

# Seasonal Bycatch Survey

Optimizing the Georges Bank scallop fishery by maximizing meat yield and minimizing bycatch



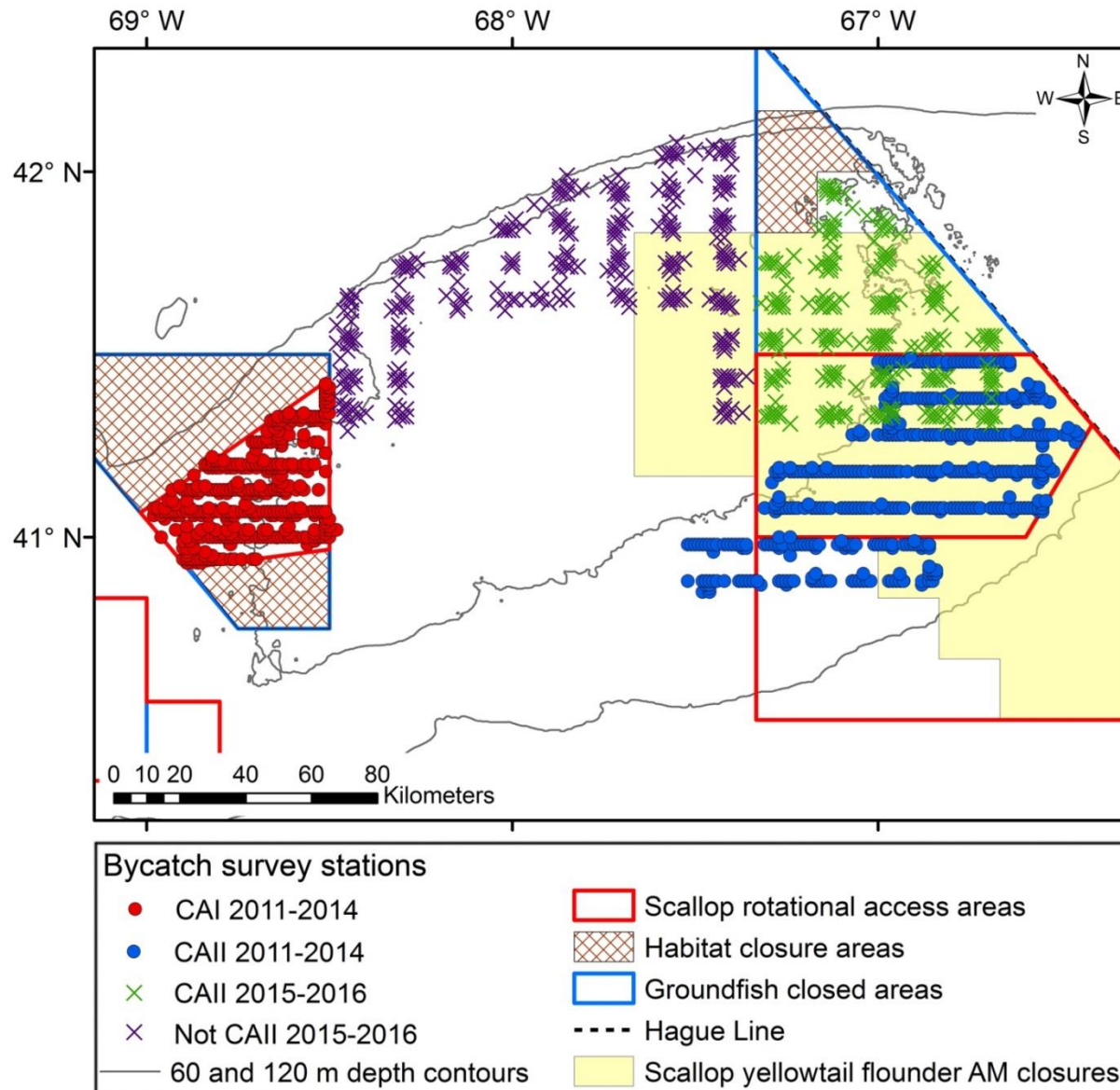
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Dave Rudders – Virginia Institute of Marine Science  
Roxanna Smolowitz – Roger Williams University

# Research priorities

- Groundfish bycatch rates vs scallop meat yield
- Spatial-temporal changes in bycatch
- Seasonal changes in scallop meat quality
- Seasonal changes in scallop and fish reproductive biology and disease status
- Bycatch reduction with modified dredge bag



# Consistently sampled stations



- The survey uses a fixed grid design
- From May 2011 – March 2014, the survey was conducted every four to six weeks in the scallop access areas of CAI and CAII
- The survey was moved onto northern Georges Bank beginning in August 2015
- Since 2011, one of the dredges has been a turtle-deflector dredge with a 7-row apron



# Methods

30 minute tows  
4.8 knots  
Control vs. Experimental



Depth  
Bottom temperature  
Location coordinates  
Month, day, and time

## Scallops

## Bycatch

Catch analysis  
on board



Laboratory

Molecular and histological  
analyses of disease

Weight  
Size  
Sex

Reproductive stage/egg presence  
Disease (yellowtail)  
Damage (lobster)

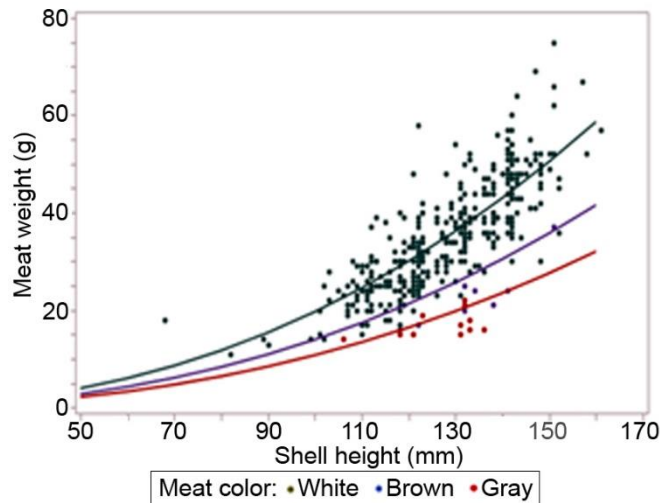


Shell height  
Meat/gonad weight  
Sex  
Reproductive stage  
Diseases/quality of the meat

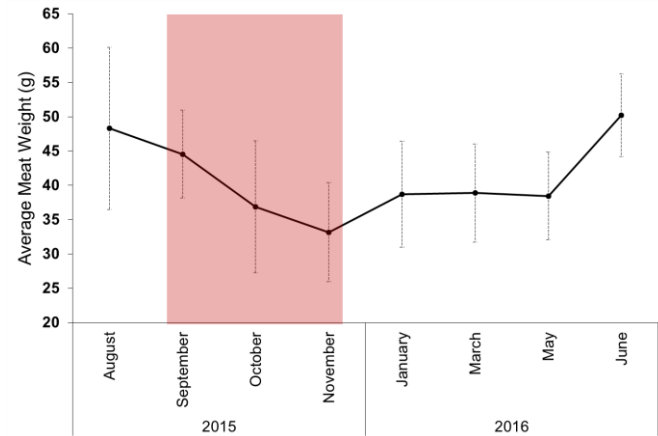


# Scallop SHMW and reproduction

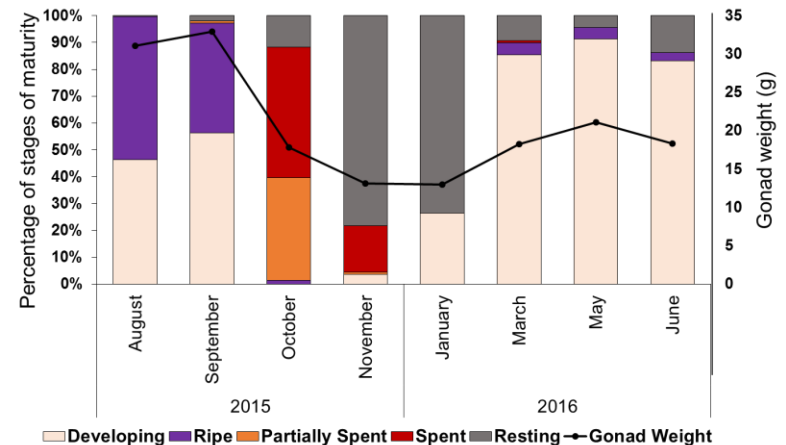
- Seasonal changes in meat weight
- Effect of meat color on meat weight
- Reproductive stages and gonad weight



The effect of meat color on the predicted meat weight of scallops (November 2015 open area).



