dispersal simulations using the Sea Turtle Active Movement Model (STAMM), which considers environmental variables such as currents, ocean temperature and productivity to predict sea turtle movements.

Upwell worked with Mercator Ocean International to apply STAMM to predict the paths sea turtle hatchlings follow as they depart from ten important nesting beaches and navigate vast expanses of ocean. Informed by Upwell's field research on how leatherback hatchlings actively swim and use ocean currents when dispersing from nesting beaches, STAMM can extend our predictions on where sea turtles go and how they use marine habitats as they develop. We can use these predictions to mitigate risks sea turtles face during vulnerable early life history stages.

"When I talk about my job, people ask: 'How can you help sea turtles from your office in Toulouse, a city far from the sea?' or 'What does ocean physics have to do with sea turtle conservation? I would rather expect a biologist to work on such a subject.' ... I can help sea turtles from my office by providing information about juvenile sea turtle movements that contribute to the implementation of effective conservation actions at sea."

– Tony Candela, Oceanographic Researcher for Upwell and Mercator Ocean International



Simulated dispersal trajectories for 10 key Northwest Atlantic leatherback nesting beaches

CONSERVATION TECHNOLOGIES

Watching out for leatherbacks

East Pacific leatherbacks are likely the most imperiled sea turtles on the planet. Ranging from Mexico to Chile, this population of leatherbacks experienced an estimated decline of over 95% during the past three decades. To recover these leatherbacks, reducing fisheries bycatch is imperative. Upwell's new tool helps fishers watch out for East Pacific leatherbacks.

South Pacific Turtle Watch is based on a novel methodology Upwell developed with partners at the University of Maryland Center for Environmental Science. It yields monthly predictions of leatherback intensity across the Equatorial and Southeast Pacific. To inform the predictions, Upwell solicited decades of data on leatherback sightings and fisheries interactions logged by observers stationed on fishing boats and incorporated satellite tracking data from collaborating scientists studying leatherback movements within the region. Upwell's data scientists incorporated fisheries observation records and satellite tracks into the model encompassing the Southeastern Pacific region—from coastal internesting habitats, ranging from the southern portion of Mexico's Baja Peninsula to Panama, to distant foraging habitats flanking the coasts of South America and throughout the South Pacific Gyre.

The novel modeling framework for analyzing fisheries observations used in South Pacific Turtle Watch can also be used to conserve other vulnerable populations and species of sea turtles. Check out our recent publication on South Pacific Turtle Watch (p. 16) involving seventeen co-authors from four different countries!

Incorporated over 780 fisheries observation records and 114 satellite tracks into the South Pacific Turtle Watch model

CONSERVATION TECHNOLOGIES

Using the past to create a new future for leatherbacks

Upwell convened a series of 6 virtual workshops convening 50+ international sea turtle conservation experts and endangered species recovery specialists to explore the merits and challenges of additional ex situ actions that could be taken for critically endangered East Pacific leatherbacks.

We presented the results of our Population Viability Analysis (PVA), a wildlife management tool for risk assessment that uses existing demographic data to determine the probability of extinction and guide species recovery. To complete the PVA, Upwell researchers solicited input from leatherback experts, conservation managers, and government decisionmakers to develop and refine the parameters of the model. Among over 200+ scenarios evaluated, the PVA analyzed possibilities for egg translocation (moving eggs from "doomed nests" laid on one beach below the high tide line to safe locations on other beaches) and headstarting hatchlings (temporarily rearing them in captivity until they are big enough to avoid risk of predation by seabirds and most fish).

Upwell commissioned experts from the International Union for the Conservation of Nature (IUCN) to lead workshop participants in a collaborative decisionmaking process aimed at driving consensus around actionable conservation goals called a Population and Habitat Viability Analysis (PHVA). This process generated rich discussions and reinforced the urgency of exploring every available option for saving the critically endangered East Pacific leatherback population.

"Personally, I feel like the urgency for Pacific leatherbacks is greater since I saw the outstanding analysis that was completed and presented during the workshop. It is my hope that the workshop will inspire everyone on the front lines to be bolder and more aggressive in their work."

— Dr. Pamela Plotkin, Director and Research Associate Professor, Oceanography - Texas Sea Grant at Texas A&M University

COMMUNITY OUTREACH

A bright spot in dark times

Our Sea Turtle Spotter program offered sailboaters and divers in the Gulf of California a bright spot in the early days of the pandemic. They spotted sea turtles in abundance! Sea Turtle Spotters reported that foraging green turtles and critically endangered hawksbills appeared to be enjoying the marked downturn in the number of tourist boats and jetskis within the bays fringing the Baja Peninsula.

Sea Turtle Spotter enables marine enthusiasts to directly report turtle sightings with photos and location information from their smartphones. Citizen scientists involved in the program have enjoyed continued connections with sea turtles and marine conservation efforts amid the pandemic. Data on live turtle sightings and strandings collected by citizen scientists and uploaded to Sea Turtle Spotter is available for anyone to download. Sea Turtle Spotter gives everyone the opportunity to join Upwell's research team and presents a powerful avenue for deepening public awareness about the threats turtles face at sea, including fisheries bycatch and boat strikes.

