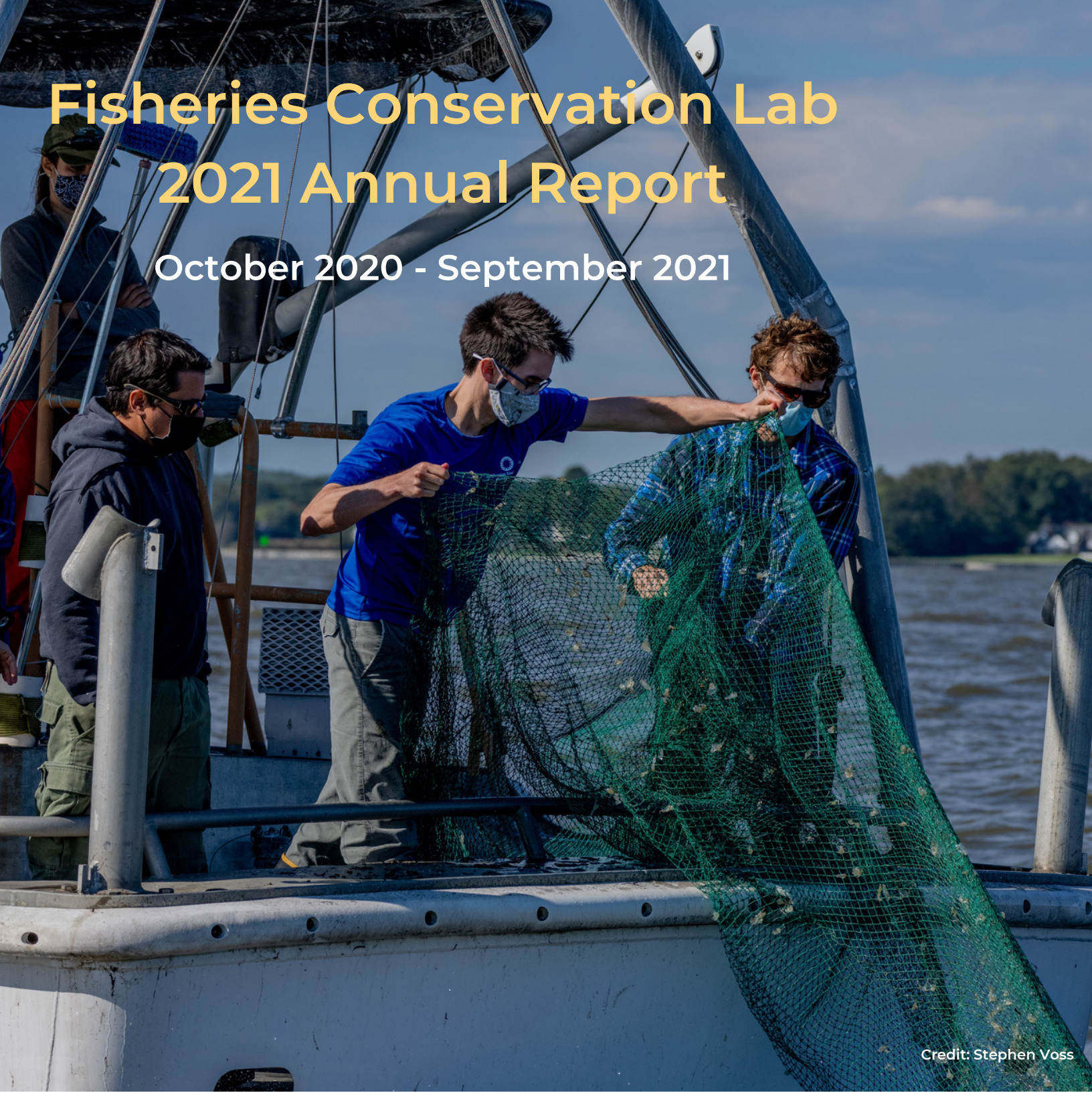
Fisheries Conservation Lab 2021 Annual Report

October 2020 - September 2021



Credit: Stephen Voss

Investigating the Ecology, Management, and Conservation of Marine and Estuarine Fisheries

Smithsonian
Environmental Research Center

Credit: SERC

NOTES FROM THE FIELD

If 2020 was characterized by the upheaval COVID-19 brought to all of our lives, 2021 was marked by the first major steps back toward normal operations, and the rush of catching up on delayed projects.

We continued to expand our research on large-scale efforts to restore oyster reefs in the Chesapeake Bay. Postdoctoral Fellow Allison Tracy led a field study in fall 2020 investigating how restoration and harvest shape oyster reef habitat and oyster parasite dynamics. In summer of 2021, SERC Graduate Fellow and Duke University doctoral student Laura Givens collected environmental DNA samples to study biodiversity on restored and harvested reefs. Finally, Allison Tracy led a project seeking to reduce the cost of oyster reef monitoring using video-monitoring methods developed by the lab.

