Mallet Oyster Hatchery

Present and future solutions for the PEI Industry

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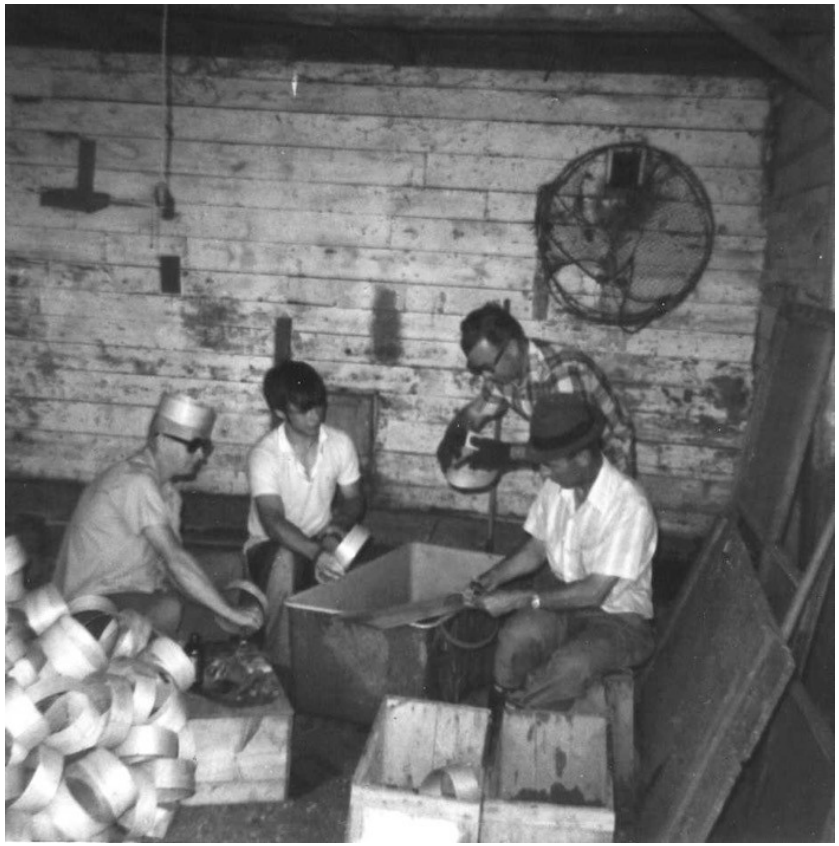
co-owner, Mallet Oysters

Mallet Oysters

- Established 1972
  - Longstanding ties to PEI
    - French seed collectors
    - Mallet Research Services
    - Commercial hatchery est. 2009, sales to PEI starting ca. 2015



- Presentation to PEI Aquaculture Alliance in 2017
  - Take Home (7 years ago)

Summary

- **Hatchery seed is already a commercial reality in the Maritimes**
  - Currently 5-7 hatcheries in operation or in advanced development, can easily produce enough to meet demand
- **Need more nursery and grow-out capacity**
  - This is the real barrier to widespread availability of hatchery seed
- **Support your spat suppliers!**
  - Build working relationships, and don't buy seed only in times of spatfall failure
  - Need R&D support to establish best grow-out procedures

How much hatchery seed does PEI need?

- Current oyster production in PEI (approx.)
  - ± 80 million off-bottom
  - ±40 million fishery
- Current supply of hatchery seed to PEI
  - ±30 million (±1/3 of off-bottom)
  - Demand and supply generally well-balanced

The nursery bottleneck…

- Mallet Hatchery
  - +80M T1 seed capacity (1mm graded seed), with additional expansion planned
  - 30M Nursery Capacity
  - + Other hatcheries !
- Lots of progress
  - + 25M existing nursery capacity on PEI
    - Nursery “Gap” is at least 25M
  - Local expertise is developing

Short Term (0-3 years)…

- Hatchery and wild set can likely continue to meet demand
- Hatcheries need time to adjust production
  - Best time to order is late Fall
- Wild Seed (PEI and NB)
  - NB 475 million on 60,000 collectors in 2023
- There is seed out there, though sourcing is logistically more complicated this year

Bouctouche, Aug15th 2024

What about the medium/long term?