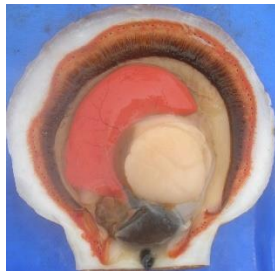
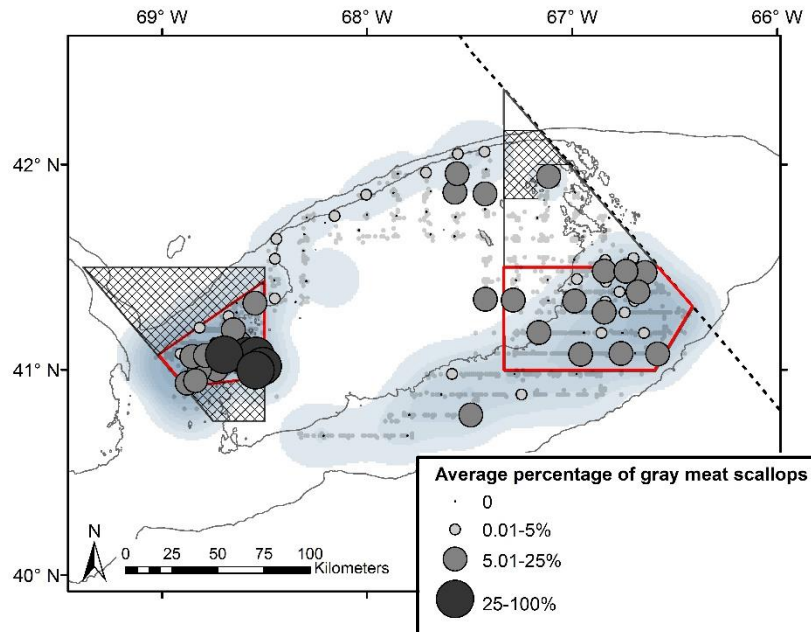
Scallop meat weight by month for a 132-mm scallop on the northern edge of Georges Bank.



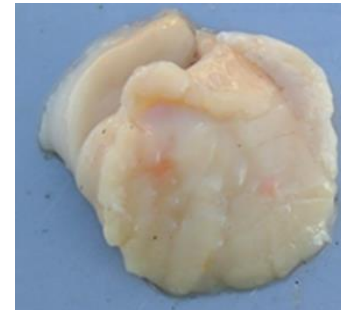
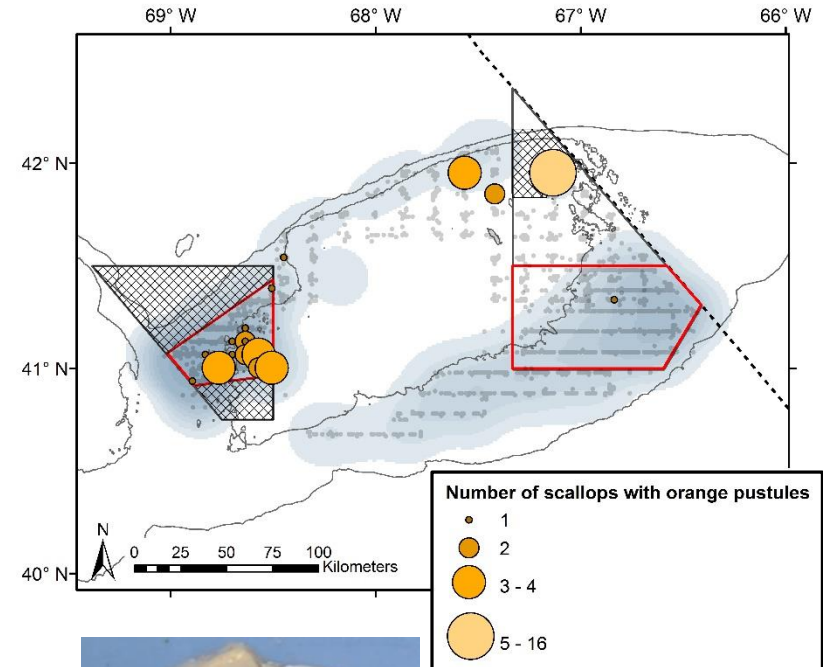
Percentage of scallops by maturity stage and gonad weight during the 2015 seasonal bycatch survey.

