

Genomic selection for multinucleate sphere X (MSX)
(*Haplosporidium nelsoni*) and Dermo (*Perkinsus
marinus*) in Eastern oysters

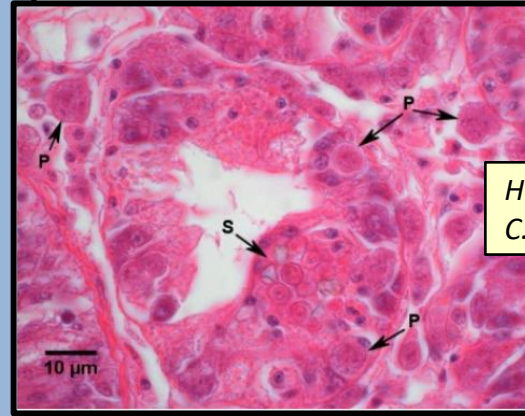


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Bideford Shellfish Hatchery
Ellerslie, PEI

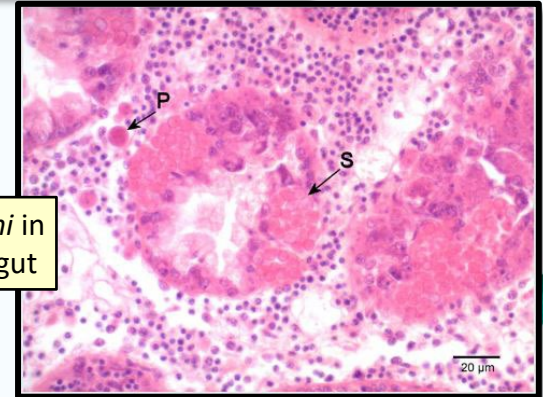


Multinucleate Sphere X (MSX)

- *Haplosporidium nelsoni* (Haplosporida)
- Eastern oyster parasite
 - 5-100 μm
 - Unknown secondary host
 - Cannot be eradicated; endemic
- NS, NB, PEI
- Etiology
 - gills \rightarrow digestive system \rightarrow gonads
 - plasmodia in all tissues
 - spore groups in haemocytes
 - 90-95% mortality
 - reproductive damage



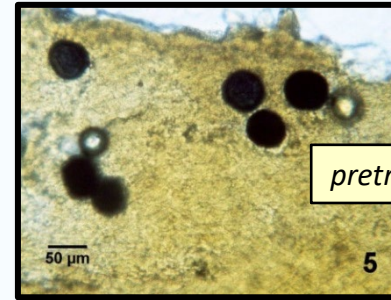
H. nelsoni in
C. virginica gut



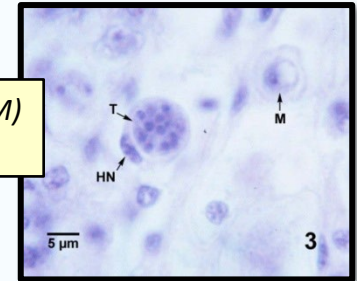
H. nelsoni in
C. gigas gut

Dermo

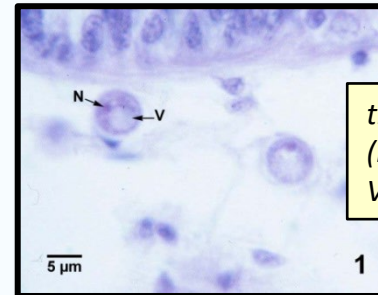
- *Perkinsus marinus* (Alveolata)
- Eastern oyster parasite
 - 2-15 μm by stage
 - lateral transmission
- NB, NS, PEI, NL
- Etiology
 - digestive gland \rightarrow epithelial necrosis \rightarrow pallial edema
 - infects hemocytes (avoids phagocytosis)
 - new trophozoites
 - peak mortalities at ≈ 24 ppt



pre-trophozoites



trophozoites (M)
and tomites (T)



trophozoites
(N=nucleus,
V=vacuole)

Preventative Measures

- Fallow leases (1-2 years)

- incomplete life cycle
- recurrence

- Prevention of transfers

- success low
- no permanence

- Genetic improvement

- successful
- numerous programs

- Genetics

- American programs
- many strains (XB, Clinton, etc)
- high effectiveness

- Gaps

- finer genetic structure
- some losses of MSXR on outcross

Bideford Shellfish Hatchery

Facility

- Tyne Valley, PEI (2016)
- Algal rearing
 - expansions
- Larval rearing
- Broodstock holdings
 - expansions
- FLUPSY systems
- Scientific lab
- Outgrow on lease



