

Observations on Atypical Growth: Rare Events or the New Normal?

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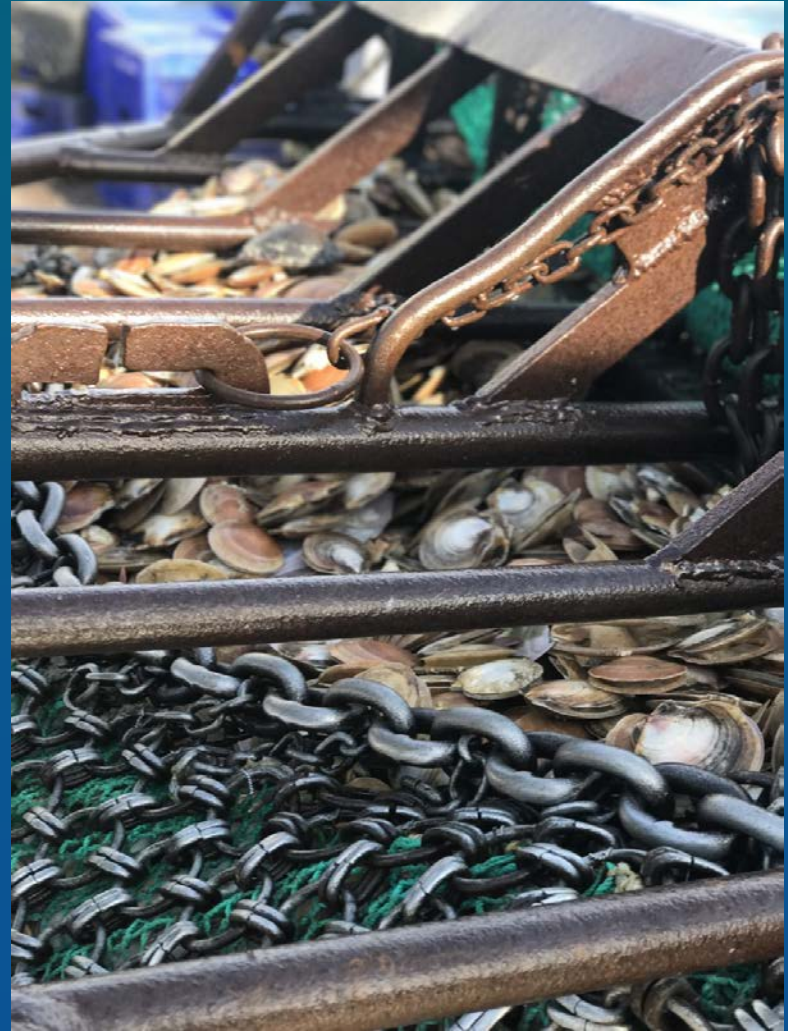
Scallop Growth

- 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.