# Scallop diseases

## Gray meat – apicomplexan parasite



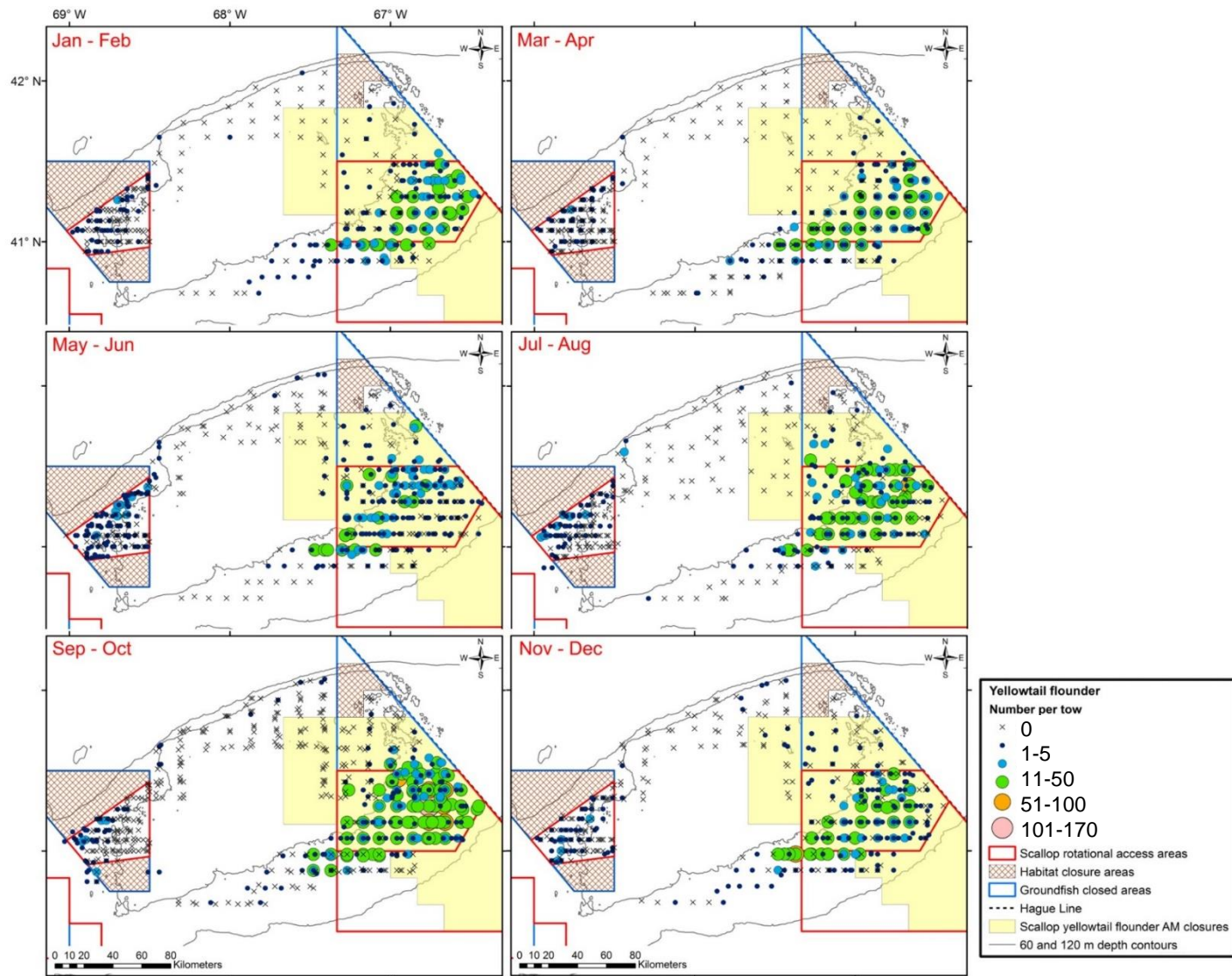
## Orange nodules - mycobacterium



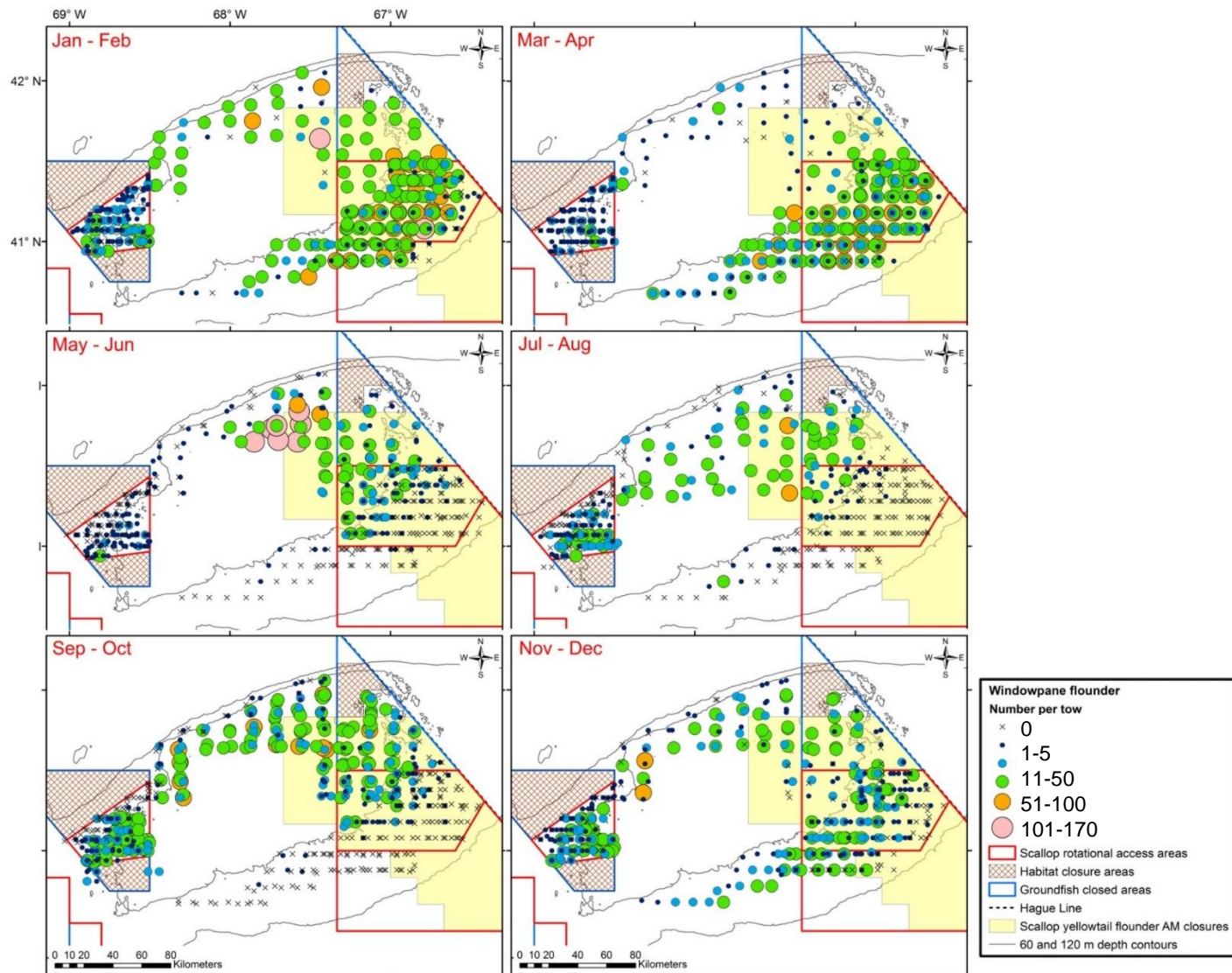
Data collected during bycatch surveys can be used to model disease presence/severity as a function of environmental parameters (bottom temperature, depth) and scallop size, density, and reproductive stage.



# Yellowtail flounder seasonal distribution and relative abundance



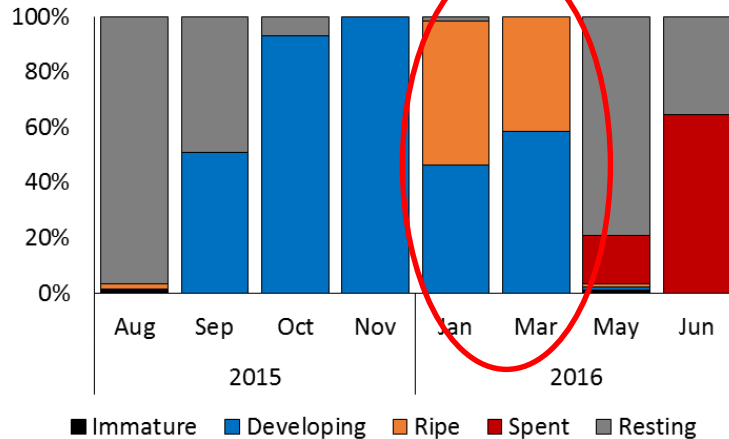
# Windowpane flounder seasonal distribution and relative abundance



