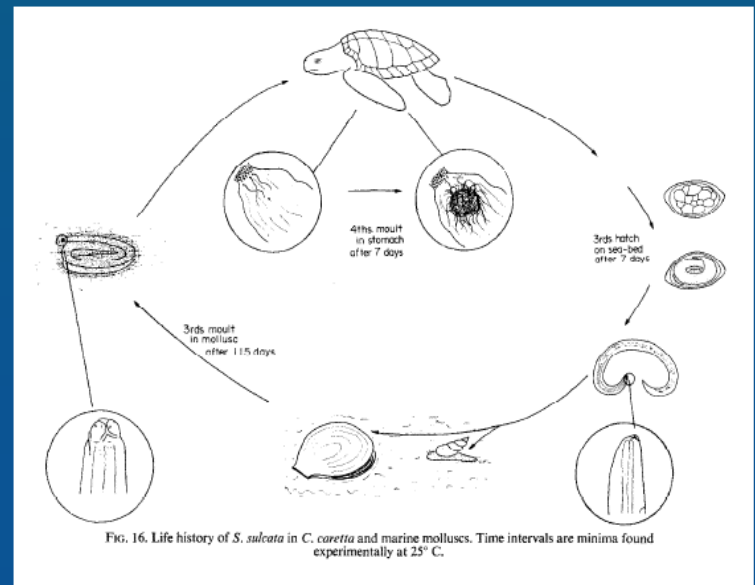


Effective Biomass and Atypical Growth: Considerations for 2018 Fishery Specifications

