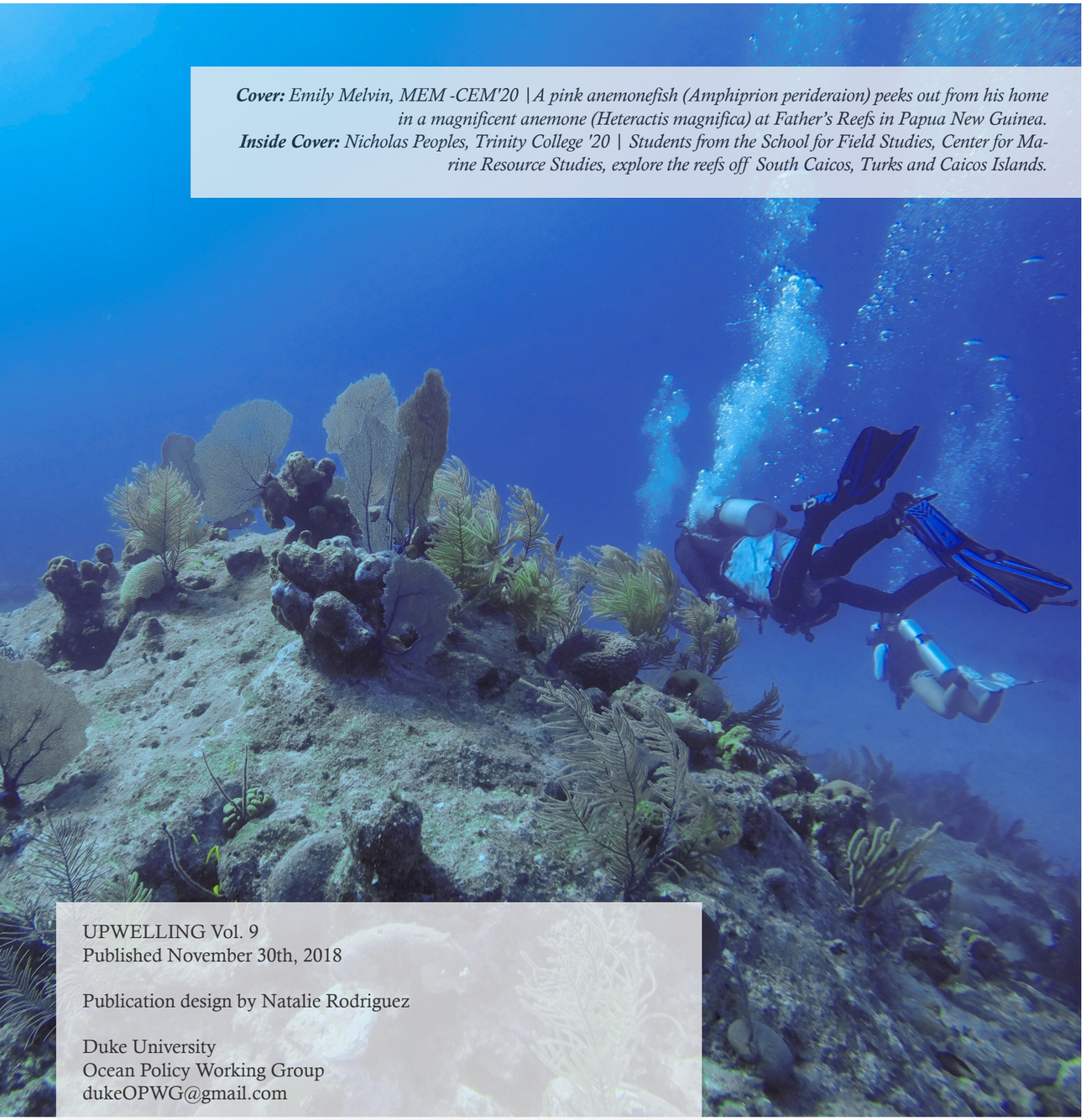
OPWG
OCEAN POLICY WORKING GROUP

# UPWELLING

VOLUME 9 | NOVEMBER 2018



***Cover:*** *Emily Melvin, MEM -CEM'20 | A pink anemonefish (Amphiprion perideraion) peeks out from his home in a magnificent anemone (Heteractis magnifica) at Father's Reefs in Papua New Guinea.*
***Inside Cover:*** *Nicholas Peoples, Trinity College '20 | Students from the School for Field Studies, Center for Marine Resource Studies, explore the reefs off South Caicos, Turks and Caicos Islands.*