Spring of 2021 was a blur of river herring research, with four concurrent projects after several were delayed from the first spring of COVID-19. We continued to monitor the return of river herring to the upper Patapsco River following the removal of Bloede Dam in 2018/2019. In exciting news, Maryland Department of Natural Resources biologists captured the first river herring using restored habitat upstream of the dam. Postdoctoral Fellow Henry Leggett launched a new project studying how land use is affecting stream temperature and potentially reducing the amount of time each spring that water temperature is ideal for herring reproduction. In the Choptank River, we tested a potentially low-cost river herring monitoring tool, using audio-recordings to record the splashing sounds made during spawning events. Finally, Biological Technician Kim Richie led a new project studying the efficiency of ten fish ladders in Delaware that are intended to allow river herring to swim past dams in order to reach freshwater spawning habitat.

Summer came hot on the heels of river herring season with long-term surveys, the expansion of MarineGEO activities, and the return of an in-person intern plus two remote interns. Frostburg State University student Zophia Galvan came to SERC to work with MarineGEO and our long-term surveys, and conducted an independent study project on long-term variation in the blue crab fishery. Duke University Masters of Environmental Management student Claire Huang investigated river herring habitat use before and after the removal of Bloede Dam. Coastal Carolina University student Sunnidae Gallien studied oyster restoration.

I am especially proud that the lab came together to develop and implement a diversity, equity, inclusion, and environmental justice (DEIJ) action plan. The plan includes strategies to improve: 1) recruitment of staff, fellows, interns, and volunteers, 2) work environment, 3) research practices, and 4) efforts to influence the discussion of DEIJ issues at Smithsonian, in the field of ecology, and in the world at large.

As I write this, we are wrapping up the final fieldwork of the year and looking forward to a well-deserved break for the holidays. It is also unseasonably warm, underscoring growing concerns about climate change. In the coming year, we will contribute to Smithsonian's increasing focus on addressing climate change and ocean conservation issues. We will also continue to engage new audiences in our research and communications.

Sincerely,

Matthew B. Ogburn
Senior Scientist

Table of Contents

Credit: Stephen Voss

FISHERIES CONSERVATION LAB MEMBERS

Principal Investigator: Matt Ogburn (OgburnM@SI.EDU)

Staff: Rob Aguilar, Keira Heggie, Jack Olson, Kim Richie, Carmen Ritter

Graduate Fellows: Laura Givens, Sarah Mallette

Postdoctoral Fellows: Henry Legett, Gabriel Ng, Allison Tracy

Interns: Sunnidae Gallien, Zophia Galvan-Lam, Claire Huang

Chesapeake Conservation Corps Member: Julie Luecke

Citizen Scientist: Dave Norman

3 volunteers; 1,328 volunteer hours

ABOUT US

The Fisheries Conservation Laboratory engages in science and conservation supporting fisheries and healthy ecosystems. Working primarily in coastal areas, we address critical challenges including:

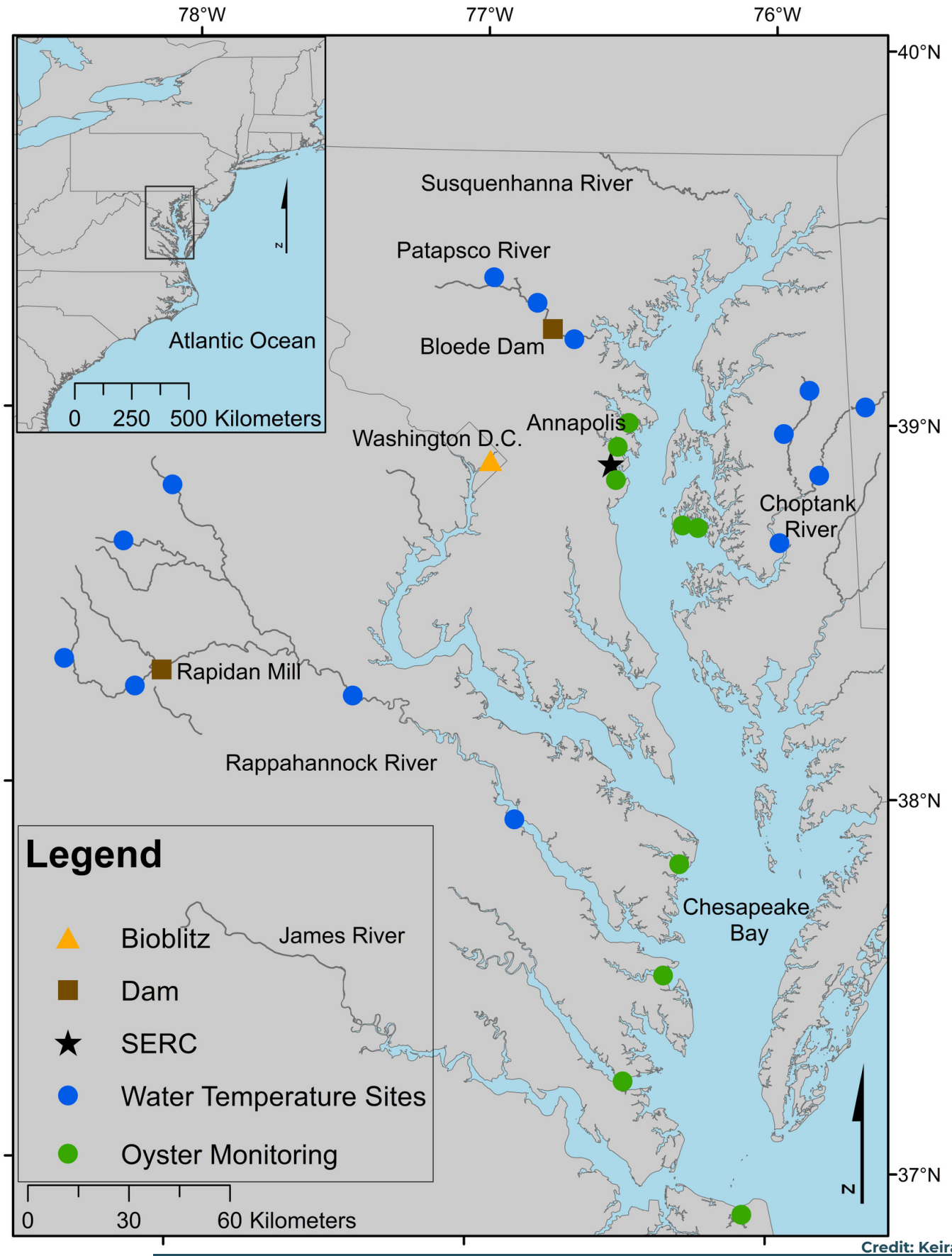
- *ecosystem impacts of fishing*
- *climate change*
- *habitat loss*
- *invasive species*
- *infrastructure development*