**Sea Scallop Industry Advisory Panel/Committee Meeting
New Bedford, MA
September 19-20, 2017**

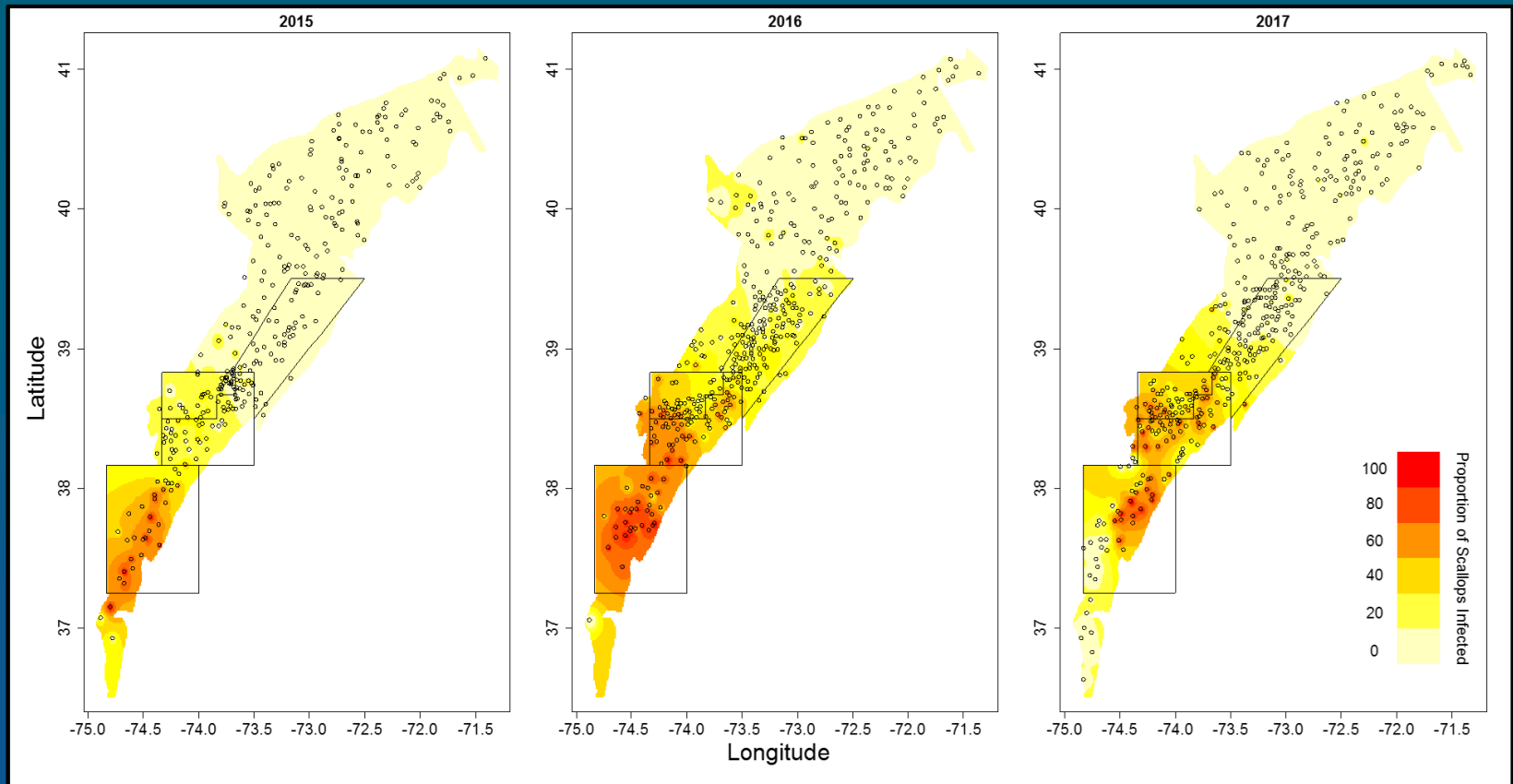
Nematode update

- 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.