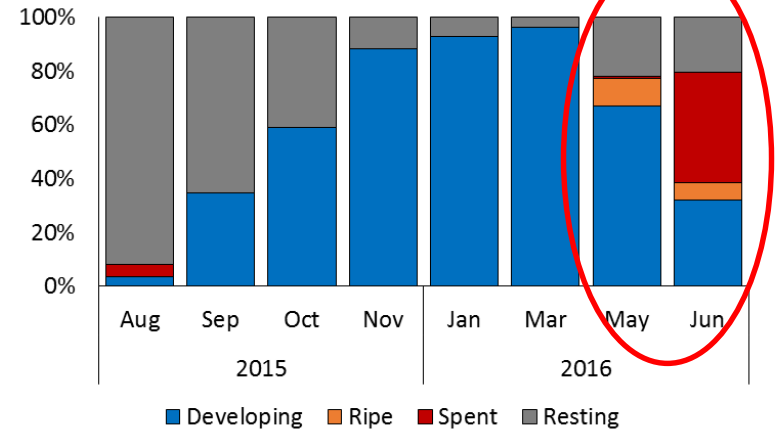


# Seasonal changes in maturity stages

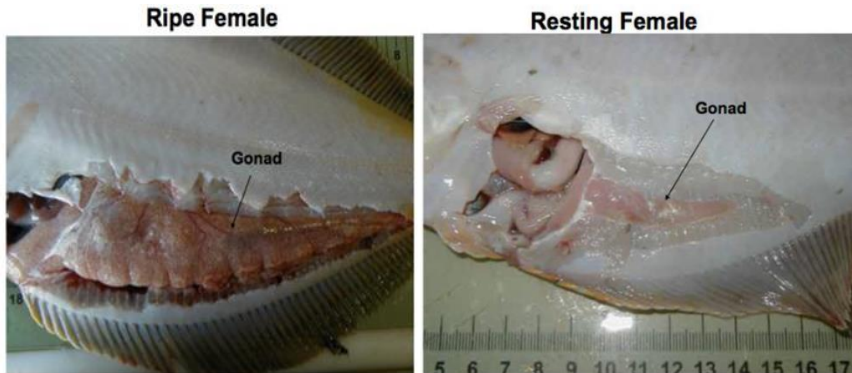
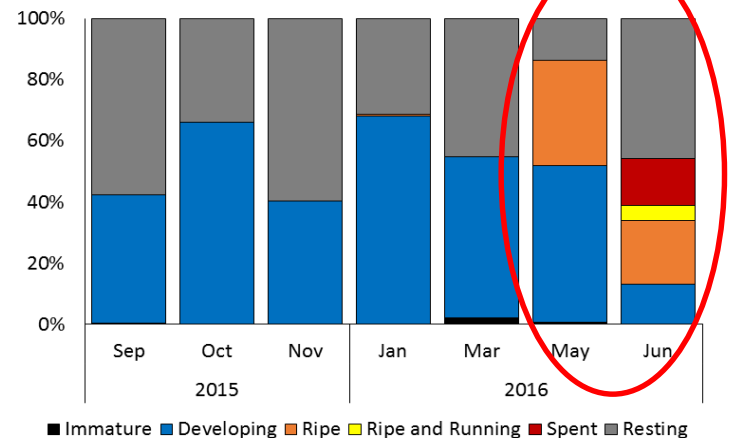
## Winter Flounder



## Yellowtail flounder

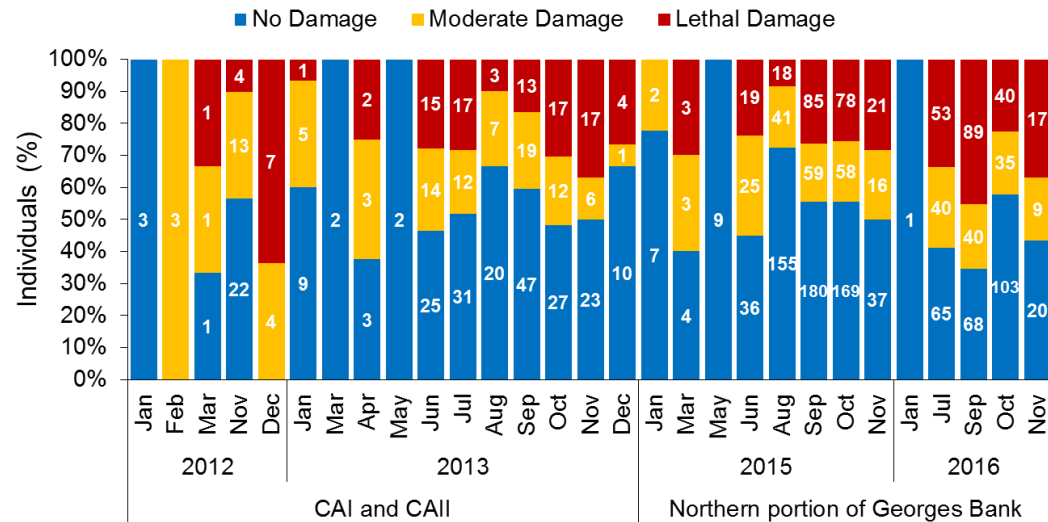
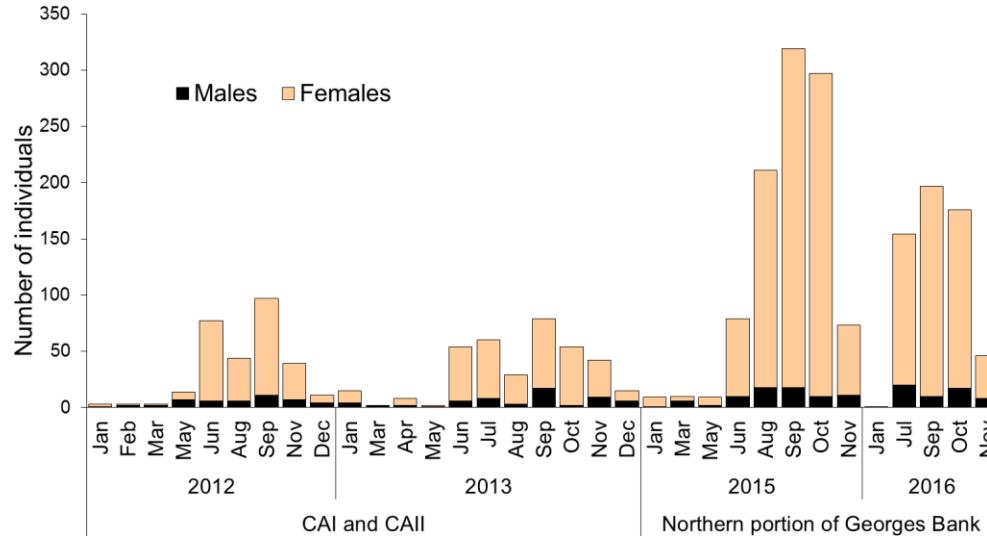