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Ocean Policy Working Group
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The Ocean Policy Working Group (OPWG) is a student organization at Duke University designed to facilitate cross-disciplinary discussions on human interactions with the ocean. Throughout the academic year, the OPWG hosts a variety of events with the purpose of exposing the Duke community to pertinent issues in our oceans. This working group strives to be a hub for ocean resources.



# In this edition



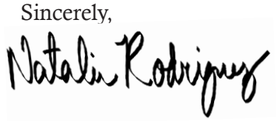
*A Note from the Editor:*

The ninth volume of UPWELLING showcases work from Duke University students, incorporating position pieces and artwork from the creative minds of undergraduate and graduate students alike.

Dive in and experience how the oceans have impacted the lives of our students. I hope these pieces encourage you to spend more time in the sea and inspire you to do more for the benefit of our oceans.

A warm thank you to the Nicholas School of the Environment, the Graduate and Professional Student Council, and the Duke University Center for International Studies for their continued support of the Ocean Policy Working Group and UPWELLING.

Sincerely,



Natalie Rodriguez
OPWG Publication Coordinator
MEM-CEM '20

# Seagrasses after Sunset

Trevyn Toone, Trinity College '19

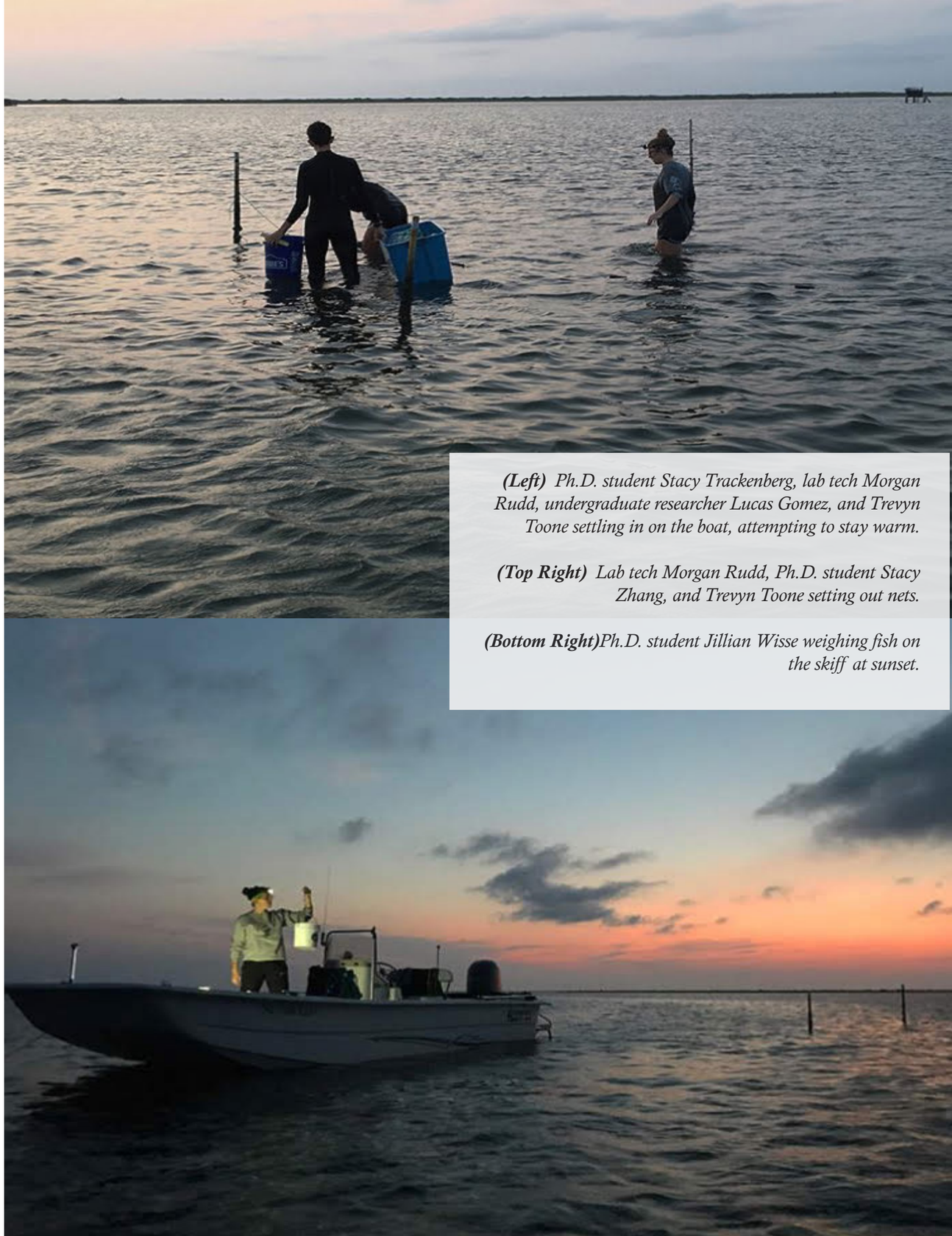
Everyone reacts differently to their first dead shark. Worms easily get caught in chest hair. Pack a second jacket, and a third… maybe even a fourth. These are just a few of the unexpected lessons I learned night sampling this summer as a lab technician for Dr. Brian Silliman at the Duke Marine Lab. When Stacy Zhang, Dr. Silliman's Ph.D. student, first asked if I wanted to help her estimate the fish populations around her field site, I imagined it as a pleasant boat ride where we would quickly set some nets, followed by a warm summer night under the stars. The actual process was something a little bit different.

