Photo credit: Aryssa Endicott, Flickr.com

Characterizing the Spatiotemporal Population Dynamics of the Atlantic Bay Nettle (Chrysaora chesapeakei) in the Patuxent River, MD

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Introduction to Jellyfish Ecology

- Introduction to '*Jellyfish*'.
- Key characteristics of the Cnidarian species group:

- Comprised of 4 distinct classes: scyphozoa, cubazoa, anthozoa and hydrozoa.
- Many members of the cnidarian phylum have evolved to ensure continuity of their species- reflected in their complex life history.
- Demonstrated in their meroplanktic nature.

Cnidarians

Ctenophora

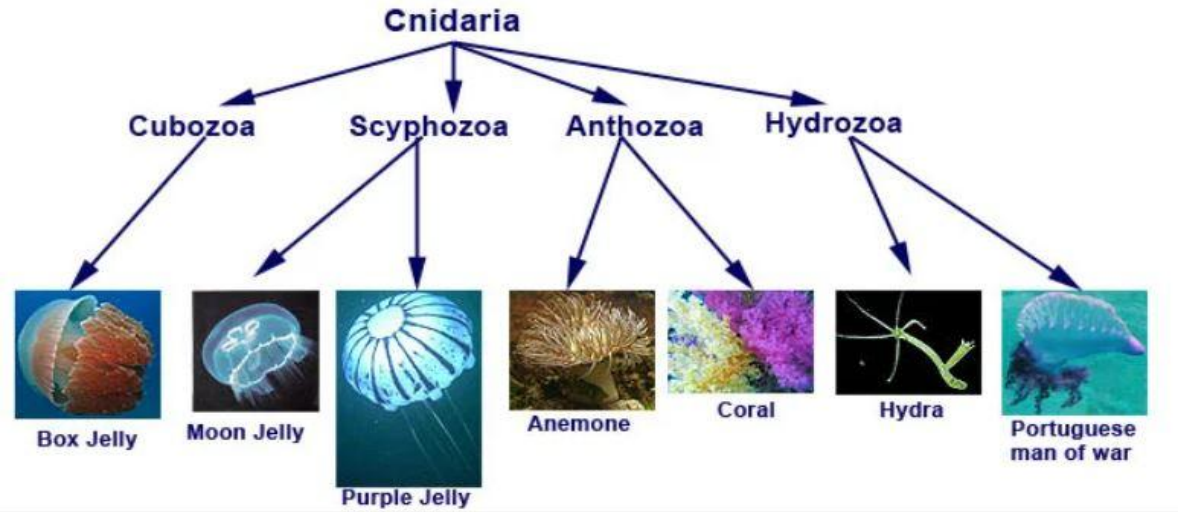


Image credit: Mesa.edu.au

Jellyfish Life History

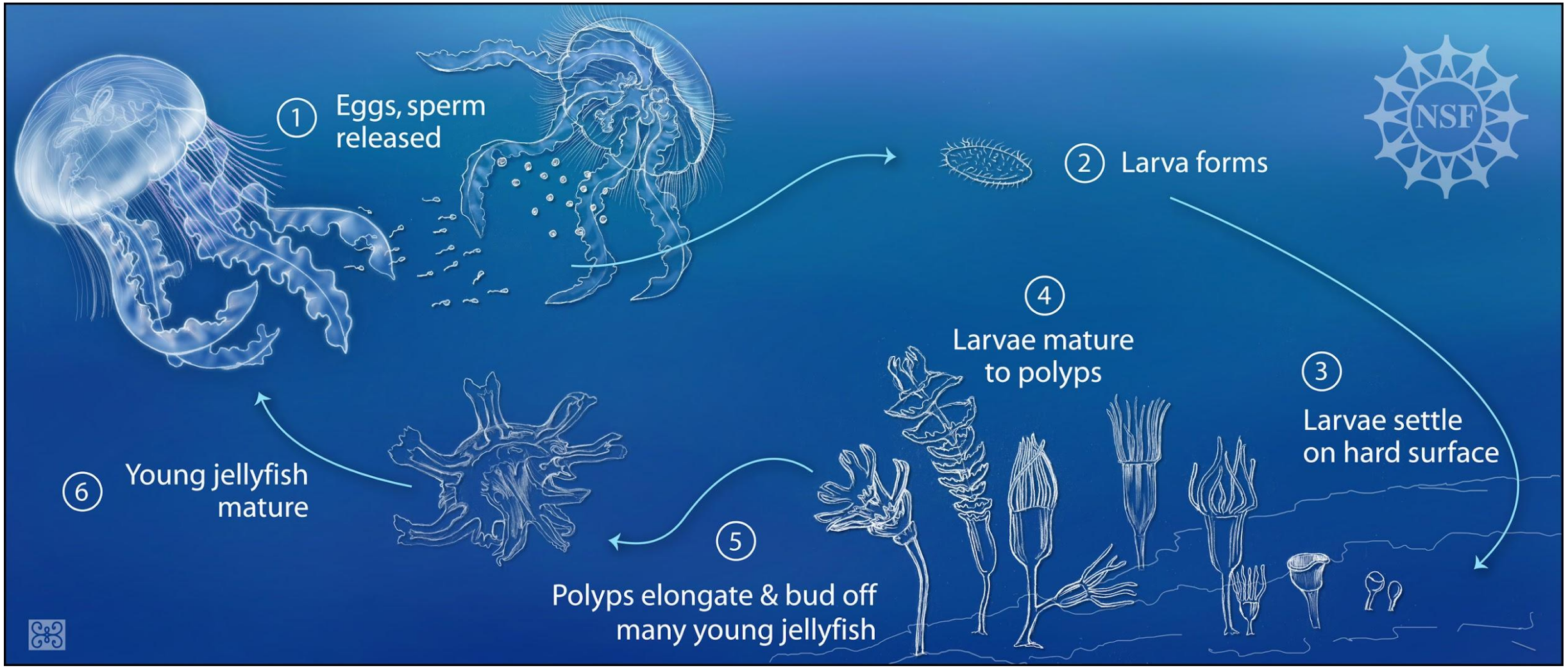


Image credit: Deretsky,NSF

Schematic Highlighting Stages of Jellyfish Life History

The Atlantic Bay Nettle (*Chrysaora chesapeakei)*

- Predominant scyphozoan species in the Chesapeake Bay, USA.
- Occupies a high position in the Chesapeake Bay food web.
- Plays an important role as a consumer of zooplankton in the Chesapeake Bay ecosystem.

✔ Promote secondary production in the food web of the lower Chesapeake.

✔ Cause shifts in trophic landscape which influence biogeochemical cycles.

✔ Predation on Mnemiopsis leidyi may support oyster populations.

Image credit: bioluminescence, National Geographic

Impact of Jellyfish Blooms

- ✔ During their blooms, jellyfish disrupt mesopelagic trophic dynamics.
- ✔ Prevent the flow of carbon to higher trophic levels.
- ✔ Outcompete forage fish during blooms and reduce populations through predation on itchyoplankton.
- ✔ Impact commercial fisheries-clogging and bursting of nets, traps- millions of dollars lost annually.
- ✔ Negatively impact aquaculture.
- ✔ Negatively impact recreational and industrial enterprises.

