Combining Fishermen's Knowledge to Locate, Evaluate, and Predict Gray Meat Outbreaks (SK 15-17)

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"These aren't the scallops you're looking for"

May the 4th be with you

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Objectives

- 1. Expand scallop captain interviews on gray meat knowledge and locations.

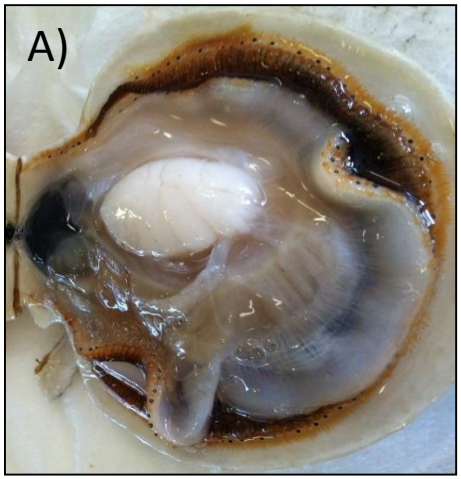
- **2. Develop a model to predict areas susceptive to gray meat outbreaks and environment attributes of these locations.**

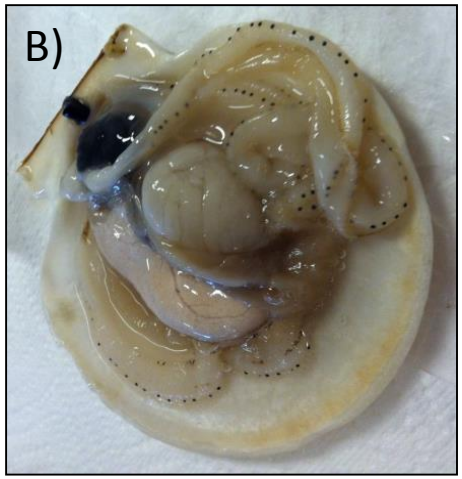
- 3. Apply results of predictive model to an economic model to assess effect of gray meat infestations on optimal periods for rotational scallop management.

- 4. Conduct laboratory experiments to test the hypotheses that gray meat tissue can be a vector for further infection.

Gray meat scallops:

- have small, darkened and stringy adductor muscle.
- are reported along the eastern seaboard.
- may be increasing in frequency (Inglis et al., 2016).
- are associated with reduced harvestable biomass & mass mortality.