## Windowpane flounder

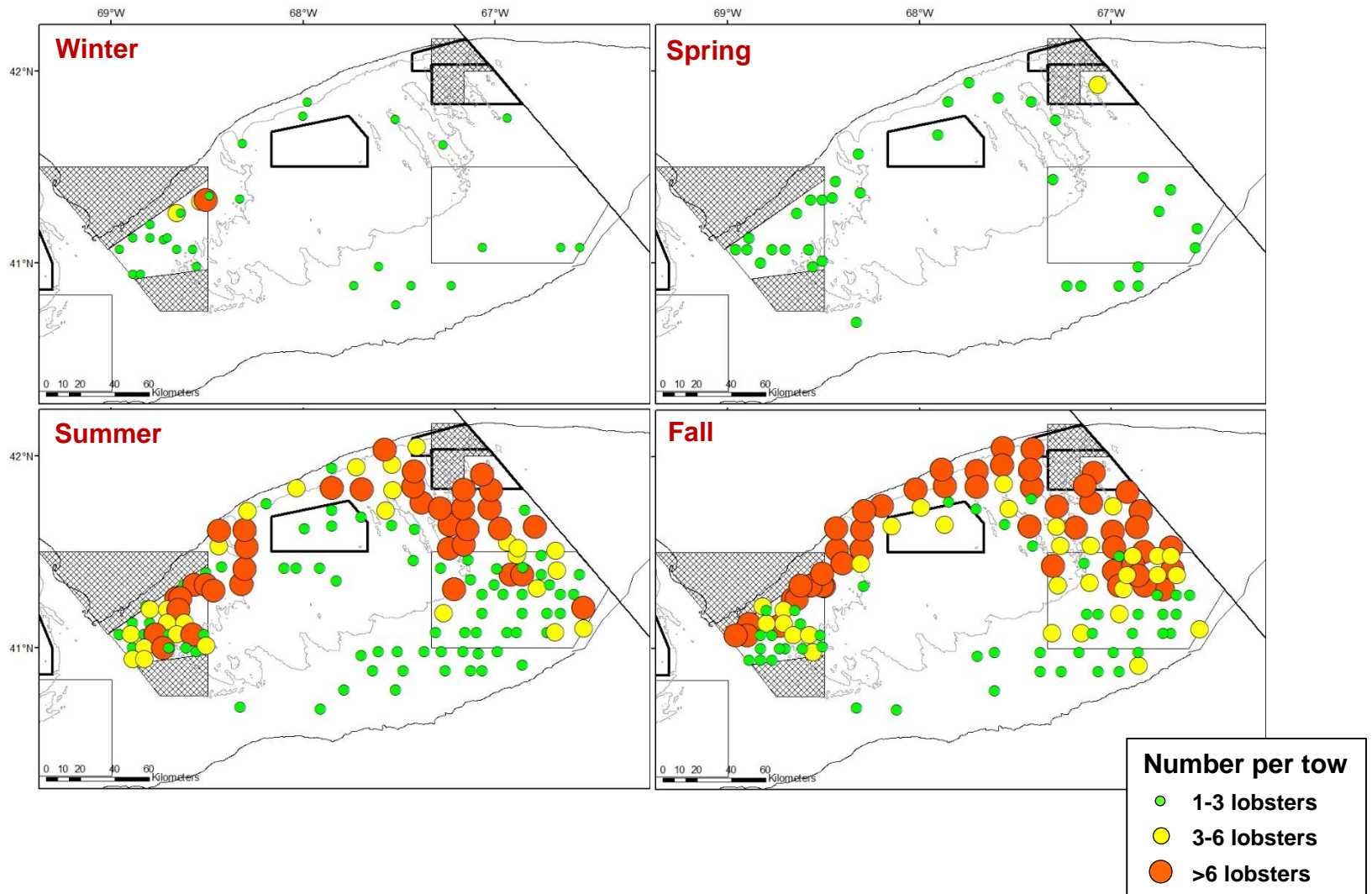


A ripe vs resting female flounder

# Seasonal changes in sex ratio and damage condition of lobsters caught in scallop dredge

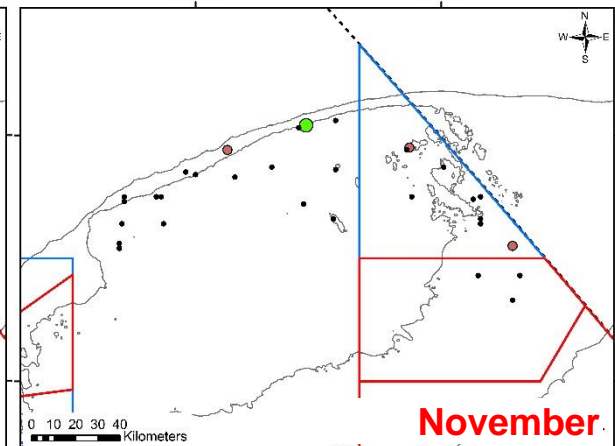
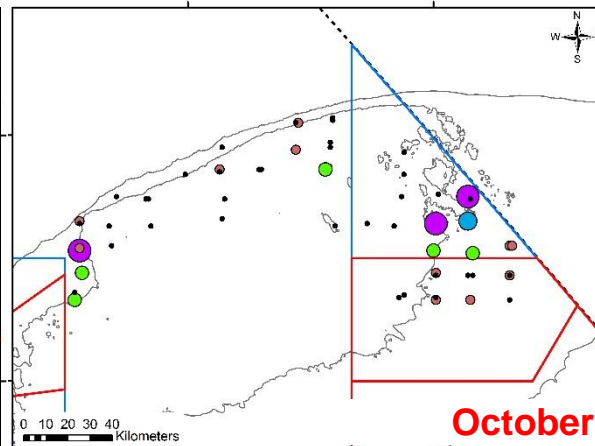
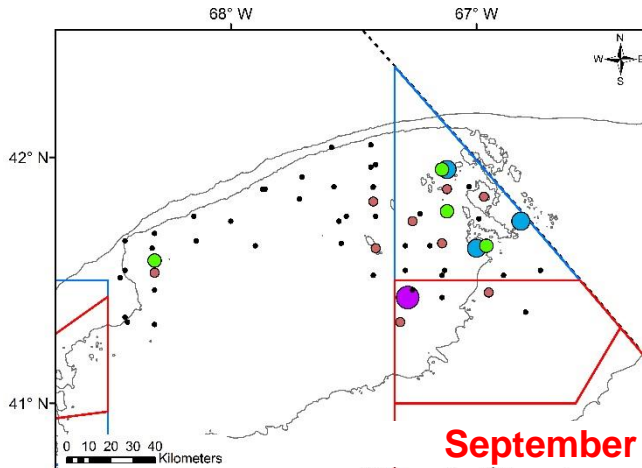
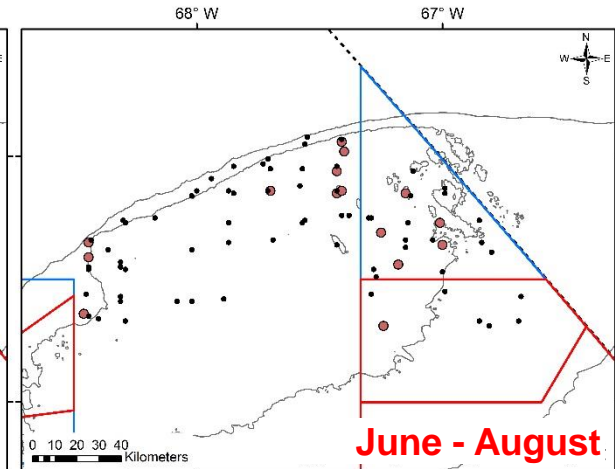
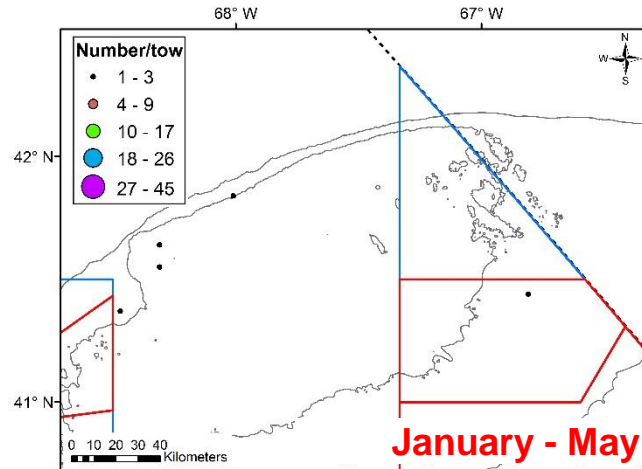