With our research, we hope to directly inform management practices that maintain sustainable harvests in today's fisheries and rebuild populations of species impacted by fisheries in the past.

Credits: Stephen Voss

WHERE WE WORK

This map shows the locations of some of our projects highlighted in this report.



Credit: Keira Heggie

Photo credit: Stephen Voss. Fish graphics: Tracey Saxby, University of Maryland

LAB ACTIVITIES

TRAWL SURVEYS

Since 1981, SERC has been sampling species from the deeper waters of the Rhode River, MD, and upper Chesapeake Bay. We record water conditions, fish lengths, and species counts to study changes in population and community dynamics. In 2021, we reported:

94
Trawl hauls

66,022
Organisms, such as Blue Crabs, Horseshoe Crabs, Penaeid Shrimp, and 31 fish species, including rare catches of Threadfin Shad and White Catfish

Bay Anchovy and Spot comprised 91.7% of the 2021 total catch!

First record of the marine parasite, Nerocila lanceolata, in the Rhode River

We found this individual infecting the tail fin of a Spot. Credit: SERC/iNaturalist.org

SUMMER SEINE SURVEY

We continued to sample nearshore, shallow water species from the headwaters in Muddy Creek to the marshy sub-tributaries and mainstem of the Chesapeake Bay. In 2021, we reported:

26
Seine hauls

6,774
Organisms, such as Blue Crabs and 35 fish species (e.g. Silversides, Mummichog, Killifish, Menhaden, Pumpkinseed, White Perch, Spot, and Sheepshead Minnow)

We found 2 Northern Snakehead, a non-native fish whose numbers may be increasing in the Rhode River.

Credits: Rob Aguilar/SERC

The Rapidan Mill Dam, Rapidan River, Virginia Credit: SERC

RIVER HERRING RESEARCH

Alewife and Blueback Herring are migratory fish native to the Chesapeake Bay. These species, collectively known as river herring, spend their adult lives in the sea, but migrate each spring to spawn in upstream habitats.

River herring migrations are ecologically and economically important for the region. Unfortunately, populations have declined in recent decades, largely due to overfishing, bycatch, climate change, and impervious surfaces like dams, roads, and culverts.

Utilizing traditional and revolutionary tracking technologies, The Fisheries Conservation Lab is studying the effects of human and environmental factors on river herring migrations, documenting fish returns after dam removals, and supporting community efforts to restore populations hopefully in the next 5 to 10 years.

Learn more with our river herring storymap

Adult Alewife (*Alosa pseudoharengus)* Credit: SERC

Henry installs a water temperature logger in the Rappahannock River. Credit SERC

Measuring Stream Temperatures

River herring migrations are linked to seasonal changes in water temperature. If waterways warm too early or quickly during the spring, river herring can have less time to migrate and spawn.

Postdoctoral Fellow, Henry Legett, measured stream temperatures throughout the Choptank, Patapsco, and Rappahannock watersheds. Henry is producing spatial models to assess:

1. thermal regimes of each watershed
2. number of days that water temperatures are suitable for river herring
3. how land use and dams are impacting seasonal temperature patterns.

INITIAL FINDINGS

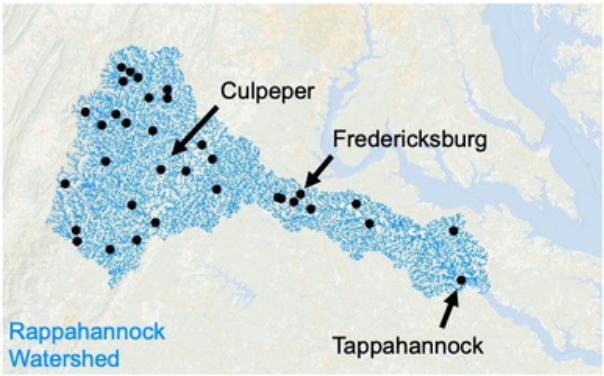
Warmest locations in the Rapphannock watershed:

- ***the mainstem of the river, downstream of Fredericksburg***
- ***streams below Culpeper, VA***
- ***streams above the Rapidan Mill Dam, VA.***

Agricultural lands (pastures and croplands) are the primary contributors to warming seasonal temperatures.