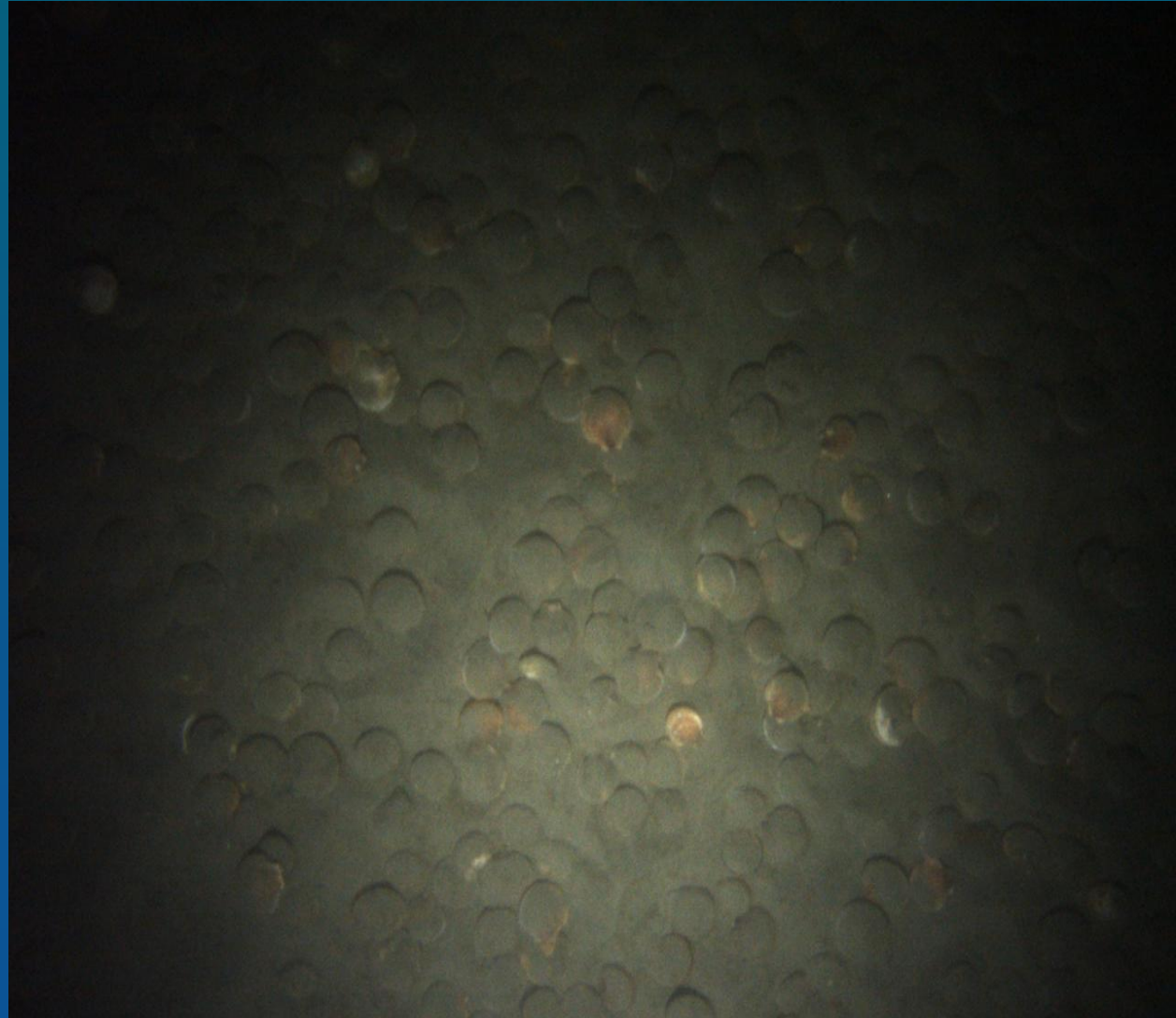
Growth under extreme conditions

- Current assessment/projection models have implicit assumptions about growth.
- 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 perform 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.



