Virginia Chesapeake Bay Commission

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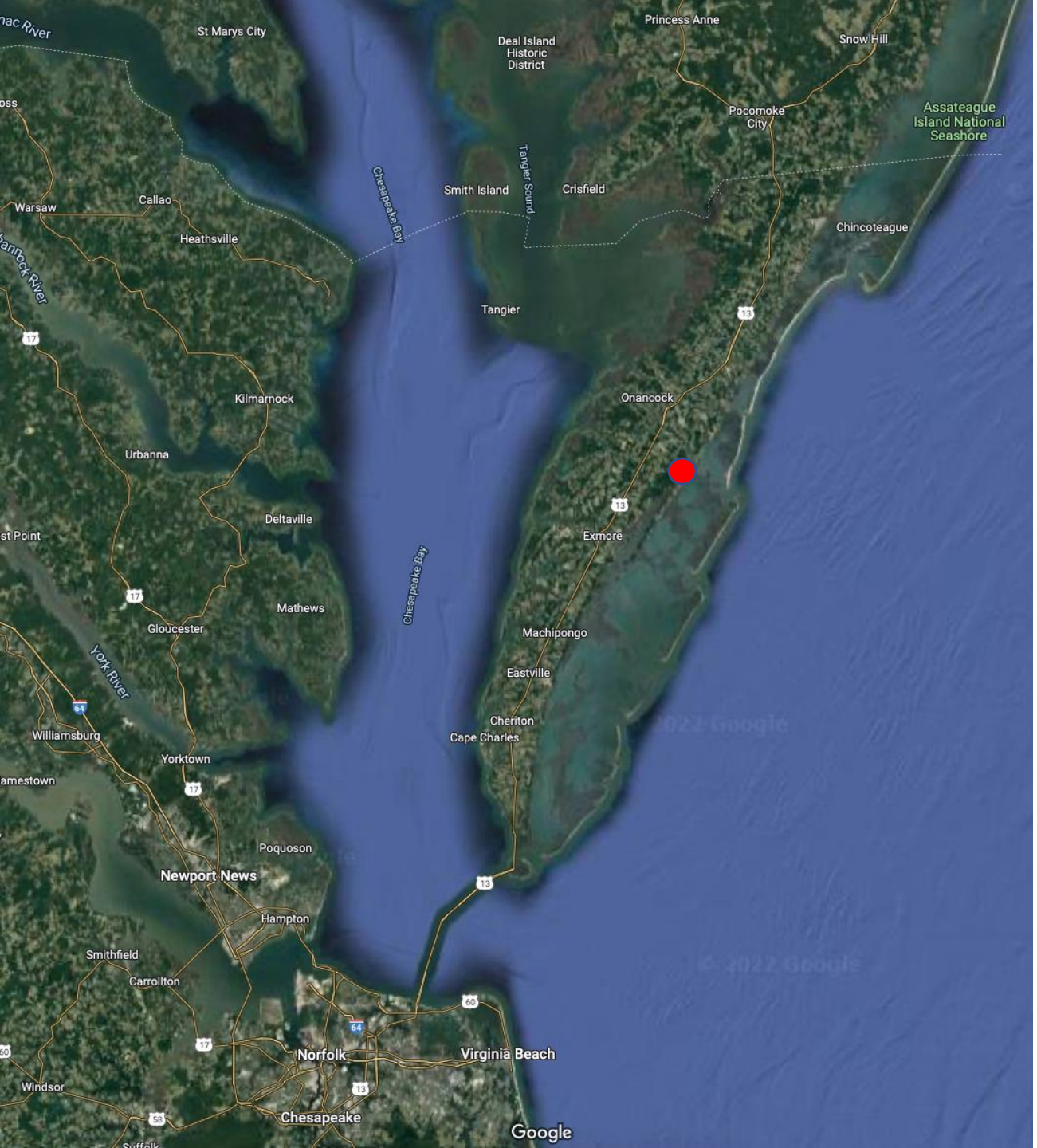
Eastern Shore Laboratory
Wachapreague, VA



Eastern Shore of Virginia (ESVA)

Undeveloped barrier island system

TNC Volgenau Virginia Coast Reserve

State, Federal lands

Economy

Agriculture, Fisheries, and Aquaculture

High unemployment and poverty rates

Hydrology

Short Watersheds

Flat topography

Groundwater discharge

Strong ocean influence

- **ESVA fisheries landings account for 57.7% of all fisheries landings value for the Commonwealth and 37% of the weight landed.**

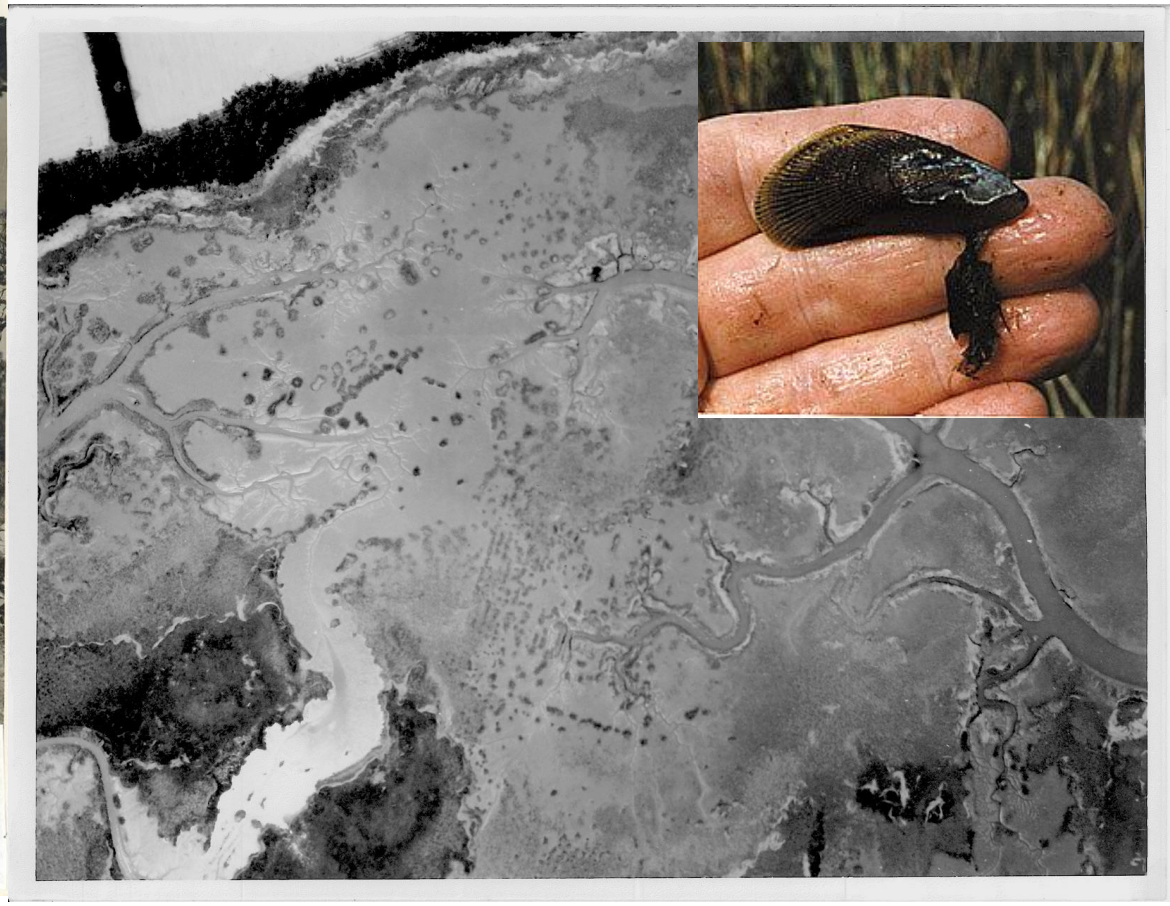
- **Hard clams are the number one seafood landings at $58 million 2021. Nearly the entirety of the hard clam landings are aquaculture, with ESVA accounting for 99.9% of the Commonwealth landings, and 83.4% from Northampton, 16.6% in Accomack.**

- **Number two and three are blue crabs and oysters at around $30 million.**

- **ESVA landings from private oyster leases account for 18% of the commonwealth total, no way to separate out intensive aquaculture from wild harvest or spat on shell culture.**

- **Growing filter feeders for excellent seafood and cleaning up the water: win:win**

Snyder, R. A. (2021) *Fisheries Landings for the Eastern Shore of Virginia (ESVA) 2021*. VIMS Eastern Shore Laboratory Technical Report No. 10.. Virginia Institute of Marine Science, William & Mary. https://scholarworks.wm.edu/reports/2657/



VIMS was started in 1938 by Prof. Donald W. Davis as the *William & Mary Maritime Laboratory*.

In 1940 it was chartered by the Commonwealth as the *Virginia Fisheries Laboratory*.

A field lab was established on Bunting Point Road north of Wachapreague. J.H. Lockead was working on aquaculture of salt marsh mussels as a source of vitamins for submariners in WWII (1941).

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Michael Castagna was the first resident director, 1962-1992. His work on bivalve aquaculture and especially the techniques for growing hard clams translated into the largest hard clam aquaculture industry in the U.S.

A new lab building and workshop were constructed, and the waterfront 2 acre Davis Oyster Company property was acquired in the 1970s.