From Berry and Cannon, 1981

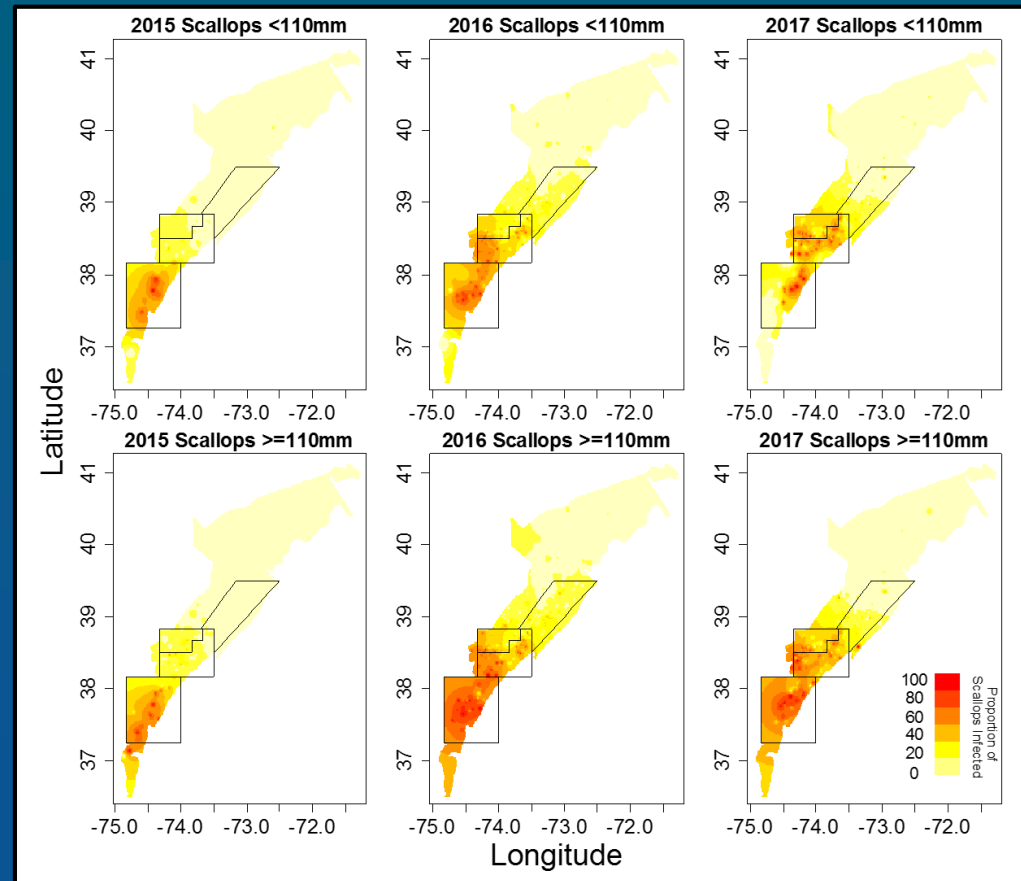
Nematode Prevalence 2015-17



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

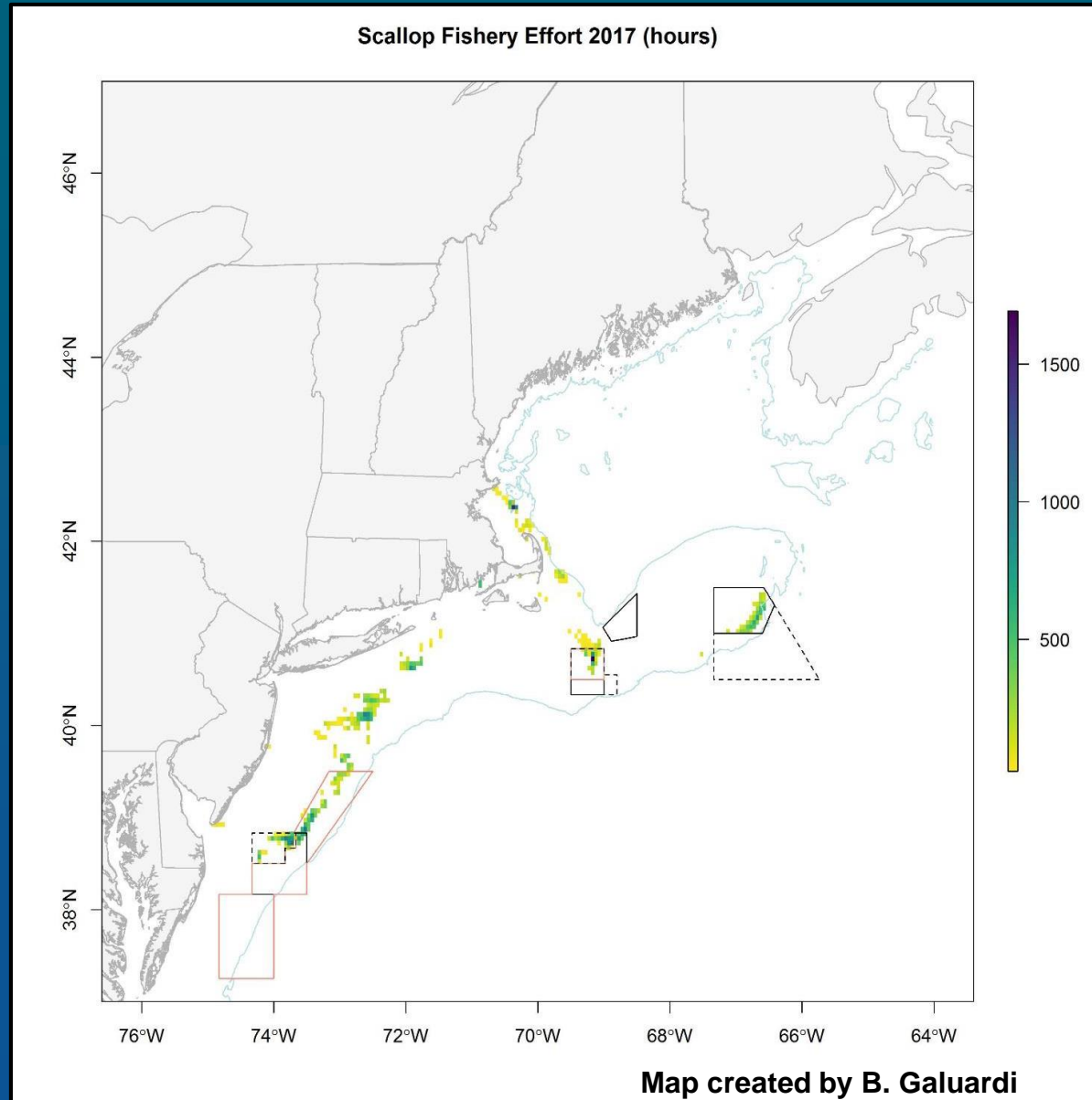
Size-based nematode prevalence 2015-17

- 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.



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?



