# From seed to settlement: Examining the connections between farmed and 'wild' oyster populations in Maine

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## Oysters are reemerging on Maine's coasts

The American oyster (*Crassostrea virginica*) once functionally extinct, is **reemerging along Maine's coast.** [1]

These intertidal and subtidal 'wild' oyster populations are **likely the result of larval spillover from reproductive (diploid) oysters raised on aquaculture farms.** [2,3]

**We investigated the connections between the coupled systems of farmed oysters and the wild oyster fishery**.

A.

B.

*(Pictured:* **A.** *Oyster spat on rock.* **B.** *Adult 'wild' oysters)*

## A result of a coupled system

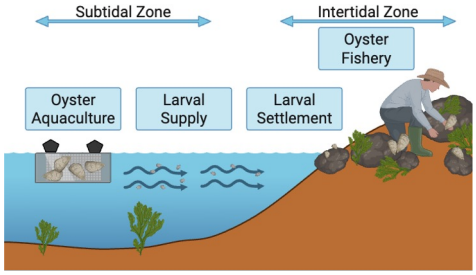


**Figure 2:** Schema showing the connections between reproductive farmed oysters and harvested intertidal 'wild' oysters in a coupled aquaculture-wild fishery system (*Image created in Biorender*).

## Exploring connections with multiple methods

**Guiding questions:**

1. When and at what size do farmed oysters spawn in the Damariscotta?
2. How many potentially reproductive farmed oysters are there in the Damariscotta?
3. If farmed oysters are spawning, are the larvae contributing to reemerging 'wild' populations and where?

**Multiple methods:**

1. Histological analysis: Monthly dissection and histology analysis of farmed oysters (May-September 2024).
2. Larval recruitment study: Shell bag collectors deployed May-October (2023-2024) in intertidal zone.
3. Intertidal walking surveys: Quadrat sampling (0.25 m²) of 'wild' oysters within intertidal zone (2023-2024).

## Farm-raised oysters are reproducing

**Method:** Histological analysis

A.

| Ploidy | Mean Height (mm) | SD | Max Height (mm) | Min Height (mm) |
|---|---|---|---|---|
| Diploid | 76.23 | 8.83 | 113 | 61 |
| Triploid | 105.03 | 12.31 | 138 | 81 |

B.

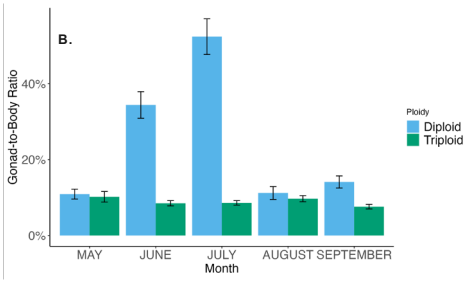


**Figure 3: A.** Size characteristics (shell height) of farmed oyster samples. **B.** Gonad-to-body ratio (as %) of triploid (n=74) and diploid (n=74) farmed oysters in the Damariscotta River estuary (DRE).

## Provide a viable larval supply

**Method:** Histological analysis

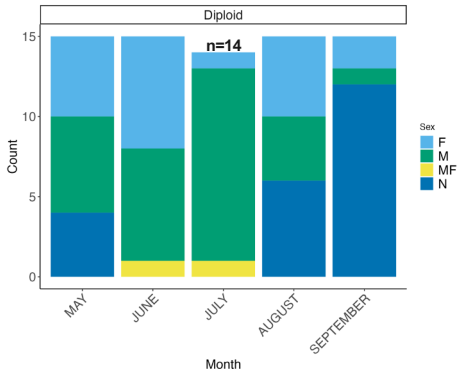


**Figure 4:** Sex ratio frequency of sampled diploid farmed oysters by month in the DRE (total n = 74, n=15 per month, except in July; male=M, female=F, MF=hermaphrodite, N=indeterminate).

