# Observations on a re-emerging epizootic of the sea scallop, *Placopecten magellanicus*, resource: Population level impacts and implications for the fishery

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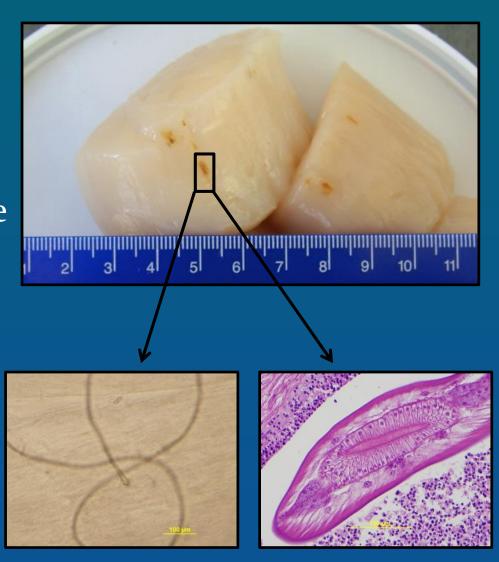
Sea Scallop Stock Assessment Working Group Woods Hole, MA February 5-9, 2017





# A re-emerging epizootic

- Nematodes were first observed in 2015 in the newly re-opened MAAA.
- Initial research efforts have focused on species identification, biology, life history and spatial distribution.
- 3 years of survey information related to spatial extent of affected scallops.



# **Preliminary identification**

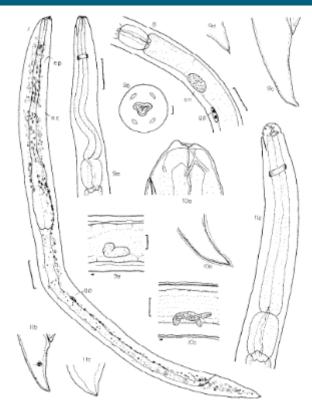


Fig. 7. Third stage larva from egg stained with aceto-orecin to show nuclei (Scale 0.02 mm): e.g., excretory pore; g.p., genital primordium; n.r., nerve ring.

Fig. 8. Lateral view of middle region of third stage larva from bivalve (Melius ephippium) infected 55 days previously (Scale 0-05 mm): e.n., excretory nucleus; g.p., genital primordium.

Fig. 9 (a.-e). Third stage larva from bivalve (Mellina aphippians) infected 86 days previously. (a) Oesophageal region (Scale 0-2 mm). (b) En face view (Scale 0-01 mm). (c) Tail showing no apparent phasmid (Scale as for Fig. 8). (d)Tip of tail showing mucrou (Scale as for Fig. 7). (c) Lattero-ventral view of middle region showing genital primordium. Arrow indicates anterior and (Scale 0-02 mm).

Fig. 10 (ir-C). Third stage larva about to moult to fourth stage larva from bivative (Melline cydigwien) infected 115 days previously. (a) Head showing third stage cuticle with fourth stage lips forming below. (Scale as for Fig. 9c). (b) Tip of tail with third and fourth stage cuticles. (Scale as for Fig. 7c). (c) Latero-ventral view of middle region showing genital primordium and third and fourth stage cuticles. (Scale as for Fig. 7c).

Fig. 11 (a-c). Fourth stage larva from bivalve (Melina ephippinos) infected 115 days previously. (a) Oesophageal region, (Scale as for Fig. 3a), (b) Tail showing phasmid. (Scale as for Fig. 10c). (c) Tip of tail showing no mucron. (Scale as for Fig. 7).

- Preliminary morphological and molecular analysis have been completed on samples taken from the 2015/16 MAB surveys.
- DNA results suggest that the sequences analyzed have a high correspondence identity with reference samples of *Sulcascaris sulcata* from GenBank.
- This species is cosmopolitan and has been identified in many genera of bivalve molluscs.
- Saucer scallop (Aus.), Calico scallop (US), Surf clams (US).
- Similar ephemeral observation of similar affected sea scallops was reported in May 2003.