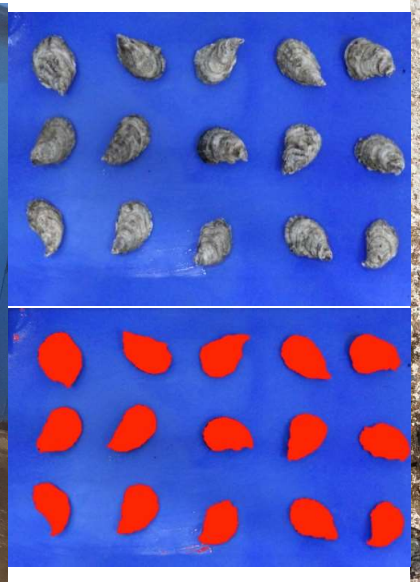
- In the long term, the development of MSX-resistance will be key

Breeding for Resistance

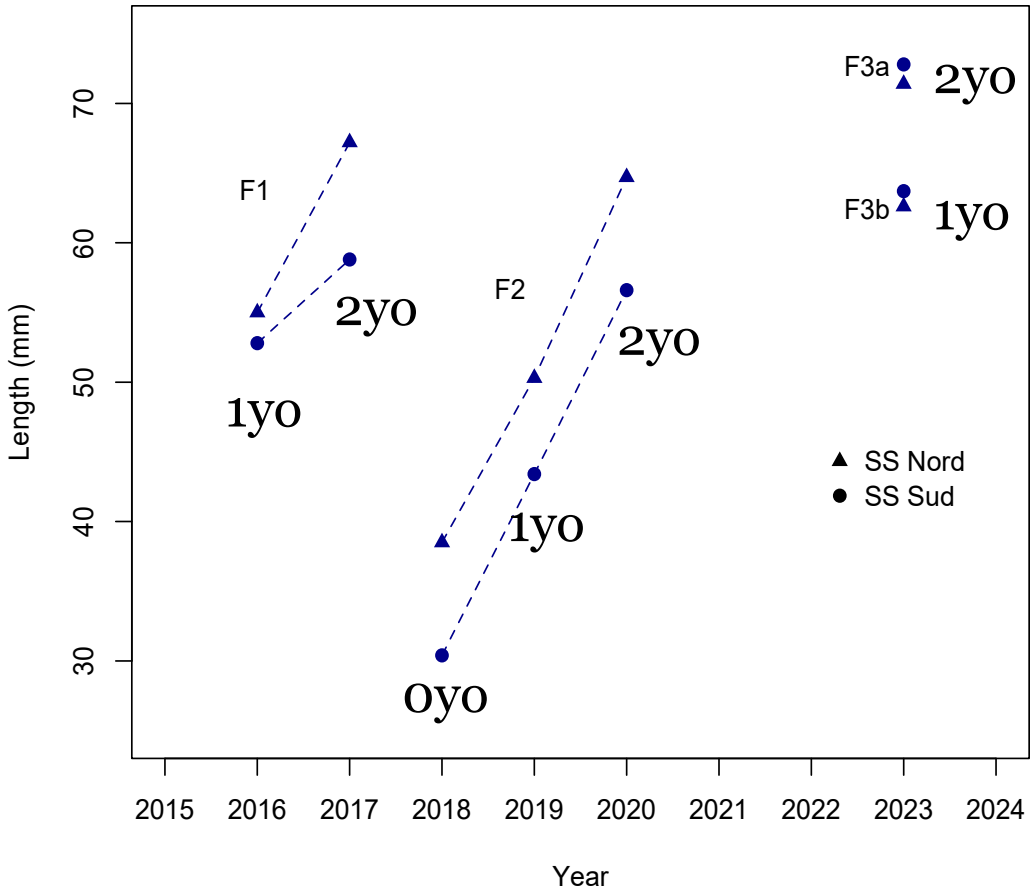
- Different Approaches
  - Evolution of Natural Resistance
    - Process can play out very differently depending on local conditions (evolution is hard to predict)
  - Hatchery-Assisted Resistance
    - Breeding Strategies