On our first trip, we were joined by two other lab members for a smooth, half-hour, trip to the site. We took a quick dip to set six or seven nets on the seagrass bed to soak and got back in the boat. What we quickly realized, however, was that it was turning into the coldest, windiest June night possible. The four of us now had six wet, cold, miserable hours ahead of us upon our small skiff. Instead of a fun sleepover atmosphere where we would swap stories and secrets, we commiserated over the wind chill and tried to squeeze as many people as possible into the covered anchor locker—which can only hold around two people if you're curious.

At approximately one in the morning, it was finally time to bring the nets in. It was at this moment that I realized all the fish I'd end up killing professionally may cancel out my three years as a vegetarian. The process was fairly simple: take the fish out of each net, put them in a bucket, take them back to the boat to be weighed and measured, and then toss the fish back. In practice however, this often ended with Stacy's pockets full of fish, renegade floating buckets, and more than a few curses when trying to untangle particularly stubborn fish. Without a doubt, the most common sounds were the yelps and gasps when unknown creatures brushed up against us, worms made surprise contact with our skin, and gregarious needlefish decide to make an obstacle course out of our legs.

Eventually we recorded everything that the nets had ensnared – including some bellicose stone crabs, a decent number of sharks, almost too many pinfish to count, and the star of the show: one especially belligerent horseshoe crab. Once docked at the lab, we trekked back to our quarters as a much quieter, smellier, and wetter group than the one that had set out so many hours before. It could have been the Stockholm Syndrome inherent in any field scientist, or that my discomfort was burned away by a scalding hot shower, but as I laid down to sleep I still imagined the boat rocking under me and stars glowing above. I couldn't help but feel excited for the weeks of night sampling ahead of me– and very glad I packed my winter jacket for the summer.