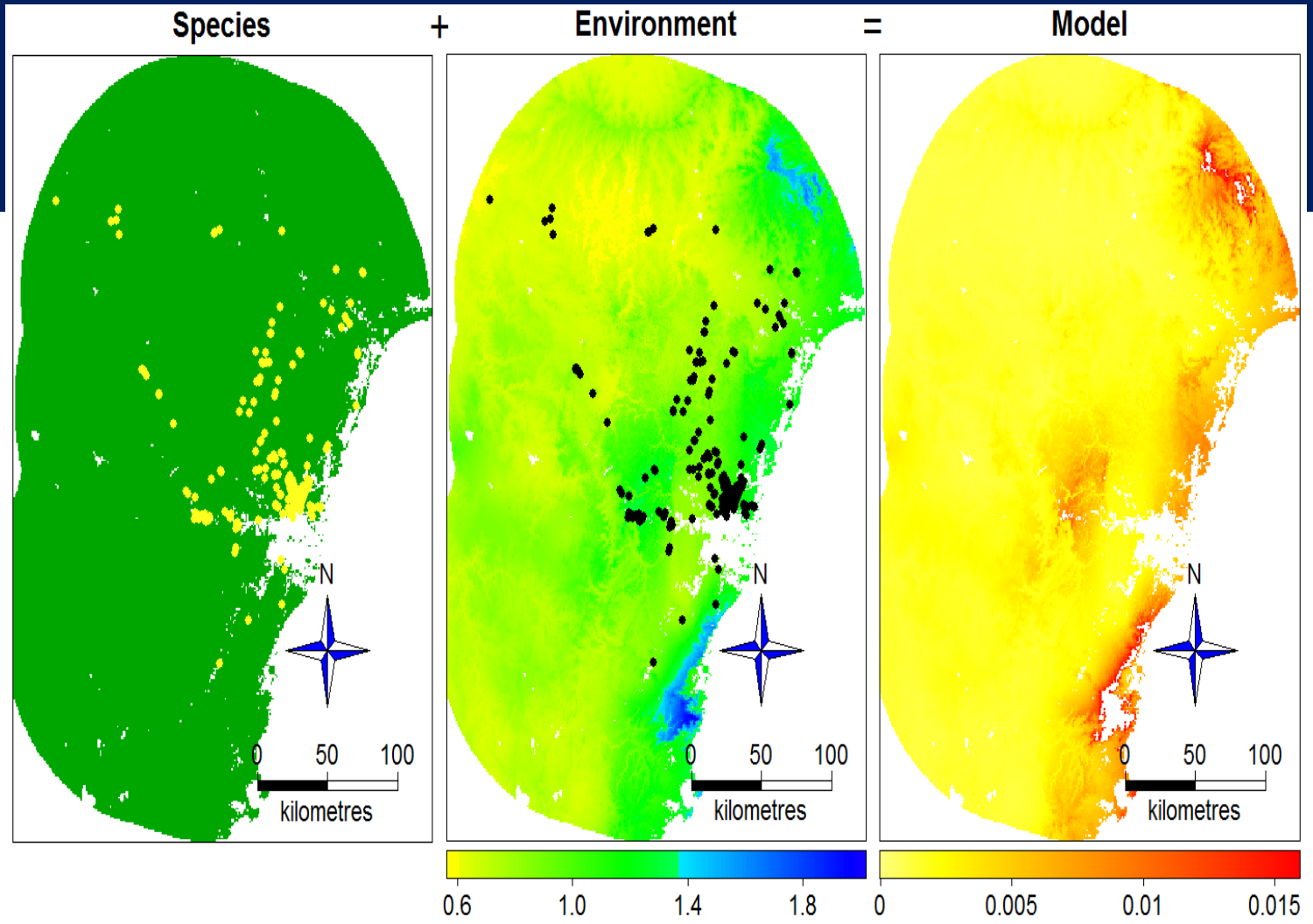




Gray meat predictive modeling

GOAL:

- 'Simple' spatial model of gray meat prevalence
- Prevalence / probability a function of:
  - environmental covariates
  - Fishing history
  - Scallop density
- Fit model to data from:
  - Presence/Absence info from surveys/VTRs/observers
  - Qualitative information from interviews



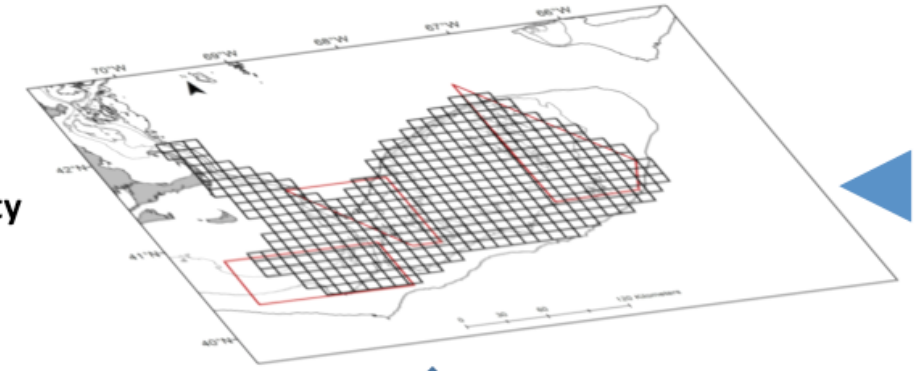
- Species distribution modeling
- Make inference about spatial distribution based on observations

Modeling overview

Whaling City Auction
Proportion of lots containing gray meats

Scallop captain interviews
Qualitative ranking of gray meat intensity

Fishery independent survey
Presence / absence of gray meats



Spatial grid of gray meat intensity (10km^2 cells)