Image credit: Getty Images, NOAA

Increases in Magnitude and Periodicity of Jellyfish Blooms

- Researchers have noticed an increase in magnitude and periodicity of jellyfish blooms globally.
- These increases may be linked to anthropogenic activities such as:

✔ Overfishing

✔ Eutrophication in coastal regions

✔ Habitat modification

✔ Climate change

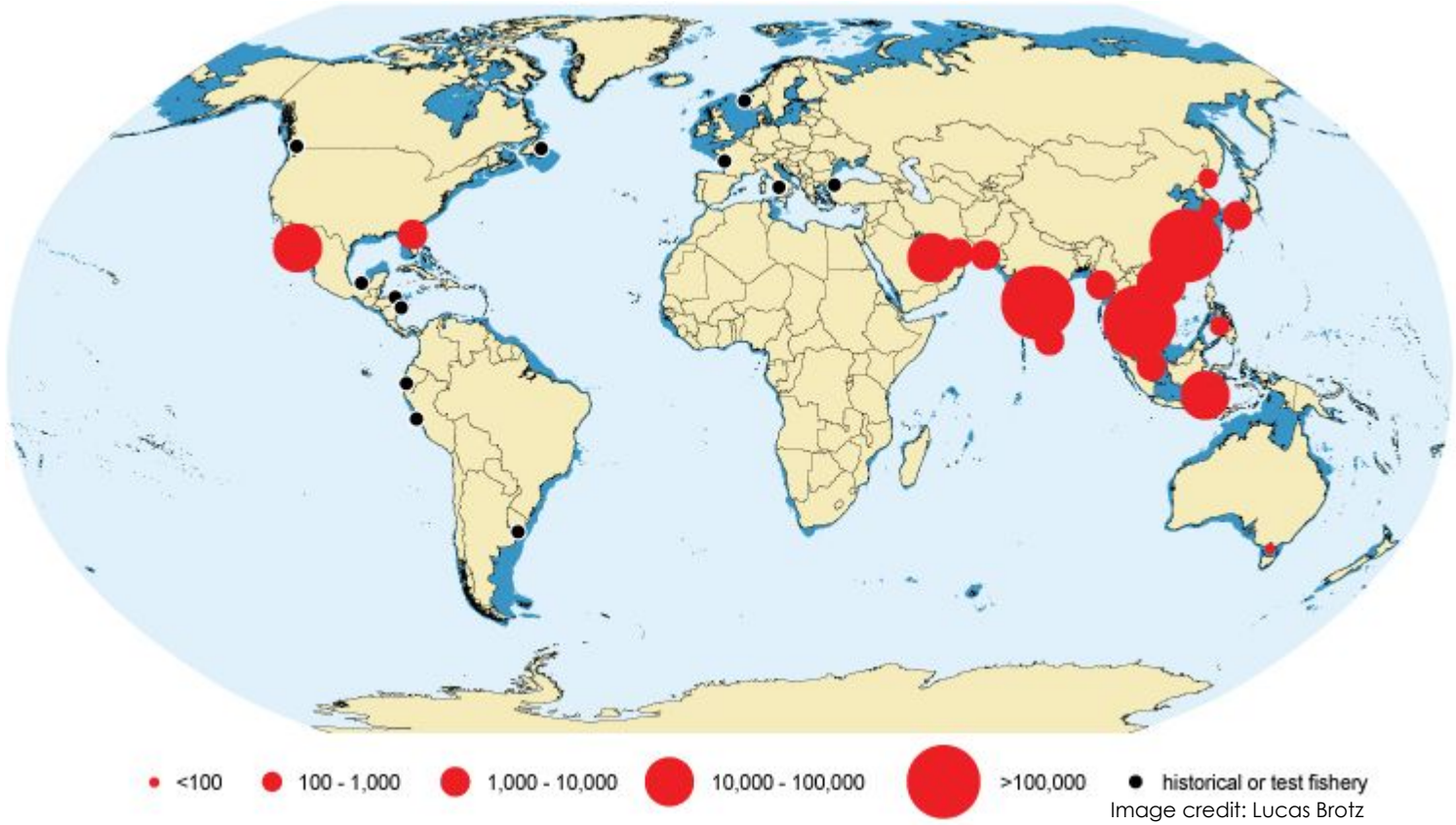


Image credit: Lucas Brotz

Research Objectives

Gaps in Knowledge:

- Studies related to bay nettle population dynamics have not included the full spatial scale of their life history (source-sink).
- Studies omitted key data related to bay nettle population dynamics in source habitat.