## Recruitment to the intertidal zone is low

**Method:** Larval recruitment study

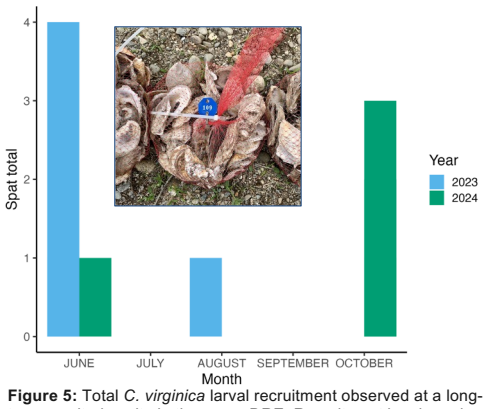


**Figure 5:** Total *C. virginica* larval recruitment observed at a long-term monitoring site in the upper DRE. Recruitment has been low in the past two years with very few spat observed. *Photo inset shows shell bag larval collectors.*

## Yet, 'wild' oysters populations are present

**Method:** Intertidal walking surveys

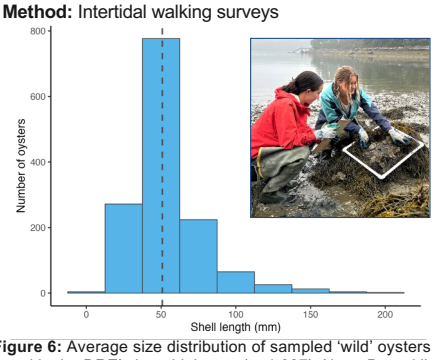


**Figure 6:** Average size distribution of sampled 'wild' oysters found in the DRE's intertidal zone (n=1,387). Note: Dotted line shows legal harvest size. *Photo inset shows survey methods.*

## A new fishery under pressure

| | |
|---|---|
| **Overharvest** | "I think I had my first [shellfish] license in 2017 and you couldn't even sell what [oysters] you could find. Then the oysters kind of gained in popularity… in 2019. Then there were a lot of people out there doing it. And now I would say you can't get much." |
| | "I would say it's gone down quite a bit. I think [oysters] gained in popularity, and the price went up. So that made a lot of people gather the product...it's probably been getting a little overfished." |
| **Farming triploids** | "I don't believe the wild oysters are repopulating themselves... And now a lot of [aquaculture farms] are also buying the triploids, not the diploids. So they're supposedly not going to reproduce." |
| | "Now there actually hasn't been as many spawning events with the American oyster, and I don't quite know why. I would say is because [aquaculture farms] went from [raising] diploids to triploids." |

**Table 1:** Quotes from shellfish harvesters on the DRE (n=3).

## Conclusions

- American oysters raised on farms **are reproductive and may be a viable larval source**.
- Although recruitment is low, **'wild' oysters are present in the intertidal zone and are actively targeted by commercial harvesters.** These wild oysters **represent a new fishery opportunity**.
- However, **two factors may be limiting the growth of intertidal and subtidal wild oyster populations**:
  - Overharvesting of adults.
  - Movement towards raising triploids over diploid (reproductive) oysters on farms.
- **Oyster aquaculture may facilitate the restoration of wild oyster populations and can be leveraged to enhance restoration efforts**, for both ecosystem services and fisheries enhancement.

**References:** [1] Larsen, P., Wilson, K. A., & Morse, D. (2013). Observations on the Expansion of a Relict Population of Eastern Oysters (Crassostrea virginica) in a Maine Estuary: Implications for Climate Change and Restoration. [2] Delago, D. F. (2021). *Investigating Larval Spillover From Oyster Aquaculture Through Geospatial Habitat Suitability Index Modeling: A Damariscotta River Estuary Case Study.* [3] Risley, S. C., Britsch, M. L., Stoll, J. S., & Leslie, H. M. (2025). Mapping local knowledge supports science and stewardship.

## Acknowledgements

We thank A. Dorr, K. Sutherland, M. Lutkus, and the staff of the Town of Damariscotta, the Damariscotta-Newcastle Joint Shellfish Committee, K. Pellowe, C. Strauch, J. Woodall, M. Williams, S. Swett, C. Rolfe, A. Papi, A. Hufnagel, J. O'Neal, B. Mirra, A. Leung, M. Yost, W. Spaller, A. Skena, C. Gordon, and all the other high school and undergraduate student researchers who supported this research. This work was supported by anonymous friends of the Darling Marine Center, The Broad Reach Fund: Maine Shellfish Restoration and Resilience Project, NOAA Saltonstall-Kennedy award NA17NMF4270198, NSF DEB-1632648 and NSF award #11A-1355457 to Maine EPSCoR at the University of Maine.