As a member of E.W. Scripps Associates, Friends of the Scripps Collections, and Friends of Birch Aquarium, you directly impact the work of Scripps Oceanography researchers and students and Birch Aquarium scientists and educators.

Thank you for your continued partnership in advancing ocean, earth and atmospheric science.

MEMBERSHIP GROUPS

Scripps Institution of Oceanography at UC San Diego is one of the world’s oldest, largest and most important centers for ocean, earth and atmospheric science research, education and public service. Since its beginnings, the institution has featured a public aquarium and outreach center — now Birch Aquarium at Scripps — to serve as a public exploration center, interpreting Scripps research, and communicating scientific understanding of the oceans, Earth and atmosphere, for the benefit of society and the planet.

E.W. SCRIPPS ASSOCIATES

E.W. Scripps Associates (EWSA) is a premier group of annual donors who make a difference in the global research conducted by Scripps Institution of Oceanography scientists. Members learn firsthand from Scripps scientists about the ocean, earth and climate science they support at Behind-the-Scenes events.

FRIENDS OF THE SCRIPPS COLLECTIONS

Friends of the Collections support the largest and most complete university-based oceanographic collection in the world. Comprised of millions of biological and geological marine specimens, the collections are an irreplaceable record of the ocean environment at specific points in time over the past century. They tell a unique and evolving story of life on Earth and provide answers to questions about our planet’s future.

FRIENDS OF BIRCH AQUARIUM

Friends of Birch Aquarium is a giving society grown from the legacy of Ellen Browning Scripps and Ellen’s Circle. Continuing in these footsteps, Friends of Birch Aquarium furthers youth access and education through support of the aquarium’s mission to connect understanding to protecting our ocean planet.
DUAL-MODULATION KINETIC FLUOROMETER
SUPPORTED BY E.W. SCRIPPS ASSOCIATES

The study of the biophysical and biochemical aspects of photosynthesis led to the continuous development of Pulse Modulated Amplitude (PAM) fluorometry starting in the 1980s. PAM fluorometry is a noninvasive, in vivo method to probe the photosynthetic apparatus using microsecond pulses of light to examine various stages of photosynthesis via changes in fluorescence of chlorophyll. Over the course of more than 30 years of development and related consequential studies, considerable theory has been formulated regarding the kinetics of PAM fluorescence and what it can tell us about photosynthesis.

PAM fluorometry has become an important methodological tool for phytoplankton research. This research, both at basic science and applied technological levels, is actively pursued at Scripps Institution of Oceanography within three different divisions: Marine Biology Research, Integrated Oceanography and Geosciences. Interests range from mass algal cultivation to ocean productivity to coral bleaching to biogeochemistry. However, there has not been a PAM fluorometer on Scripps Oceanography campus for general use.

For the 2019–20 season, funding from the E.W. Scripps Associates resulted in the purchase of a PAM fluorometer from Photon System Instruments (Czech Republic) by Professor Brian Palenik and researcher Christopher Hewes. The basic instrument arrived in the middle of November 2019, while the custom head arrived in June 2020 due to COVID-19 delays. When UC San Diego went into Covid closure, one graduate student was actively training on the instrument, while two others showed interest in starting projects. It is expected that active use will resume when campus reopens for research.

COASTAL ECOSYSTEMS IN GREENLAND FJORDS
SUPPORTED BY E.W. SCRIPPS ASSOCIATES

In 2019–20, seed funding from the E.W. Scripps Associates supported Maria Vernet, a biological oceanographer, in her work to provide preliminary data of phytoplankton productivity in a Greenland fjord. Alongside physical oceanographer, Fiamma Straneo, they established a relation between meltwater fraction, water-column stratification, nutrient enrichment and phytoplankton productivity along Sermilik Fjord, as well as upstream and downstream of the fjord mouth, to predict fish productivity in support of local fishing and hunting. This first joint cruise with Dr. Straneo provided critical seed data needed to address a National Science Foundation proposal call, Navigating the New Arctic.

Greenland fjords are characterized by marine ecosystems featuring high densities of seabirds, marine mammals and fishes. As a result, many Inuit settlements are located near glacial fjord systems that support traditional subsistence hunting and commercial fisheries and generally contribute to the regional economy. These productive ecosystems are located at the edge of marine-terminating glaciers, such as the Helmhein glacier in Sermilik Fjord. Present-day changes in the Greenland ice sheet alter fishing and hunting grounds through changes in fjord physical and sea ice properties. However, little is known of how advances in understanding of the Greenland physical system are translated into coastal ecosystems productivity.