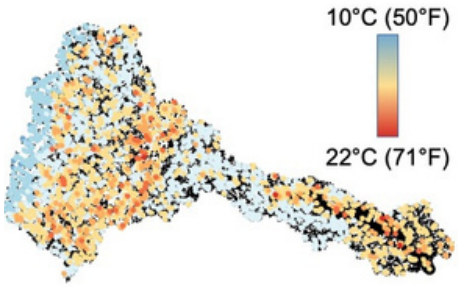
THE RAPPAHANNOCK WATERSHED

1) Hourly water temperature was measured at 34 sites

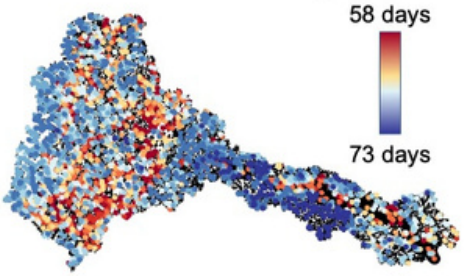


2) Measurements were used to estimate temperature metrics every 1 km (0.62 miles), such as…

Mean daily temperature from March to May



Number of days that water temperatures were suitable for river herring.



River herring start migrating at 48 °F and stop at 70 °F

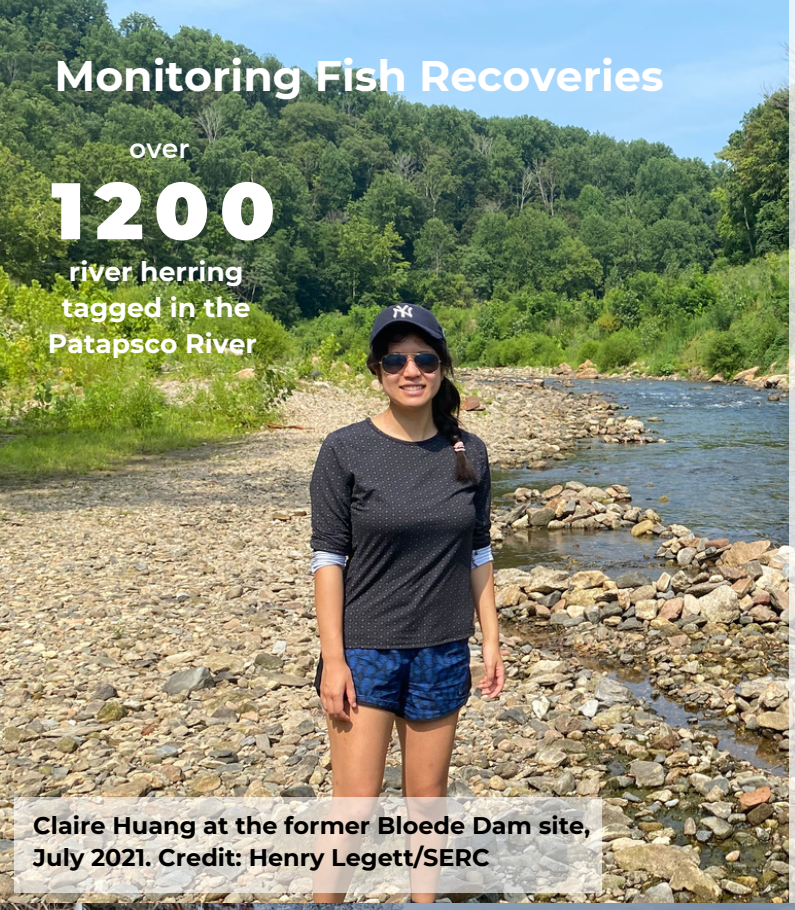
Credit: Henry Legett/SERC

Monitoring Fish Recoveries

over

1200

river herring tagged in the Patapsco River



Claire Huang at the former Bloede Dam site, July 2021. Credit: Henry Legett/SERC

THE PATAPSCO RIVER

The Bloede Dam once blocked fish species from migrating up the Patapsco River. In 2018, the dam was demolished, restoring over 60 miles of potential habitat. We monitored the river upstream and downstream of the Bloede Dam for four years before the dam's removal. Last summer, SERC intern Claire Huang joined our lab to lead a project investigating river herring responses to this recent and drastic habitat alteration.

We found river herring environmental DNA at most sampled sites in restored upstream habitat!

The change in detecting river herring downstream the former dam site also increased from 21-56%. However, we reported no evidence of increased fish egg abundance upstream or downstream the former dam.

Looking Ahead

Delaware Fish Ladder Research

In 2022, the lab will continue to study the efficiency of fish ladders in Delaware. This photo shows a fish trap for capturing river herring using the fish ladder at Silver Lake, Milford, DE. Credit: SERC

Acoustic Tagging Project

Our lab has performed extensive tracking of river herring with Passive Integrated Transponders (PIT tags). This spring (2022) we will use innovative acoustic tags to better study the potential effects of warming temperatures in the Chesapeake Bay on river herring migration.