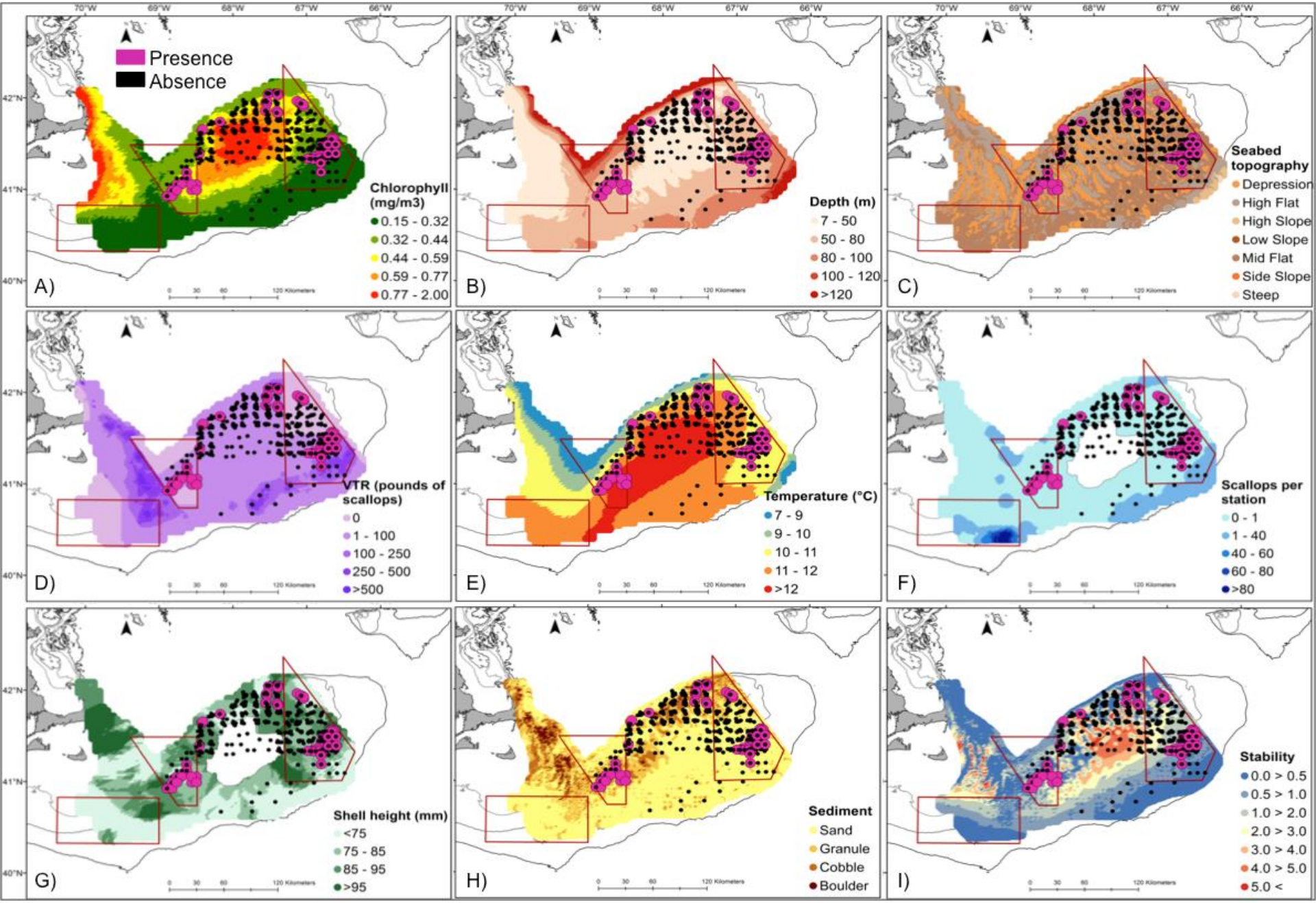
Environmental covariates

Chlorophyll
Depth
Sea bed topography
Sediment type
Sediment stability
Fishing intensity
Temperature
Scallop abundance
Scallop size