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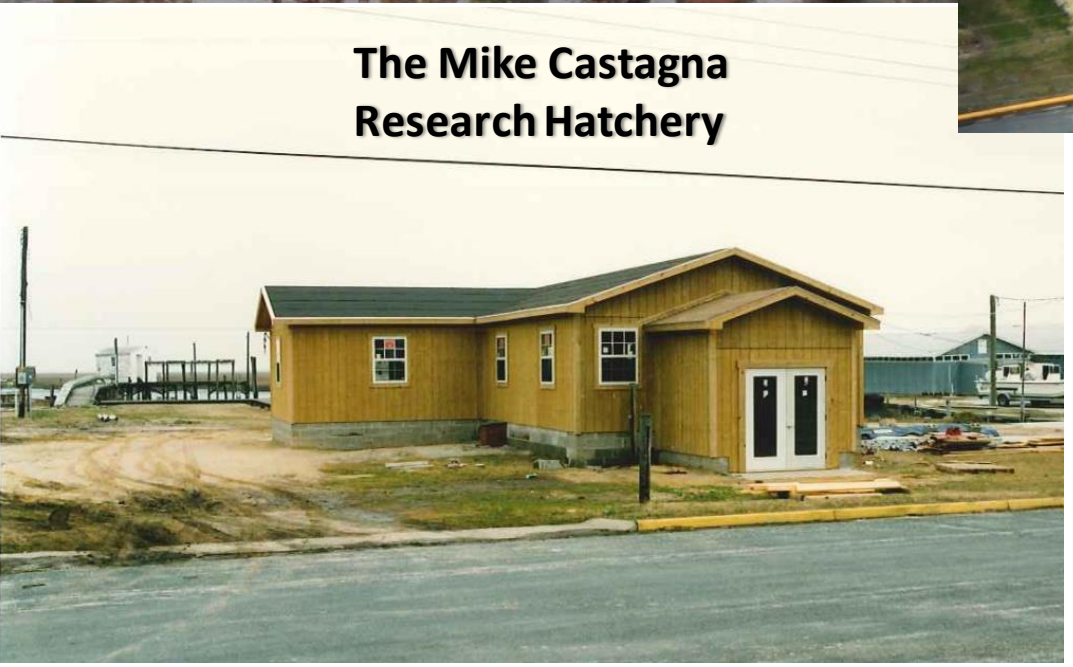
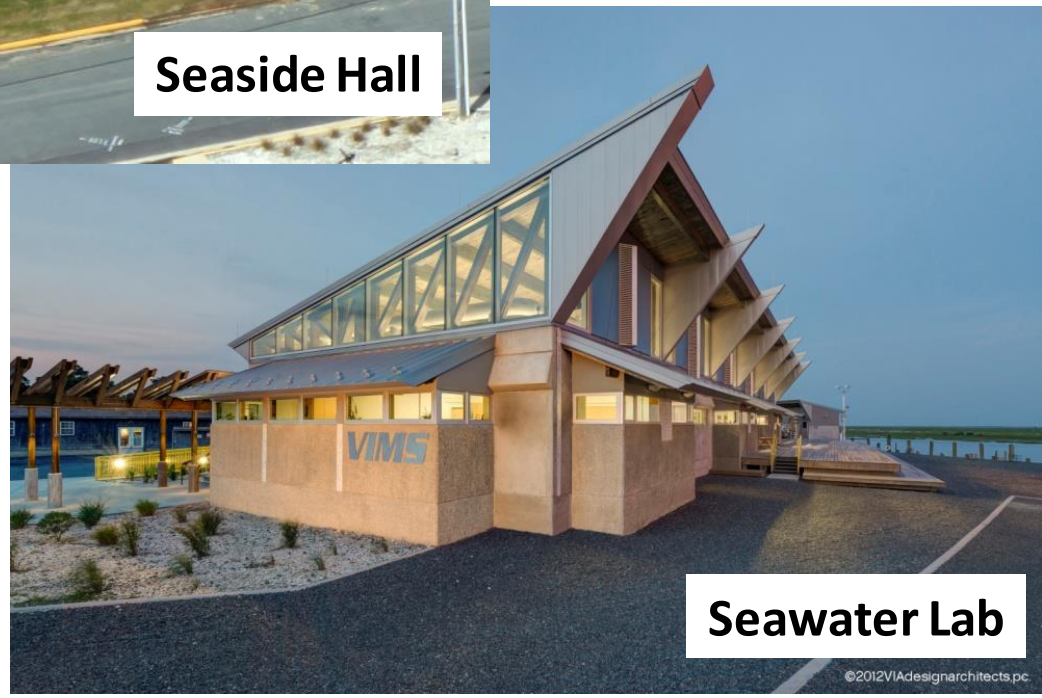
Seaside Hall

The Mike Castagna Research Hatchery





Seawater Lab

Dr. Mark Luckenbach was the second director, 1992-2014. His research focused on non-native oysters, aquaculture, oyster biology, oyster reef ecology and restoration, and benthic marine ecology. He established new buildings on campus including the Castagna Research Hatchery, Seaside Hall and the Seawater Lab.

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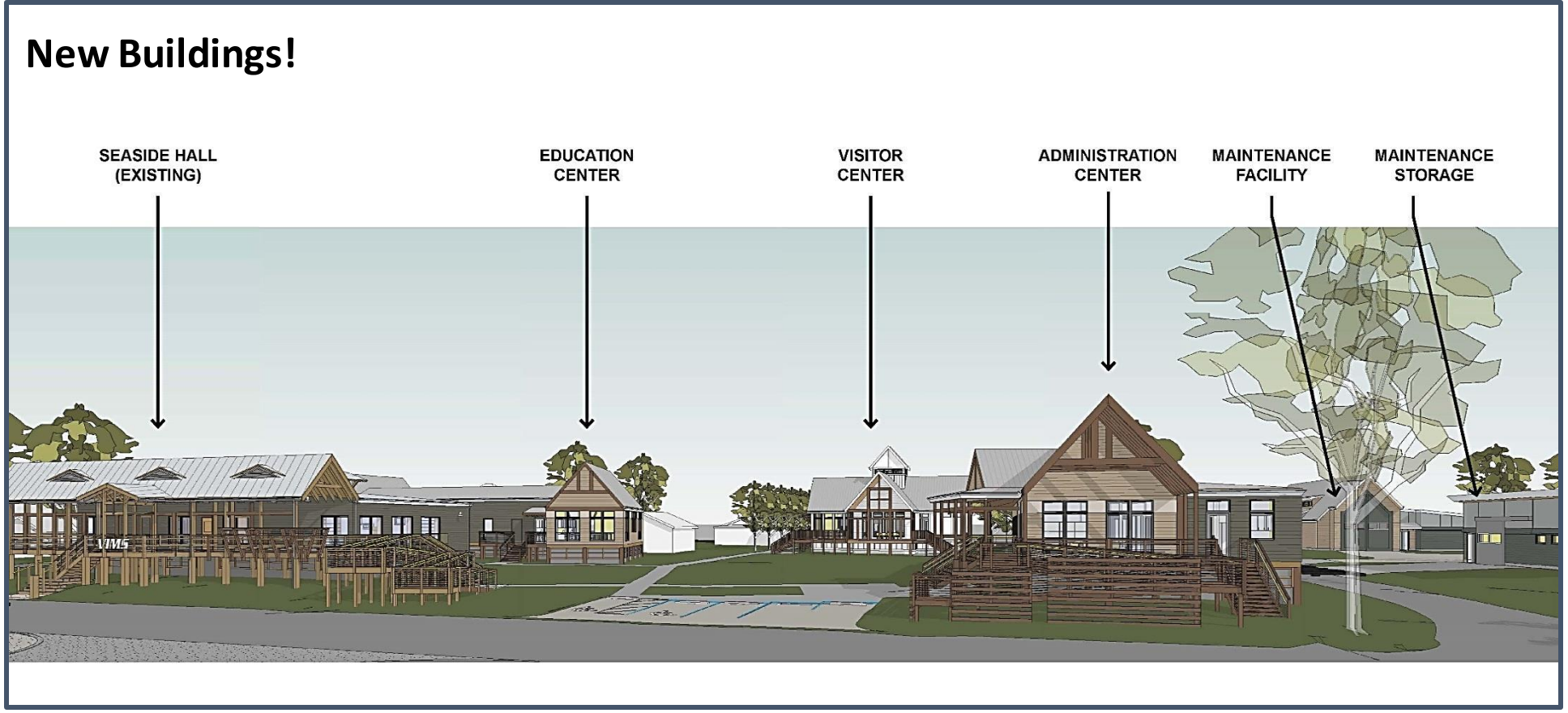
New Buildings!



Looking north from Atlantic Avenue:

The Education Center contains labs for molecular biology, microbiology, algae culture, general marine ecology and a classroom.

The Visitor Center can hold 26 overnight guests with a common kitchen and lounge area.

The Administration Center houses staff offices, a conference room, and a public display lobby.

The Maintenance Facility and Storage will allow repair and maintenance of the grounds, buildings, vessels, and vehicles, as well as custom fabrication of scientific gear.

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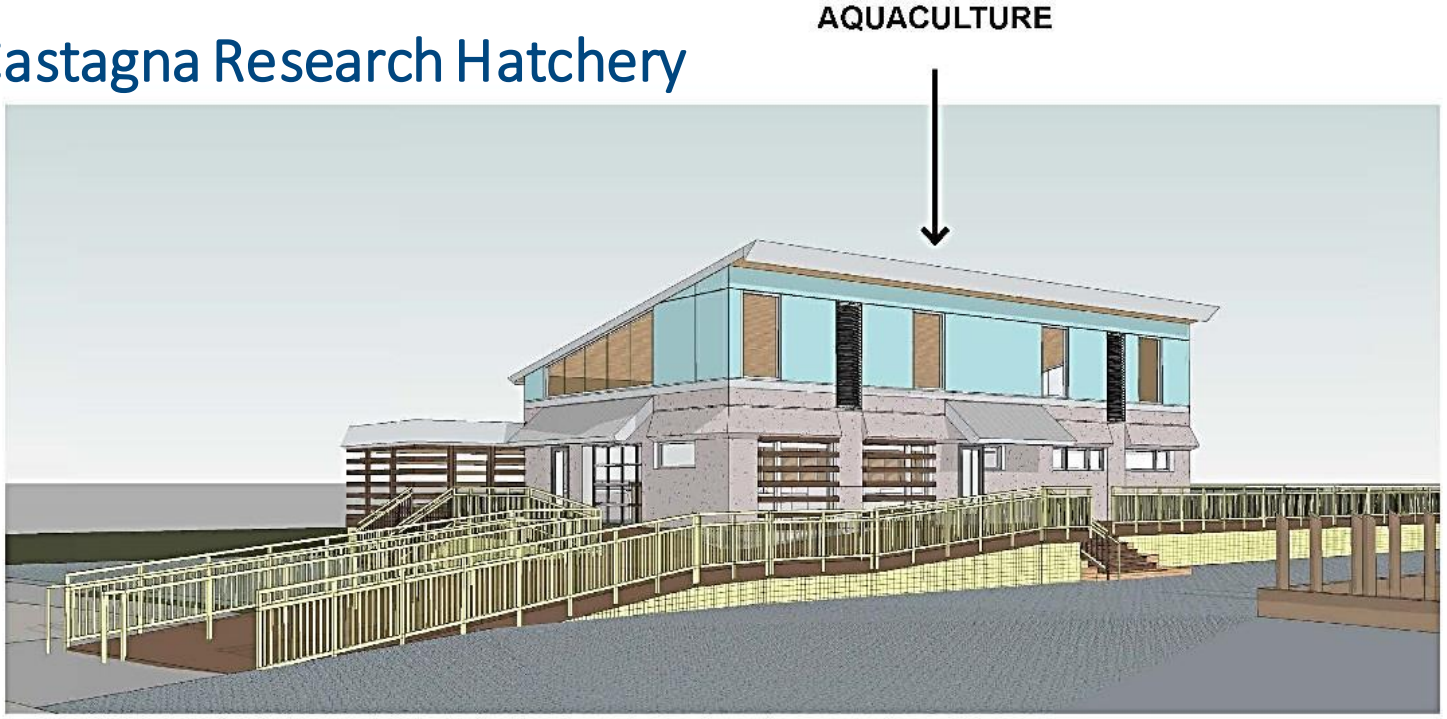
Looking south from Atlantic Avenue

