A pathway to transition from vulnerable to resilient fisheries social ecological systems: a transdisciplinary case study of the US Atlantic sea scallop fishery

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Introduction

- The Atlantic Sea Scallop (sea scallop) fishery is increasingly threatened by ocean warming (OW) and acidification (OA) [1,2].
- Landings values eclipse $500m in recent years, with certain ports highly dependent on scallops[3].
- Overdependence increases vulnerability given predicted changes[4].
- Through a transdisciplinary approach we assess vulnerability, resilience, and adaptive capacity.

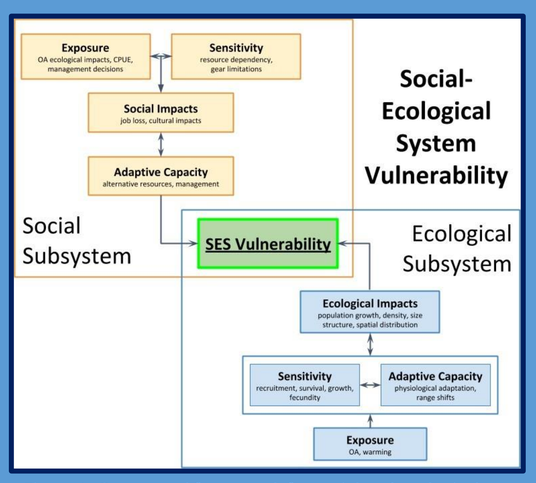


Figure 1. Conceptual framework for social and ecological system (SES) vulnerability of the Northeast U.S. Atlantic sea scallop fishery. (adapted from Cinner et al., 2013; Ekstrom et al., 2015; Thiault et al., 2018; Cutter 2005).

Project Methods: Social Science Component

- Oral histories with scallop industry and community members
- Community profiles of key ports
- Landings diversity and port trends
- Workshops in scallop fishing communities to share results and learn from fishermen
- Participant observation (e.g. auctions, piers, public management and advisory meetings, etc.)
- Regular communication with our natural science and outreach collaborators

Figure 2: Oral histories are conducted with key industry and community members both in-person and virtually.

Figure 3: Oral histories investigate social and environmental aspects of the fishery.

Figure 4: Participant observation includes various in-person efforts, including visiting the New Bedford scallop auction.

Initial Results

Industry views on acidification and warming

"That area [and] those shells, it just seems like **they're scallops that never grew up**."
- Barnegat Light, NJ

"If we're dealing with ocean acidification let's start to get some ideas of what's where. And then what's it like next year**? Is it changing? Is it moving? Is it getting worse in that area?**"
- Barnegat Light, NJ

"You could basically **crush them with your hands,** just the shell. **That's how fragile they were**."
- New Bedford, MA

Figure 5: Workshop station for industry members to describe shells from two different areas of Georges Bank.

Figure 6: A workshop presentation in New Bedford, MA.

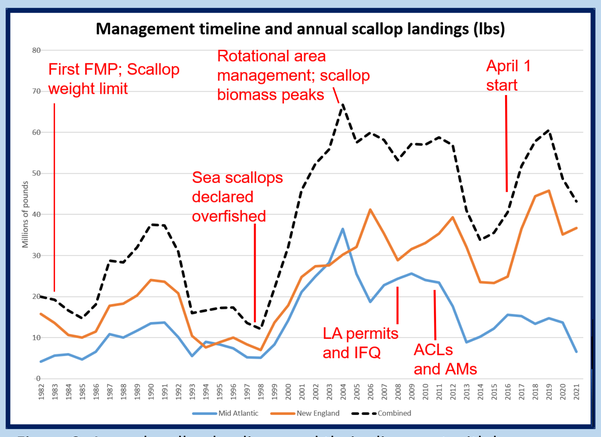
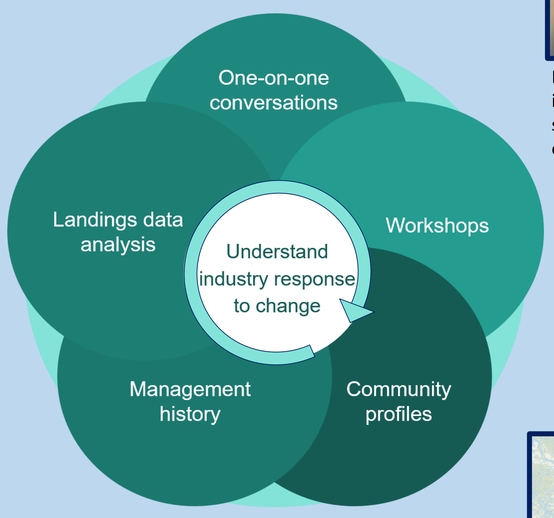


Figure 8: Annual scallop landings and their alignment with key management decisions (red font).



