



New England
Aquarium

blue

It's time to *live blue*™

Bluespotted Maskray Pups

Epaulette Sharks

Ocean Science Moves Online

Members' Magazine

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@neaq.org

Our website is full of conservation information, animal facts, and details that will help you plan your next trip to the Aquarium.

On the cover: Bluespotted maskray pup. Photo: Vanessa Kahn

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Dear Friends,

This issue of *blue* hits electronic mailboxes right around the time the Aquarium closed to the public one year ago on March 13. Our story is similar to those of other organizations—at the time, we had no idea how great the challenges ultimately would be, or how long they would last. With our doors closed six of the last 12 months, we are still recovering from the financial losses of the past year, yet our work never stopped, it just changed.



Photo: Webb Chappell

From the President and CEO

One of our biggest shifts was how we inspire and engage others in our efforts to protect the blue planet. We used to do that primarily in person, but now we’re delivering almost all of our educational programming virtually. Most of that programming is free of charge and accessible to all on our social media channels, such as Facebook, and on our website (www.neaq.org/virtual-visit) and YouTube channel.

We also created paid virtual educational programming knowing many students wouldn’t be able to visit the Aquarium with their teachers and schools (read more on page 2), and paid virtual animal encounters for individuals and groups interested in learning more about our penguins, sea lions, fur seals, harbor seals, and the animals living in our Giant Ocean Tank.

Organizationally, we’ve worked to further integrate our now leaner organization for greater impact. One example of this is a research project that scientists in our Anderson Cabot Center for Ocean Life worked on with our Animal Care staff members. That story begins on page 4.

Amid all the seemingly endless challenges we faced in the past year, we have cause for celebration. For the first time in four years, bluespotted maskray pups were born at the Aquarium this winter! While it will still be a while before you will be able to visit them in their permanent Aquarium habitat, you can see and read all about them on page 6.

Thank you for your ongoing support during this past, most challenging year. I look forward to continuing to work together for a vital and vibrant ocean for generations to come, and to seeing you on Central Wharf!

Best,

Vikki N. Spruill
President and CEO, New England Aquarium

Ocean Science Education Moves Online



A passion for protecting the blue planet isn't something you keep to yourself. The Aquarium's dedicated educators help visitors of all ages get to know our animals and learn how our aquarists and scientists work with them.

In less-distanced times, they also led on-site professional development workshops for teachers and shared engaging resources and activities, including ocean science kits that teachers could borrow to use in their classrooms. Now, as the pandemic reshapes teaching and learning, our educators are finding new ways to help thousands of people stay connected with the work we do on Central Wharf.

For Sean Osborne, a visitor education specialist who helped plan the curriculum for our new Virtual Academy programs, his job provides the perfect link between his love for marine biology and his passion for sharing that love with others.

"My goal has always been to find ways to help protect the environment, and I find that directly engaging with people to do this is the best way I can help accomplish that," he says.

In the era of online learning, it's more important than ever to find ways to make science education engaging, relatable, and fun. Thanks to our educators' efforts, teachers can now use free Virtual Visit videos on [YouTube](#) and [Facebook](#) to augment their science lessons. They can also schedule a Virtual Animal Encounter for their students to spend face time with sea lions, fur seals, harbor seals, penguins, and animals in our Giant Ocean Tank. And they can access an ever-expanding list of at-home activities, from letter-writing campaigns to coral-reef-inspired crafts projects, through our website and our educator newsletter.

Among our most popular online educational offerings are the Virtual Academy programs, which combine Zoom sessions on ocean life, sea turtle rescue, and animal physiology with hands-on activities to build STEM skills for K-5 students.

"The primary hope is to provide fun, educational resources that connect teachers and students to marine life and conservation efforts, no matter where they are," says Katie O'Brien, a visitor education specialist who teaches in the Virtual Academy programs and helps ensure that they meet state and national standards for STEM education.

Since the they launched in November, classroom groups from all over Massachusetts and further afield have taken part in the three 45-minute Virtual Academy programs, which each include a hands-on component

that helps students connect scientific knowledge with their own experiences. Depending on the program, this might mean using tracking maps to follow rehabilitated sea turtles through the open ocean, studying how animals respond to stress, or writing letters to their school communities and families to advocate for single-use plastic bans.