Research Objectives:

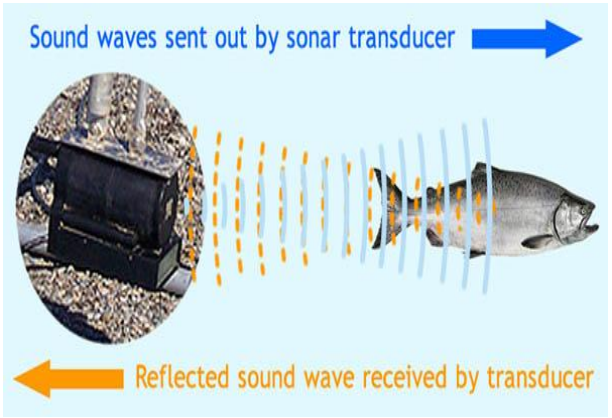
- To determine the spatial distribution of the *Chrysaora chesapeakei* abundance in the Patuxent River and the adjacent creeks.
- To explore the environmental factors that can contribute to the distribution of the *Chrysaora chesapeakei.*

Hypothesis:

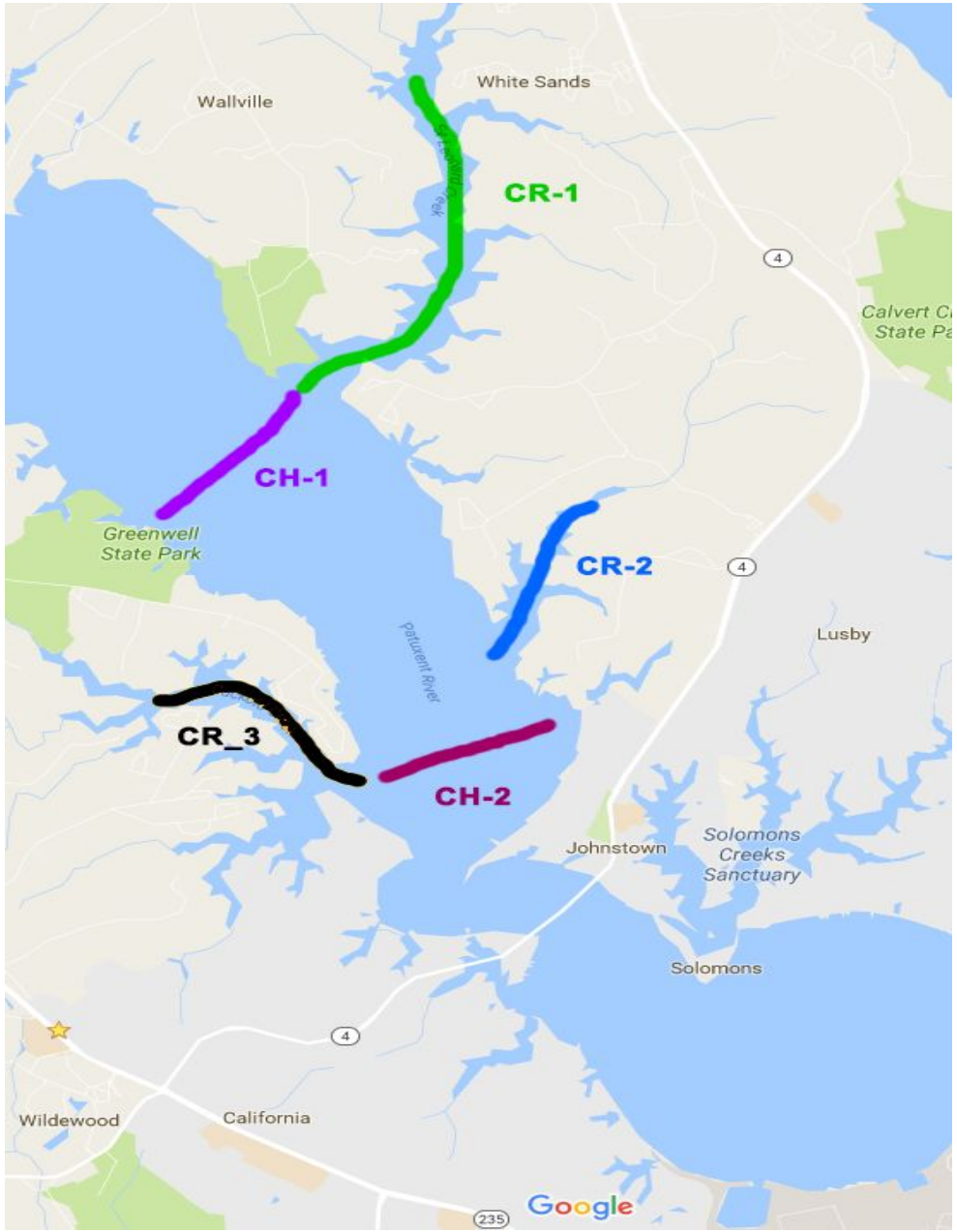
- There is no significant difference in the abundance of bay nettle in source vs. sink habitats.