(Left) Acoustic tags in different sizes (Right) Receiver. Credits: Innovasea.

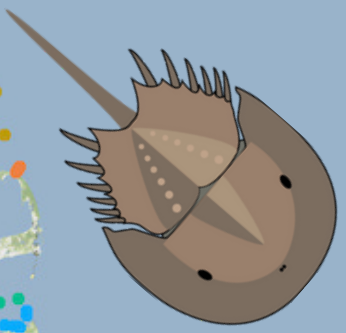
LEADING THE ACT NETWORK

Map showing active receiver arrays along the North American Atlantic coast

Map Credit: Kim Richie. Horseshoe Crab: Tracey Saxby. Photo: SERC

9.3 MILLION DETECTIONS

matched to a corresponding animal tag



In 2021, our lab acoustic-tagged many Horseshoe Crabs (*Limulus polyphemus*).

over
101
Projects

55
Institutions

138
Researchers

2152
Active transmitters

523
Listening stations

95
Species

In April of 2020, Fisheries Conservation Lab assumed leadership of the Atlantic Cooperative Telemetry (ACT) Network, a grassroots initiative of researchers on the Atlantic coast of North America that facilitates data and resource sharing for animal tracking efforts, many of which are part of the Smithsonian Movement of Life.

Acoustic telemetry allows our lab and other research groups to more frequently locate marine species. Acoustic receivers identify, record, and upload information from any acoustic transmitter, regardless of its origin. Different researchers can access and share data, allowing tracking efforts to expand farther than any team could accomplish on their own!

In 2022, the ACT Network will host more virtual meetings and workshops to foster network collaboration.

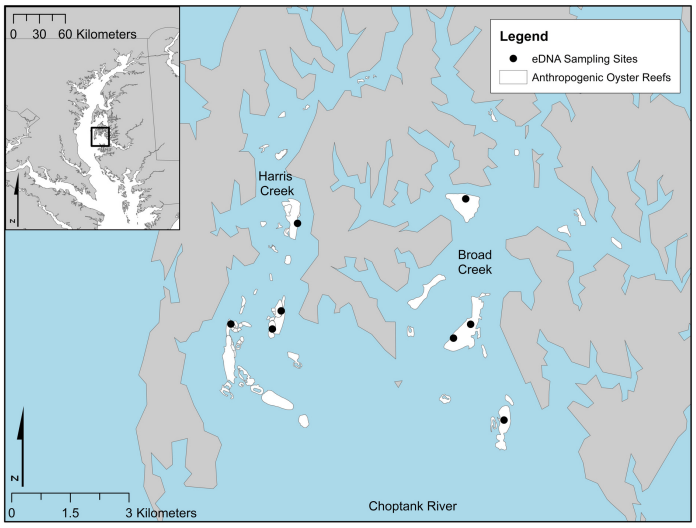
"I look forward to continuing to grow this community and advance the work that others have started!"
- Kim Richie, ACT Data Manager

LAURA GIVENS: OYSTER RESTORATION RESPONSES

Laura uses a Niskin sampler to collect water samples filled with aquatic eDNA. Credits: Keira Heggie/SERC

Oyster reefs provide essential habitat structure in the Chesapeake Bay. This past summer, SERC Graduate Fellow and Duke University doctoral student Laura Givens teamed up with our lab to explore the effectiveness of oyster reef restoration in the Rhode River.

Combining her interests in molecular biology and ecosystem ecology, Laura collected environmental DNA (eDNA) from oyster harvesting sites in Broad Creek and the restored area of Harris Creek to estimate biodiversity across the different reef zones.



Credit: Keira Heggie

Since her return to Duke University, Laura has been working in the lab to process, extract, and amplify DNA sequences from her water samples. Using a DNA reference database, made possible by the Chesapeake Bay Barcode Initiative, Laura will match DNA sequences with their respective species.

Credit: Laura Givens/Duke University

JACK OLSON: MARINEGEO UPDATES

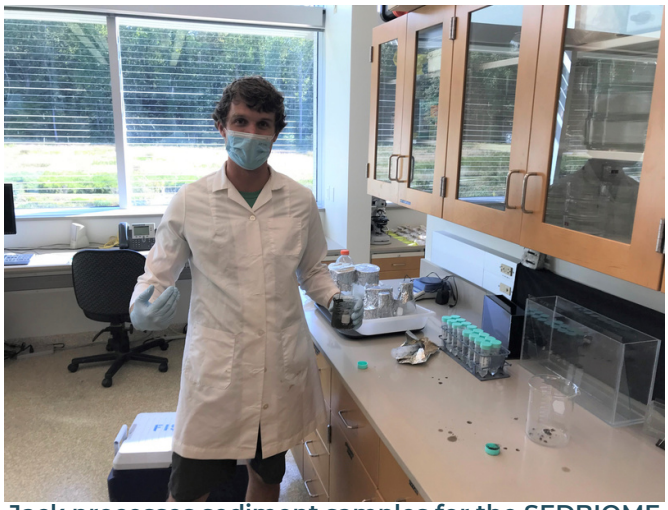
Jack recovers a "biobox" from an oyster reef in the West River, a tidal tributary of the Chesapeake Bay. Bioboxes are used to sample oyster reef mobile fauna. Credit: SERC

"This year was a busy year for SERC MarineGEO, as we expanded our research sites, developed new methods, and increased community collaboration. Despite pandemic restrictions, we increased our suite of focal habitats and communities in the Rhode River and nearby tributaries. While doing this, we expanded the salt marsh monitoring protocol to sample macroinvertebrate communities, which can play an outsize role in marsh function. We also began data collection on local oyster reefs, following protocols developed at the Smithsonian Marine Station in Florida.