# Lobster seasonal distribution



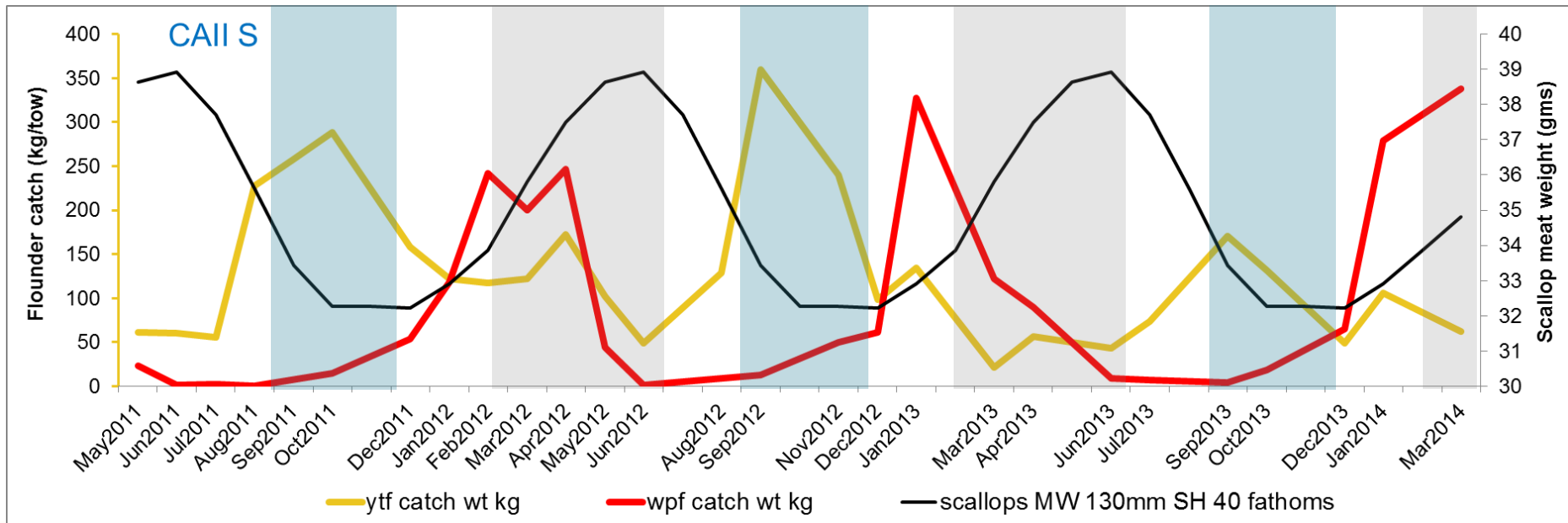


# Egg-bearing females

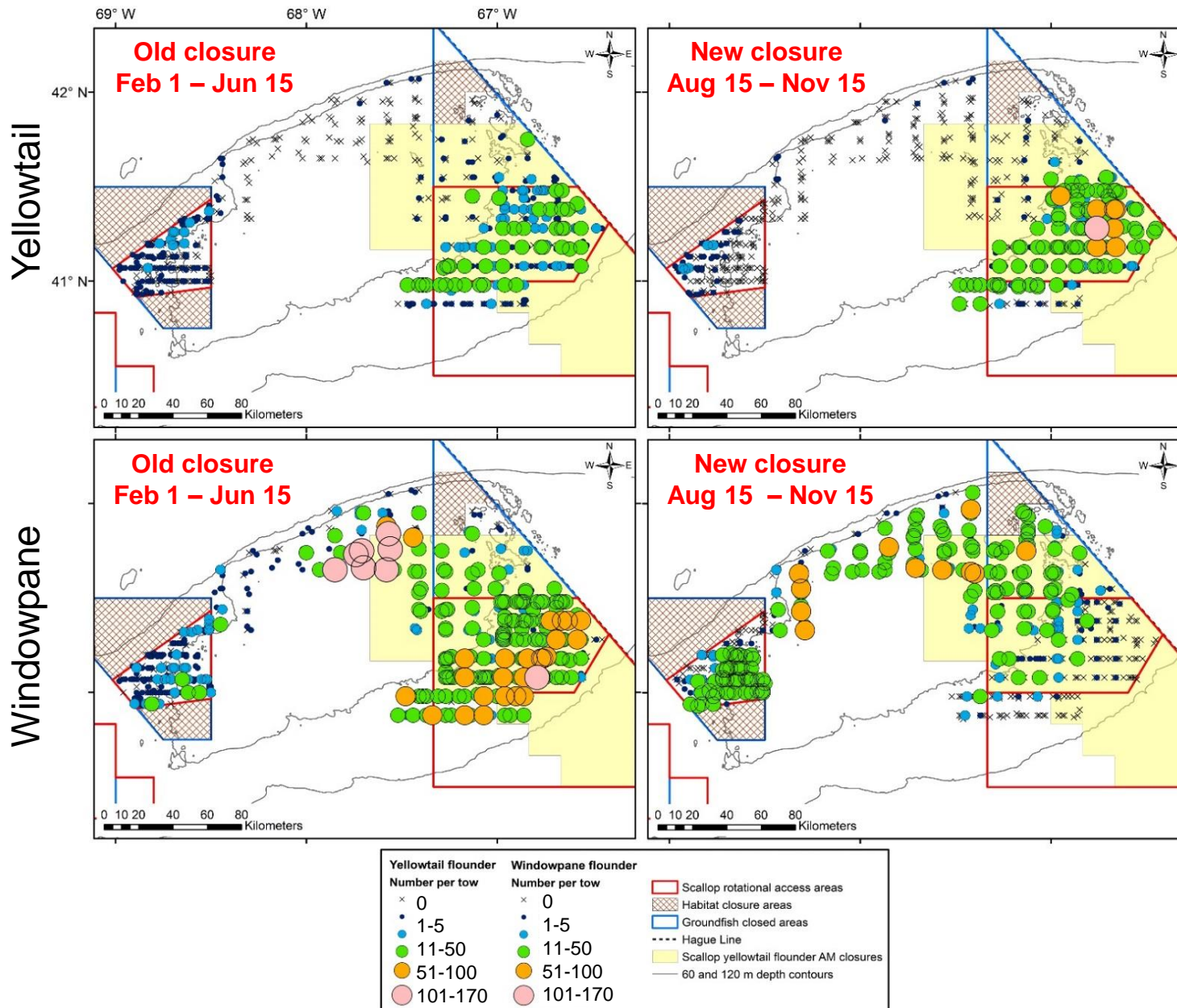


# Seasonal bycatch of yellowtail vs. windowpane flounder in CAI

- Scallop meat weights change seasonally
- Yellowtail flounder relative abundance changes seasonally
- Seasonal closures were initially from February through June – were shifted to August through November to open scallop grounds when scallop meat weights are high and yellowtail abundance is low
- Windowpane flounder relative abundance peaks when yellowtail abundance is low
- Has windowpane flounder catch increased because of change in access months?



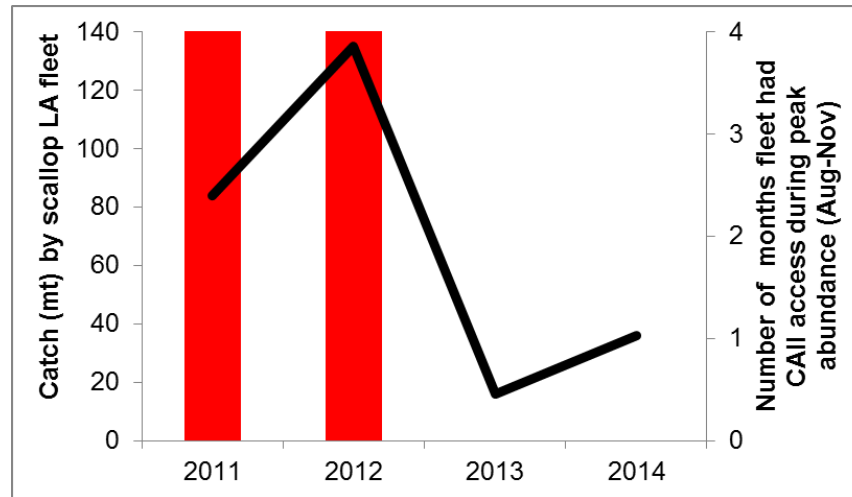
# Relative abundance in CALL during closures