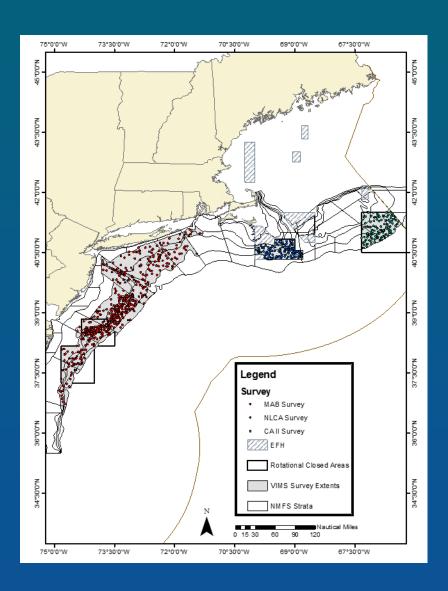
# Sulcascaris sulcata life cycle

- The life cycle of Sulcascaris sulcata involves two hosts.
- Adult nematodes attach to the GI tract of Loggerhead and Green sea turtles (CFF video).
- Eggs pass through the GI tract and enter the benthos via the feces.
- Eggs are filtered by benthic molluscs and the larval stages (1-4) develop.
- Fourth stage larvae are ingested by turtles.



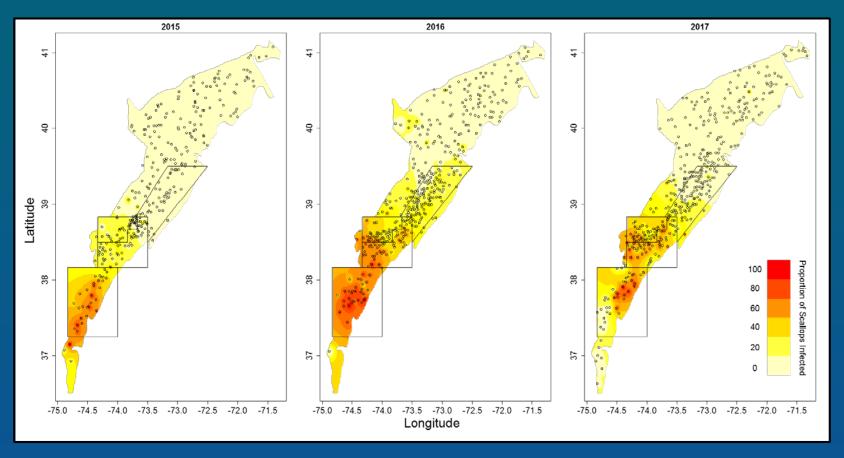
From Berry and Cannon, 1981

## Parasite surveillance



- For the 2015-17 surveys, VIMS
  expanded the biological sampling
  protocol to capture the spatial extent
  of the parasite as well as the
  prevalence and intensity of infected
  scallops.
- Sampled 15 animals at every station that had scallops.
  - Histological and genetic samples.
  - Gross observation of the number of infected scallops/sample (prevalence).
  - Gross observation of the number of nematodes/scallop (intensity).

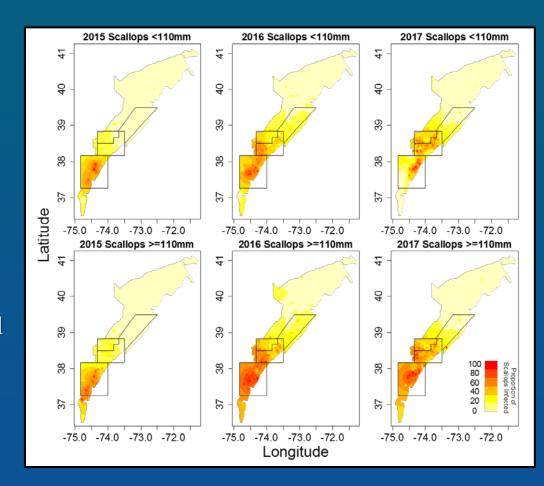
#### **Nematode Prevalence 2015-17**



- % of scallops in a sample that contain at least one lesion.
- Northward expansion 2015-16.
- Apparent stabilization of the spatial extent 2016-17.