Our Selective Breeding Program

- First generation 2015 (F1)
- F4a 2024
- 80-120 crosses produced annually (N_b>600 per cohort)



Some Results



0yo – end of 1st summer

1yo = end of 2nd summer

2yo = end of 3rd summer

3 weeks! (NS grower)

- Great grower feedback
- Need to perform formal trials in a wider range of field sites
- Control (unselected) strain nearly ready

Breeding for MSX-Resistance (ERB strain)

- Protect and Build on Existing Gains
  - Faster growth is itself a mitigation strategy
- Incorporate MSX resistance into existing program
  - Need to expose animals to *H. nelsoni*
    - *Can't directly breed survivors*
  - Family structure allows for the information to be used even if animals can't move out of PCZs
  - Genomic tools will further increase selection accuracy and response

Genomic Acceleration (GAPP Project)

- SNP chip (144k)
- Genomic Selection
- Wild Population Study

Design and validation of a high-density single nucleotide polymorphism array for the Eastern oyster (*Crassostrea virginica*)

Amanda Xuereb ✉, Rodrigo Marín Nahuelpi, Eric Normandeau, Charles Babin, Martin Laporte, André Mallet, José M Yáñez, Martin Mallet, Louis Bernatchez Author Notes

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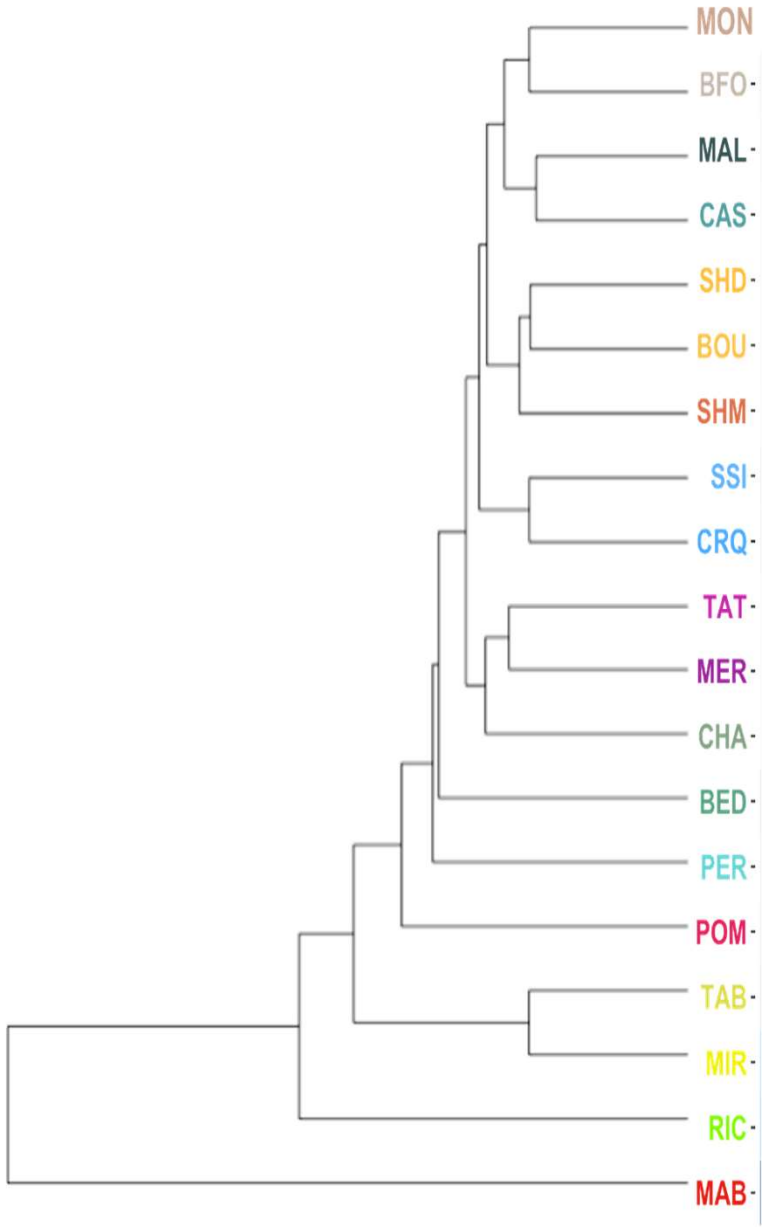
ERB Strain Genomics