Castagna Research Hatchery



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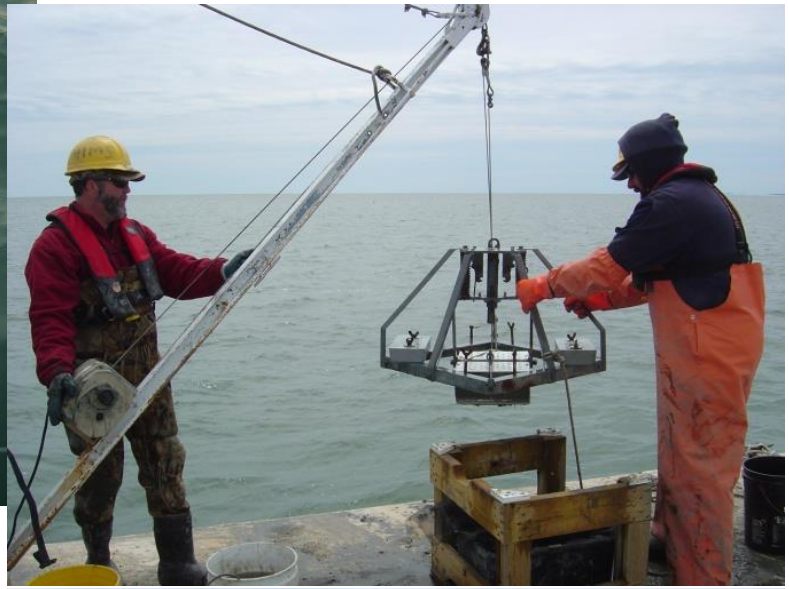

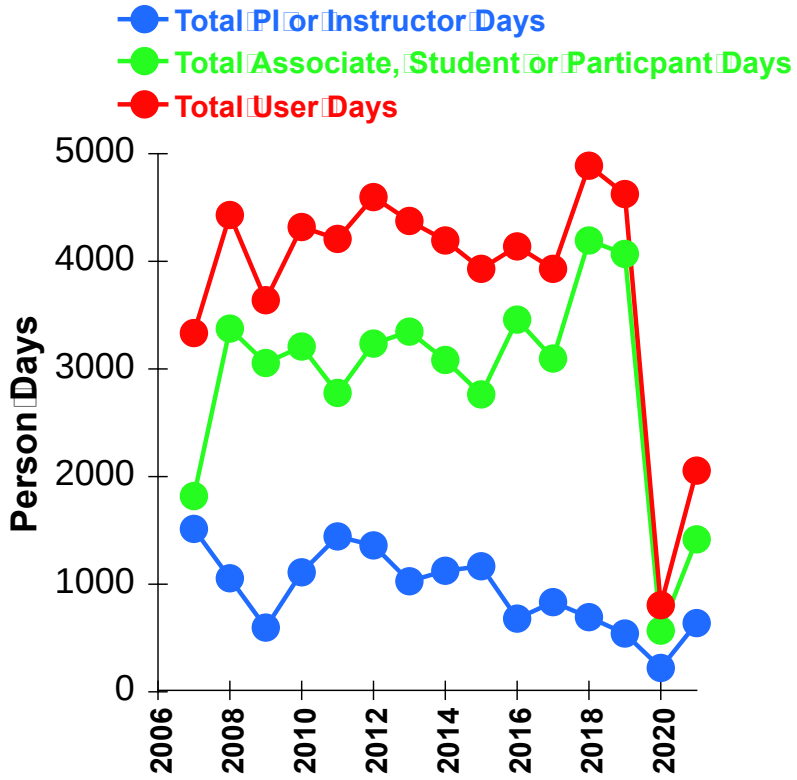

ESL supports a wide variety of research and education activity by providing boat operations and fieldwork, shop support, field research, flowing seawater systems, long term databases, and analytical labs.

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Resident research

Aquaculture

Marine Ecology

Ecosystem restoration

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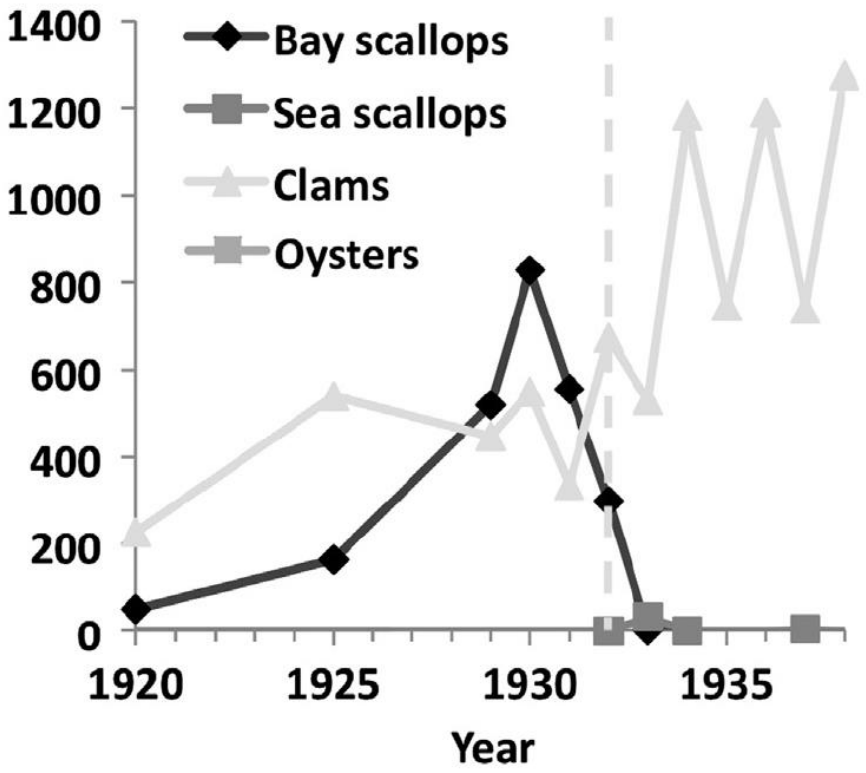
Water Quality

Wild bay scallops and bay scallop aquaculture



Oreska, PJ, B Truitt, RJ Orth, and MW Luckenhbach. 2017. The bay scallop (*Argopecten irradians*) industry collapse in Virginia and its implications for the successful management of scallop-seagrass habitats. *Marine Policy* 75: 116-124.

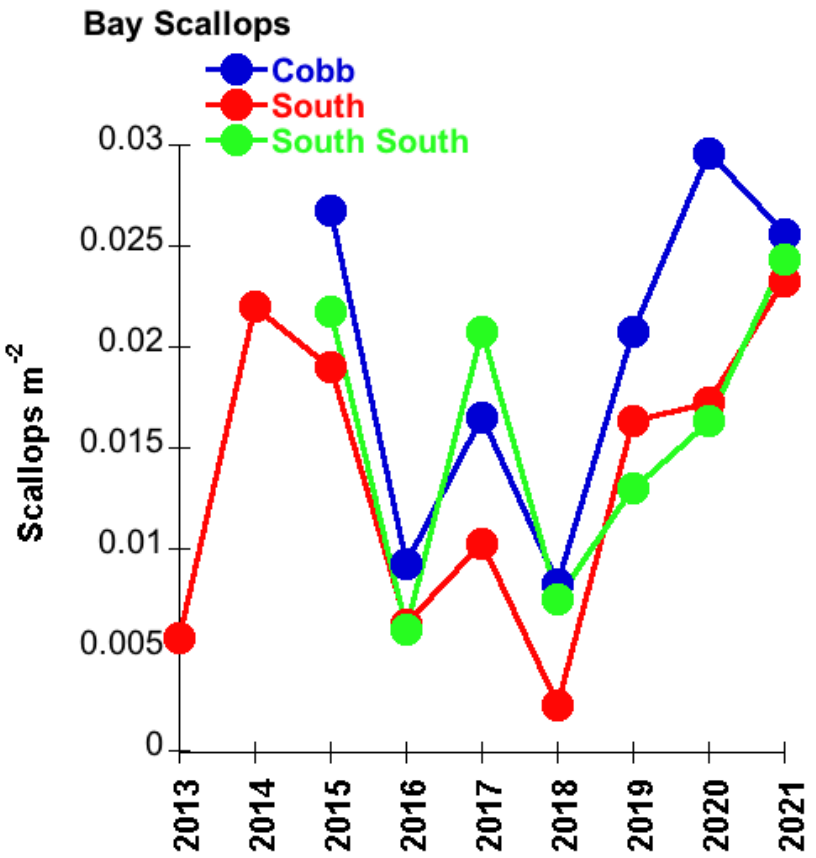
VIMS ESL has been engaged in R&D for bay scallop culture in the 1960-1980s

VIMS ESL assisted the startup of the first bay scallop only aquaculture business in Virginia, sales fall of 2021.