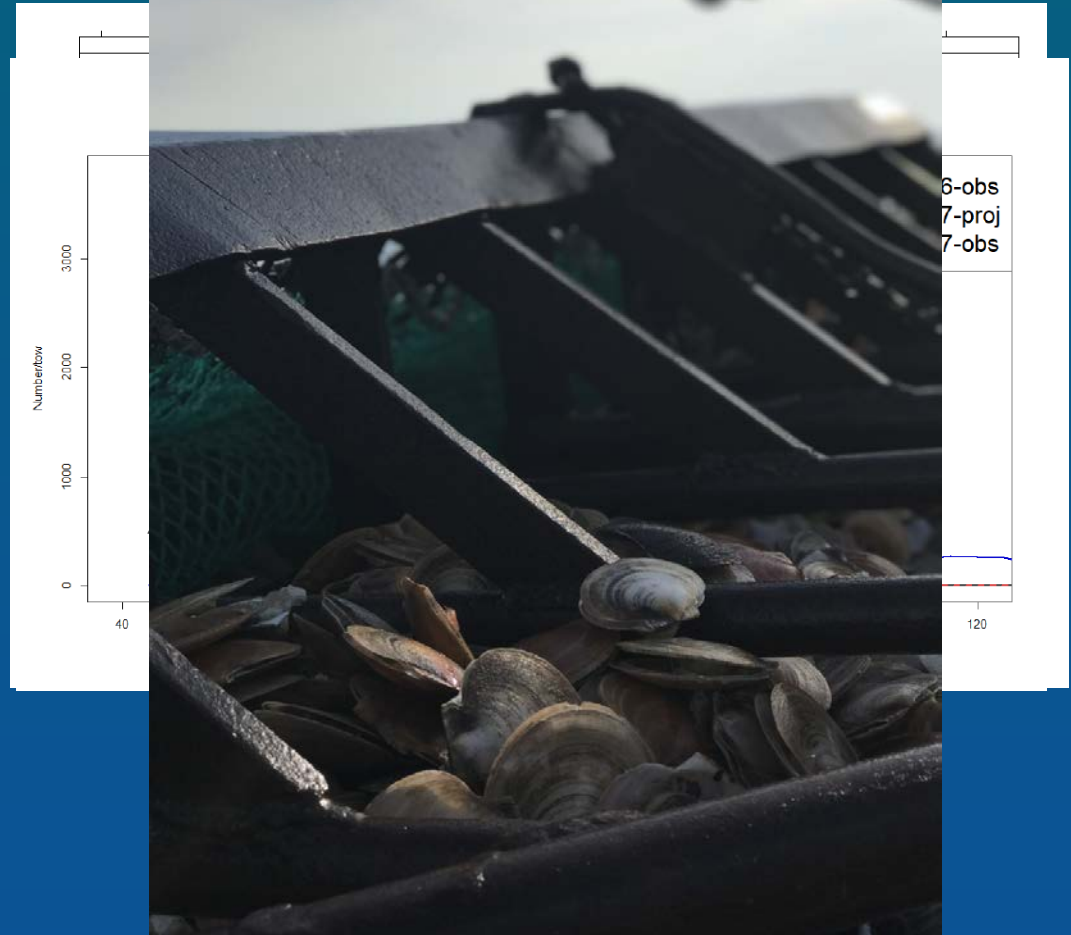
Potential for density dependence

- 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



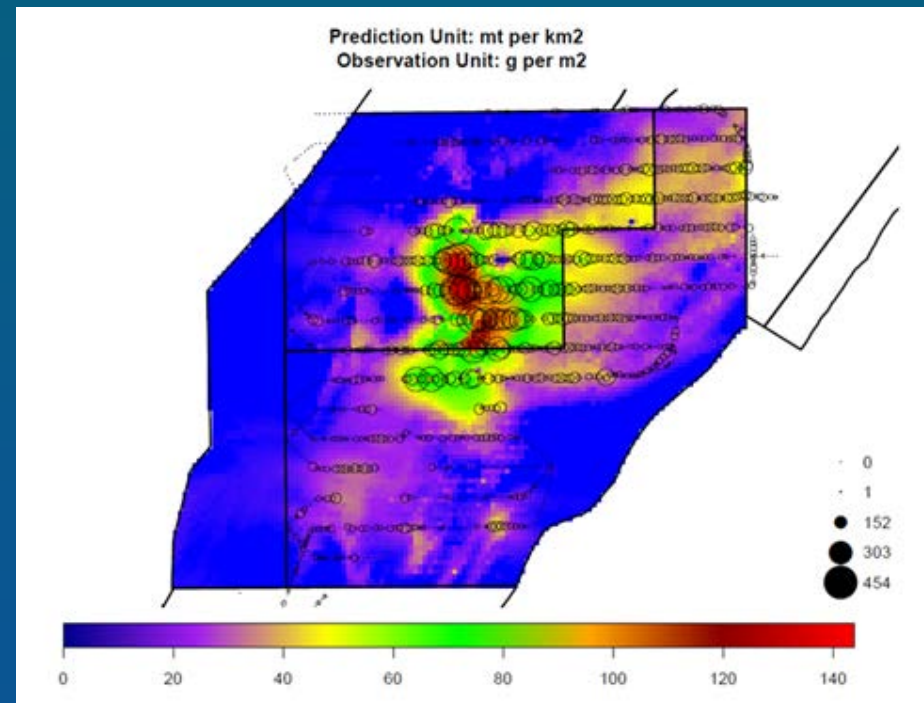
NL-S – high density, small size

- 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.