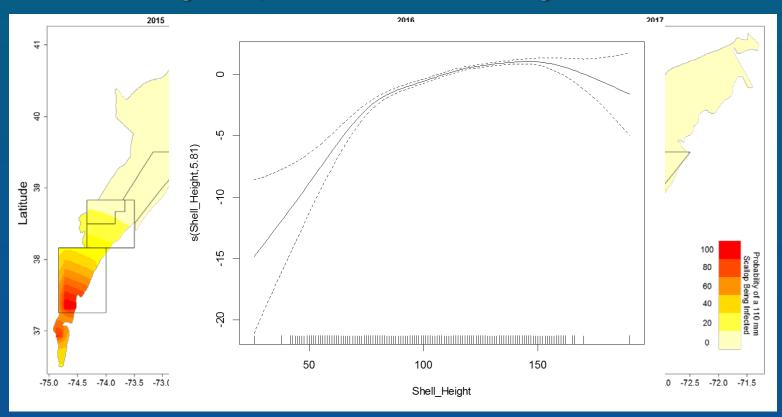
#### Size-based nematode prevalence 2015-17

- Spatial distribution of the prevalence of the parasite in sampled scallops by year and size class
- Smaller sizes appear to be less infected over time
- The spatial extent of infections in larger scallops has contracted in 2017 compared to 2016, but the extent still covers the majority of the southern range.



#### **GAMM** for nematode prevalence 2015-17

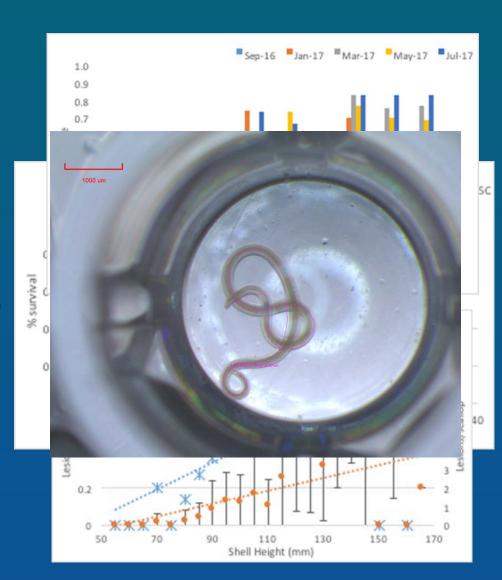
- GAMM was developed to predict the probability of a scallop being infected with nematodes.
  - Covariates evaluated [shell height, bottom temp, depth, density, SAMS area, year]
- Significant predictor variables included year, tensor product of latitude & longitude, SAMS area & shell height.



#### Nematode biology

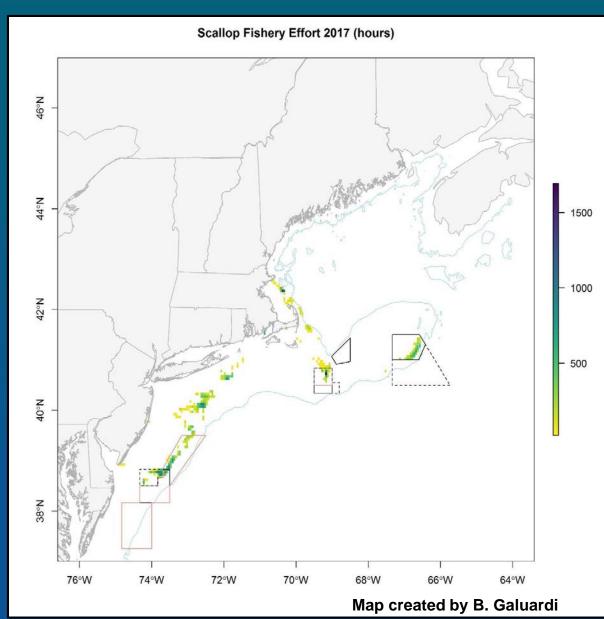
Rutgers/VIMS collaboration

- Investigated the etiology of the parasite/host relationship
  - Do larvae migrate from discarded viscera/meats?
  - Do larvae transmit from infected to uninfected scallops?
  - Seasonality of infection
  - Thermal tolerance of larvae
  - Infected scallop survival



## **2017 Fishery Effort**

- Aggregate 2017 effort (March-July).
- MAAA effort centered upon "flex and HC portions.
- Very little effort in ET Open and DelMarVa.
- Potentially influenced by product quality issues?



## Summary

- Data suggests that nematode distribution did not appreciable expand in 2017 from levels observed in 2016.
- Southern areas of the resource (i.e. DMV, ETCA) still appear to be affected.
- Distribution in affected areas is patchy.
- Larger scallops appear to be more likely to be affected.
- Inter-scallop transmission unlikely.
- Possible increase in mortality.\*\*
- Nematodes potentially affecting distribution of fishing effort.