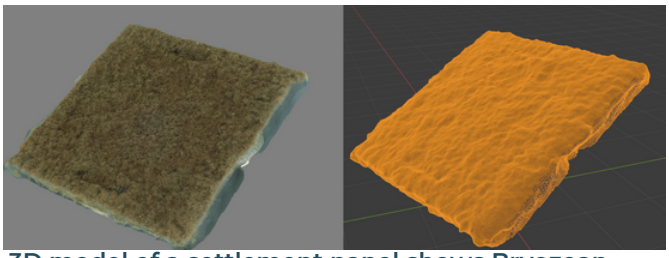
Our oyster reef sampling focused on aspects of the structure and function of subtidal oyster reef communities including predation intensity, fish size distribution, reef rugosity, calcium accretion, and benthic cover. Several of our chosen reefs have been restored and are managed by local non-profit organizations, which we hope will lead to exciting opportunities for collaborative science.

This summer, we also participated in two MarineGEO network experiments alongside partners from 28 countries. The projects – SEDBIOME and PANELS – investigated aspects of soil and fouling-community diversity, respectively, using molecular techniques. In the coming year, we are especially looking forward to completing and publishing several MarineGEO manuscripts on fish assemblage structure across the Western Hemisphere."

-Jack Olson, SERC MarineGEO site technician



Jack processes sediment samples for the SEDBIOME 2021 MarineGEO network project. Credit: SERC



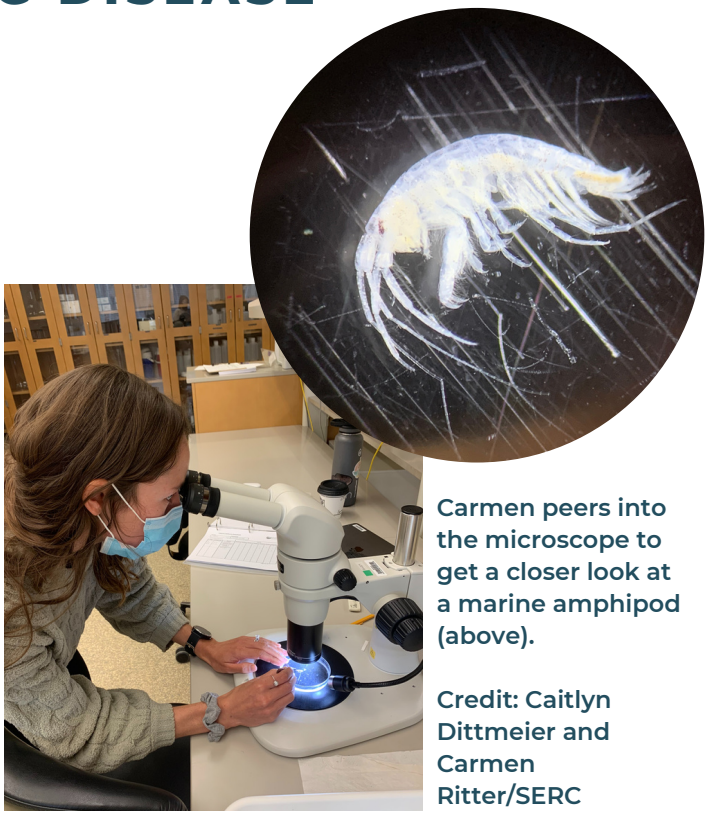
3D model of a settlement panel shows Bryozoan growth after 90 days in the Rhode River for the PANELS project. Credit: David Branson

CARMEN RITTER: EELGRASS WASTING DISEASE

MarineGEO and Fisheries Conservation Lab technician Carmen Ritter traveled to Oregon and Alaska this past summer for a National Science Foundation (NSF) funded project led by Emmett Duffy studying large-scale eelgrass die-offs, caused by an aggressive wasting disease, along North America's west coast.

For the past three years, scientists have been surveying changes in eelgrass density and health with on-the-ground measurements and aerial mapping at six sites stretching from San Diego to Alaska. Other aspects of the project include sequencing the disease with qPCR methods that measure DNA; continuously monitoring environmental factors such as temperature; and analyzing eelgrass blades for disease lesions.

Carmen focuses on the epifaunal invertebrates that live on and around the eelgrass beds. At the SERC lab in Maryland, she sorts and identifies crustaceans, worms, and mollusks from each site, and hopes to identify a relationship between the resident animals and the disease threatening their habitats.