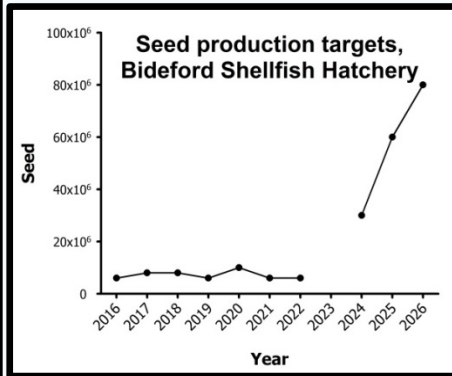
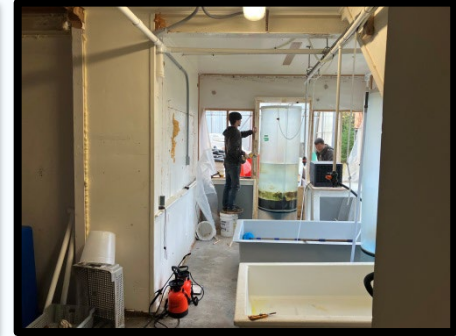
Bideford Shellfish Hatchery



Bideford Shellfish Hatchery

Progress

- Broodstock
 - Bedeque Bay (survivors)
 - Malpeques
 - Commercial sources (3)
 - First Nations broodstock collab (NS)
- Algae
 - Production increase \uparrow 320% 2025
 - Production increase \uparrow 90% 2026
- Larvae/seed
 - three spawns this year
 - 2026 Target: 60M
- Scientific capacity
 - Genomics, genetics

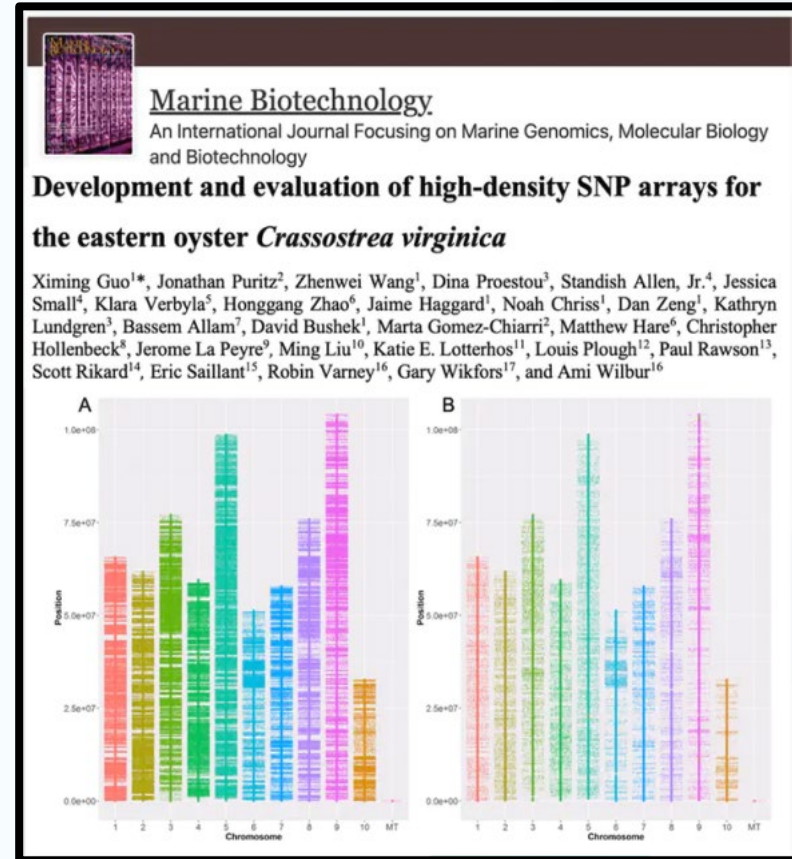
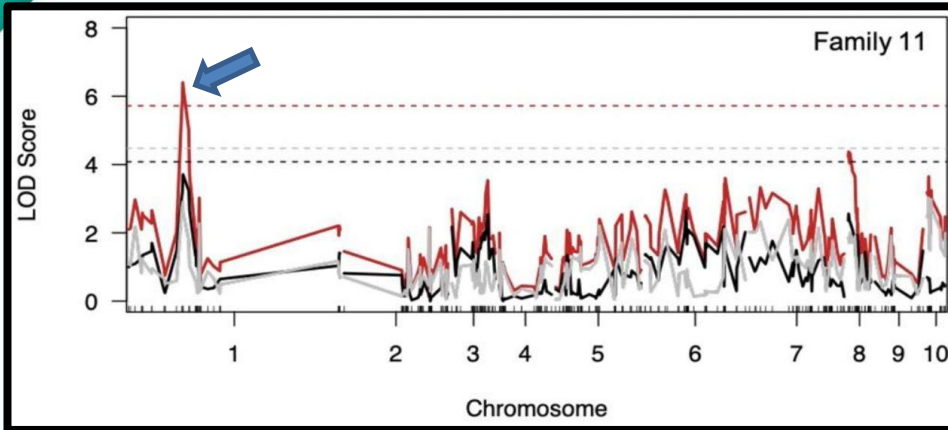