Method

- The study was conducted in the Patuxent river's main channel and three adjacent creeks.
- 4 cruises were carried out from June to July.
- The ARIS was deployed across each transect (UPX, LPX, CUC, HLC, SLC)

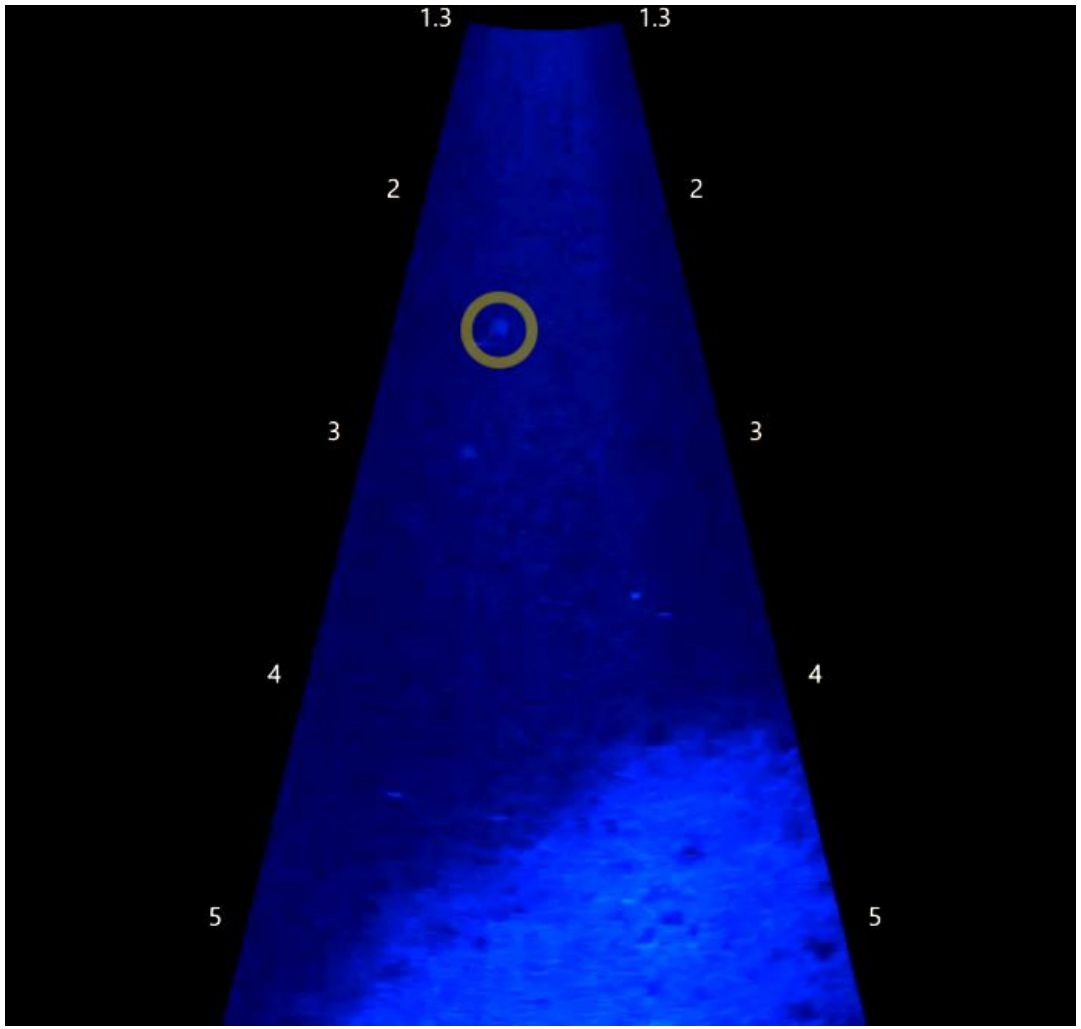


- A CTD instrument was also deployed simultaneously to measure temperature and salinity.



Data Capture and Analysis

Dr. Chunlei Fan demonstrating deployment of ARIS3000



Visual representation of ARIS data capture in the Patuxent River via ARISFish Software