***(Left)*** *Ph.D. student Stacy Trackenberg, lab tech Morgan Rudd, undergraduate researcher Lucas Gomez, and Trevyn Toone settling in on the boat, attempting to stay warm.*

***(Top Right)*** *Lab tech Morgan Rudd, Ph.D. student Stacy Zhang, and Trevyn Toone setting out nets.*

***(Bottom Right)****Ph.D. student Jillian Wisse weighing fish on the skiff at sunset.*

# Water

Julia Whitten, MEM-ESC '20

Hot water
Will melt the grime away
Or perhaps a pressure washer
Four hundred pounds
Of force with the pull
Of a trigger.
We already know
Chemicals won't do the trick
no, it's gotta be water
Hot or hard is the question
Hot softens and tugs
It's a burn
It's a sweat
It's a purge
And a swell
A flush
Of what's gotten stuck:
The filth, the algae
The slime, the mold.
But the pressure,
The expulsion of water
To lift and loosen
To mandate evacuation
Of what's overstayed its welcome
It's a slam of the door
The slice of a blade
And precision of a laser
Somehow it's satisfying
To behold all that
Power
Be careful --
It'll get under your skin.

How did we get here?
Why did we let
The gunk and the green
Grow to its size, its breadth?
Don't you remember
The drip
Drip
Drip
In fact,
The pipes are still dripping

Not quite every second
You'll forget to breathe
If you try and keep time
Carries miniscule
Particles of plants
Molecules of muck
And thus
The green-black layer of slime
Grows and grows
With the drip
Drip
Drip

So we ask:
What shall we use?
Hot water or power water
When water brought us here
Brought us down to the
Green ground.

It's funny, or is it
That our roots
Are our thorns
And our weeds
Are our tools.
We worship ourselves
As if we can find
A way out of our mess

The waves in the ocean
Push us and pull us
They fill our lungs with
Saltwater and turn our
Feet into fins.

Forget the boiling water
And the pressure washer.
Clear the gray matter of grime
With salt and strokes.

Swim beyond the tide pool into
open ocean
If you leave your trays and tables
and tubes the
Drip
Drip
Drip
May fade into nothing
And you'll swim through
The black and green mud and
muck
Until it turns clear,
And you're free.

Swim into blue
Into schools of fish
pods of dolphins
And flocks of seabirds
Swim until the sun sets
And the water reflects
Orange, red, purple, pink,
Every color you can imagine
Swim towards the horizon
As if you know where you'll find it
Lie on your back so your
Eyes melt into your head
And the salty sea water
Fills your ears
Then you've done it
You're floating
not on algae or mud
You're floating on
Salt and the burning sun.
You're lying on a marble
Baring your soul to
Outer space.
Don't forget how you got here.
Don't forget the drip
Or the water you held
In your hands.
Remember the high and low tides,
The currents and the strokes
You wouldn't be here
You wouldn't be anywhere
Without water

***(Left)*** *A beautiful day at the beach in Jupiter, FL. Waverly Reibel, MEM-CEM '20*

***(Top Right)*** *Not a fur seal, but a Galapagos sea lion soaking up the sun. Emily Melvin, MEM-CEM '20*

# Bioeconometrics of the Fur Seal Hunt

Martin D. Smith, Nicholas School of the Environment,
Professor of Economics

Furrily Swirily
economist Wilen
dynamically models
pelagic seals

On shoulders of Vernon
phase-diagramingly
boom and bust cycles, both
pelts and fish meals