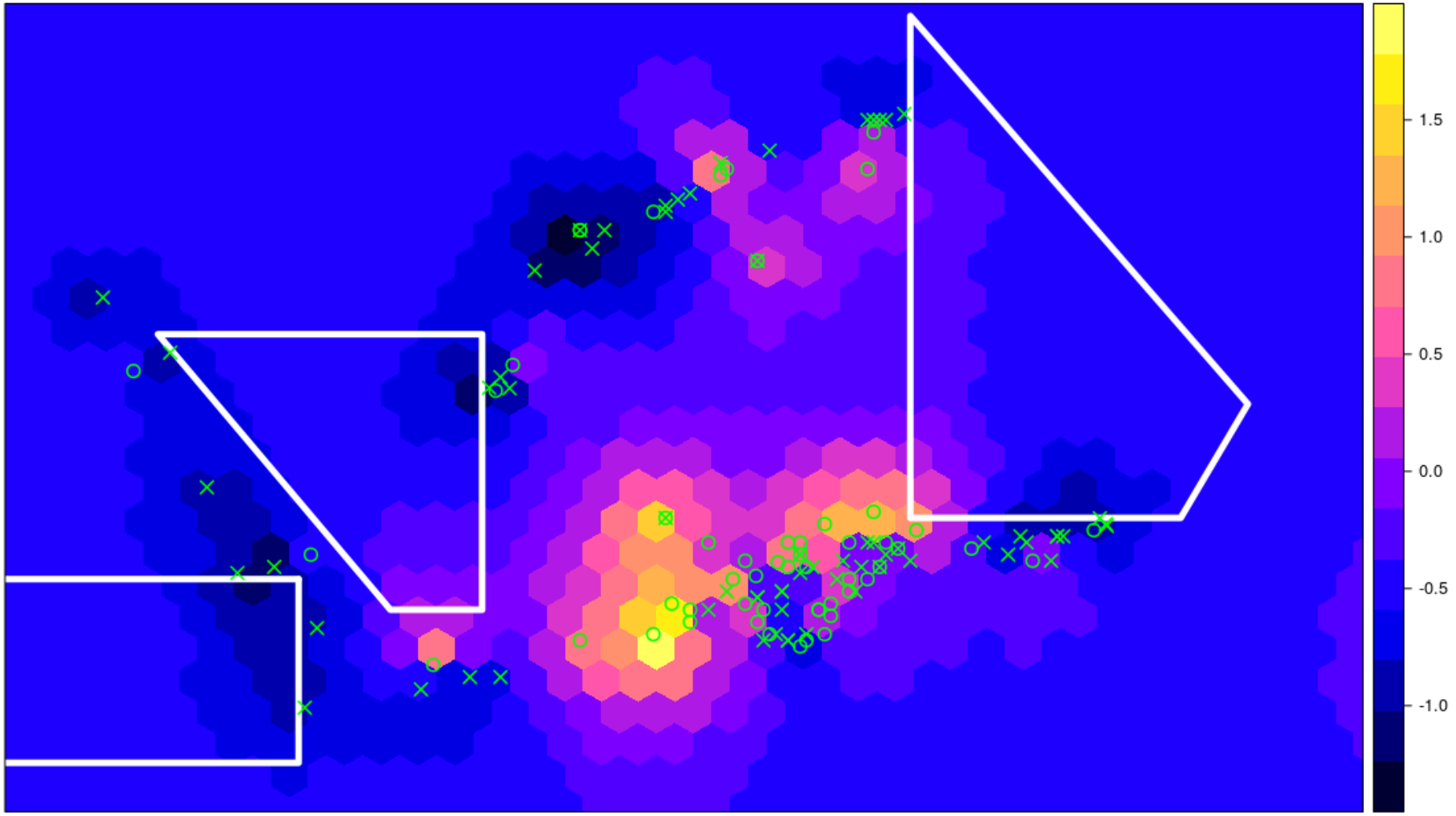
Model parameters governing spatial distribution of gray meats

‘Environmental’ covariates

- Lots of variables associated with trips where gray meats were and were not observed.
- e.g.
  - Temperature
  - Depth
  - Scallop Density
  - Fishing history
  - etc. etc.
- Goal: **evaluate relative importance** of these for determining gray meat intensity and distribution.


Presence
Absence
Chlorophyll (mg/m3)
0.15 - 0.32
0.32 - 0.44
0.44 - 0.59
0.59 - 0.77
0.77 - 2.00
A)
Depth (m)
7 - 50
50 - 80
80 - 100
100 - 120
>120
B)
Seabed topography
Depression
High Flat
High Slope
Low Slope
Mid Flat
Side Slope
Steep
C)
VTR (pounds of scallops)
0
1 - 100
100 - 250
250 - 500
>500
D)
Temperature (°C)
7 - 9
9 - 10
10 - 11
11 - 12
>12
E)
Scallops per station
0 - 1
1 - 40
40 - 60
60 - 80
>80
F)
Shell height (mm)
<75
75 - 85
85 - 95
>95
G)
Sediment
Sand
Granule
Cobble
Boulder
H)
Stability
0.0 > 0.5
0.5 > 1.0
1.0 > 2.0
2.0 > 3.0
3.0 > 4.0
4.0 > 5.0
5.0 <
I)
70°W
69°W
68°W
67°W
66°W
42°N
41°N
40°N
0 30 60 120 Kilometers