Warming of the ocean and atmosphere around Greenland is expected to drive, on average, a retreat of marine terminating glaciers and an increase in the discharge of surface melt. These changes could decrease productivity in a fjord like Sermilik by increasing water turbidity and relaxing input of nutrients. Less productive Arctic conditions are expected to alter phytoplankton species composition and abundance with consequences for the carbon cycling by the local food web, affecting food availability to the marine species of interest to Greenlanders, fish, polar bears and seals. As a result of funding from the E.W. Scripps Associates, during the 2019 cruise, Maria Vernet and her team collected the variables needed to model the fjord food web to initiate possible scenarios of carbon flow in relation to glacier retreat.

The Photon Systems Instruments (PSI) Dual-Modulation Kinetic Fluorometer, FL 6000F, with computer and required software, displaying results of “OJIP” kinetic fluorescence response experiment on a marine diatom (algae).

The Helmhein glacier seen from a ship in Sermilik Fjord, August 2019. The floating ice was delivered by the Helmhein glacier into the ocean.
MARINE VERTEBRATES

COLLECTION

SUPPORTED BY FRIENDS OF THE SCRIPPS COLLECTIONS

In 2019–20, the Marine Vertebrate Collection (MVC) welcomed two new master’s students, Ashley Nicoll, who is studying deepwater fish communities in the La Jolla Canyon using a video lander, and Jimjohn Milan, who is studying the anatomy and behavior of a local goby called the longjaw mudsucker.

As a result of funding from Friends of the Collections, MVC lab members were able to publish six studies on a variety of topics including the evolution of sexual dimorphism in tube blennies, the biogeography of fringehead blennies, the movement ecology of young open ocean sharks, and unusual occurrences of fish species during warm water events in Southern California. Collection Curator Phil Hastings and colleagues also described a new species of tube blenny from the Caribbean. In addition, the MVC employed student workers to reorganize the collection and maximize space. This process was daunting and involved moving almost all 140,000 jars.

The MVC recently acquired the largest known driftfish, a rare open ocean species that came in at over four feet long and a weight of more than 40 pounds. It was caught by a fisherman in Ventura, CA, and a publication on the find is forthcoming.

In July 2019, the lab attended the Joint Meeting of Ichthyologists and Herpetologists in Utah, where graduate student Zach Skelton presented on his shark research. Collection Manager Ben Frable presented a poster at the event and at the Gilbert Ichthyological Society meeting in Washington on the integration of the UC Los Angeles Fish Collection into the MVC. Ben Frable also participated for the third consecutive year on a panel at 2019 San Diego Comic-Con entitled, “The League of Extraordinary Scientists and Engineers: More Science in Your Fiction.” In addition, Ben Frable attended a workshop on fish histology at the University of Washington’s Friday Harbor Labs in order to better understand how to preserve and maintain fish tissues.

In October 2019, gyotaku artist Dwight Hwang visited the collection to demonstrate the Japanese art of fish printing. He joined the team in March 2020, just before the COVID-19 shutdown, aboard the R/V Robert Gordon Sproul to demonstrate these techniques to the Biology of Fishes class.

Unfortunately, due to COVID-19, collection activities have been curtailed since March, but the team hopes to get back to normal operations in the not too distant future.

Philip Hastings, Collection Curator
Benjamin Frable, Collection Manager

PELAGIC INVERTEBRATE

COLLECTION

SUPPORTED BY FRIENDS OF THE SCRIPPS COLLECTIONS

Donor support continues to play a crucial role in many activities, including sustaining active curation efforts (7,300 samples last year) that ensure long-term viability of plankton samples in the Scripps Pelagic Invertebrate Collection, the largest such collection in the world.

The team continues to work closely with colleagues at the Southwest Fisheries Science Center to acquire plankton samples from the California Cooperative Oceanic Fisheries Investigations (CalCOFI) program. Over the course of the year, they accepted approximately 550 samples from the California Current Ecosystem Long-Term Ecological Research program and about 200 samples from the California Wetfish Producers Association, the latter monitoring California market squid. A dozen peer-reviewed scientific publications resulted from use of this collection’s materials in 2019–20. Some examples include discovering that changing presence of krill in the California Current modifies the timing of blue whale migrations, validating zooplankton measurements by a novel robotic Zooglider, investigating the patterns of suspended and zooplankton-ingested microplastics, and defining spawning patterns in the California market squid via observations of their larval stages.