Annual crop
Fresh local market strategy

What about Virginia?

Bay Scallop Restoration



Hour long lecture on bay scallops:
https://www.youtube.com/watch?v=CSLlcuI9p9w

SCIENCE ADVANCES | RESEARCH ARTICLE

APPLIED ECOLOGY

Restoration of seagrass habitat leads to rapid recovery of coastal ecosystem services

Robert J. Orth[1]*, Jonathan S. Lefcheck[2], Karen S. McGlathery[3], Lillian Aoki[3], Mark W. Luckenbach[1], Kenneth A. Moore[1], Matthew P. J. Oreska[3], Richard Snyder[1], David J. Wilcox[1], Bo Lusk[4]

There have been increasing attempts to reverse habitat degradation through active restoration, but few large-scale successes are reported to guide these efforts. Here, we report outcomes from a unique and very successful seagrass restoration project: Since 1999, over 70 million seeds of a marine angiosperm, eelgrass (*Zostera marina*), have been broadcast into mid-western Atlantic coastal lagoons, leading to recovery of 3612 ha of seagrass. Well-developed meadows now foster productive and diverse animal communities, sequester substantial stocks of carbon and nitrogen, and have prompted a parallel restoration for bay scallops (*Argopecten irradians)*. Restored ecosystem services are approaching historic levels, but we also note that managers value services differently today than they did nine decades ago, emphasizing regulating in addition to provisioning services. Thus, this study serves as a blueprint for restoring and maintaining healthy ecosystems to safeguard multiple benefits, including co-benefits that may emerge as management priorities over time.

Ecological Monitoring Program at VIMS ESL Annual Report

Paige G Ross and Richard A Snyder, Eds.

The EMP has established standardized templates for long-term ecological datasets providing a broader context of local status and trends for researchers and educators visiting the VIMS ESL.

https://www.vims.edu/esl/research/emp/index.php

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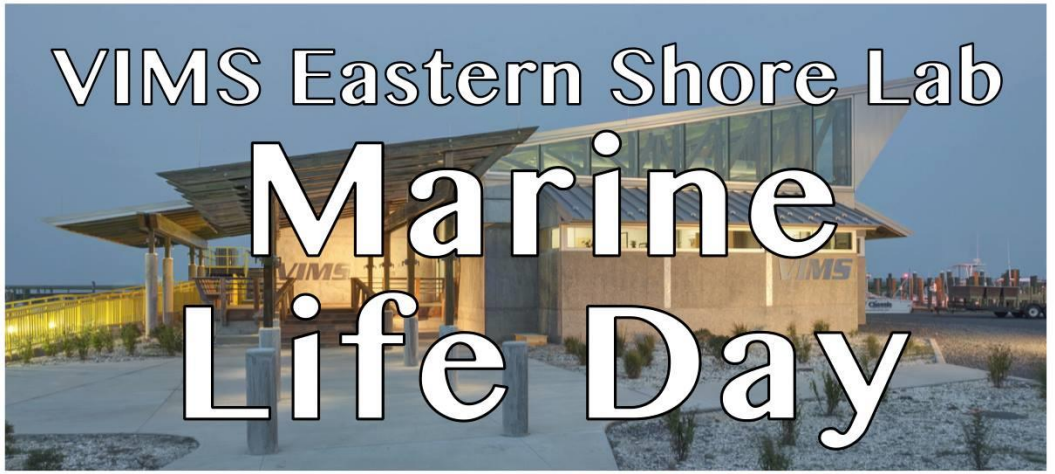
Outreach and Education



Saturday September 19 – 23

Noon – 4pm

Admission is free!

Join us for a fun and educational day learning about marine life found on Virginia's Eastern Shore and beyond.

Visitors of all ages will enjoy:

- Learning about marine science research
- Viewing live displays of rays, fish, sharks, scallops, and more
- Using microscopes to explore marine critters
- Interactive and educational children's activities and crafts
- Exploring marine creatures in touch tanks

Register online at vims.edu/mld
For more information, call 757.787.5816

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Water quality in Accomack County Freshwater Streams

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VIMS ESL Technical Report #7
https://scholarworks.wm.edu/reports/2328/

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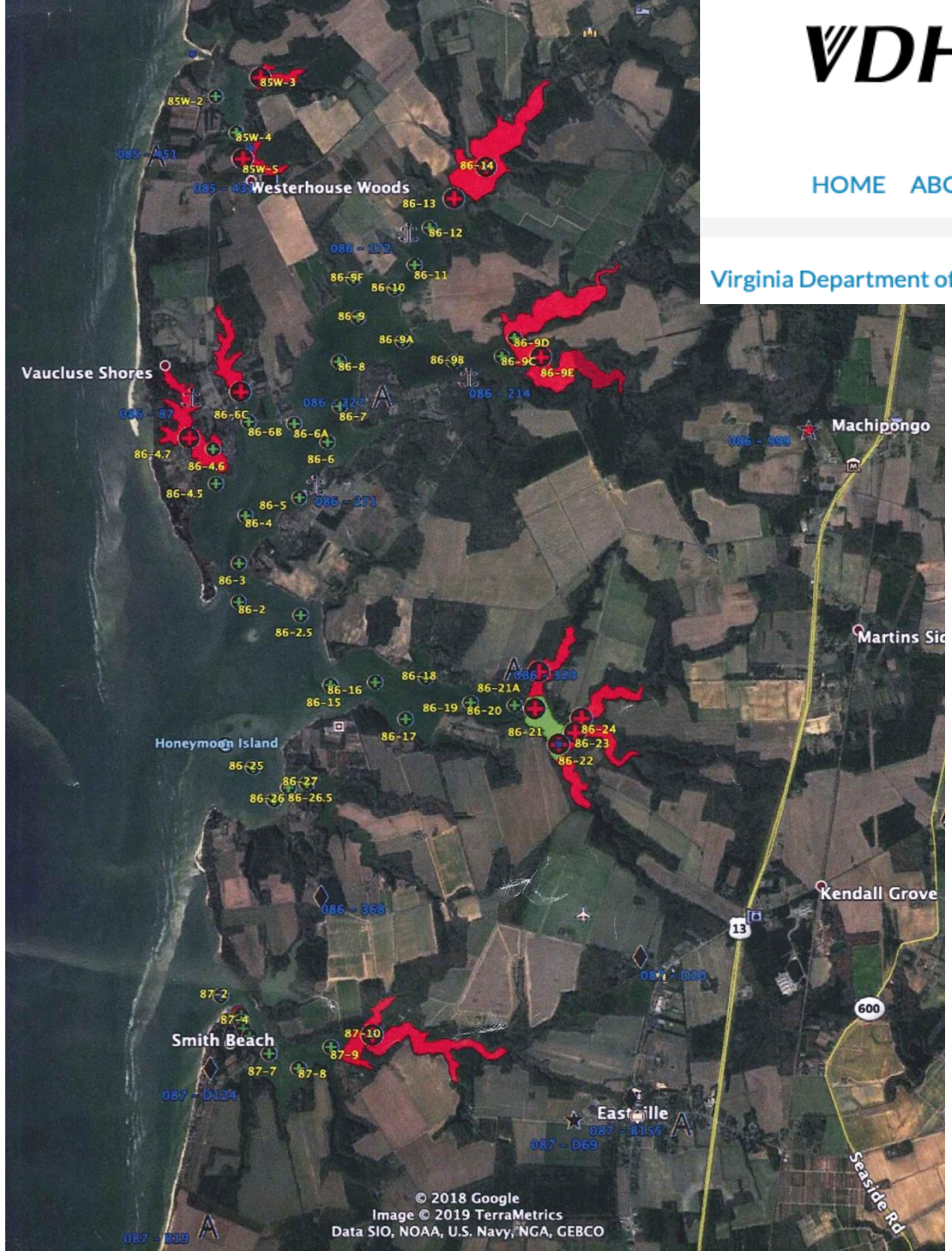

VDH VIRGINIA DEPARTMENT OF HEALTH

To protect the health and promote the well-being of all people in Virginia

HOME ABOUT US HOW DO I HEALTH TOPICS A-Z HEALTH DEPARTME

Virginia Department of Health > Environmental Health > Shellfish Safety

Fecal coliform monitoring upper reaches of creeks

<u>Shellfish Protection</u>

Wild Harvest

Aquaculture


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Dissolved and Total Nutrients

- **Ammonia**
  - Most biologically reactive form of nitrogen, can be a gas or dissolved in water
- **Nitrate**
  - Oxidized nitrogen, most abundant biologically reactive form
  - Readily moves through soil and groundwater
- **Phosphate**
  - Tends to not dissolve in water, typically soil particle bound
- **Poultry litter**
  - 3% Total Nitrogen; 1.5% Total Phosphorous
  - Uric acid + Bacteria + Water = Ammonia (90% of litter N)

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Methods

- 83 Stream-road crossings in Accomack County, bayside and seaside
- Base flow (groundwater) sampling followed a drought
- Storm Flow (groundwater + runoff water) 2” sampling after rainfall events
- Samples processed by VIMS Analytical Services (VELAP certified ID #: 450151)
- Locations of active poultry operations were obtained from DEQ Inspection records
- Land use was estimated from VBMP 2017 aerial photography