Preliminary results: auction data only



Logistic regression using Coonamessett Farm Foundation survey data 2013-2015

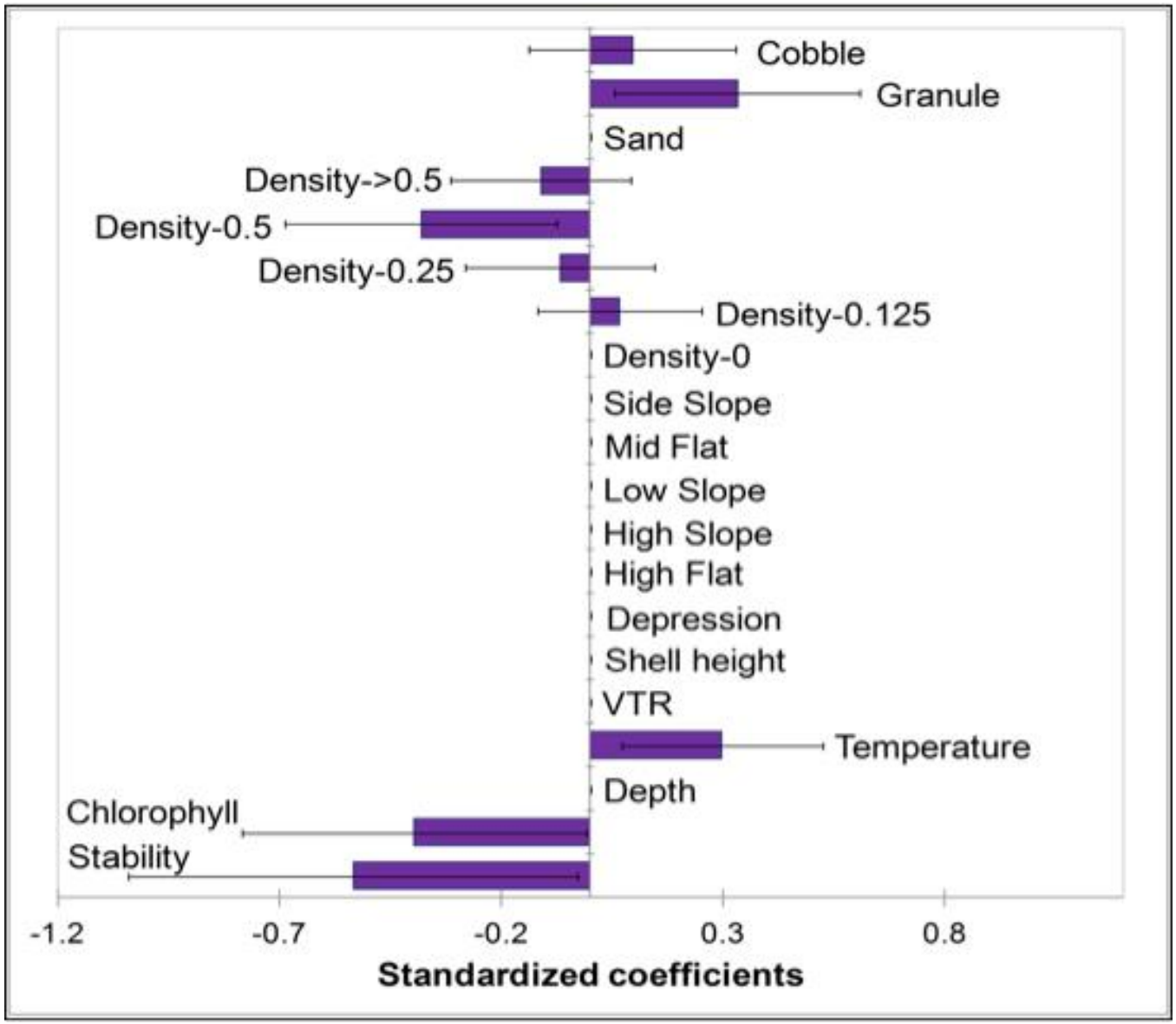
(Rossellon-Druker)

Gray meats are associated with adverse environmental conditions

Probability of gray meat presence increased with:

- stable and coarser sediments,
- low chlorophyll levels,
- high temperatures, and
- low scallop densities.

Coefficients for best model



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Summary

- Results suggest gray meat scallops are related with suboptimal habitats. Stressed out scallops may be less adept to fight the parasite.

Next Steps:

- Simultaneous fitting of geospatial models to all data sets.
- Further work will use laboratory experiment results and link outputs to economic models.