

## CRUISE PLAN OPTIONS FOR THE AUGUST 2017 TWIN TRAWL STUDY ON THE KAREN ELIZABETH

Prepared by:

Northeast Fisheries Science Center's Ecosystems Surveys, Population Dynamics and Cooperative Research Branches

### **Summary**

The intent of this document is to provide information that can guide the Northeast Trawl Advisory Panel in recommending how best to use 10 sea days on the F/V Karen Elizabeth in August of 2017. The work scheduled on the August 2017 cruise is a continuation of the 2015 and 2016 comparison between a chain sweep and rockhopper sweep using a twin trawl setup. The goal of this work is to inform the efficiency of the trawl gear used on the Northeast Fisheries Science Center bottom trawl survey. In 2015 and 2016 summer flounder and winter flounder were sampled at the lowest number of stations of any of the flatfish or skate species. The length-structure of these two species was also poorly covered in that sampling. Three sampling options were developed. The first option covers a broad spatial range and depth range through the Gulf of Maine, Southern New England and the Mid Atlantic Bight, with the intent of spreading effort among flatfish species and red hake. Options two and three focus on summer flounder and winter flounder with the recognition that other species (e.g. windowpane, red hake) would also be collected, while the first option seeks a broader coverage of species. The second option covers southern New England and the Mid-Atlantic Bight. This spatial coverage emphasizes summer flounder with the expectation that winter flounder would also be sampled at the easternmost stations. The third option covers Southern New England and the western Gulf of Maine. The western Gulf of Maine sampling would target winter flounder, while the Southern New England sampling would sample both species, with an emphasis on summer flounder.

### **Research Priorities**

Research priorities for this cruise were discussed at the Northeast Trawl Advisory Panel (NTAP) meeting in June 2017 and within the Northeast Fisheries Science Center. The NTAP meeting provided the following priorities:

1. Flounders in groundfish fishery
2. Red hake and skates
3. Summer flounder.

The internal Northeast Fisheries Science Center discussions noted the scheduling of this cruise relative to assessment scheduling. It was determined that cruise results will not be complete in time to include in the 2017 Operational Assessment updates. The first possible use of these results is in the 2018 summer flounder benchmark assessment.

Funding for further sampling in 2018 (i.e. a fourth cruise) may not be available. In that case the 2017 sampling combined with the 2015 and 2016 sampling would constitute all of the available data.

### **Currently Available Data**

This experiment relies on obtaining an adequate number of positive stations because stations with zero catch do not provide useful information to the analysis. The number of positive stations directly affects the precision of catchability estimates.

I calculated the ratio of the chain sweep to rockhopper sweep catch weight per tow for the set of species sampled during the 2015 and 2016 experiments, with the 95% confidence intervals estimated using bootstrapping of all of the tows across both years. The standard deviation of the 1000 bootstrap samples divided by the mean is presented in the table below for night tows and daytime tows separately (higher values indicate higher uncertainty in the estimate).

Half of the groundfish species in the study use age-structure data in the assessments. The use of age-structured data means that more effort will be needed to ensure enough of the older/larger age classes are sampled. Finally, the number of positive stations with catches in either net is included in the table.

	Day SD/Mean	Night SD/Mean	Number Positive stations	Age Structured
Thorny skate	0.21	0.27	70	No
Leucoraja skate	0.34	0.04	155	No
Smooth skate	0.18	0.19	104	No
Barndoor skate	0.09	0.12	177	No
Summer Flounder	0.10	0.08	64	Yes
Winter Flounder	0.09	0.08	72	Yes
American Plaice	0.04	0.12	120	Yes
Windowpane Flounder	0.09	0.05	110	No
Yellowtail Flounder	0.08	0.04	139	Yes
Witch Flounder	0.06	0.06	117	Yes
Goosefish	0.04	0.07	225	No

Summer flounder followed by winter flounder have the highest CVs and the lowest number of tows, as well as age-structured assessments.

It is important to consider how well the length structure of key species has been covered by the available tows (See attached Spreadsheet). I calculated the cumulative biomass of each species (or target stock) by length class averaged across 2009-2016 and compared the cumulative biomass at length to the number of stations where the species was caught in either net. The table below provides a measure of how well the length classes contributing to the biomass of each stock were covered by the twin trawl study, using a cutoff of 30 stations with catch in either the chain sweep or rockhopper sweep nets.

	Lower Bound %	Lower Bound cm	Upper Bound %	Upper Bound cm
Summer flounder	8%	35	33%	43
GOM Winter flounder	38%	26	83%	35
American plaice	1%	12	90%	44
SNE windowpane flounder	18%	21	99%	33