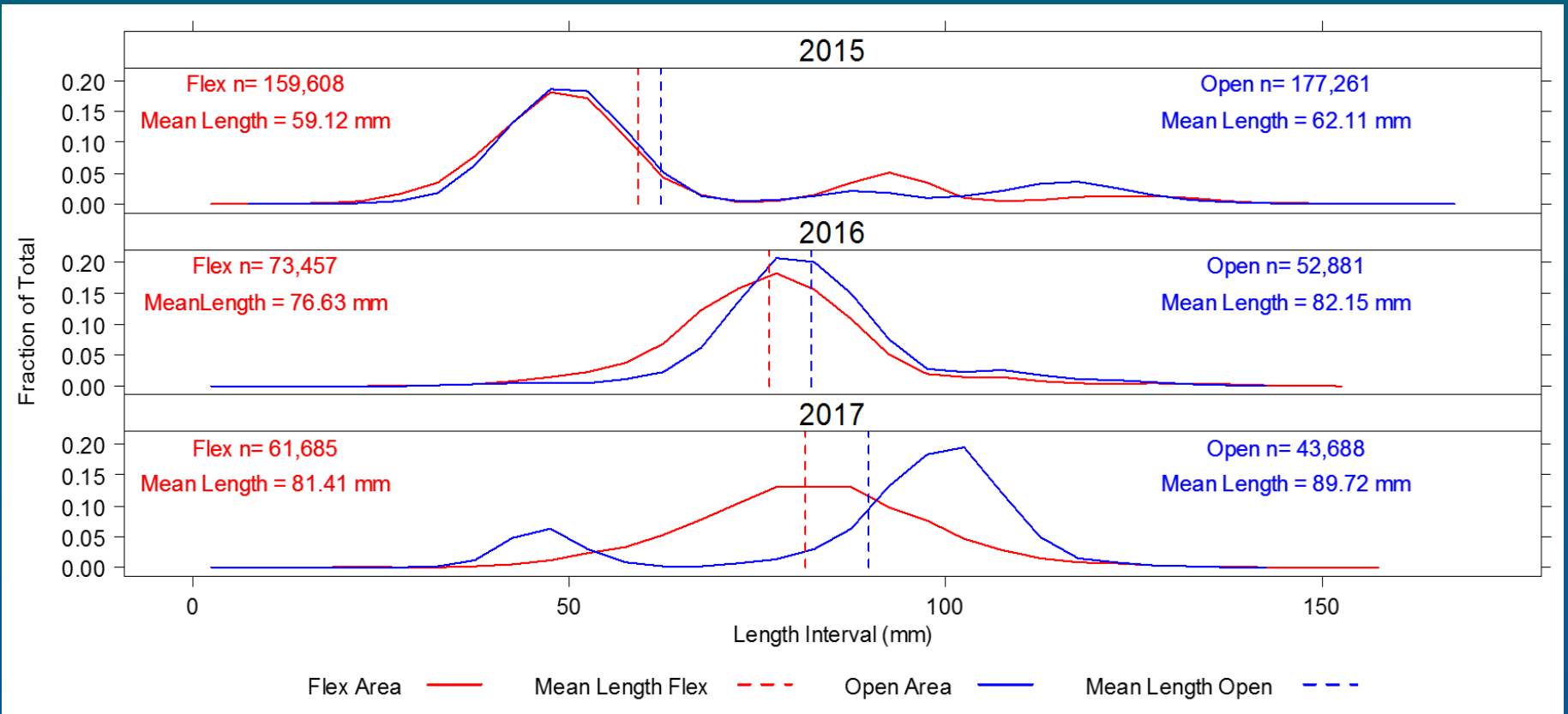


ET Flex

- 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.