While the collection was closed in mid-March 2020 to follow UC San Diego’s guidelines for the COVID-19 pandemic, the team continued to supervise remote database work for undergraduate lab assistants. Limited on-site activity was resumed in June on a per-request basis for research purposes. The team worked to continue to digitize and bring tens of thousands of pelagic invertebrate reference specimens online and available for the research and education communities.

As a result of support from Friends of the Collections, regular annual activities continue to include obtaining new samples, maintaining an up-to-date digital catalog of all holdings, enumerating zooplankton samples, updating databases of zooplankton enumerated by microscopy and digital Zooscan, building a library of digital photomicrographs, training graduate students and other researchers in taxonomy, supporting UC San Diego undergraduate and graduate courses, providing public tours to visitors, and facilitating numerous research projects.

Mark Ohman, Collection Curator
Linsey Sala, Collection Manager
Thanks to funding from Friends of the Collections in the 2019–20 year, the Benthic Invertebrate Collection acquired 678 new specimens, digitally catalogued 4,373 existing specimens, and supported 21 new scientific publications resulting in the description of 30 species new to science.

Among these discoveries are the iridescent deep-sea “Elvis” worms (*Peinaleopolynoe elvisi* and three relatives), known for their glimmering scales and a mysterious rhythmic “jitterbug” behavior.

Another example is Southern California’s local parchment worm, now recognized as unique and named *Chaetopterus dewysee* after a longtime research supporter. These tube-building creatures have inspired bioluminescence research at Scripps, are ecologically important in La Jolla’s submarine canyons, and now include the first worm “cybertype,” a freely available 3D micro-CT scan that helps scientists conduct biodiversity research remotely.

In August, Collection Curator Greg Rouse led an expedition off San Nicolas Island aboard the R/V Robert Gordon Sproul to collect an elusive deepwater mollusk for genomic research.

This spring, Professor Rouse and collaborators explored the remote deep-sea canyons off Western Australia aboard the R/V *Falkor* using the ROV *SubBastian*. These previously unexplored habitats, adjacent to the Ningaloo Reef UNESCO World Heritage Site, held astonishing biodiversity, including a galaxy-shaped siphonophore that is likely the longest marine animal ever recorded.

Greg Rouse, Collection Curator
Charlotte Seid, Collection Manager

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During the 2019–20 year, the Geological Collection team used funds to curate fossils in the Geological Teaching Collection. The fossils include casts of saber-tooth cats, rhinoceros, killer whales and human ancestor skulls, among many others, as well as trilobites, ammonites, plants and microfossils. These fossils are used in numerous UC San Diego classes in archaeology, marine geology and paleobiology, as well as summer classes for undergraduates and high school students. The support from Friends of the Collections has helped to obtain a university grant to expand efforts with the teaching collections, including creating a new website to allow users to easily search the collection. The collection can be searched through the web to help assemble lab sample sets and to make the whole collection of use to a wide variety of classes at UC San Diego.

Collections gift funds were also used for a project curating a large education collection of deep-sea sediment made available to educators, scientists and artists. These samples were used in several outreach programs last year. In the fall, Collection Curator Dick Norris taught two School of Rock workshops to teach elementary and high school teachers, as well as aquarium educators from around the world, about marine geology using the research and teaching collections. In addition, Collections Manager Alex Hangsterfer engaged in many outreach activities that included about twenty lab tours, as well as going into classrooms to give presentations to students before COVID-19 shut down in-person activities.

To continue engaging in outreach while physical distancing requirements are in place, the Geological Collections are creating web-based material for educators, which includes working on virtual lab tours that will be available for the 2020-21 academic year. Finally, Alex Hangsterfer has been working to help create a software tool that automatically assigns digital identifiers to samples in the collection. Once the software goes live, the tool will help to efficiently assign unique digital identifiers to the core collection, so that samples taken from cores can also be assigned identifiers that will be easily incorporated into publications, increasing the discoverability of the samples in the collection.