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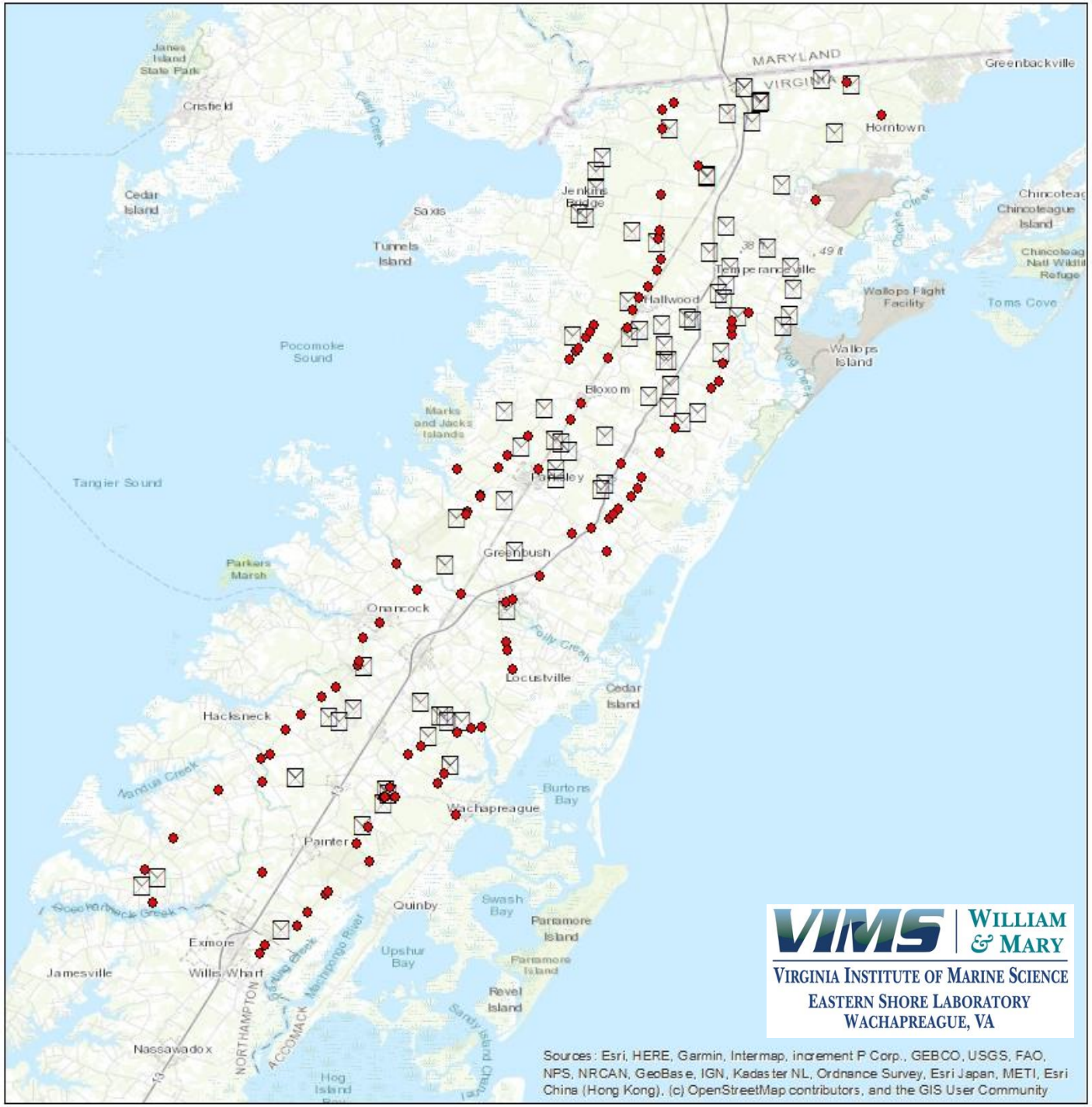
Legend

- 2020 Sample Sites
- Poultry facilities



Base Flow	Turbidity NTU	Flow L/min	NH3 mg/L	NOx mg/L	TN mg/L	TP mg/L	Loading NH3 g/hr	Loading NOx g/hr	Loading TN g/hr	Loading TP g/hr
Average	3.99	110	0.097	1.588	2.065	0.078	1.225	16.43	22.14	1.16
std	2.22	16.8	0.166	0.747	0.449	0.099	1.881	7.46	7.11	1.54
min	0.58	0.000	0.000	0.000	0.506	0.008	0.000	0.00	0.00	0.00
max	59.4	40,795	1.222	5.800	5.866	0.528	161	1352	1109	46.09
Storm Flow										
Average	12.5	35198	0.058	0.783	1.994	0.333	7.45	129.29	434.31	56.87
std	2.70	7.55	0.109	0.512	0.426	0.314	5.29	8.72	6.72	7.95
min	1.76	0.000	0.000	0.000	0.635	0.026	0.00	0.00	0.00	0.00
max	439	1,975,47	0.913	10.820	13.074	2.663	654	11402	27961	7227
Difference Storm/ Base										
Average	3.13	320	0.60	0.49	0.97	4.27	6.08	7.87	19.6	49.0
std	1.2	0.451	0.756	0.845	0.882	1.209	1.8	0.97	0.86	3.1

Storm Flow	NH_3 mg/L	NO_x mg/L	TN mg/L	TP mg/L
No Poultry	0.073	0.815	1.845	0.242
stdev	0.130	0.591	0.481	0.279
Poultry	0.030	0.741	1.943	0.278
stdev	0.031	0.352	0.292	0.208
Base Flow	NH_3 mg/L	NO_x mg/L	TN mg/L	TP mg/L
No Poultry	0.121	1.251	1.897	0.082
stdev	0.261	0.721	0.497	0.091
Poultry	0.096	1.470	2.065	0.071
stdev	0.152	0.772	0.439	0.061

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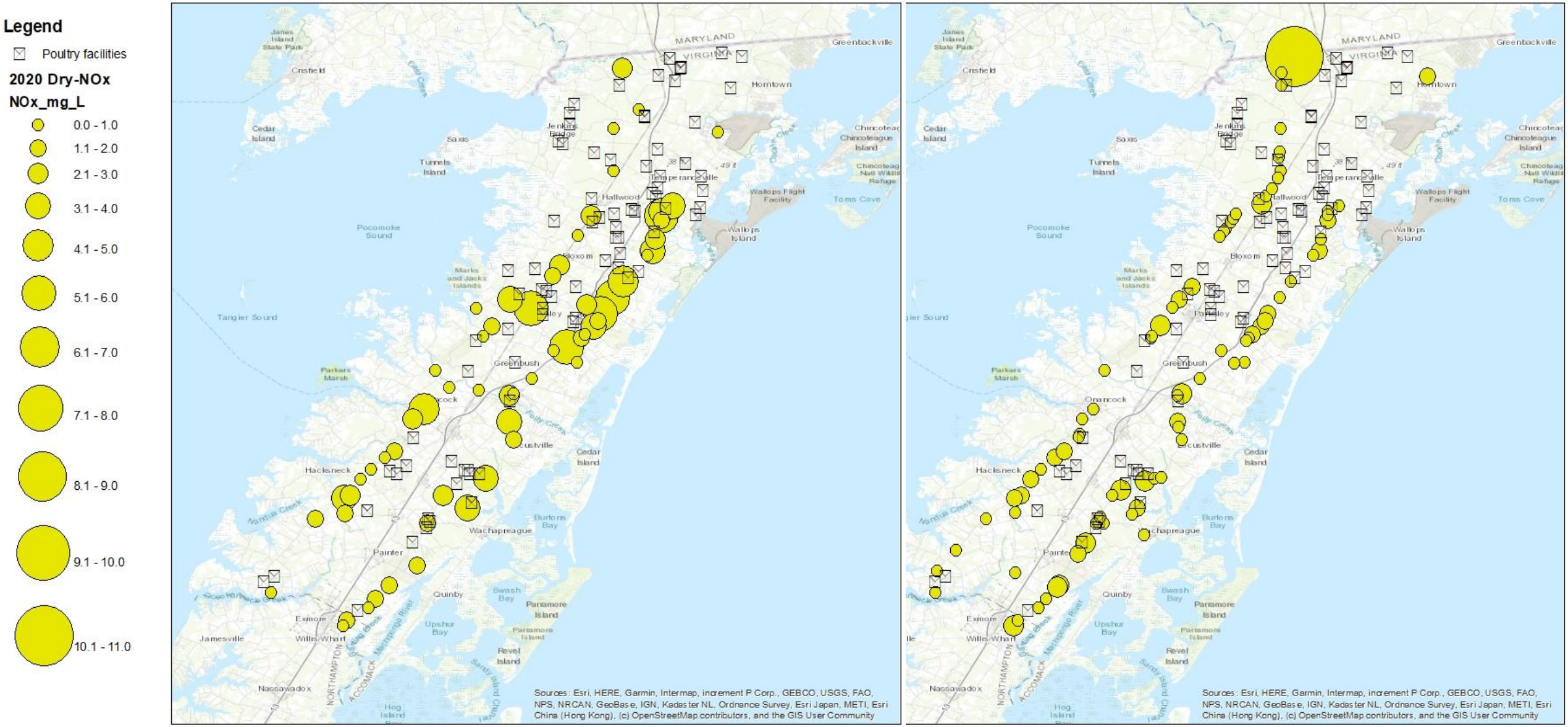
Nitrate