Scallop Growth

- Scallop growth is an important component of assessment models.
- On average, growth is fairly well understood across the range of the resource although it varies in time and space.
- Scallop management is predicated on assumptions regarding growth.



Growth under extreme conditions

- Spatial management attempts to identify areas of high juvenile scallop density, close these areas to fishing and take advantage of fast growth.
- We assume that these high density areas grow and survive according to the resource averages.
- Currently, two areas exist in the resource that contain densities rarely seen in the monitoring time series.
- These two areas (NL-S and ET Flex) currently contain ~50% of non-EFH biomass.



Potential for density dependence

- Can affect one or more vital rates (i.e. growth, survival, fecundity).
- Effect can get stronger as population grows and individuals compete for resources.
- Where is the threshold? It is likely complicated.
- NL-S and ET-Flex represent natural experiments



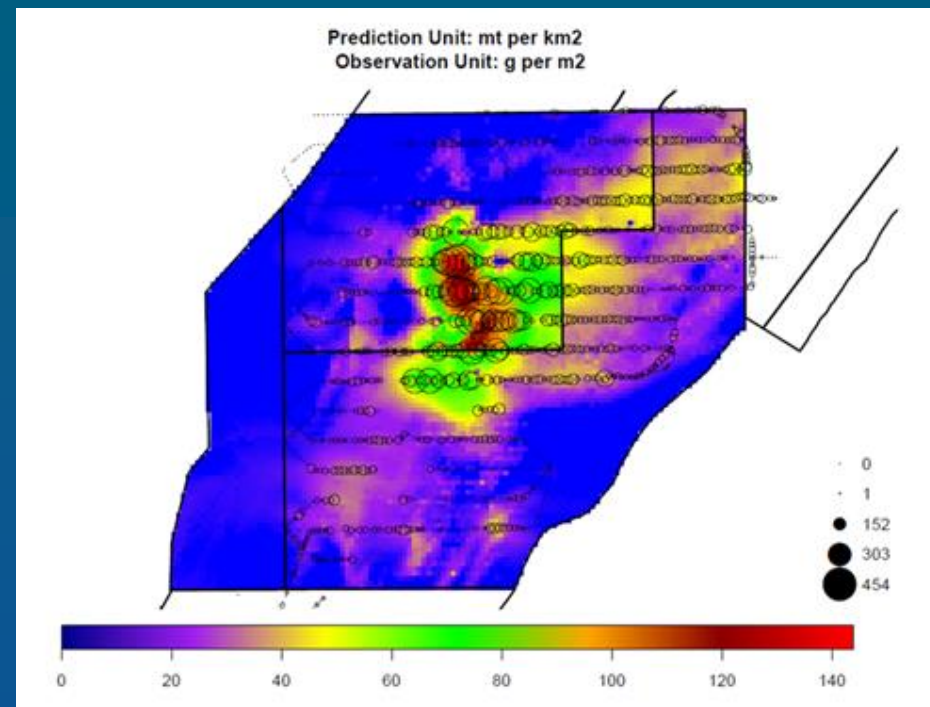
NL-S – high density, small size

- 5 YO scallops average 77 mm.
- YOY growth of ~15 mm
- Large variation in size across space.
- Can adjust growth assumptions in SAMS model.
- Reality is that there is a huge biomass of high count scallops with a finite scope of growth in marginal habitat.