Carmen peers into the microscope to get a closer look at a marine amphipod (above).

Credit: Caitlyn Dittmeier and Carmen Ritter/SERC

Carmen (front) leads other members of the NSF funded team in Oregon during their first fish seine survey to accompany eDNA measurements from the waters near eelgrass beds. Credit: Eelgrass wasting disease project team

OUTREACH AND EDUCATION

PODCAST FEATURE

The Smithsonian's *Sidedoor* Podcast released an episode telling the story of our lab's efforts to detect river herring returns after the removal of the Bloede Dam in the Patapsco River. Here, journalists interview Rob Aguilar and Keira Heggie as they prepare to tag fish. Listen to "Holding Out for a Herring," 4.21.2021.

Credit: Matt Ogburn/SERC

RAPPAHANNOCK WORKING LAND & SEASCAPES

Matt Ogburn

Allison Tracy

Henry Legett

Smithsonian marine and terrestrial ecologists study how land use change influences biodiversity and ecosystem services on the land and in the water within the Rappahannock Watershed.

Members of our lab on the team are synthesizing diverse datasets, evaluating oyster restoration, and monitoring river herring habitats. We exchange knowledge with local communities to translate scientific research into conservation practices that benefit people and nature.

Credit: Meredith Hickman

Visit the RappWLS storymap.

52

Stakeholder collaborators on Henry Legett's water temperature project including:

15 Organizations & **37** Individuals

Credit: SERC

THE ANACOSTIA RIVER BIOBLITZ
SEPTEMBER 16-19 2021

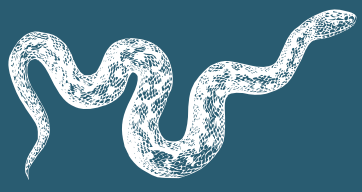
Our lab teamed up with citizen scientists and volunteers from the Anacostia Watershed Society to add to the growing record of fish and other species living in the Anacostia River watershed. This year, the Bioblitz's main tool, iNaturalist, reported a record number of observed reptiles, mollusks, arachnids, insects, and fish.

We achieved our goal to enhance fish biodiversity sampling; the number of fish species observed tripled from 2020 to 2021! This data includes observations of many young Alewife and American Shad, a great sign for their populations in the Anacostia River.

We spotted many Longnose Gar (*Lepisosteus osseus*). Credit Rob Aguilar

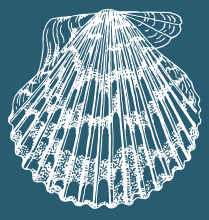
TOTAL SPECIES OBSERVED

435
Plants



9
Reptiles

24
Fish



17
Mollusks

59
Birds

Credit: Anacostia Watershed Society

HOW TO SUPPORT OUR WORK

STAY CONNECTED

The Smithsonian Environmental Research Center
The Fisheries Conservation Lab
Working Land and Seascapes
Movement of Life
MarineGEO

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@SmithsonianEnv

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@SmithsonianEnv

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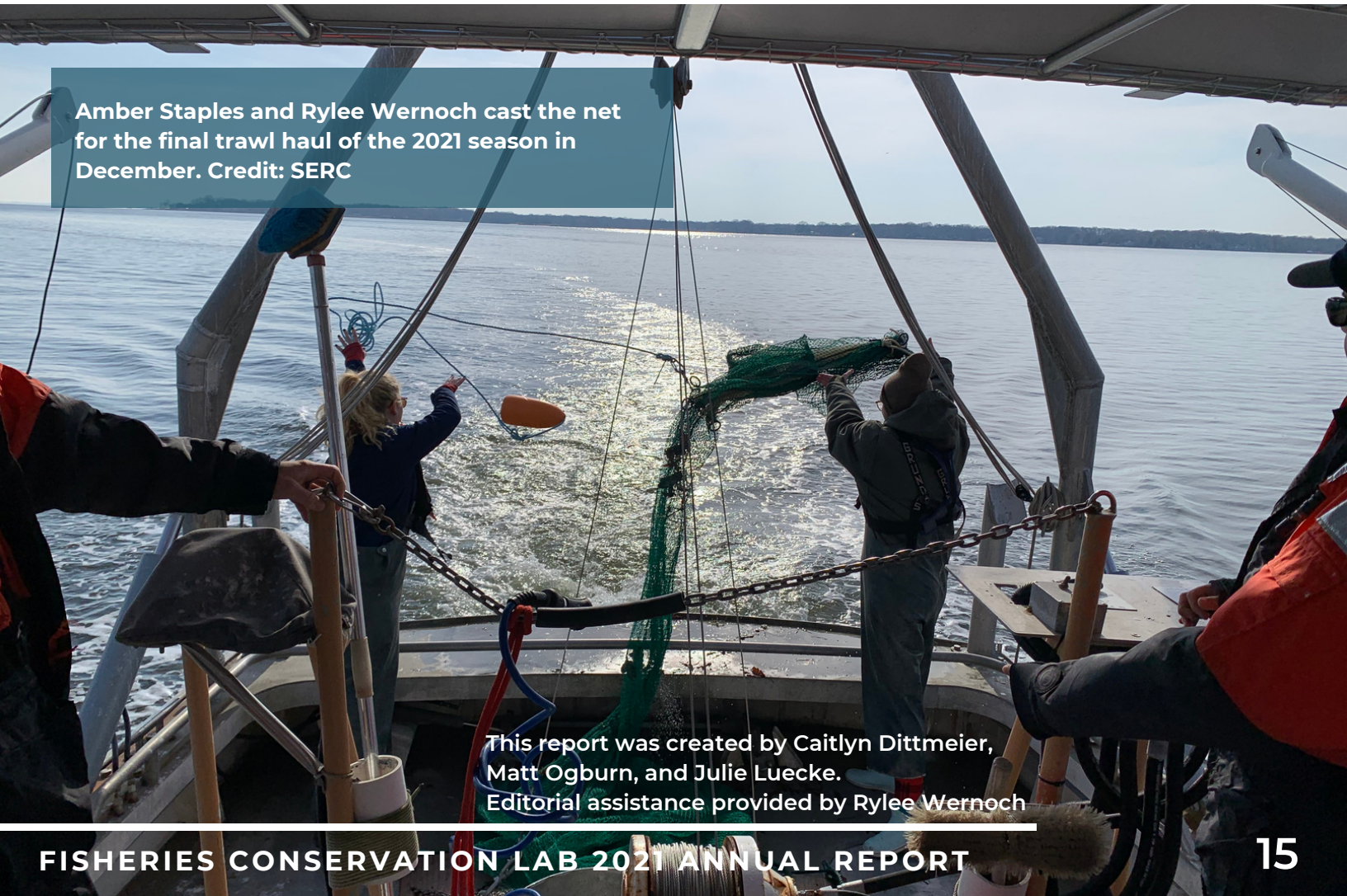
1. Scan this QR code or click here and select "Fisheries Conservation Lab" in the designation box.
2. Or make out a check to SERC and mail it to Smithsonian Environmental Research Center, 647 Contees Wharf Road, Edgewater, MD 21037. Please add "Fisheries Conservation Lab" on the memo line.