Dry

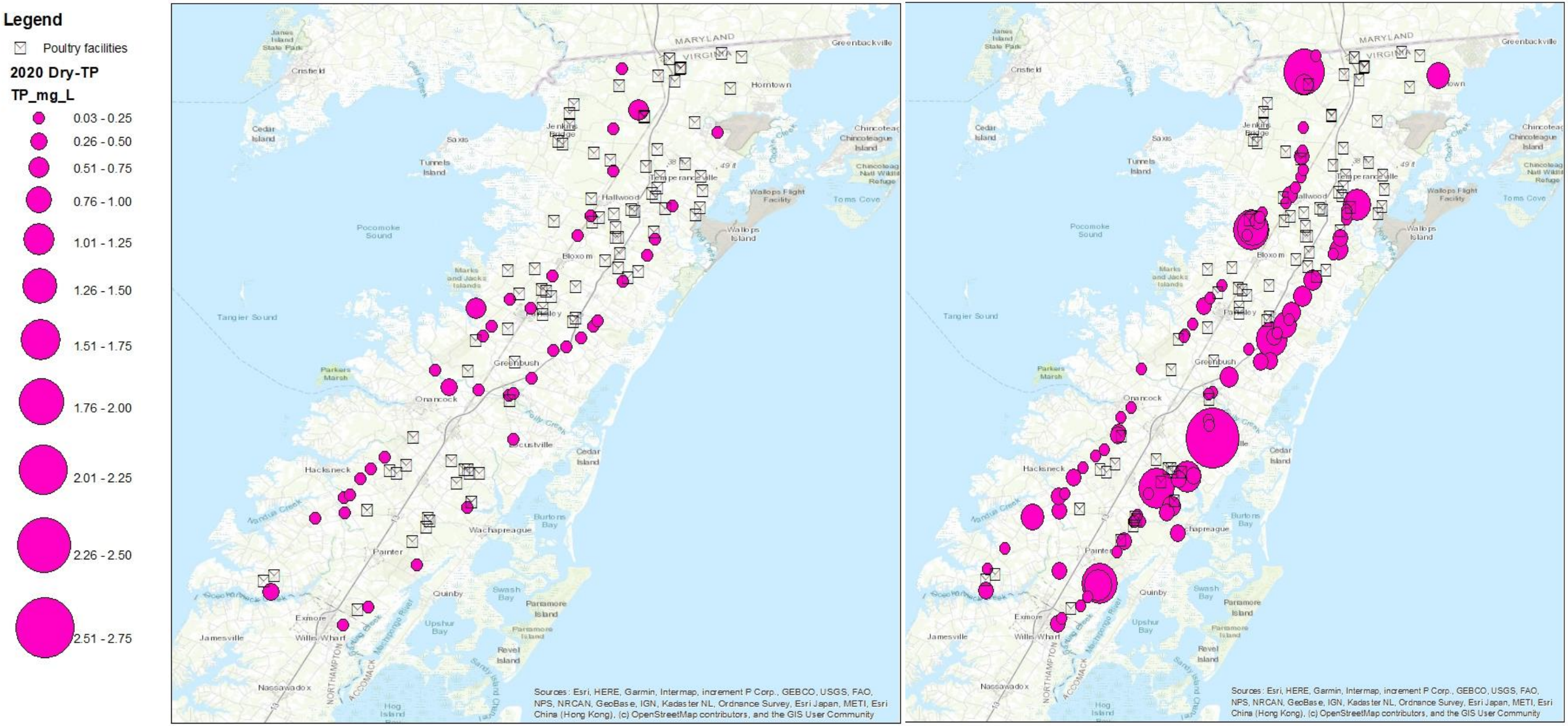
Wet



Total Phosphorous

Dry

Wet



Turbidity

Dry

Wet

Legend

Poultry facilities

2020 Dry-Turbidity

Turbidity

1 - 10

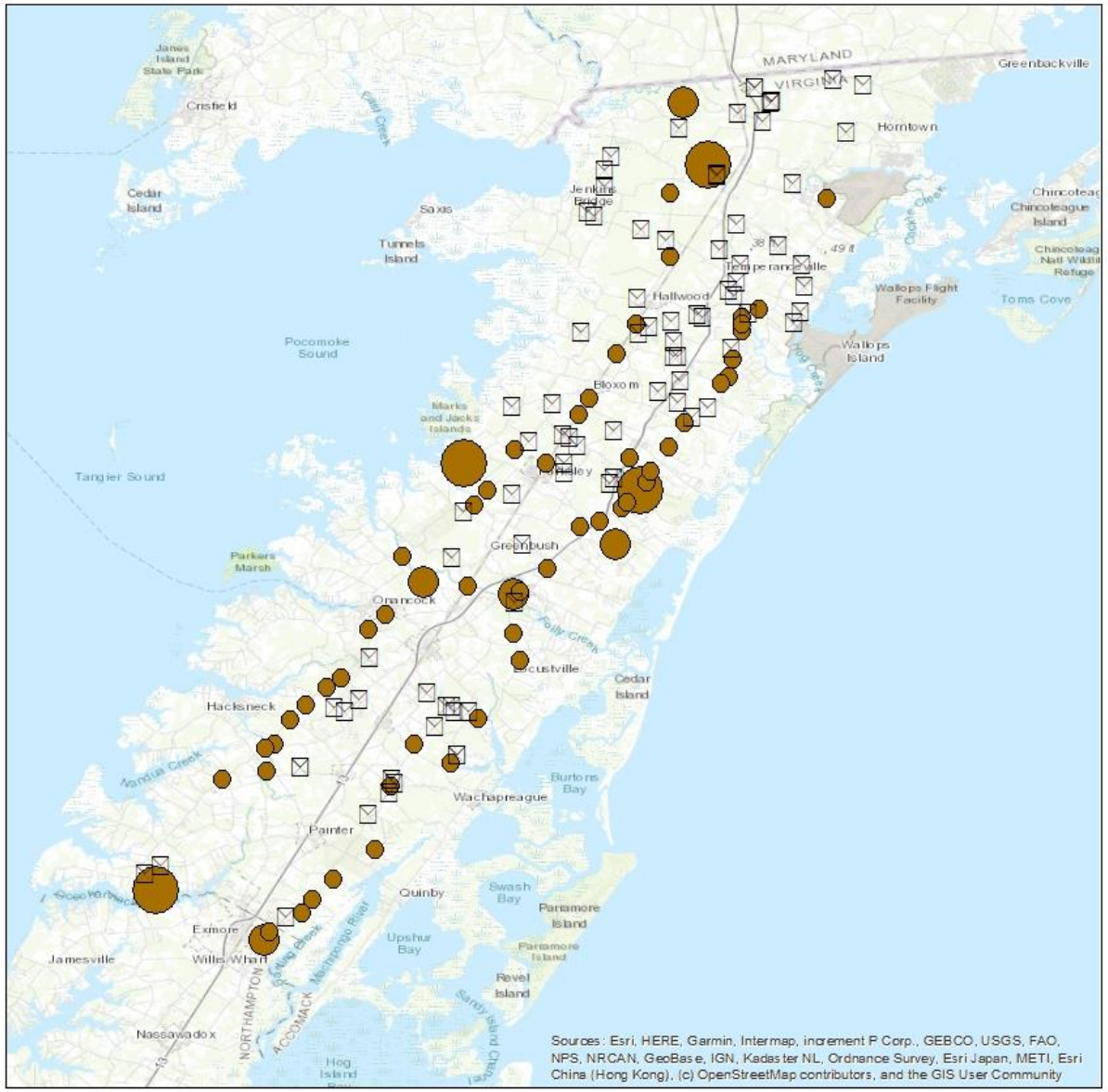
11 - 20

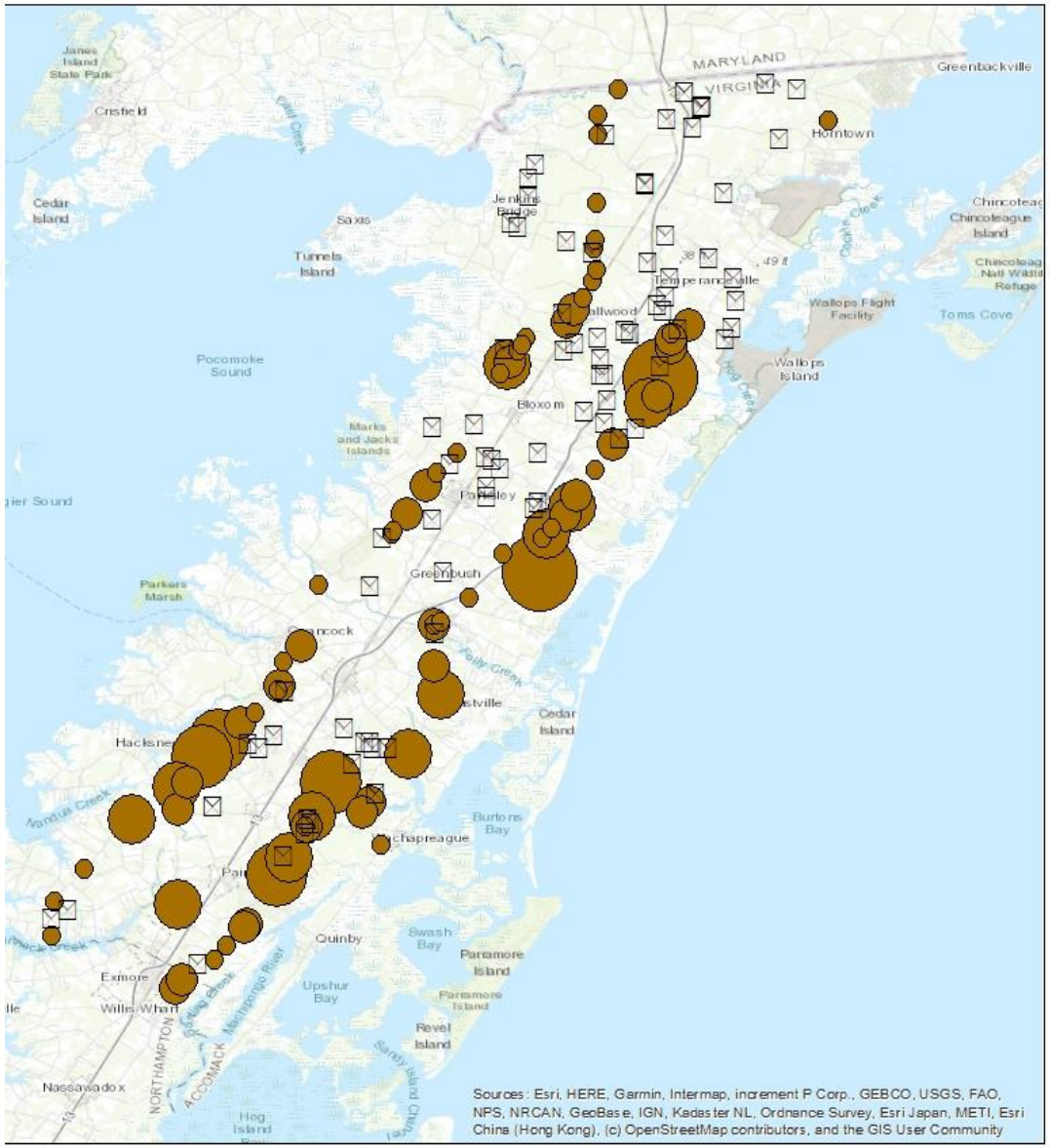
21 - 30

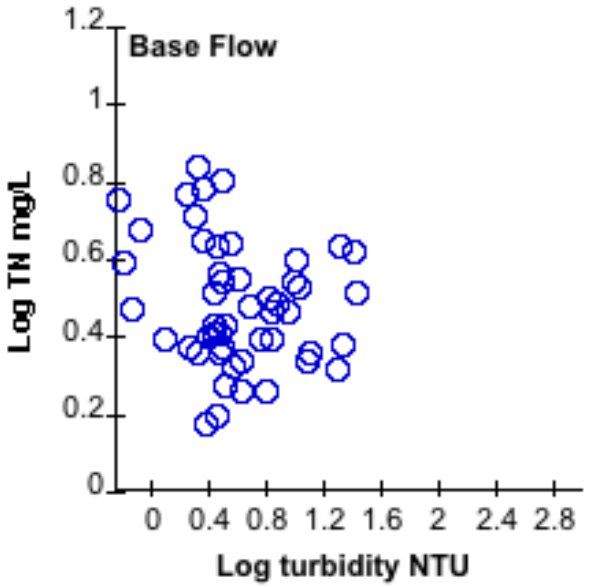
31 - 40

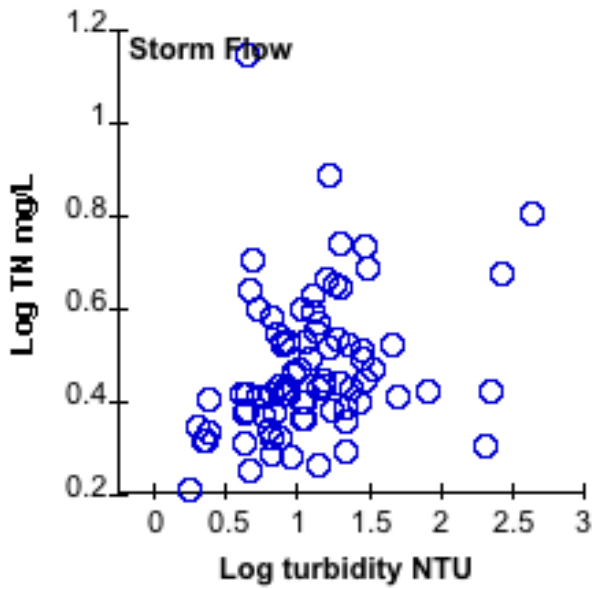
41 - 50

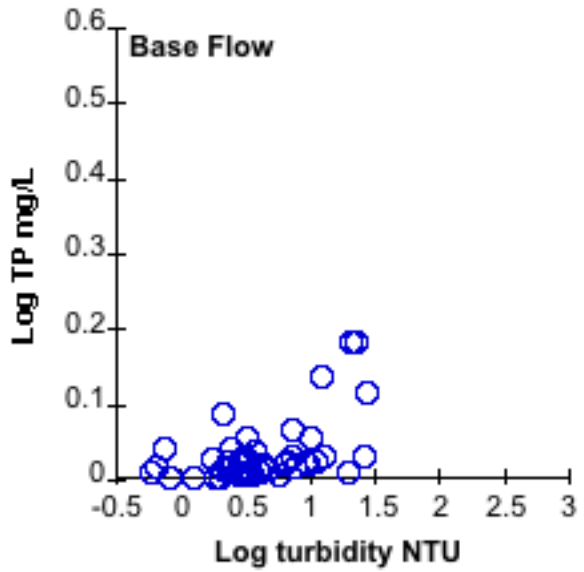
51 - 60

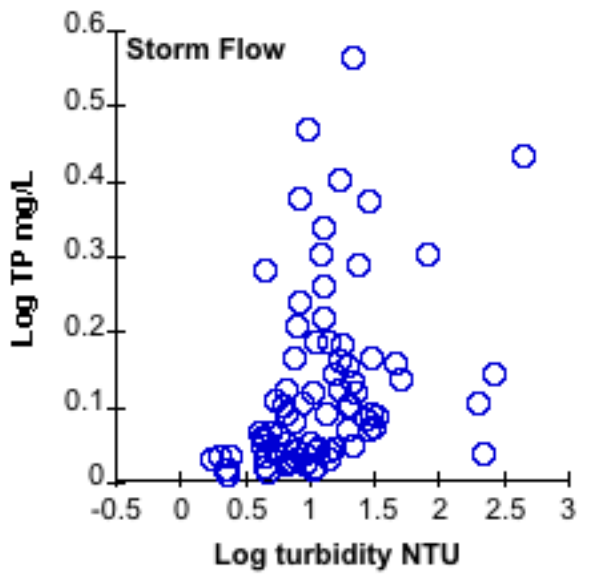