Dick Norris, Collection Curator
Alex Hangsterfer, Collection Manager
SUCCESSFUL BREEDING OF WEEDY SEA DRAGONS

SUPPORTED BY FRIENDS OF BIRCH AQUARIUM AT SCRIPPS

For the first time ever, Birch Aquarium at Scripps has bred and successfully hatched two rare Weedy Seadragons with the help of generous philanthropic support in the 2019–20 year. This is a first for Birch Aquarium, now one of the few aquariums in the world to hatch this unusual fish. The inch-long babies displayed the characteristic camouflaging appendages of the elaborate Weedy Seadragons in miniature.

“We are elated to have breeding success with our Weedy Seadragons. This is a momentous event for our team and our seahorse and seadragon breeding program,” said Jennifer Nero Moffatt, Birch Aquarium’s senior director of animal care, science and conservation. “Seadragons are charismatic, sensitive and require detailed husbandry. We have spent over 25 years working with these animals and love that we have made the next steps to conserve this delicate species.”

Weedy Seadragons are native to southern Australia, and Birch Aquarium has had a population on display, and as part of a behind-the-scenes breeding program, since 2012. The Seadragon Breeding Program was created because of the aquarium’s success in breeding other seahorse, or signathid, species. Since 1995, Birch Aquarium has bred thirteen different seahorse species, sharing more than 5,000 juvenile seahorses with other aquariums around the world.

The Weedy Seadragon hatching comes on the heels of the May 2019 opening of Seadragons & Seahorses, Birch Aquarium’s newest permanent exhibition that highlights the husbandry team’s dedicated work and the state-of-the-art research laboratory behind the scenes, part of which is viewable by the public. Support from Friends of Birch Aquarium assists in the exhibition’s aim to breed seadragons in captivity and help scientists answer basic questions about the species. Currently, the most common answer to a seadragon questions is, “We just don’t know.”

For the time being, the baby Weedy Seadragons will remain behind-the-scenes and not viewable to the public as the husbandry team monitors their growth.

BIRCH AQUARIUM EDUCATION

SUPPORTED BY FRIENDS OF BIRCH AQUARIUM AT SCRIPPS

Birch Aquarium recognizes its unique position as the education outreach center for Scripps Oceanography and, by extension, UC San Diego. It is the largest provider of K-12 ocean science education in San Diego County serving nearly 25,777 students in the 2019–20 school year. Thanks to incredible philanthropic support, scientists and educators were able to specialize in communicating real-time scientific research with the public through informal STEM (science, technology, engineering and math) education experiences. Birch Aquarium’s well established education programming seeks to inspire a lifelong love and stewardship of nature while promoting scientific curiosity.

Of the nearly 25,777 students served, 47 percent received financial aid, providing educational access to many underserved students and communities. The students were able to experience Birch Aquarium on-site or at their school through Discovery Labs (6,661), Beach Teach (91), self-guided visits (8,191), and Beach Science Programs (1,183). Students participated in hands-on activities led by Birch Aquarium instructors, either in their classroom or during day-long field trips.

In September 2019, Birch Aquarium finished aligning all classes for kindergarten through grade 12 with national Next Generation Science Standards (NGSS). The revised 14 Discovery Labs, Beach Teach and Beach Science Programs utilize the “SE” instructional model, which is a research-based method for developing science lessons with a learning sequence approach, making the classes even more exploratory and student-centered.

As the world faces unprecedented environmental changes and a global pandemic, finding innovative ways to respond to the changing earth has become essential. In 2020, as a result of COVID-19, Birch Aquarium has moved swiftly to bring much of its education to a virtual platform, including online learning materials, live chats with aquarium experts, and educational videos. This new type of virtual engagement has been able to reach nearly 200,000 viewers at home.

As Scripps Oceanography expands its research initiatives, Birch Aquarium will serve as a conduit for converting new insights into inspiration for change, led by learners of all ages.
Continue the nontradition.

Thank you for supporting Scripps Institution of Oceanography and Birch Aquarium at Scripps. Your contributions are part of the Campaign for UC San Diego — our comprehensive fundraising effort concluding in 2022. Together with our philanthropic partners, we will continue our nontraditional path towards revolutionary ideas, unexpected answers, lifesaving discoveries and planet-changing impact.

For more information about how you can support your passion at Scripps Oceanography and Birch Aquarium and continue the nontradition, please contact:

SCRIPPS INSTITUTION OF OCEANOGRAPHY
UC SAN DIEGO
9500 Gilman Drive #0210
La Jolla, CA 92093-0210
(858) 822-1865
supportscripps@ucsd.edu
scripps.ucsd.edu/giving/give-now