Teacher Services Supervisor Corrine Steever, a co-creator of the Virtual Academy programs, says that one silver lining of the online format has been the ability to reach students and teachers who would not normally be able to come to the Aquarium, including recent groups from Maine and Illinois.

"By building these online platforms," Steever says, "we've broadened who we can reach and the kinds of stories we can tell."



Visitor Education Specialist Katie O'Brien hosts an Animal Facts video for the Aquarium's social media channels.



Educator Lindsay Jordan hosts a Virtual Academy session using Aquarium biofacts.

At the end of each activity, the educators also allow ample time for students to voice their questions about ocean life and conservation.

"One difference between the Virtual Academies and visitor education is that you get more time to interact, so you can give more in-depth explanations," says Osborne. "I love seeing the excitement from kids when they get their questions answered."

Like O'Brien and Steever, Osborne has enjoyed discovering new ways to share the Aquarium with students and teachers online, but he is also looking forward to the moment when he'll be able to connect with them again in person.

"The Aquarium is a special place for me, so I can't wait to get back to sharing it with visitors regularly," he says.

—John Shakespear



Photo: Marisa Bernal

Virtual Academy Programs

Through three 45-minute programs on Zoom, student groups can learn from Aquarium staff and participate in activities that develop their STEM skills.

Ocean Animal Life Cycles: Students learn how we care for animals from their larval stages onward, observing and comparing how different animals change over time.

Sea Turtle Rescue: Through our sea turtle rescue and rehabilitation work, students learn what they can do to protect animals and take action in their own communities.

Flight, Fight, and Freeze: Participants learn to recognize stress responses in themselves and in other animals, connecting ocean life with their own experiences.

Learn more at neaq.org/virtual.



SHARK RESEARCH IS A TEAM SPORT *AT THE AQUARIUM*

Epaulette sharks are the elite athletes of the Indo-Pacific region. These small but mighty elasmobranchs can walk on the ocean floor with their back fins, survive in environments free of oxygen, and thrive in extreme tidal flat environments. They are also some of the most popular animals in the Aquarium's Trust Family Foundation Shark and Ray Touch Tank.

In the wild, epaulettes live in Australia's Great Barrier Reef, a vast ecosystem threatened by coral bleaching from rising ocean temperatures. Because epaulette sharks are especially adaptable to their environment, researchers at the Aquarium's Anderson Cabot Center for Ocean Life chose to use the species as a model organism to study the effects of climate change. After all, if an Olympic athlete is responding poorly to a changing environment, how is your average human going to respond?

"They're known as a very resilient species and one that has this fascinating physiology," said Dr. John Mandelman, vice president and chief scientist at the Anderson Cabot Center for Ocean Life at the New England Aquarium.

Epaulettes are also oviparous, meaning they lay egg cases where the embryos develop and hatch outside the mother shark's body. The Aquarium has had a successful epaulette shark breeding program for years and the egg cases have appeared on exhibit in the Aquarium, "but we'd never used the egg cases for a research study before," said Mandelman.

Enter Caroline Wheeler, a Ph.D. candidate at the University of Massachusetts Boston and at the ARC Centre of Excellence for Coral Reef Studies at James Cook University. At the Anderson

Cabot Center, she studies sharks under Mandelman's guidance. Using egg cases from the Aquarium's healthy breeding population of epaulette sharks, Wheeler set up an experiment to examine how increasing temperature impacts how embryos grow and develop within their egg cases, and enlisted the help of the New England Aquarium husbandry team.

The egg cases laid on exhibit were retrieved by the animal care teams working in the Aquarium and transferred to the Aquarium's Animal Care facility in Quincy, MA, which is led by Barbara Bailey, curator of husbandry and sustainability.

Bailey's team set up a tank system with different temperature gradients, and a group of aquarists, interns, and volunteers assisted Wheeler with everything from cleaning and maintaining tank water quality to "candling" the eggs—a process where you shine a light behind the egg cases and record tail beats and respirations of the developing shark embryo.

"This was really the first collaborative study of this kind [for the Aquarium]," said Bailey, adding, "And for the scientific community, it's an important one."