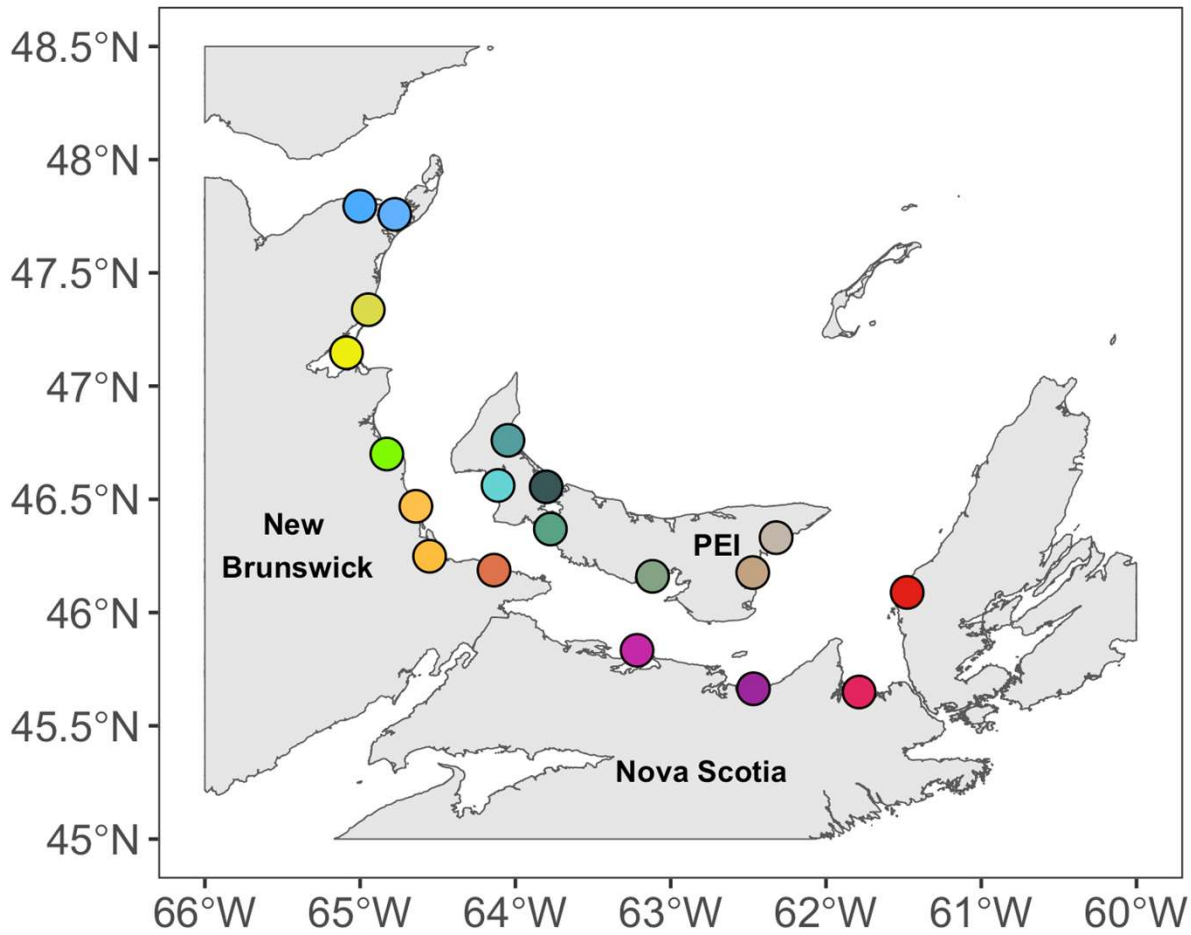
Set –	n[1]	n_{QC}[2]	Call-rate[3]	MAF > 0.01[4] n	HWE[5] n	Post QC	H_O[6]	H_E[7]	F_{IS}[8]	*MIN* F_{IS}	*MAX* F_{IS}
F1	558	553	144570	138992	130148	105048	0.32 ± 0.12	0.32 ± 0.12	0.0001 ± 0.05	-0.41	0.08
F2	3798	3797	144570	138820	107600	105048	0.32 ± 0.12	0.32 ± 0.12	-0.007 ± 0.06	-0.43	0.33