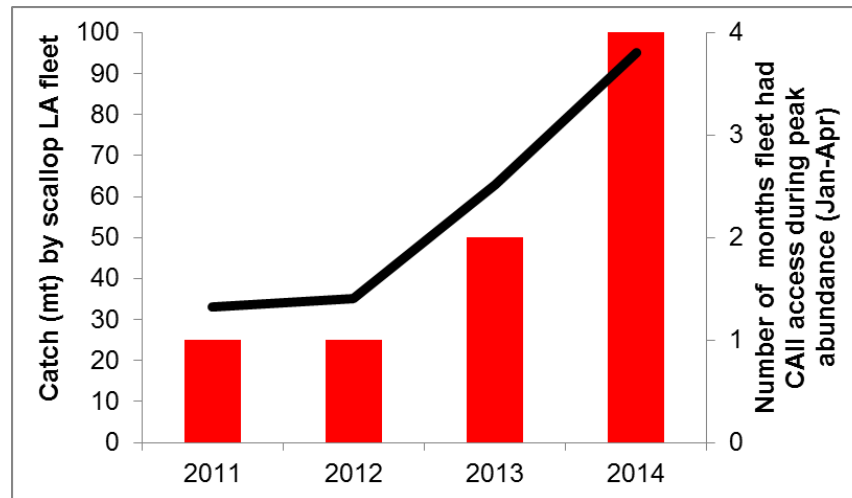


# Changes in bycatch estimates with fishing during months with peak abundance

## Yellowtail flounder



## Windowpane flounder



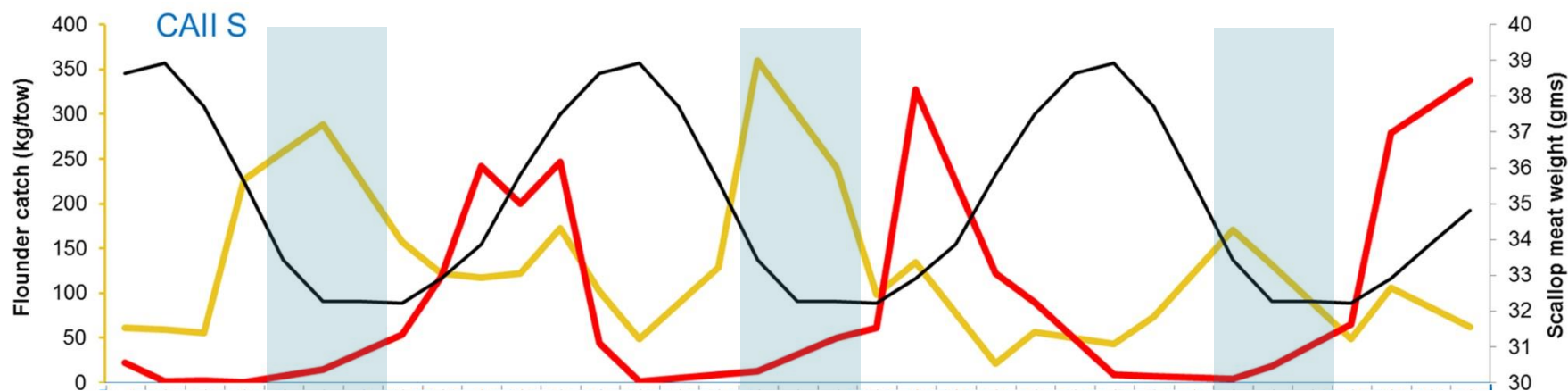
Data from

NOAA Reports - Yellowtail Flounder Sub-ACL for the Directed Scallop Fishery Georges Bank Stock Area  
NEFMC. 2016. Draft Alternatives - Framework Adjustment 56 to the Northeast Multispecies FMP

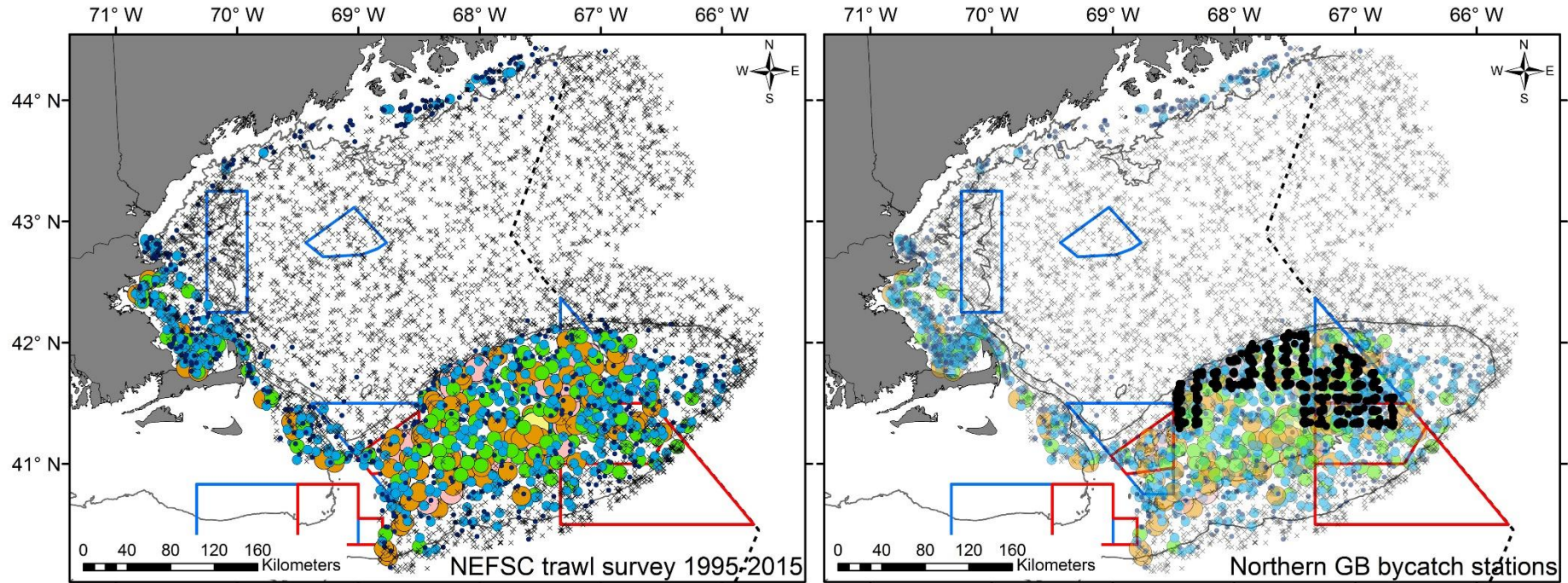
# Incorporating fishing effort

- Scallop sub-ACL meat pounds from May 2013 – April 2015 (GARFO reports after the new closure started)
- Average by month (2 data points each)

**Could the scallop closure be adjusted?**



# Northern windowpane flounder biomass



Windowpane are caught during the NEFSC trawl surveys on Georges Bank, in the Great South Channel, and in Cape Cod and Massachusetts bays.