The Genomics of MSX Resistance

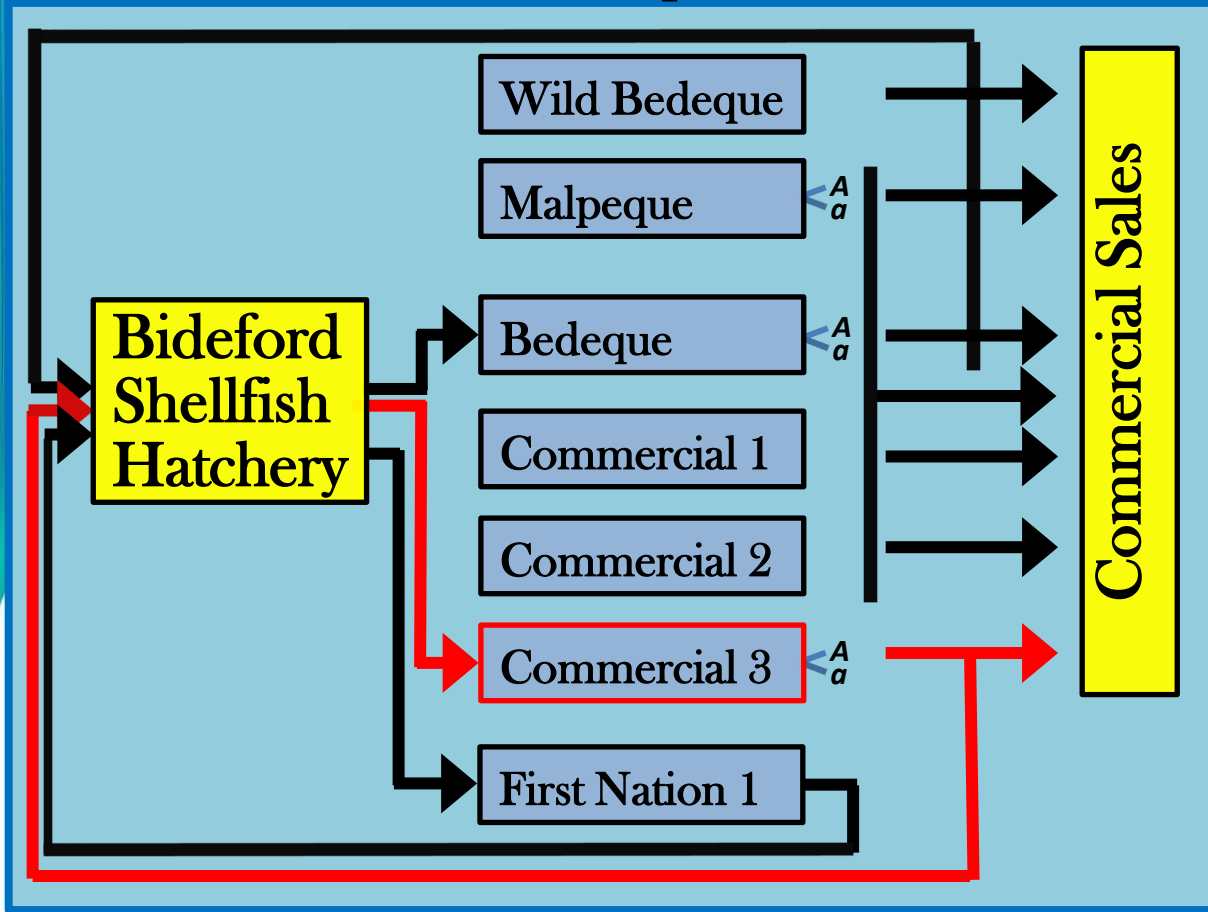


Eastern oyster genome

- 10 chr, 675 MBP + mtDNA
- genomewide association study (GWAS)
 - MSX resistance, economic traits
- genomic selection (GS)
- 66K SNP array