Results

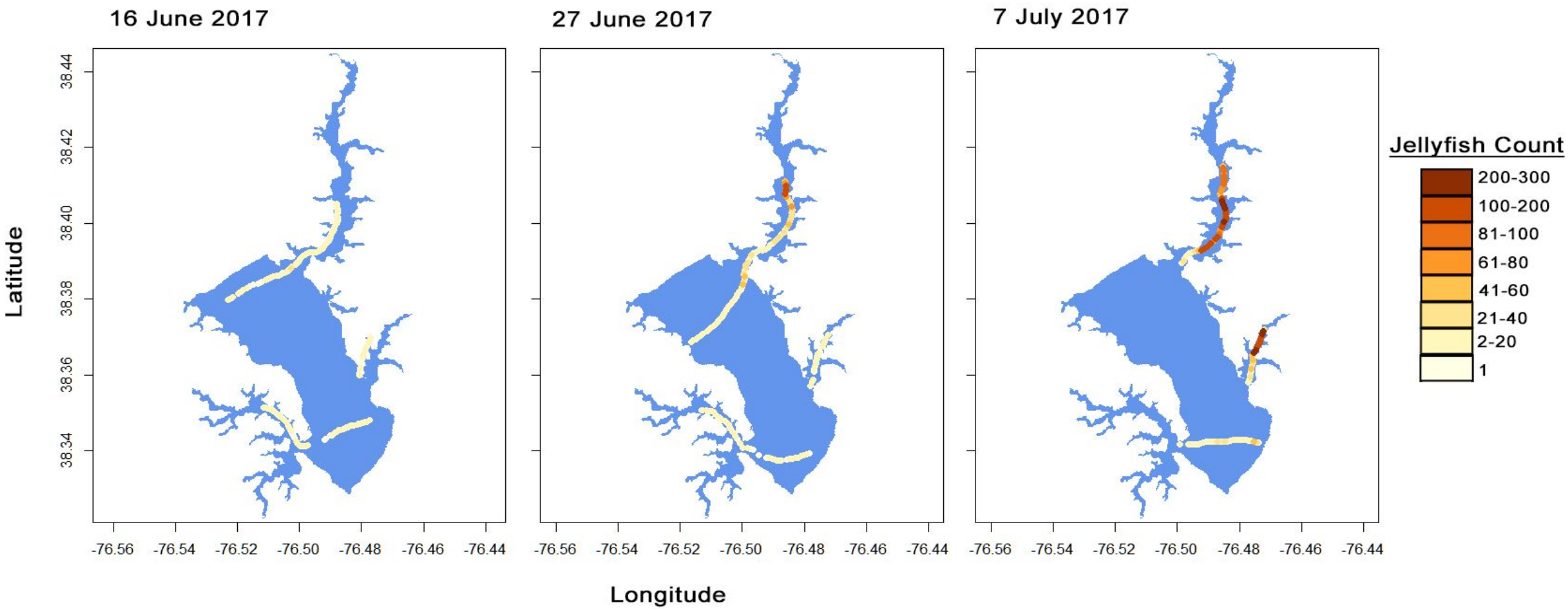


Figure generated based on manual jellyfish counts from ARIS Patuxent River cruises summer (June-July 2017), Image credit- Shahrestani et al.

Results

- Over the large spatial and temporal scale of the study, the jellyfish abundance exhibited a large variation- null hypothesis accepted.
- A significant difference in jellyfish abundance was found between a specific transect (source habitat) and the main channel over different sampling dates.