The study, published in the journal *Scientific Reports* in January, found that as their ocean environment warms, the baby epaulette sharks were born smaller, exhausted, and undernourished.

"We found that the hotter the conditions, the faster everything happened, which could be a problem for the sharks," said Wheeler. "The embryos grew faster and used their yolk sac quicker, which is their only source of food as they develop in the egg case. This led to them hatching

earlier than usual." Wheeler said the hatchlings were not only smaller but they needed to feed almost immediately because they lacked significant energy.

In short, the study found that the warmer temperatures made it harder for the epaulettes to thrive in their environment—an environment getting increasingly hostile due to human-caused climate change.

The New England Aquarium is in a unique position to perform these types of studies. Aquarium staff are experts at keeping animals healthy and thriving in their exhibits on Central Wharf and the researchers at the Anderson Cabot Center for Ocean Life are masters at studying these organisms in a scientific way.

"There is a strong connection between our exhibits and the conservation work that's going on at the Aquarium. Our skill set is in husbandry—taking care of the animals—whereas Anderson Cabot's is in designing studies and conducting the research," said Bailey. "When those two pieces come together, it makes the work stronger."

"When you wed the two of those things, you can produce really interesting, rigorous, high-impact results," said Mandelman, calling this study "a real team effort."

—Emily Greenhalgh

This research was funded by the New England Aquarium with support from individual donors' restricted funds to Anderson Cabot Center for Ocean Life.

[Read more about the study in a recent story by the Associated Press.](#)



Top: Epaulette shark pup; bottom left: Caroline Wheeler working in the lab; bottom right: epaulette shark egg case with embryo visible inside.

Photos: E. Moothart.

Seeing Blue



Photo: Vanessa Kahn

The Aquarium's Shark and Ray Rearing Program BY THE NUMBERS

70

animals call our Shark and Ray Touch Tank home

7

years since the inception of our bluespotted maskray rearing program

18

months needed to rear a bluespotted maskray

6

species in our shark and ray rearing program

16

shark pups are currently being raised off exhibit

3-4

years for a blue-spotted maskray to be fully grown

To learn more, watch our [Virtual Visit about the Bluespotted Maskrays!](#)



Photo: Sam Cheng

In January, the Aquarium welcomed four adorable bluespotted maskray pups! They're the first bluespotted maskrays born at Central Wharf since 2017. With distinctive mask-like shading around the eyes and a smattering of iridescent blue spots on their fins, this gracefully swooping ray species is featured in our Trust Family Foundation Shark and Ray Touch Tank exhibit.

"They're a really beautiful, striking-looking species with those blue spots," says Sarah Tempesta, supervisor of interactive exhibits and manager of the shark and ray rearing program. Members of the *Neotrygon* genus and *kuhlii* species of rays, bluespotted maskrays are native throughout the Indo-West Pacific region.

"The first week they were born, they just stayed buried in the sand all day. They barely moved," says Tempesta. "There's no relationship between mom and offspring. Once she gives birth, that's it. The little pups are on their own. That's how it would be in the wild."

To ensure survival, they are born with their stinging barbs and an internal yolk that nourishes them for their first week or so.

The pups are being reared by Tempesta off exhibit (behind the scenes at Central Wharf) in conditions that mimic the wild; in this case, a large tank with a sandy bottom where they can burrow and nap as they please. She describes the pups (born in two different litters) as "super cute" and "miniature versions of the adults, who have to be able to swim, bury, and evade predators right from day one."

Once they reach a month old, the pups become more active and begin eating a

more varied diet. "Sometimes it can be really, really difficult to get them to start eating . . . it can take a lot of trial and error with different foods, but so far," says Tempesta, "these pups are adapting well."

Tempesta feeds them small pieces of shrimp, clams, squid, and a little bit of fish several times a day. "When stingrays are young, they have a pretty quick growth rate and so they need a lot of food. In the wild, they would be grazing throughout the whole day," she says.

At a few weeks of age, the first litter of pups weigh between 100–150 grams (roughly equivalent to 20 nickels) and measure approximately five to six inches wide. The solo pup born to the second litter is considerably larger; he weighs in at 250 grams and is almost seven inches in diameter. The pups will reside together for the next 18 months before the two female pups move to the Trust Family Foundation Shark and Ray Touch Tank exhibit and the two males head to other aquariums.