- functional sequencing (CRO)



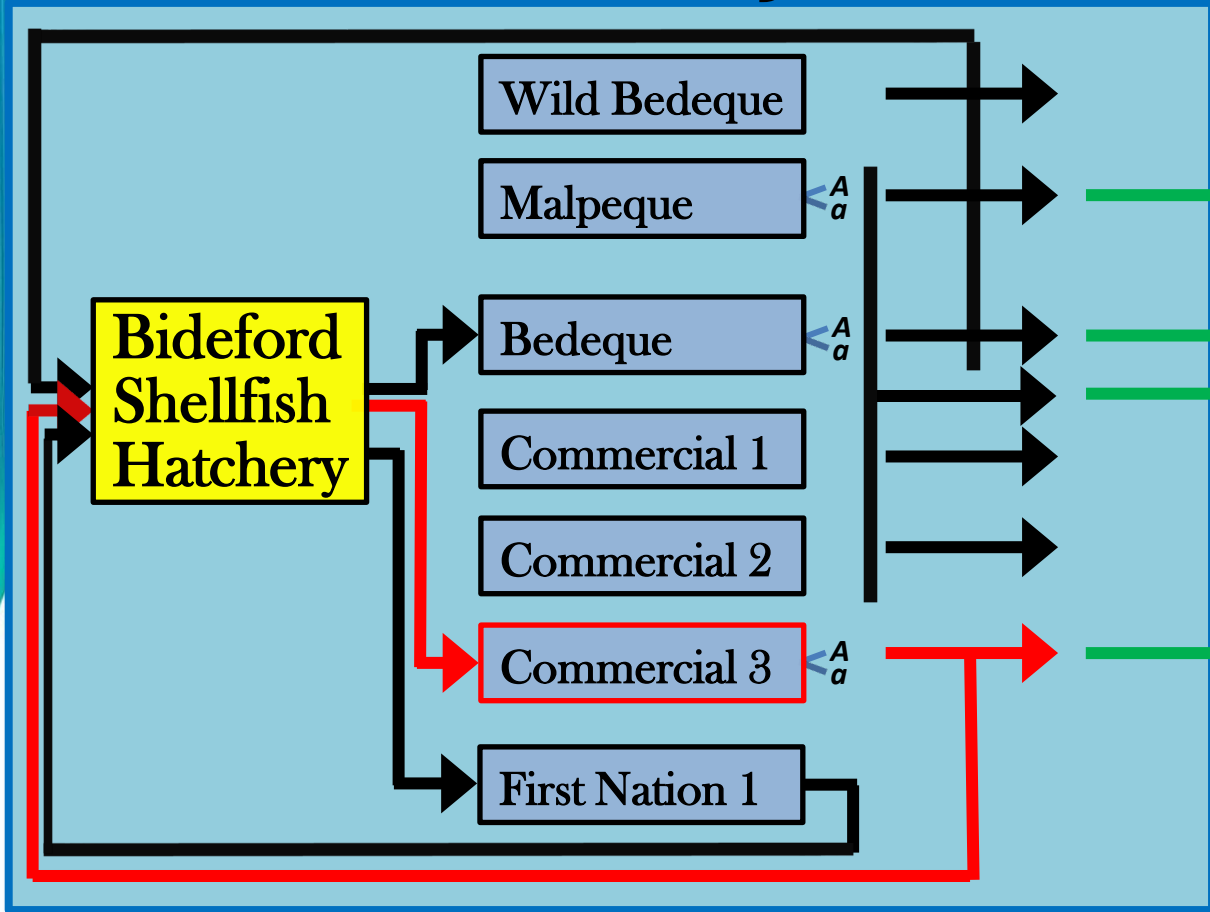
Spawn Structure



Mixed profile

- Year 2
- "strain"
- Comm 3 closed rep loop
- Yr 1 closed rep FN1
- GWAS
 - selected targets
 - expansion
- endogenous controls