# Drones in Conservation

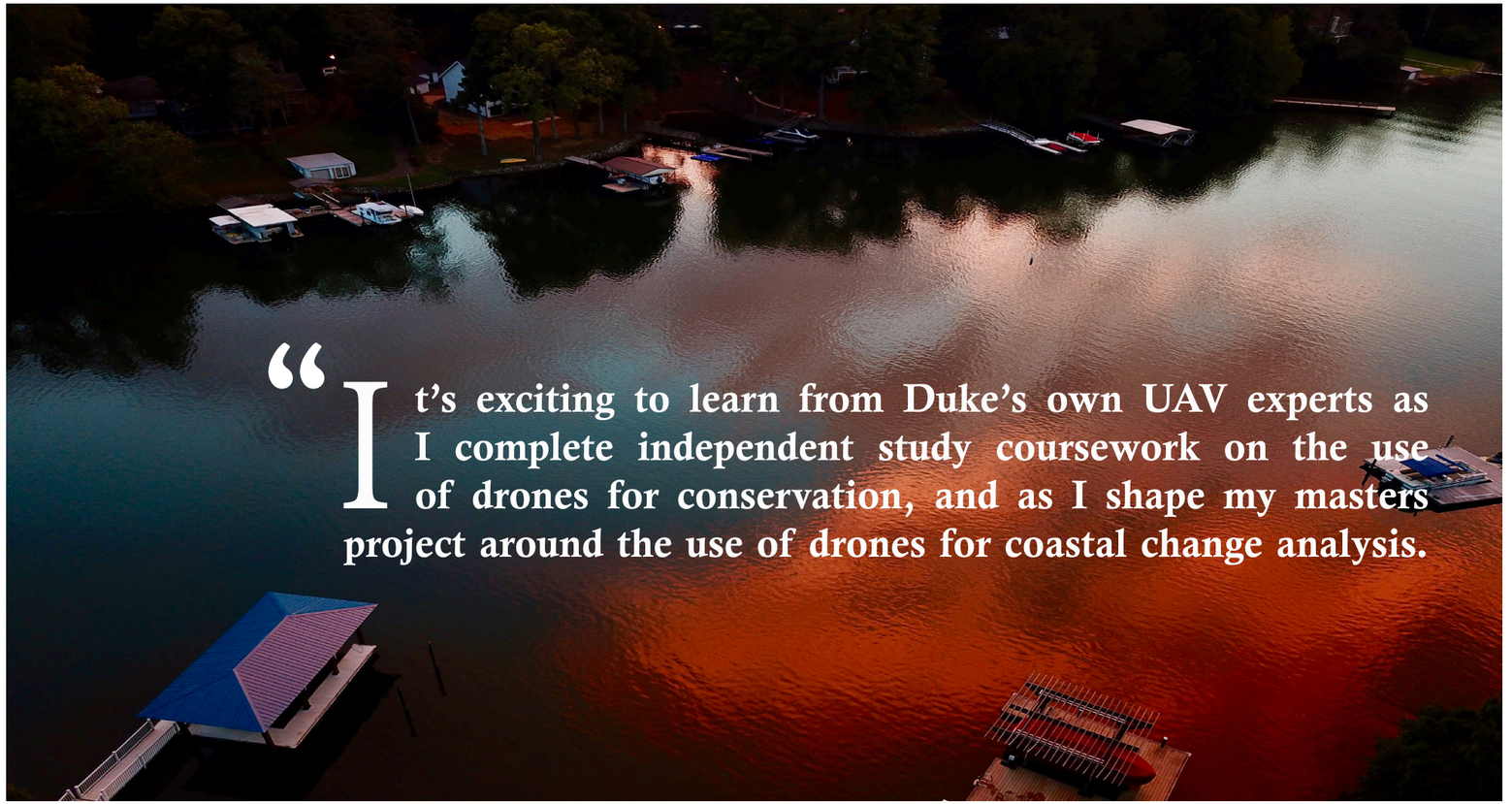
Molly Bruce, JD/MEM-CEM '21

Though government and private industry have been utilizing drones or unmanned aerial vehicles (UAVs) for decades, they became more widely available for recreational purposes in the past ten years. These photos were captured using a UAV—specifically a DJI Mavic Quadcopter—over Lake Norman in North Carolina's piedmont. Lake Norman is the state's largest lake with over 500 miles of shoreline. Regrettably, it has also been site to coal ash disposal problems, to storm runoff, to wastewater disposal, and to countless other environmental stressors. Furthermore, the Catawba River Basin, of which Lake Norman is a part, drains into the Santee River Basin which then drains into the Atlantic Ocean. Thankfully, researchers who recognize the value of drone technology have begun deploying it for conservation.

It's exciting to learn from Duke's own UAV experts as I complete independent study coursework on the use of drones for conservation, and as I shape my masters project around the use of drones for coastal change analysis.