Amber Staples and Rylee Wernoch cast the net for the final trawl haul of the 2021 season in December. Credit: SERC

This report was created by Caitlyn Dittmeier, Matt Ogburn, and Julie Luecke.
Editorial assistance provided by Rylee Wernoch

NEW PUBLICATIONS AND GRANTS

PUBLICATIONS

Bailey H, Fandel AD, Silva K, Gryzb E, McDonald E, Hoover AL, Ogburn MB, Rice AN. 2021. Identifying and predicting occurrence and abundance of a vocal animal species based on individually specific calls. Ecosphere 12:e03685. doi: 10.1002/ecs2.3685

Bangley CW, Edwards ML, Mueller C, Fisher RA, Aguilar R, Heggie K, Richie K, Ahr B, Ogburn MB. 2021. Environmental associations of Cownose Ray (*Rhinoptera bonasus*) seasonal presence along the U.S. Atlantic coast. Ecosphere 12(9):e03743.

Donelan SC, Breitburg DL, Ogburn MB. 2021. Context-dependent carryover effects of hypoxia and warming in a coastal ecosystem engineer. Ecological Applications, https://doi.org/10.1002/eap.2315

Heggie K, Ogburn MB. 2021. Rapid video assessment detects qualitative differences in oyster reef habitat. Marine Ecology Progress Series, 667 , 219-224. https://doi.org/10.3354/meps13708

Hruska AM, Cawood A, Pagenkopp Lohan KM, Ogburn MB, Komatsu KJ. In Press. Going remote: Recommendations for normalizing virtual internships to promote diversity and inclusivity. Ecosphere.

Ritter CJ, Harper LM, Lefcheck JS, Paul VJ, Whippo R, Jones S, Ogburn MB, Duffy JE. 2021. Patterns of consumption across a Caribbean seascape: Roles of habitat and consumer species composition through time. Frontiers in Marine Science 8:742907. doi: 10.3389/fmars.2021.742907

Semmler RF, Ogburn MB, Aguilar R, North EW, Reaka ML, Hines AH. 2021. The influence of blue crab movement on mark-recapture estimates of recreational harvest and exploitation. Canadian Journal of Fisheries and Aquatic Sciences, 78 (4) , 371-385. https://doi.org/10.1139/cjfas-2020-0112

GRANTS

Johnson A, Komatsu K, Ogburn MB, Bennett R, Connette G. Bridging Smithsonian science with community partners to enhance conservation opportunities for native biodiversity – a case study for grassland birds. 2022. Smithsonian Working Land and Seascapes. $55,000.

Furey NB (University of New Hampshire), Ogburn MB, Legett HD. Leveraging multispecies and multiyear telemetry datasets to identify seasonal, ontogenetic, and interannual shifts in habitat use and phenology of Chesapeake Bay fishes. 2022-2024. NOAA Chesapeake Bay Office. $249,017.

Ogburn MB. Animal Telemetry Network Data Manager for the Atlantic Cooperative Telemetry Network. 2021-2022. NOAA. $69,531

Ogburn MB, Tracy AM. Validating a rapid assessment protocol for monitoring subtidal oyster reefs. 2021-2022. NOAA. $86,605.

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Smithsonian Conservation Commons