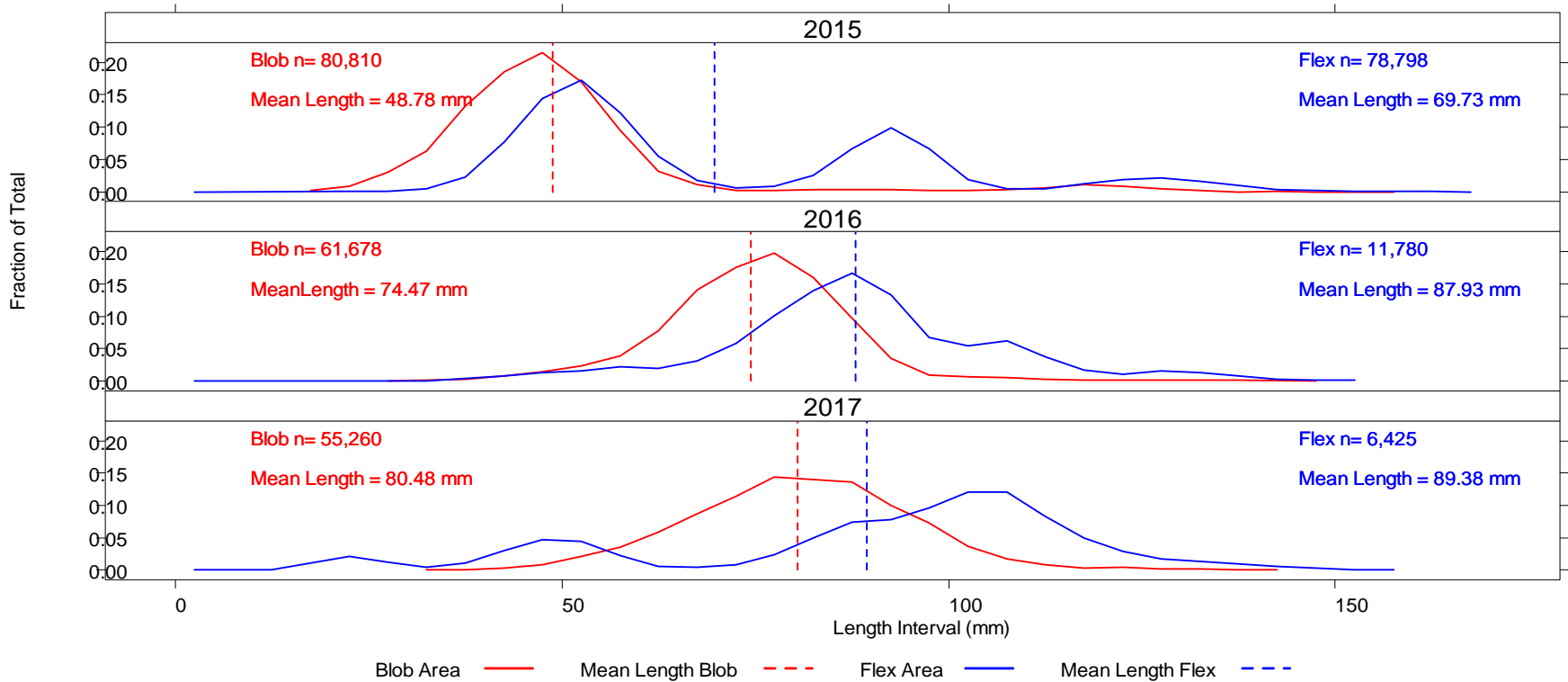


ET Flex vs. ET Open



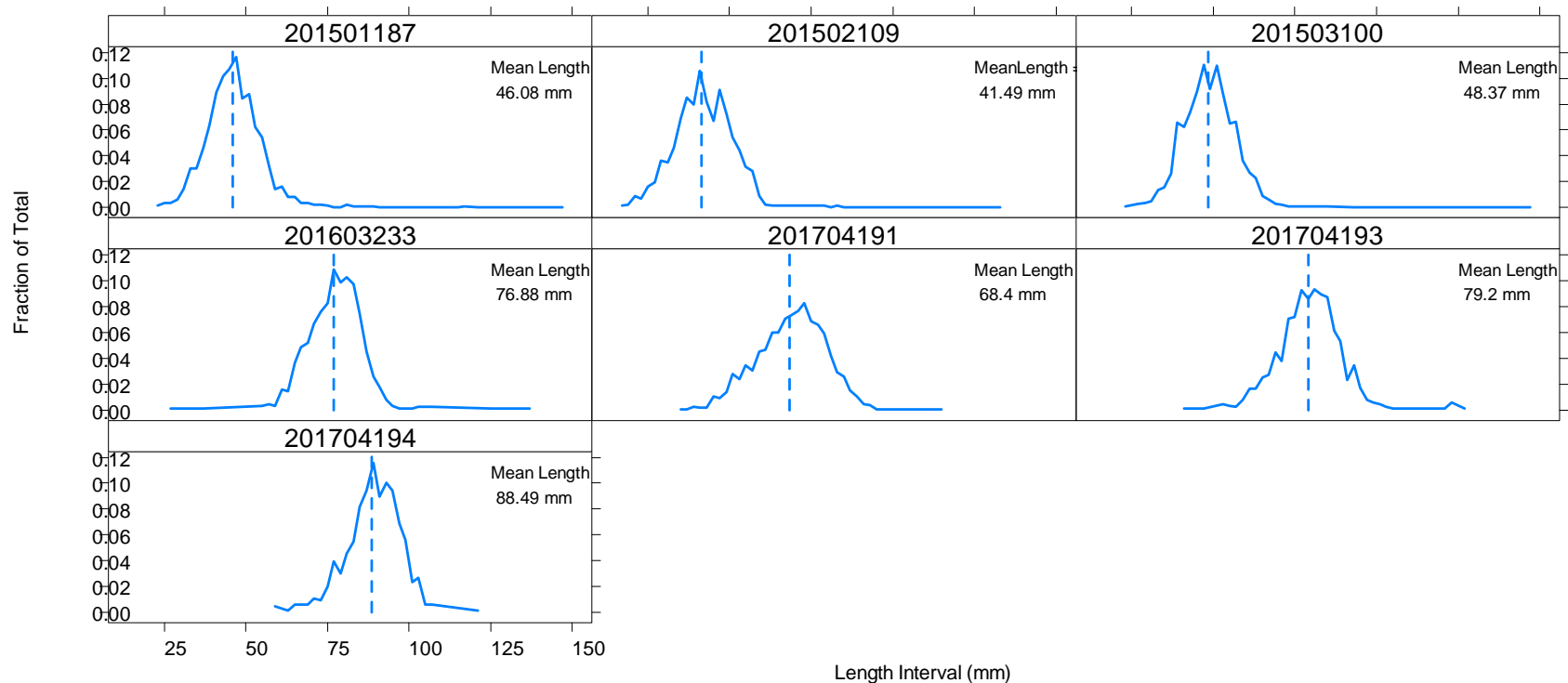
- SHF for ET Flex (red) and ET Open (blue) 2015-17.
- 2013 YC appears to have differential growth wrt. area.