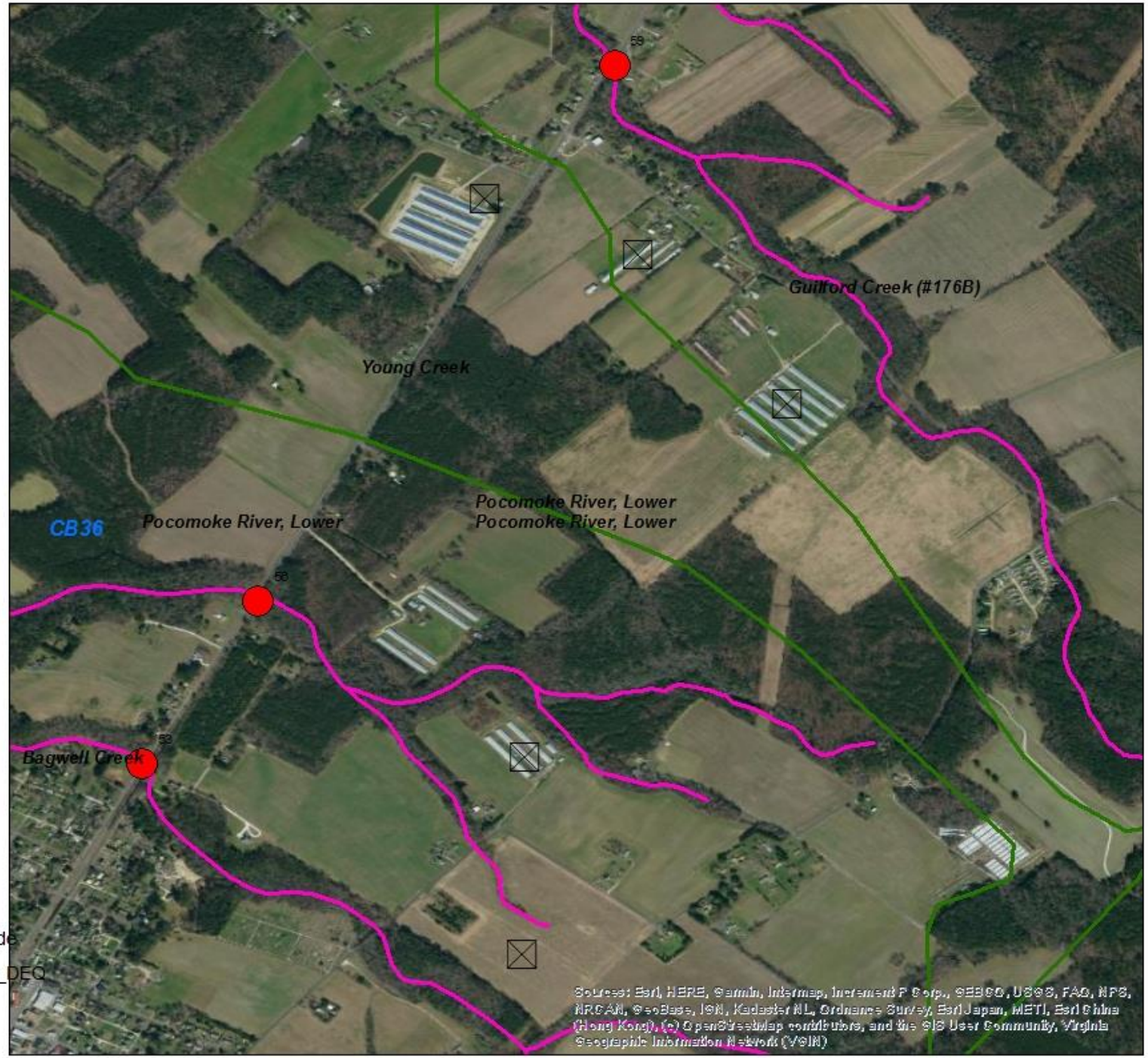



Base Flow
Log TN mg/L
Log turbidity NTU
1.2
1
0.8
0.6
0.4
0.2
0
0 0.4 0.8 1.2 1.6 2 2.4 2.8


Storm Flow
Log TN mg/L
Log turbidity NTU
1.2
1
0.8
0.6
0.4
0.2
0 0.5 1 1.5 2 2.5 3


Base Flow
Log TP mg/L
Log turbidity NTU
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.5 0 0.5 1 1.5 2 2.5 3


Storm Flow
Log TP mg/L
Log turbidity NTU
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.5 0 0.5 1 1.5 2 2.5 3