- Factors contributing to this pattern in bay nettle abundance and distribution:

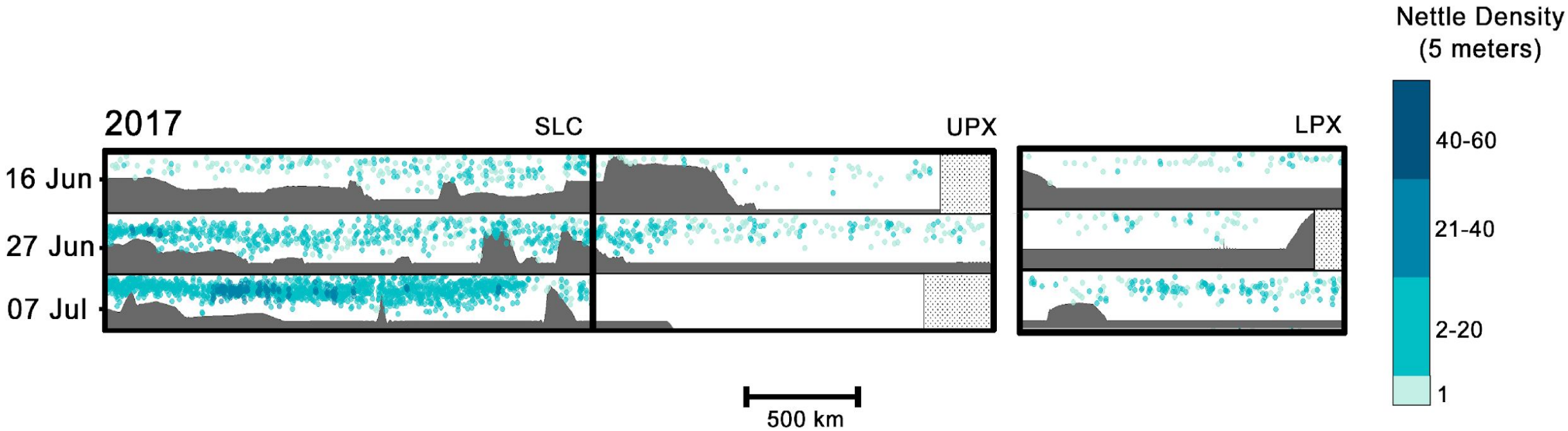


Figure based on ARIS counts of bay nettle in the Patuxent River, June-July 2017- Image credit: Shahrestani et al.

Future/Current Work

- Investigate long term population dynamics in source habitats.
- Investigate impact of ecological and environmental factors on seasonal population dynamics of bay nettle in source habitats.
- Investigate impact of freshwater flow on the spatial distribution patterns on the bay nettle in source and sink habitat.