Industry views on the future

"Science has a role. Regulations have a role. And managing has a strong role. **And hopefully we can be good stewards. That's my goal.**"
- New Bedford, MA

"You've got to figure out a direction and **pivot and go**."
- Point Judith, RI

"**How do we work around [acidification]** and how do we try to ensure where sets of scallops are landing, and if [they're not] conducive for growth…**how are we going to get them to better places?**"
- Barnegat Light, NJ

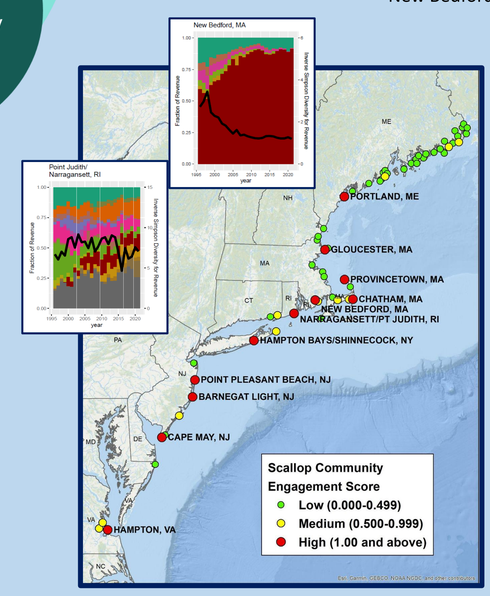


Figure 7: Map of regional ports indicating engagement in the scallop fishery, with two figures showing inverse simpson diversity of revenue for Point Judith, RI (upper left) and New Bedford, MA (upper right).

Next Steps: The Transdisciplinary Process

- Continuing all research and working through transdisciplinary challenges as we go!
- Hosting Year 3 workshops across the Mid Atlantic and New England at key scallop ports.
- Co-developing management recommendations with workshop participants and industry.
- Understanding how adaptive capacity involves tradeoffs between present concerns (e.g. offshore wind energy development) and future challenges (e.g. increasing OA and OW).

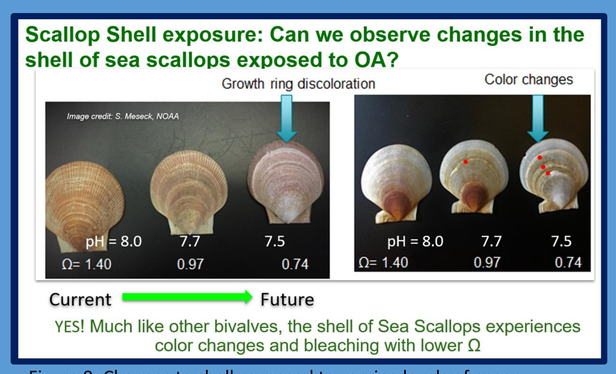


Figure 9: Changes to shells exposed to varying levels of ocean acidification in the lab.

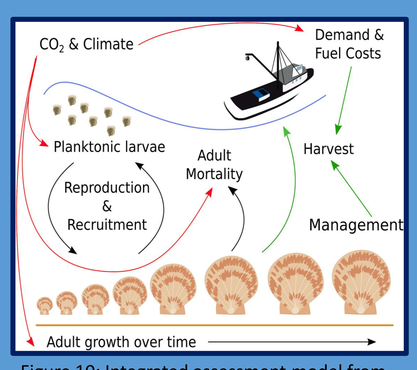


Figure 10: Integrated assessment model from Rheuban et al. 2018.

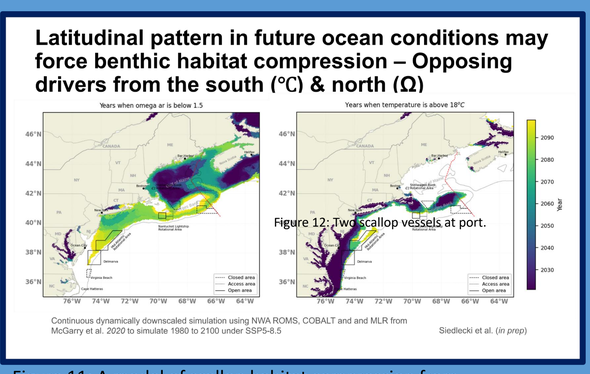


Figure 11: A model of scallop habitat compression from increased acidification (from north) and warming (from south).

Citations

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4. Colburn, L. L., Jepson, M., Weng, C., Seara, T., Weiss, J., & Hare, J. A. (2016). Indicators of climate change and social vulnerability in fishing dependent communities along the Eastern and Gulf Coasts of the United States. *Marine Policy, 74,* 323-333. doi:10.1016/j.marpol.2016.04.030

Collaborators

WELLESLEY

UCONN AVERY POINT

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Project website