Analytic Structure



Modelization

$$y = \mu + \alpha_i + \alpha_i(\gamma_j) + \epsilon_{ijk}$$

Hybrid

$$y = \mu + \alpha_i + \gamma_i + \epsilon_{ijk}$$

$$y = \mu + \alpha_i + \alpha_i(\gamma_j) + \epsilon_{ijk}$$

Hybrid

$$y = \mu + \alpha_i + \gamma_i + \epsilon_{ijk}$$

Status

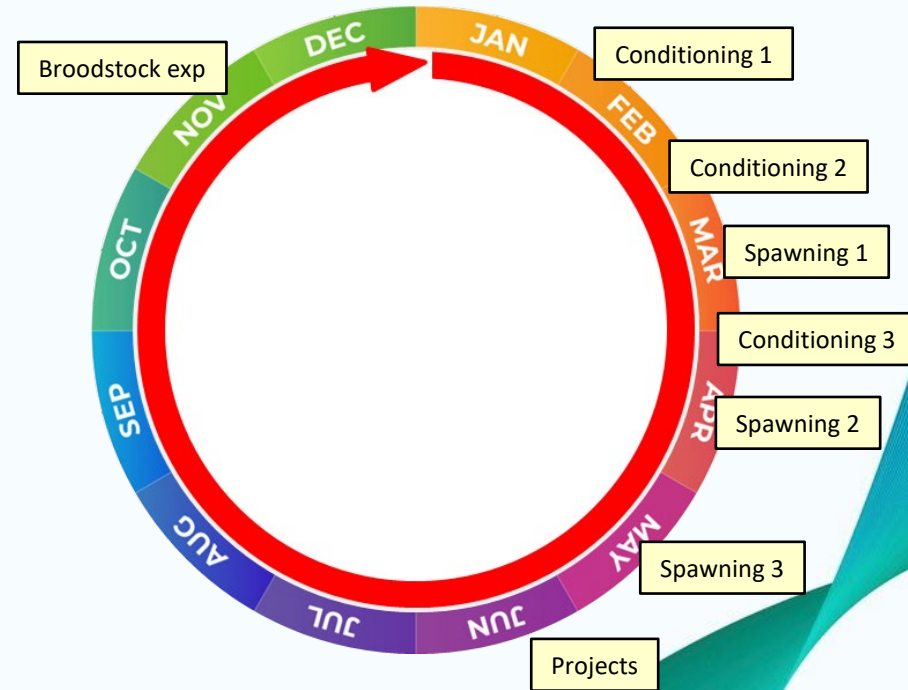
Summary

- Broodstock expansion
- Upgrades to algae production
- Commercial reproduction closure

Timeline 2026

- Three spawns (Feb, Mar, Apr)
- Holding cap at reduced temp
- FN1 spawn support
- Dermo experiment (summer)
- External collab projects (summer)

2026 Timeline



Acknowledgements

Atlantic Canada Opportunities Agency



Atlantic Canada
Opportunities
Agency

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Canada

Pêches et Océans
Canada

Atlantic Veterinary College



UNIVERSITY
of Prince Edward
ISLAND

Department of Fisheries and
Communities



Lennox Island First Nations



References and links

Bideford Shellfish Hatchery

<https://www.shellfishpei.ca>

Atlantic Veterinary College

<https://www.upei.ca/avc>

University of Prince Edward Island

www.upei.ca

Dalhousie University

<https://www.dal.ca/>

Virginia Institute of Marine Sciences

<https://www.vims.edu/>

Veschuren Centre

<https://www.verschurencentre.ca/>

Department of Fisheries and Communities

<https://www.princeedwardisland.ca/en/topic/fisheries-tourism-sport-and-culture>

Department of Fisheries and Oceans

<https://www.dfo-mpo.gc.ca/>

Canadian Food Inspection Agency

<https://inspection.canada.ca/>

MSX Hub

<https://msxinfohub.com/>

CFIA MSX Update Panel

<https://inspection.canada.ca/en/animal-health/aquatic-animals/diseases/reportable-diseases/multinucleate-sphere-unknown>