- ERB strain is
  - Outbred
  - Heterozygous
  - Will respond to selection

Trait (unit)	n	Mean	SD	CV (%)	Min	Max	h^2_{SNP}
Weight (g)	3653	47.50	14.61	30.76	7.79	121.50	0.49 (0.03)
Length (cm)	3653	6.19	0.79	12.82	3.49	9.68	0.51 (0.03)
Area (cm^2)	3653	22.86	5.6	24.5	6.79	53.67	0.55 (0.02)
Width (cm)	3653	4.74	0.61	12.89	2.53	7.51	0.54 (0.03)
Shell Weight (g)	2816	31.35	9.23	29.45	5.48	86.05	0.40 (0.03)
Tissue Weight (g)	2816	8.14	2.43	29.83	0.76	20.88	0.38 (0.03)

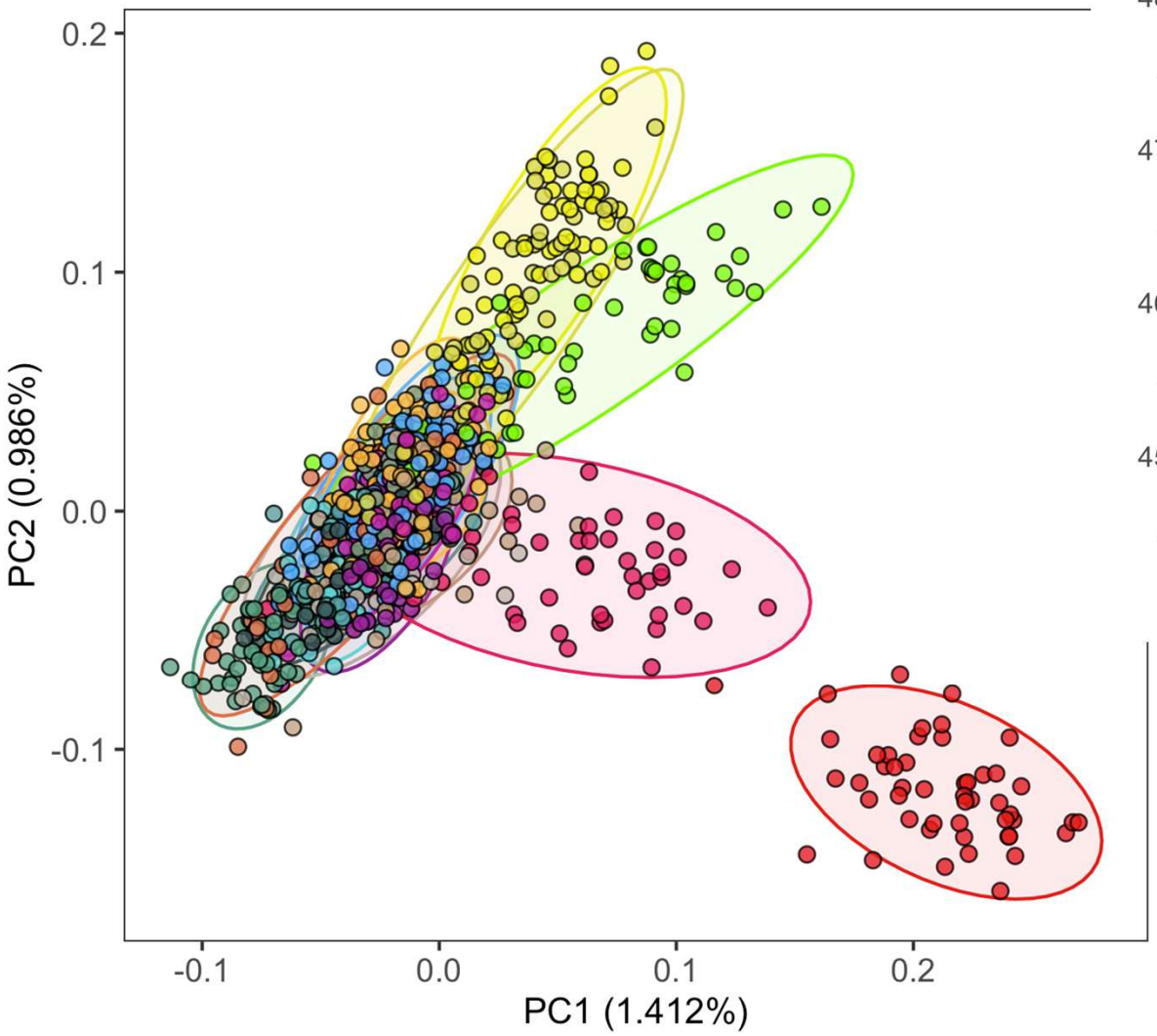
Population genomics of Gulf Oysters

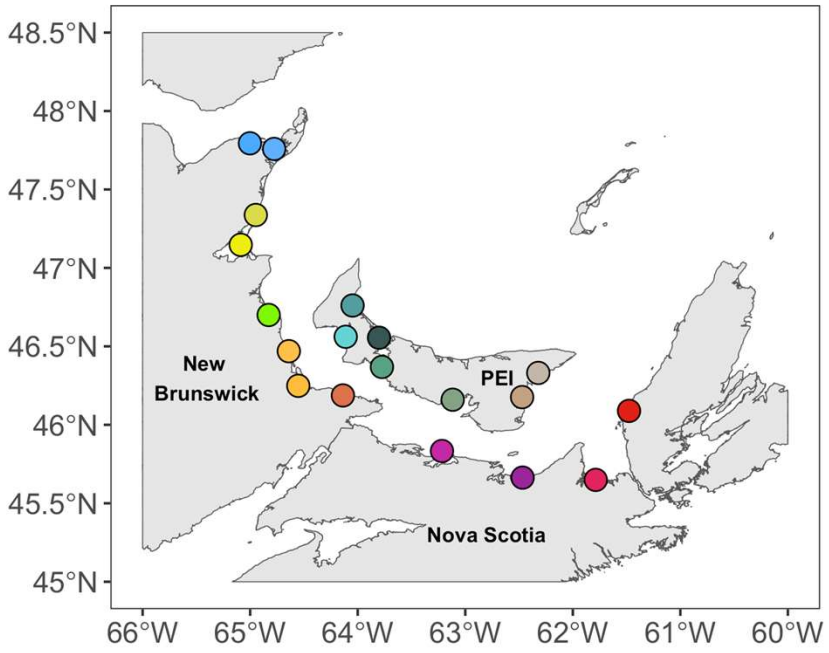