GOM yellowtail flounder	10%	26	99%	44
Witch flounder	6%	24	99%	50

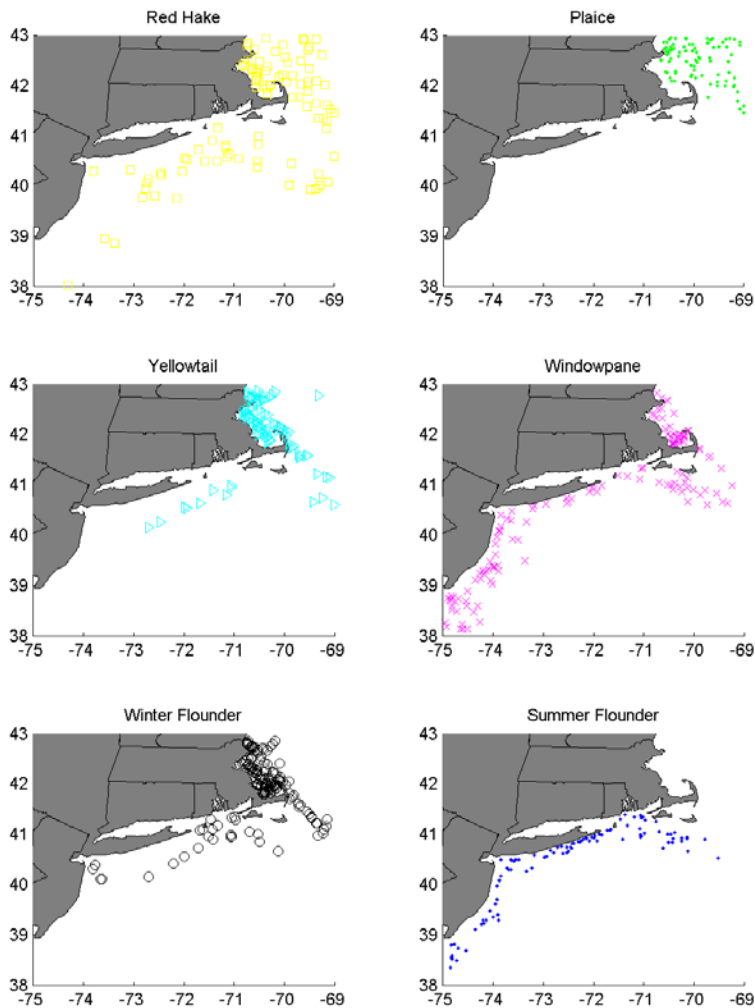
For example, for windowpane flounder the smallest length bin with  $\geq 30$  stations with catch was 21 cm and 18% of the biomass on the fall survey is contributed by individuals  $\leq 21$  cm. The largest length bin with 30 stations with catch for windowpane flounder was 33 cm and 99% of the biomass on the fall trawl survey is contributed by individuals  $\leq 33$  cm. Based on this evaluation, coverage is most needed on large and small winter flounder, large American plaice, and small windowpane and yellowtail flounder. The coverage on all sizes of summer flounder in the available data is very poor.

## Distributions of positive stations

The spatial distribution of stations sampled from 2012-2016 that collected >10 individuals on the fall trawl survey is shown below. The intent of these maps is to identify the general regions where each species can be sampled.

In general winter flounder, summer flounder and windowpane overlap south of Rhode Island and Martha's Vineyard. South of Long Island summer flounder overlaps with windowpane. Red hake and yellowtail flounder occur further offshore of summer flounder in Southern New England and would likely be minimally sampled in tows targeting summer flounder.

In the Gulf of Maine, winter flounder, windowpane, yellowtail flounder, and red hake occur in many of the same regions. Plaice tends to be in the deeper areas of the Gulf of Maine, particularly for the largest size classes that were not as well sampled in previous work. Summer flounder is unlikely to occur in many Gulf of Maine tows.



### Sampling plan and sample workup

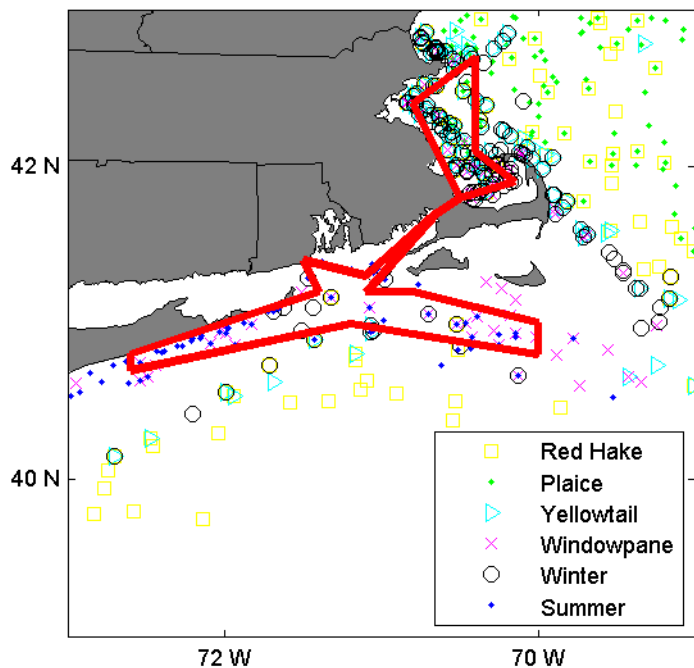
Station locations will be determined by the captain in consultation with the chief scientist. During past cruises, this strategy has yielded a high proportion (>90%) of positive tows for the targeted species of interest. The station selection for the current cruise will also attempt to ensure multiple habitats are sampled by limiting the clustering of stations in space.