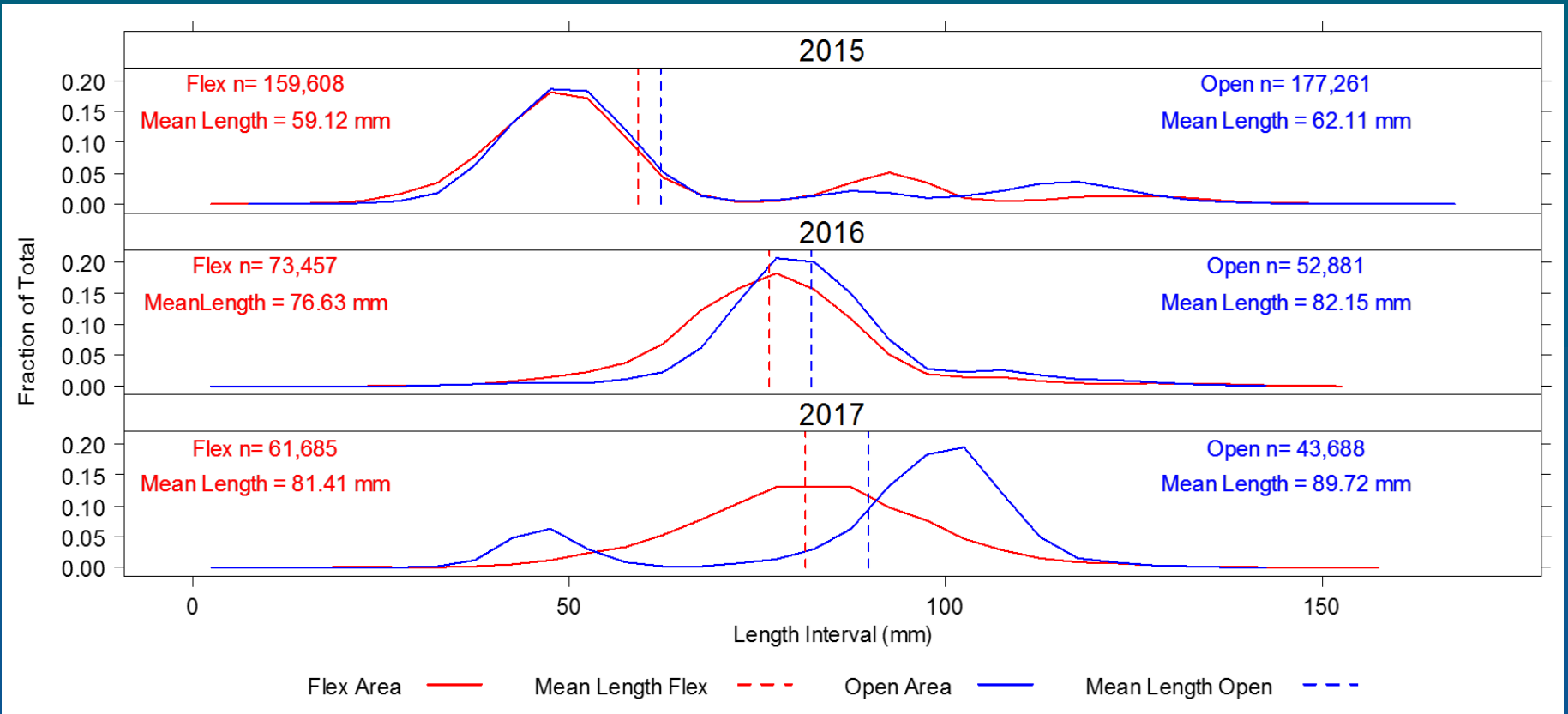


ET Flex

- Another area with extremely high densities but situated in prime scallop habitat.
- Similar processes as the NL-S?
- 2013 YC with an expected SH of at least 100 mm.
- These animals are driving the biomass in the area.