COMMUNITY OUTREACH

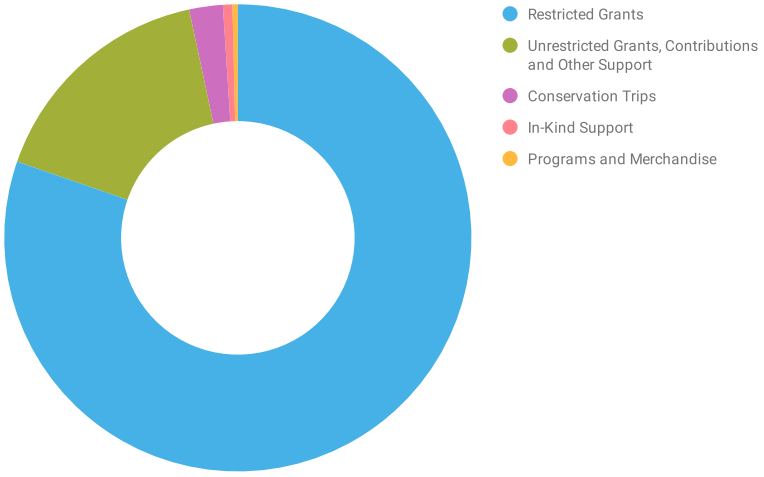
Partnering with artisanal fishers

No one really knows how many sea turtles are captured as bycatch in artisanal fisheries in the Gulf of California each year. Fisheries managers do not collect bycatch data from artisanal fishers. Several artisanal fishing cooperatives in the region are keen to distinguish their catch as sustainable to capture premium prices in local seafood markets. Chefs and ecotourism companies are willing to pay more for seafood captured without harming sea turtles. But who would actually measure the number of turtles affected and using what methods?

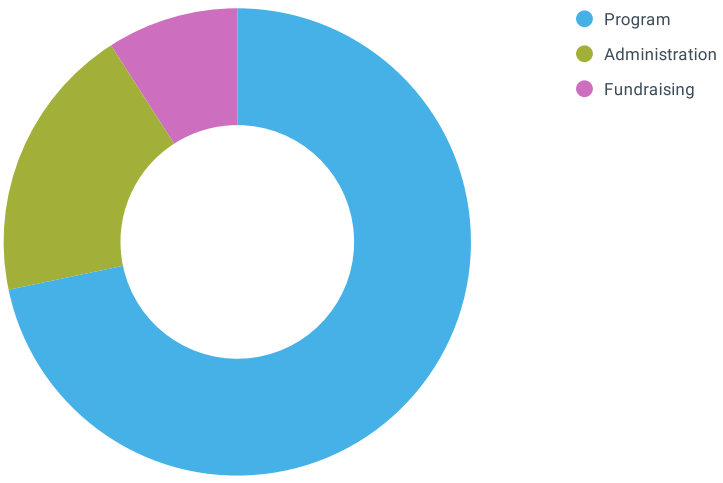
Upwell researcher Stephanie Rousso has initiated a new pilot project to collect incidental capture data on the five species of sea turtles. Drawing on established partnerships with selected cooperatives fishing in the Gulf of California, the project aims to measure the extent of artisanal fisheries bycatch across fishing seasons, gear types and areas. Bycatch data will be compared with data on sea turtle distribution and examined to assess whether species-specific habitat preferences contribute to higher fisheries interaction rates.

2020 Financials

Income



Expenses



Recent Publications

Degenford, J.H., Liang, D., Bailey, H., Hoover, A., Zarate, P., Azócar, J., Devia, D., Alfaro-Shigueto, J., Mangel, J., de la Paz, N., Davila, J., Barturen, D., Rguez-Baron, J., Wiliard, A., Fahy, C., Barbour, N., Shillinger, G. (2021). *Using Fisheries Observation Data to Develop a Predictive Species Distribution Model for Endangered Sea Turtles.* Conservation Letters and Practice.

Hoover, A. L., Shillinger, G. L., Williamson, S. A., Reina, R. D., & Bailey, H. (2020). *Neonate dispersal of Atlantic leatherback turtles (Dermochelys coriacea) from a non-recovering subpopulation.* Scientific Reports.

Ortiz-Alvarez, C., Pajuelo, M., Grados, D., Abrego, M. E., Rebeca Barragán-Rocha, A., Barrantes, M., Cotto Sánchez, A., Fonseca, L. G., Gadea Espinal, V., Mangel, J. C., Rguez-Baron J.M., Santidrian-Tomillo P., Sarti L., Santana-Hernández H., Shillinger G. L., Prado M., Wallace B., Williard A.S., Zavala-Norzagaray A.A. and Alfaro-Shigueto J. (2020). *Rapid Assessments of Leatherback Small-Scale Fishery Bycatch in Internesting Areas in the Eastern Pacific Ocean.* Frontiers in Marine Science 6.

Barbour, N., Shillinger, G.L., Hoover, A.L., et al. (2020) *Environmental and biological factors influencing dispersal of neonate leatherback turtles (Dermochelys coriacea) from an endangered Costa Rican nesting population.* Front. Mar. Sci. - Marine Megafauna.

Vierros, M.K., Harrison, A-L, Sloat, M., Ortuño Crespo, G., Moore, J.W., Dunn, D.C., Ota, Y., Cisneros-Montemayor, A.M., Shillinger, G., Watson, T.K. and Govan. H. (2020). *Considering Indigenous Peoples and local communities in governance of the global ocean commons.* Marine Policy.

Image credits Michael Patrick O'Neill, Cover; Stephen Frink, 2; Karin Forney, 4; Andrew DiMatteo, 6; Michael Patrick O'Neill, 7; Jim Abernethy, 8; Jay Paredes, 9; Miguel Aguilar, 10 &11; Tony Candela, 12; Jürgen Freund, 13; George Shillinger, 14; Miguel Aguilar, 15.

UPWELL

99 Pacific Street, Suite 375-E, Monterey, CA 93940 • www.upwell.org