ET Blob vs ET Flex



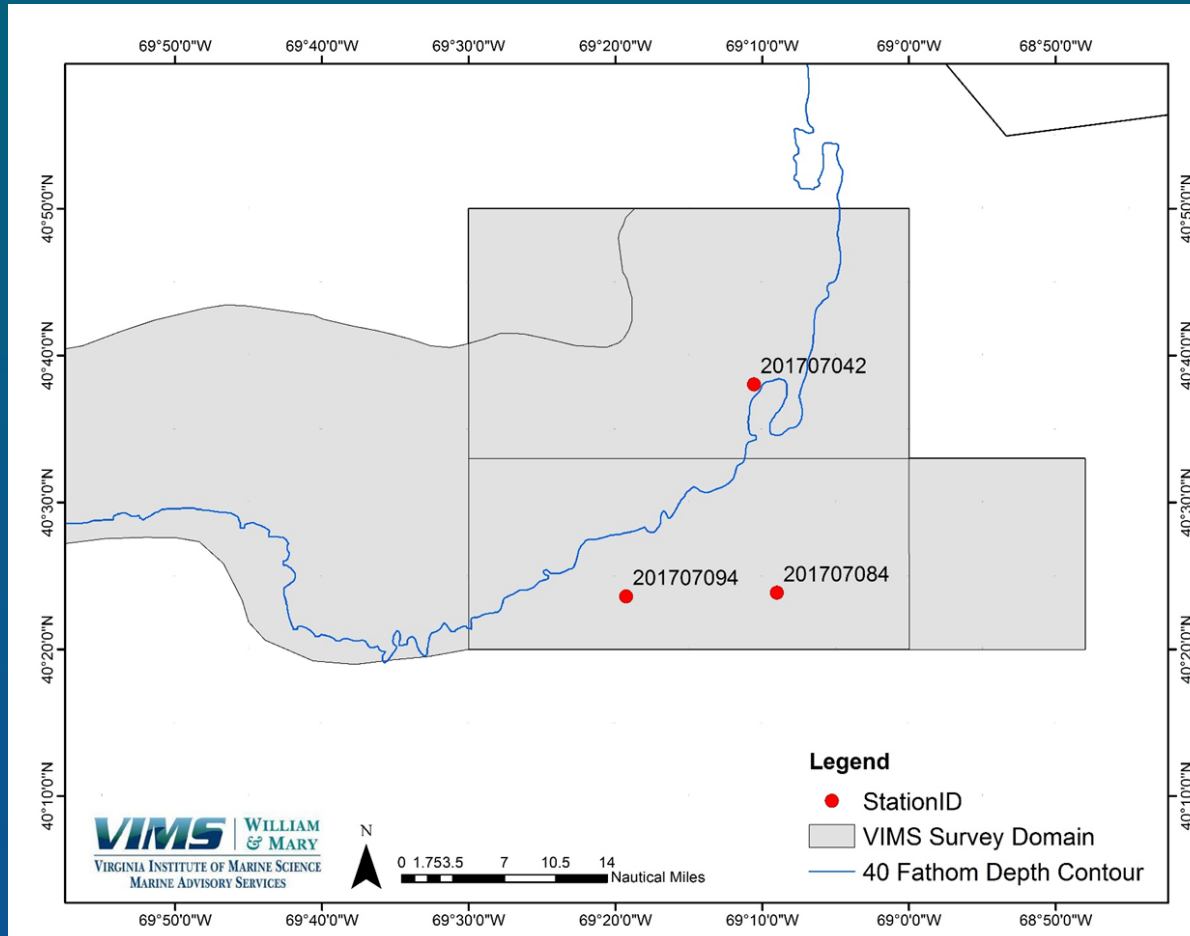
- Comparing the high density vs the rest of the ET Flex area, differential growth of the 2013 YC is again seen.
- The area of below expectation growth is the majority of estimated biomass.

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.

Digging deeper into the NL



- Additional shell samples (~25 stations) were collected during the 2017 NL dredge survey.
- Objective was to characterize growth across the range of abiotic and biological conditions present in the management area and understand what factors are important in explaining the observed variation.
- To date, a small subset has been read.
- Results seem to support the potential influence of density, but other factors (i.e. depth, food availability) are also likely important.

Station	K	L_{∞}
42	0.46	151.25
84	0.37	101.1
94	0.42	81.37

Summary

- Scallop growth, while variable in the NL-S and ET-Flex (Blob) appeared to be below expectation.
 - The short term concern is that a large portion of the total resource wide biomass is contained in those areas.
 - A longer term concern relates to the assumptions of growth, as the management approach and the assessment/projection models are predicated on this understanding.
- Has this phenomenon always been part of this species dynamics and are we just better equipped to observe it?
- Or...is this something new that we need the capacity to characterize empirically and then incorporate into how we model the resource?