Northern windowpane flounder  
relative abundance  
CPUE kg/km<sup>2</sup>

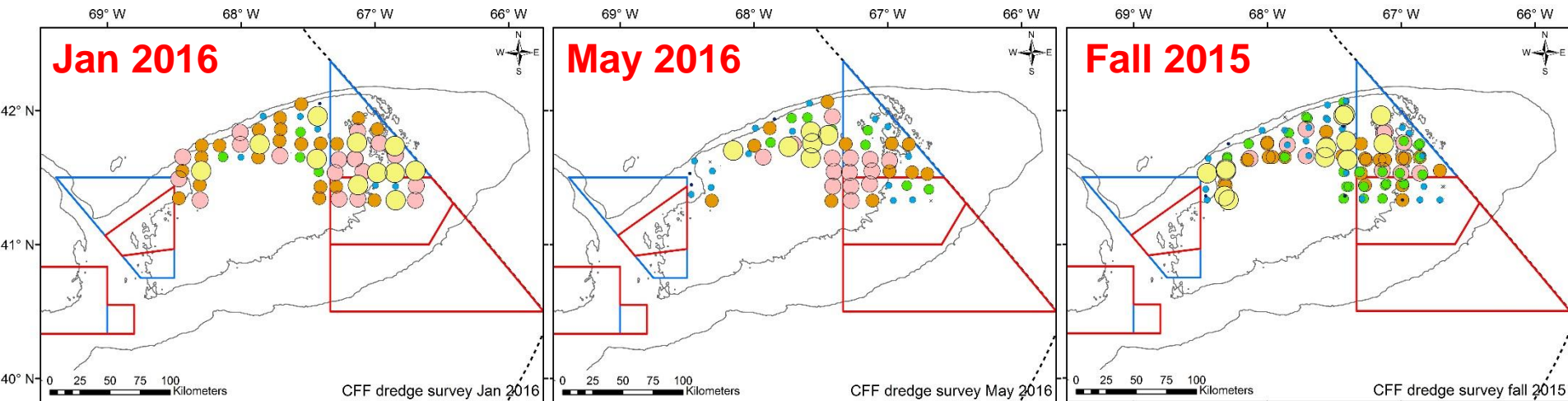
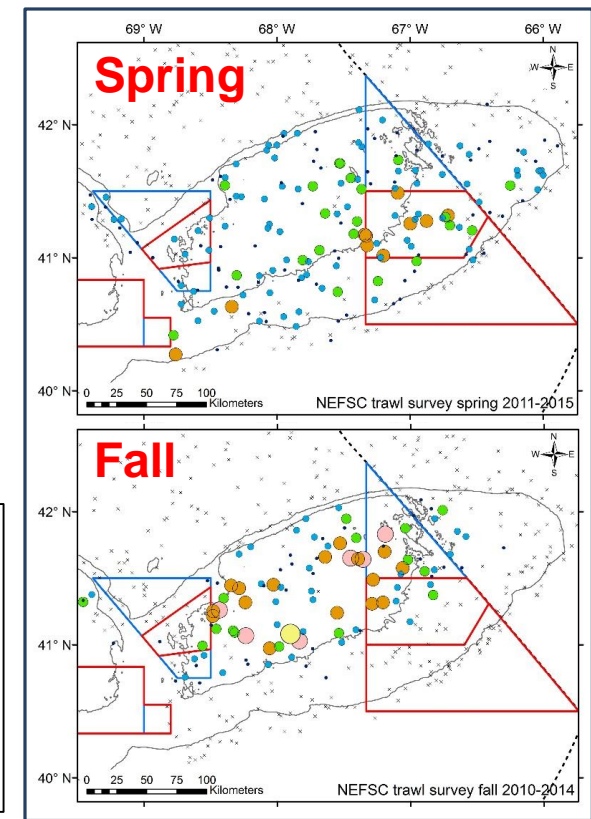
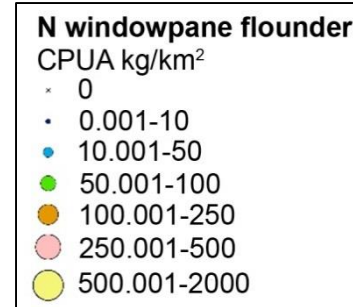
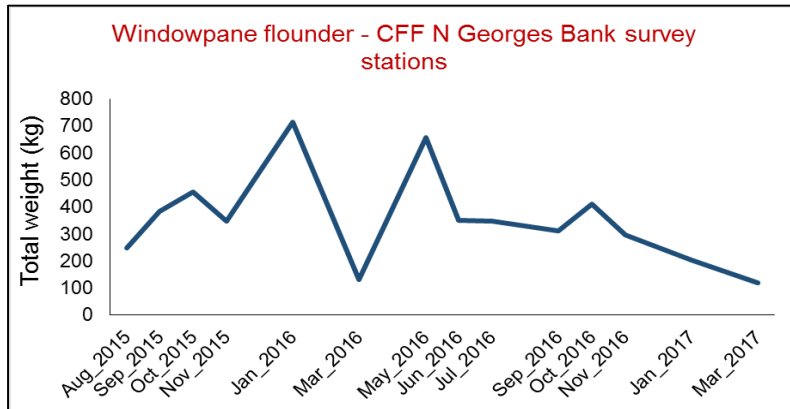
- × 0
- 0.001 - 10
- 10.001 - 50
- 50.001 - 100
- 100.001 - 250
- 250.001 - 500
- 500.001 - 2000

- Bycatch stations 2015-2017
- ▭ Scallop rotational access areas
- ▭ Groundfish closed areas
- Hague Line
- 60 and 120 m depth contours

The CFF N GB survey covers approximately 37% of the area on Georges Bank where windowpane flounder are commonly caught during the NEFSC surveys.



- Windowpane flounder catch was higher in the fall from 2010 to 2015 during the NEFSC trawl surveys.
- Peak catches occurred in January and May during the CFF dredge survey. Overall, catch per unit area was higher.



# Very basic swept-area biomass estimation

**Many caveats!**

Northern Georges Bank windowpane flounder biomass estimate -  
Tow swept areas (~0.04 km<sup>2</sup>) were expanded to coverage of survey (7500 km<sup>2</sup>) using the swept-area biomass formula

$$\text{Biomass} = A/q * 1/n * \sum C_a$$

Where A = total area, q = catchability estimate, n = number of tows, and C<sub>a</sub> = catch per unit area for each tow. 99.9% of fish caught were longer than L50 (22 cm).

Total biomass N GB	q=1	q=0.5	q=0.25
January 2016	2190 mt	4381 mt	8761 mt
May 2016	2051 mt	4102 mt	8203 mt
<b>Average</b>	2121	4241	8482
Total-ACL (172 mt) percentage	8.11%	4.06%	2.03%
Scallop sub-ACL (38 mt) percentage	1.79%	0.90%	0.45%

US ABC, total ACL, and scallop sub-ACL - Council preferred alternative from DRAFT ALTERNATIVES Framework Adjustment 56 to the Northeast Multispecies FMP. Date: March, 16 2017.

GB Yellowtail biomass – Georges Bank yellowtail flounder TRAC Status Report 2016/03  
GB winter flounder biomass – Georges Bank winter flounder 2015 Assessment Update Report  
ACLs – Northeast Multispecies (Groundfish) Fishing Year 2015 and 2016 regulations

For comparison	Biomass*	ACL	Percentage
2015 GB yellowtail	2241 mt	240 mt	11%
2016 GB yellowtail	1532 mt	261 mt	17%
<i>*Average of swept-area biomass US and Canadian trawl surveys</i>			
2016 GB winter flounder	2295 mt	650 mt	29%
<i>*Biomass projections from age-based model</i>			

# What's Next?

- 2017-2018 RSA – new survey area
- NOAA Marine Debris project with Sea Education Association – characterize microplastics in sea scallops and correlate presence with scallop condition and ecological parameters.
- Saltonstall-Kennedy project with Roger Williams University – develop quantitative PCR method to detect gray meat parasite.