n = 50 per bay, all bottom-harvested low-coverage WGS

Population genomics of Gulf Oysters

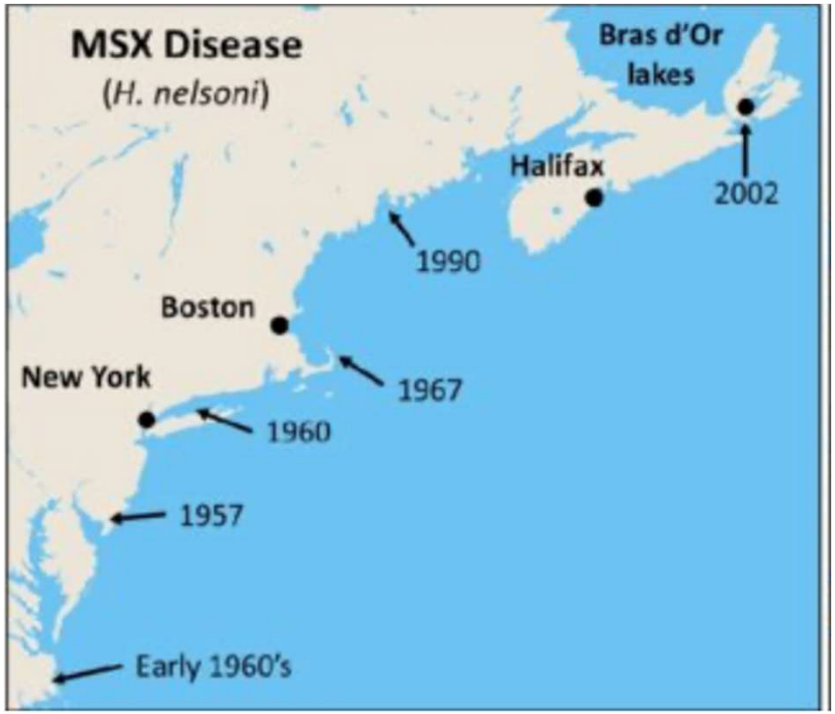


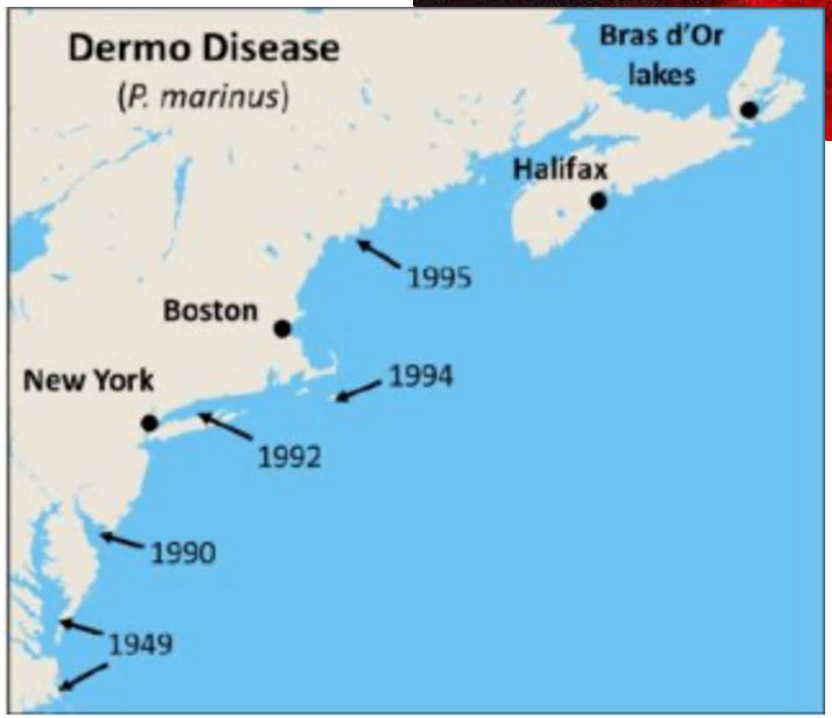


- Gulf Populations are similar to each other
- Will be distant from other populations (*i.e.*: US, Bras d'Or)

Importance of containment

- Need time to adapt!





Burge et al. (2014).

Appearance ≠ instant mortality

What's good for the goose…

- Collaboration can accelerate recovery and minimize damage
  - World-leading response and innovation is possible!
  - reverse-Malpeque ?
- Sharing information where possible
  - Best practices, mitigation
- Coordinating field research and sharing protocols
  - Need for experimental areas to support work on MSX, more knowledge of the parasite will help mitigation efforts
- 'Fair' Competition: Coopetition
  - Driving healthy competition to benefit the entire industry
  - ex: broodstock licensing, hatchery specialization (restoration)
- Lessons learned in PEI will be good for the whole region
  - Important knowledge and tools will be generated

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