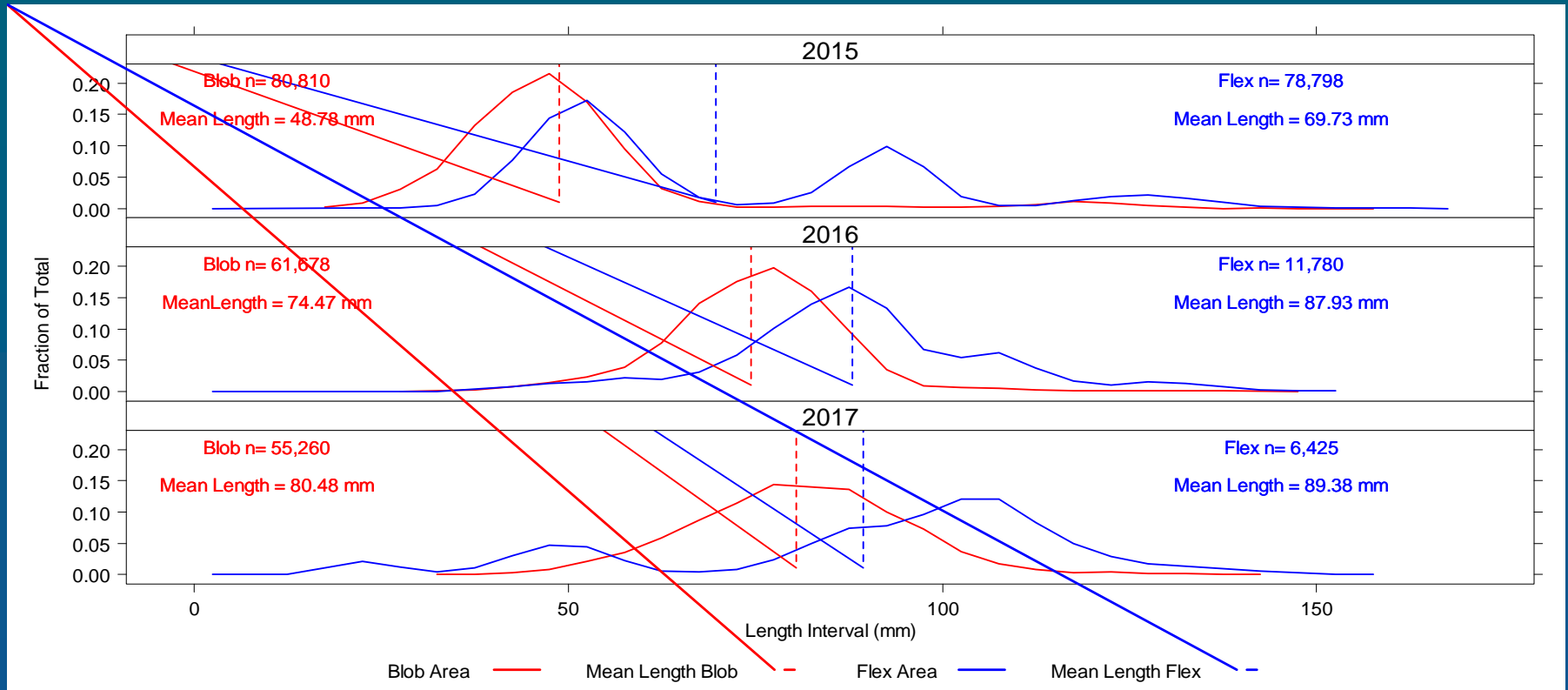


ET Flex vs. ET Open



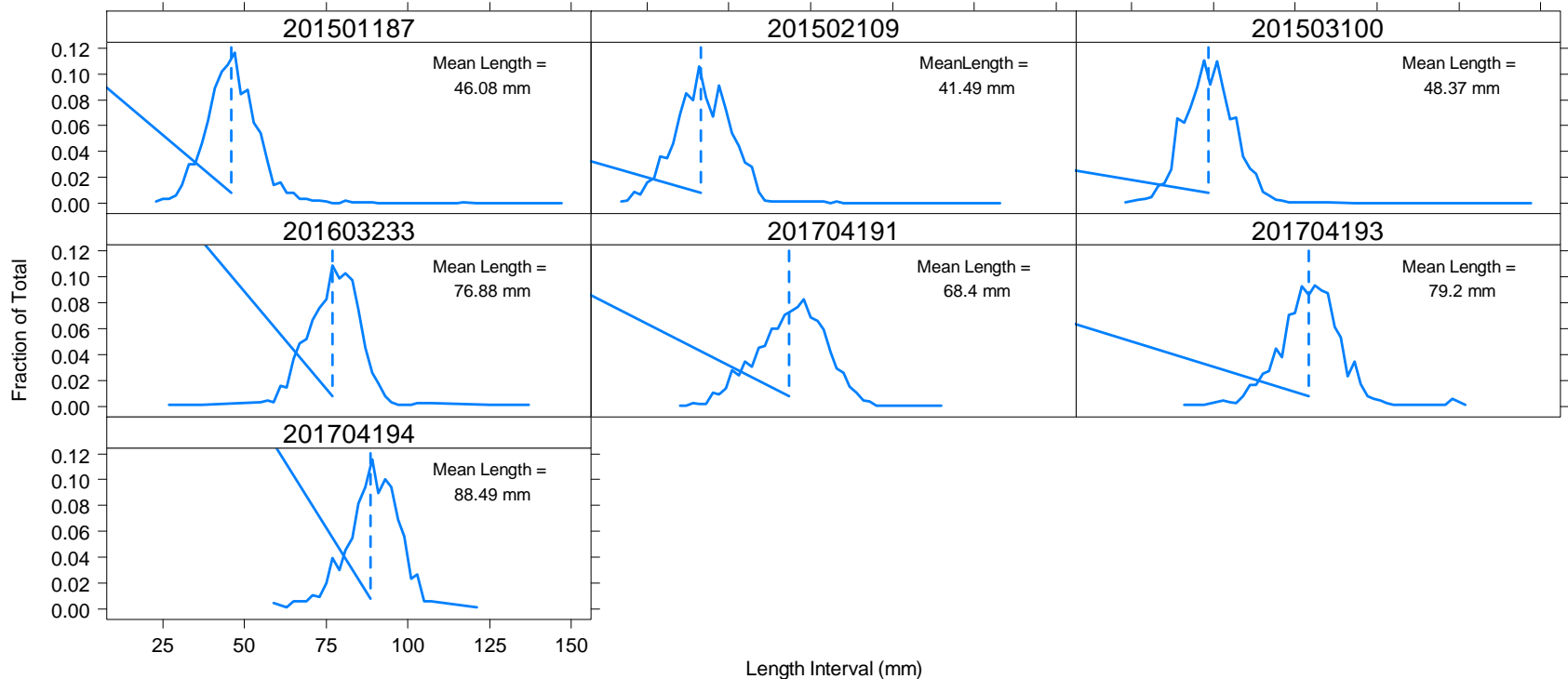
- SHF for ET Flex (red) and ET Open (blue) 2015-17.
- 2013 YC appears to have differential growth wrt. area.