As in the past, flatfish, goosefish, and thorny skates will be weighed, counted and measured, while other skate taxa will only be weighed. A change for this cruise is that red hake will also be weighed, measured and counted. There are no plans to work up any additional species beyond these, as there is a tradeoff between the number of stations sampled and the time spent working up samples.

### Sampling Option #1: Gulf of Maine- Mid Atlantic Bight: Broad coverage of flounders and red hake.

This option would cover a broader spatial area than options two and three resulting in an increase in transit time due to a larger distance covered and fewer number of stations. Approximately 65-70 stations could be sampled.

Sampling targeted at Red Hake in both Southern New England and the Gulf of Maine would result in reduced catches and fewer positive tows for summer flounder and winter flounder. This is particularly true in Southern New England where the highest catches of red hake occur offshore of both summer and winter flounder.

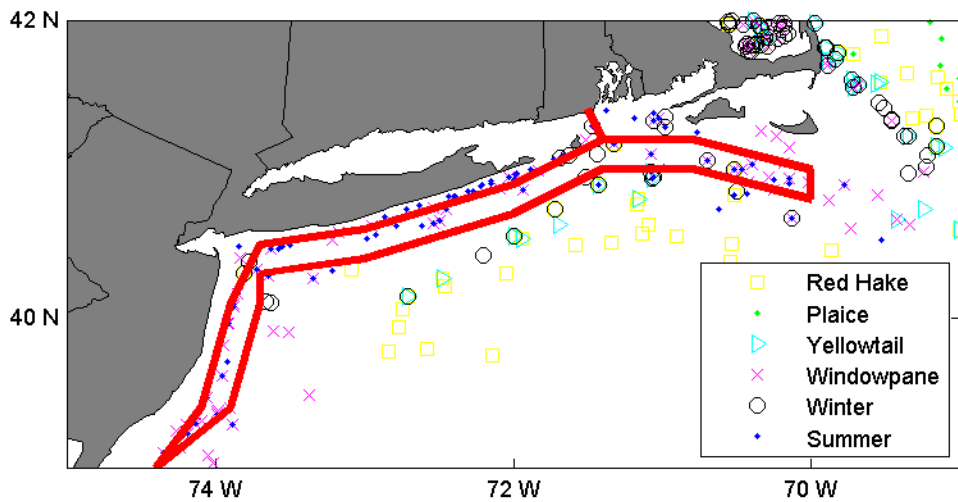


**Sampling Option # 2: Mid-Atlantic Bight and Southern New England—summer flounder focus, winter flounder secondary**

Under this option approximately 80 stations can be sampled in the area between New Jersey and south of Nantucket. This number of stations is based on the assumption of 8 knot transit speeds (515 nm for 65 hours), 1.75 hours per station to locate a tow, tow the gear and workup the sample (140 hours for 80 stations) and with time reserved unsuccessful stations (5-6 for 10 hours) and for net mending, and other factors.

This sampling would focus primarily on summer flounder, with the broad spatial coverage contributing to a wide size range of individuals collected (smaller summer flounder tend to occur further south). Winter flounder would also be sampled south of Rhode Island and Martha’s Vineyard, but not in the western most stations. Non-targeted catch would primarily be windowpane flounder. Higher abundances of red hake and yellowtail flounder are further offshore and would likely be minimally sampled.

Under this sampling plan on the order of 65-75 would sample summer flounder and 30-40 would sample winter flounder.



**Sampling option # 3: Gulf of Maine to Southern New England- winter flounder Focus, summer flounder secondary.**

This option would likely result in about 75 stations across two regions of sampling. A reduction in tow number relative to option 2 is due to Cape Cod Canal transit times, and more time allocated to selecting and sampling successful tows in the Gulf of Maine due to bottom types and fixed gear. Sampling in the Gulf of Maine would cover Cape Cod Bay, Massachusetts Bay, and possibly even up to Ipswich Bay. A focus on winter flounder would also yield windowpane flounder and yellowtail flounder. Red hake and plaice would likely be present in some tows. The large size classes of plaice are in the deep areas of the Gulf of Maine and would not be sampled.

The Southern New England leg would cover the area from south of Nantucket to eastern Long Island. Summer flounder, winter flounder and windowpane would be sampled on the eastern portion of the sampling and summer flounder and windowpane on the western portion.

Under an even GOM/SNE split of 75 stations, on the order of 30-35 would sample summer flounder and 40-50 would sample winter flounder. Relative to option # 1, fewer stations sampling summer flounder would result in higher uncertainty on the net efficiency of the rockhopper sweep for larger size classes of summer flounder.

If this option is chosen a decision would need to be made on how to allocate stations among regions, and the cruise path. With respect to the cruise path the three options are to 1) transit the Cape Cod Canal immediately and sample the Gulf of Maine first, 2) sample all of Southern New England and end in the Gulf of Maine, or 3) sample the eastern portion of Southern New England, transit the Canal, sample the Gulf of Maine, and then finish in the western portion of southern New England. Weather would factor into this decision. Additionally, sampling in southern New England is likely to yield more stations per day than sampling in the Gulf of Maine.