The Aquarium launched its bluespotted maskray rearing program in 2014, making these pups the fourth and fifth successive litters since the program's inception. "We have a really controlled rearing program here," Tempesta says. "Typically, our males and females do not live together."

This past spring, after years of careful planning, she paired two female maskrays with a male and waited. Female maskrays, similar to humans, exhibit swollen abdomens when expecting and so it wasn't all that long before Tempesta knew both females were pregnant.

The maskray rearing program aligns with the Aquarium's mission to maintain vibrant oceans and preserve and protect aquatic life. While labor intensive, it offers a sustainable way to repopulate the Aquarium's exhibits (as well as other aquariums across the country) without disturbing wild populations. The International Union for Conservation of Nature—which has determined that

more than 50 species of stingrays are threatened—lists bluespotted maskrays as data-deficient animals, meaning there isn't sufficient data to determine if this species is threatened.

And then there's the sheer awe one experiences in the company of creatures like bluespotted maskrays. "I think once they go into the touch tank, these animals will be able to inspire our visitors to become ocean stewards," says Tempesta. "We work on conservation and we also want to inspire others so that the work keeps moving forward. Someone might come here and really be entranced by seeing this species, and be inspired to take some action to try to help save the ocean."

—Maria Palomino

Sarah Tempesta feeds a bluespotted maskray pup.



Photo: Vanessa Kahn



THANK YOU FOR YOUR SUPPORT!

Photo: Vanessa Kahn

To our generous community of donors, **THANK YOU** for supporting the New England Aquarium in 2020.

We remain profoundly grateful for your unwavering commitment to our mission, especially as we continue to navigate the challenges of a global pandemic.

Last year, our board of trustees launched the Mission Forward Fund to replace lost revenue during our initial closure to the public. It proved to be an essential lifeline that allowed us to continue our critical conservation efforts despite having to shutter our doors for six of the past 12 months. Your gifts of all sizes have helped us survive, raising more than \$11 million—more than doubling our original goal of \$5 million.

We remain optimistic about the future of our beloved institution while needing your generosity as we recover financially. Your donations had a tremendous impact in 2020.

Highlights include:

- Our Anderson Cabot Center scientists published 33 peer-reviewed publications and a book on the bowhead whale.
- We ensured the care and safety of our 15,000 animals continued uninterrupted while we were temporarily closed to visitors.
- With over 569 sea turtles admitted, and 51 critical turtles remaining in-house, we had another record-breaking sea turtle rescue season.
- We were one of the first cultural organizations in Boston to provide virtual programming, allowing visitors to stay connected to the wonders of the ocean through our social media channels and Virtual Visit webpage.
- We launched our Virtual Academy, a standards-aligned interactive educational program aimed at supporting the evolving needs of K-5 students.

As we look forward to a brighter year, our focus remains on the stability of the Aquarium's future. To continue your support, please visit neaq.org/missionforward.

THE LEGACY SOCIETY

The long-lasting financial impact of being closed for a total of six months has left irrevocable damage on our institution. Although your donations played a vital role in our re-openings over the past year, a long-term investment would support us at the next level.

We hope you'll consider including the Aquarium in your will or estate plans by joining our Legacy Society. Society members have been making revocable

commitments to the Aquarium's mission and future accomplishments for years, ensuring that our work is carried on for generations to come. Your planned gift will ensure that your passion for the ocean continues through our critical mission work. Your commitment today will protect our ocean's tomorrow.

To join our Legacy Society, or to learn more, please contact Margaret Phan, Giving Officer, at mphan@neaq.org.



**New England
Aquarium**

Central Wharf
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Photo: Vanessa Kahn

Member Mornings

Tuesdays and Thursdays
February 23–April 15

To show our appreciation for your ongoing support, we are offering Member Exclusive Access every Tuesday and Thursday morning between 9:00 and 10:00 a.m. from February 23 through April 15, 2021.

You may bring additional guests during this hour by including them in your reservation. Your member discount of 10% off guest admission will apply to the number of discounted guest admissions permitted by your membership level.

To reserve your time, visit tickets.neaq.org and select **Member Exclusive Access**.