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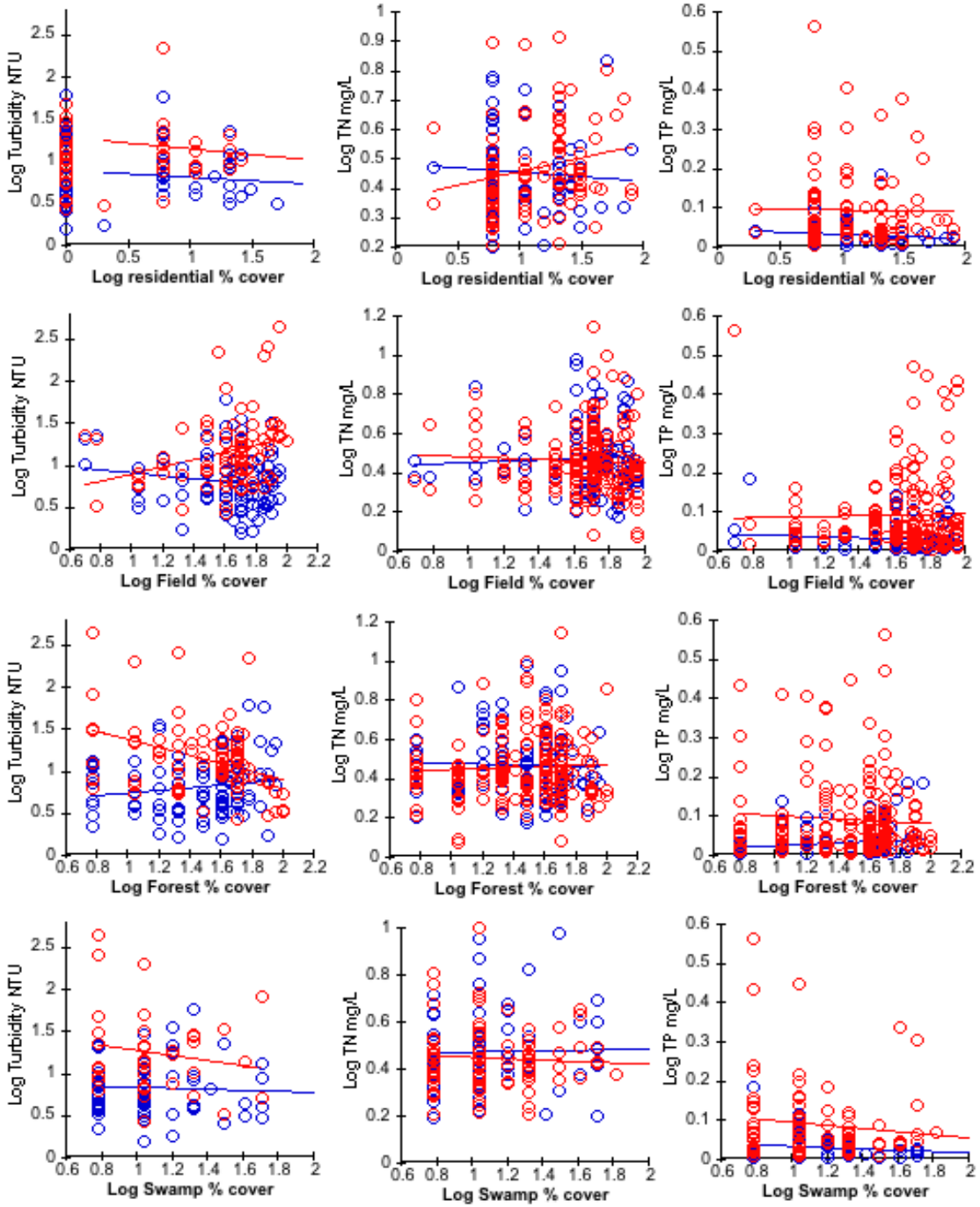
Land use effects on stream water quality

Base flow in BLUE

Storm flow in RED



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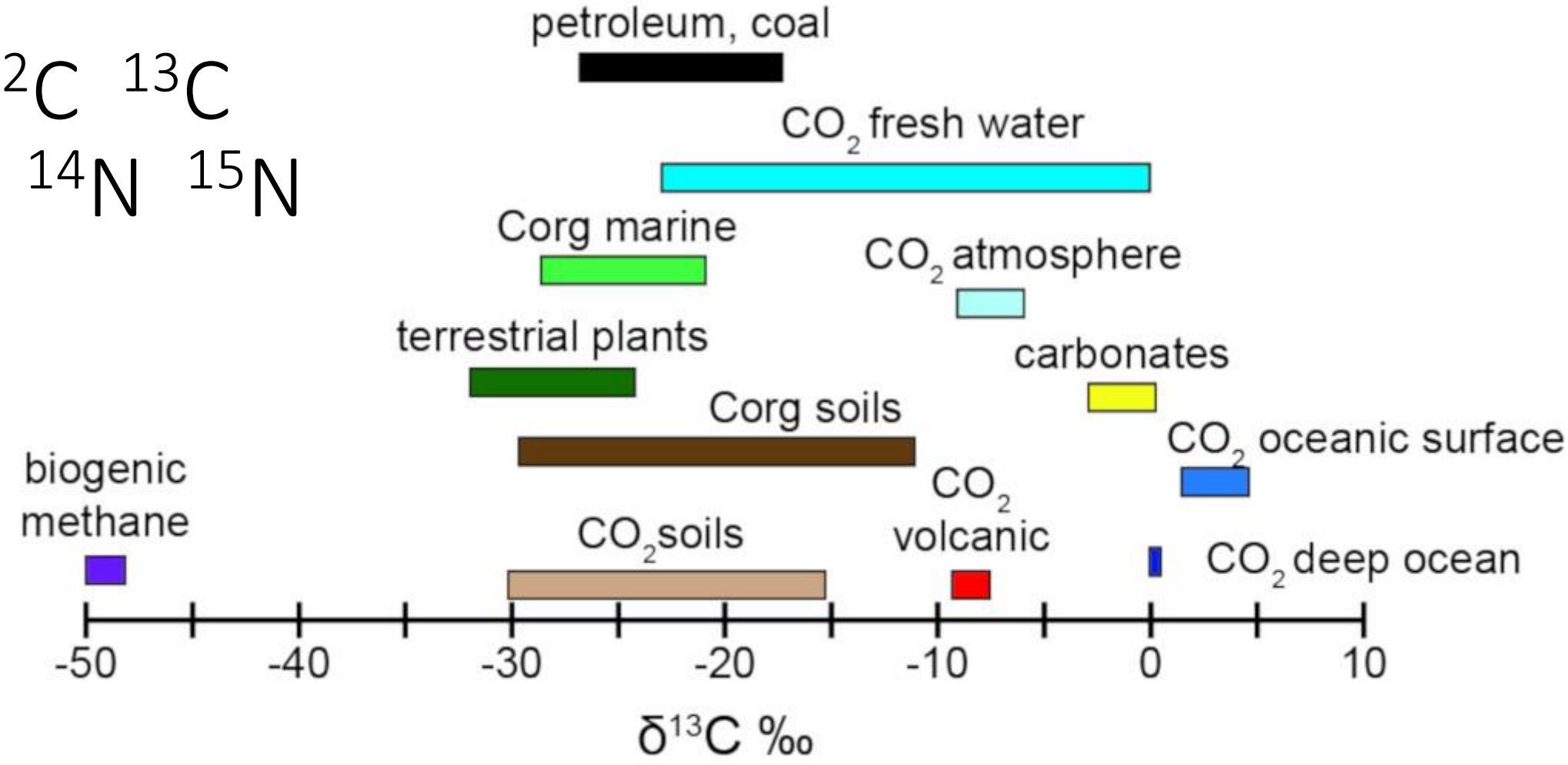
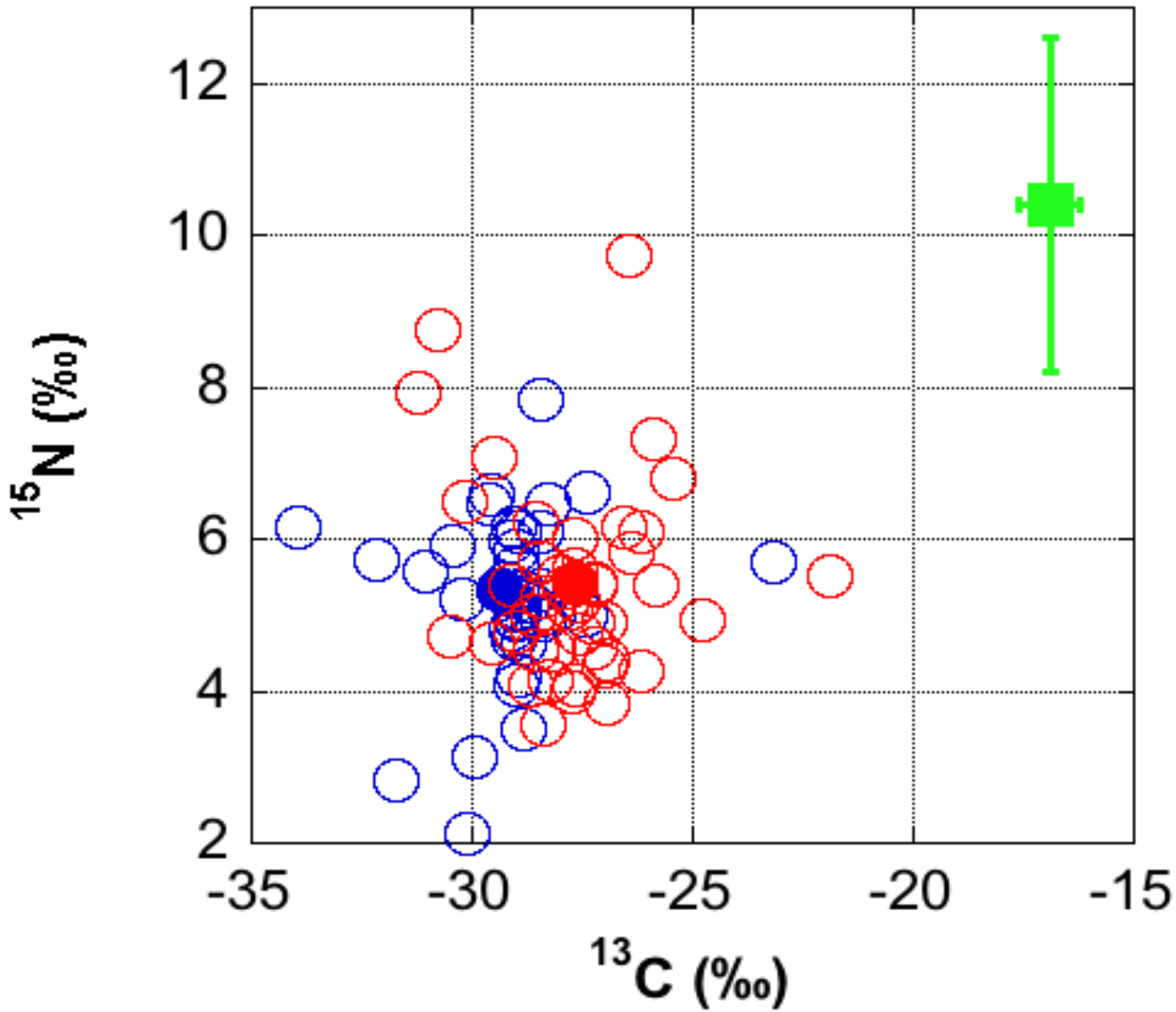
Stable Isotopes

Carbon: ^{12}C ^{13}C

Nitrogen: ^{14}N ^{15}N



https://www.encyclopedie-environnement.org/en/life/oil-evidence-biological-origin/



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