ET Blob vs ET Flex



- Comparing the high density vs the rest of the ET Flex area, differential growth of the 2013 YC is again seen.
- The area of below expectation growth is the majority of estimated biomass.

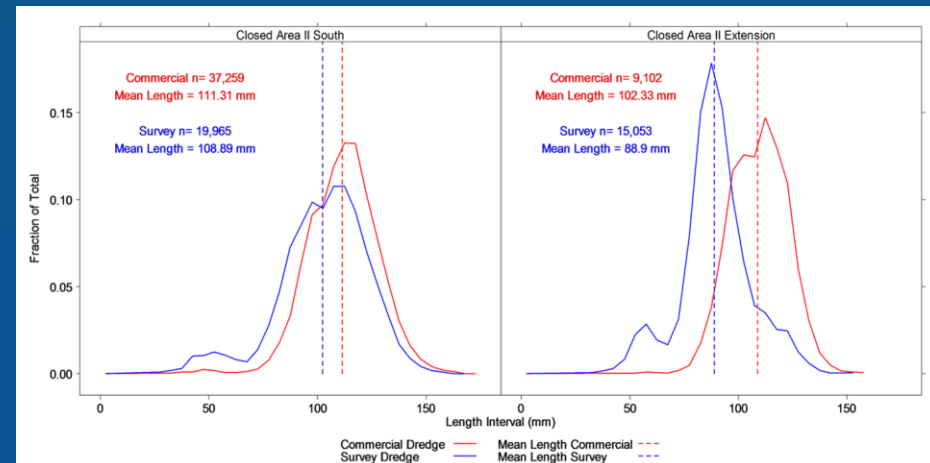
Variability at high density



- For tows >10,000 scallops, there is variability in mean size especially in 2017.
- In 2017, all tows were below the expected size for 4 YO scallops.

DelMarVa and SE Parts

- DelMarVa
 - Biomass trending down
 - Some 2017 recruitment observed
 - Persistent nematodes
 - Very little effort over last 2-3 years.
 - Revert to open area?
- CAII and extension
 - Pending SAMS run, potential trip.
 - Discarding concern in extension and YT concern overall.
 - Include Extension in AA?



Summary

- The resource appears to be in good shape although limited recruitment was observed.
- Data suggests that nematode distribution did not appreciably expand in 2017 from levels observed in 2016.
- Scallop growth, while variable in the NL-S and ET-Flex (Blob) appeared to be below expectation.
 - A large portion of the total resource wide biomass is contained in those areas.
- Both nematodes and slow growth in the NL-S and ET-Flex are issues to be considered for 2018 specifications.