*Lake Norman, NC— shot with DJI Mavic Quadcopter*



# Trapped

Ben Siegelman, Dual-Master CEM & Cultural Anthropology, '19

*Sunrise in the fishing community of San Evaristo, Baja California Sur, México, before a day of fishing.*

"We're fishing too much!" Paco Corral exclaimed. I was spending the summer in San Evaristo on the southern coast of Mexico's Baja California peninsula, studying the social life of this small-scale fishery. I liked to visit Paco, a third-generation fisherman, to hear a different opinion now and again. "Fishermen should stop using traps and nets, and fish with hook and line like our fathers did- and like I do!" It's true, Paco was an anomaly. He had the unique habit of fishing with his entire family-his wife Mariana, teenage daughter Liria, and young son Pablo- leaving home for days at a time to enjoy camping on the remote islands dotting the coast. Unlike other fishers, the Corrales don't have a steady patron and instead sell their fish to whomever pays highest on a given day. And unlike other fishers, the Corrales don't care much about earning money. They fish because they're fishers, and that's all they really need for now. The Corrales built their plywood house themselves, and adorned it with giant shells they found and painted. A star made of glass tubes hangs from their outside wall, and at their front gate stands a whalebone decorated with a painting of a marlin and the inexplicable greeting "Welcome to the Cardinal House." I liked visiting Paco and his family because they were different. They were exceptions, and sometimes a community's anomalies can teach you more than anyone else. During his conservationist rants, Paco insisted that a sustainable fishery was possible: "When our family fishes, we catch adults instead of babies. And we catch maybe 100kg, 200kg. In a trap, you'll catch 600kg of small fish, all young fish, in just one day! What are Liria and Pablo going to do when they're adults? The fish will be gone." Liria had a quick answer: "I'll be a marine biologist!"

It was odd to be an environmental management student, spending my summer understanding fishermen's often negative views on conservation; and then to hear Paco lecture me on sustainable fisheries management. It was even odder to hear these lectures in Paco's work shed, where he was fastidiously building the very fish traps he lamented.

So why was this oddball fisher, who fishes with his wife and children, believes in conservation, makes wall-art in his spare time, and cares little for accumulating wealth, building the fish traps he decries? Paco didn't have to explain this to me. I saw the pressures of a declining fishery after a day of fishing with Paco and his daughter Liria. We'd had a good day, the three of us catching a combined 100kg of large triggerfish. On our way home we saw Toni, a man from the city who occasionally visited San Evaristo to fish for extra earnings. Toni had spent the afternoon fishing alone with traps. "400 kg!" Toni smiled. "What a day!" Paco and Liria looked at him in silence. They looked at each other. "Son muy chiquititos," said Paco quietly. "They're really small."

"*I saw the pressures of a declining fishery after a day of fishing with Paco and his daughter.*

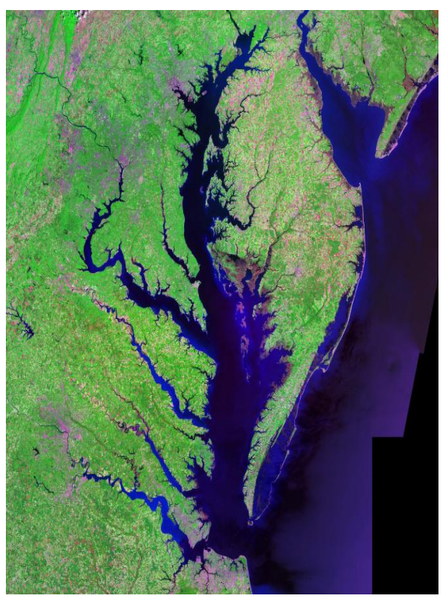
*Liria Corral fishing with hook and line near Isla San Jose in the Gulf of California.*

# Cheasapeake Bay

William H. Schlesinger, Professor Emeritus of Biogeochemistry and Former Dean of the Nicholas School

Before he retired, former Duke University Marine Lab Director Joe Ramus was fond of telling students that an estuary was where "the surf meets the turf." It is the juxtaposition of the land and sea that makes estuaries so productive along the passive continental margins of the east coast of the Americas and Asia, the northwestern coast of Europe, and other coastlines worldwide.

Freshwater rivers dump their nutrients into estuaries, where they mix with nutrients delivered by tidal exchange with the sea. The result is a proliferation of plant life—both floating algae (phytoplankton) and submerged vegetation, such as eelgrass. Plant production supports higher trophic levels, including crabs, oysters, fishes, and people. Chesapeake Bay, the largest estuary of the east coast of the United States, is famous for its blue crabs and oysters, and a century ago, millions of waterfowl gathered in the estuary during fall migration. But, estuaries are in trouble worldwide. While some nutrient loading is good, too much leads to an overproduction of floating algae, which periodically sink to the bottom waters where they decompose subsequently consuming oxygen. The resulting condition, known as hypoxia, is lethal to shellfish and fishes in these waters. (See: http://blogs.nicholas.duke.edu/citizenscientist/hypoxia/).



Estuaries have also been subject to pollution by toxic metals, chemicals, and excessive sediment. Furthermore, their popularity as recreational waters has led to the loss of their natural shorelines in favor of coastal development behind hardened seawalls, which are inappropriate habitat for shellfish. In the face of rising sea levels, hardened seawalls do not allow estuaries and their coastal wetlands to expand upslope—an event known as marine transgression. In the past, Chesapeake Bay was able to expand its wetland area in response to rising sea level, though this is now less likely.

Having lost a large amount of its crab and oyster harvest to a combination of overfishing, loss of shoreline and hard-bottom habitat, and hypoxia, Chesapeake Bay is a prime example of a degraded estuary. The loss of oysters is particularly impactful, as an average oyster filters about 50 gallons of water each day, cleaning the estuarine waters. Fortunately, we may have recognized the problem just in time. Recent efforts to control excessive nutrient loading from fertilizer and animal runoff have reduced algal productivity and hypoxia, allowing submerged vegetation to return and expand their area, creating new underwater habitat for other creatures. While seagrass habitat has been expanding, managers have been creating new oyster reefs and tidal marshes, and refining limits on harvesting. The result is a stabilization of crab, oyster, and some fish populations and a continued livelihood for coastal fishermen. Scientists, policymakers, and interest groups across several states have worked together to achieve these early successes.

Chesapeake Bay represents an environmental success in progress, but the efforts to understand and restore this estuary, and others, must not stop. The continual arrival of exotic fish, crabs, and plants disrupts the delicate ecological balance of estuaries and marshes. A recent paper has documented the importance of atmospheric deposition of nitrogen on the surface of Chesapeake Bay, where it now almost matches the delivery of this nutrient in surface runoff and rivers. Like forests, estuaries suffer from the effects of air pollution, which is a source of nitric oxide in the air and nitrate in rainwater (See: http://blogs.nicholas.duke.edu/citizenscientist/diversity/). The surf, turf, and atmosphere form a tripartite association that can maintain or kill the productivity of an estuarine ecosystem and the services it provides for humans.

***(Left)*** *Satellite picture of Chesapeake Bay (center). Wikipedia, https://en.wikipedia.org/wiki/Chesapeake_Bay#/media/File:Chesapeakelandsat.jpeg*
***(Right)*** *Tidal wetlands of the Chesapeake Bay. Wikipedia, https://en.wikipedia.org/wiki/Chesapeake_Bay#/media/File:ChesapeakeTidalWetlands.jpg*

***Emily Melvin, MEM '20***
*Divers explore the Leru Cut located in the Central Province of the Solomon Islands. The Leru Cut forms a shallow passage into the center of a remote island, where divers can surface in the midst of a lush forest.*

# Submit to UPWELLING

UPWELLING is a biannual journal that allows the Duke community to share their thoughts, opinions and research pertaining to the oceans and ocean policy. We are interested in any ocean-related work, including short research articles, OpEds, photographs, maps and other creative content. Content is fairly flexible, and topics may include a summer internship experience, a conference that you attended, the research that you are currently involved in, or other experiences. We welcome work from Duke University students in any department, researchers, faculty, alumni and professors.

Please send submissions to dukeOPWG@gmail.com.

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