



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northeast Fisheries Science Center
166 Water Street
Woods Hole, MA 02543-1026

April 6, 2009

Capt. Paul J. Howard
Executive Director
New England Fishery Management Council
50 Water Street
Newburyport, MA 01950

Dear Capt. Howard:

This letter is in response to the New England Fishery Management Council's request of October 15, 2008, for a description of the observer program protocols in the scallop fishery and how yellowtail flounder bycatch is estimated. Specifically, the motion supported by the Council was: *that the Council send a letter to NEFSC that requests the NEFSC conduct an analysis comparing 2006 and 2008 observer data and how that data was used for yellowtail flounder monitoring. Specifically, how is volume converted into lbs, was there an improvement from 2006 to 2008 concerning how an observer estimates bycatch (count/measure), fishing behavior impacts, how data is extrapolated, etc.* A letter was also attached from the Fisheries Survival Fund sent to the Scallop Committee on September 9, 2008, with specific questions that they would like addressed.

The Northeast Fisheries Science Center (NEFSC) collaborated with the Northeast Regional Office (NERO), Fisheries Statistics Office (FSO) in this response. As requested, this letter includes: (1) overviews of relevant observer program protocols (NEFSC); (2) history of changes in procedures used by observers to estimate yellowtail flounder bycatch 2006-2008 (NEFSC); (3) description of methodology used to estimate total yellowtail flounder bycatch in scallop access area fisheries (limited access and general category) (NERO); (4) discussion of impact of outliers on the final estimate (NERO); and (5) analysis of some potential effects of observers on fishing behavior (NEFSC).

We hope this information will be informative to help the Council and public better understand how yellowtail bycatch is estimated. Work on these topics is ongoing and further comparisons and examinations are being conducted to inspect patterns of yellowtail bycatch in access areas, to better inform the industry on trends on bycatch patterns, and to further assess observer effects in the industry-funded scallop observer program. If you need further information or clarification, please contact Amy Van Atten at 508-495-2266, and the Fisheries Sampling Branch (FSB) staff will be glad to help you.

Sincerely,

Nancy B. Thompson, Ph.D.
Science and Research Director

Enclosure

cc: P. Kurkul, NMFS/NERO
F. Almeida
F. Serchuk
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A. Van Atten



NEFSC NORTHEAST FISHERIES OBSERVER PROGRAM (NEFOP) SEA SCALLOP FISHERY CATCH ESTIMATION METHODS

The preferred method for the collection of catch weights is to weigh the entire catch of each species. When it is not possible to weigh the entire catch, observers may use the following acceptable catch estimation methods described below: tally / basket count, volume to volume ratio, or cumulative sum. Observers are required to document their estimation, subsampling, and extrapolation methods on a catch estimation worksheet, and the weight type is labeled as an “estimate”. Multiple factors impact the observer’s ability to weigh the entire catch, including the time between tows, the number of dredges used, the total amount caught in the tow, the relative amount of bycatch in the tow, deck space, weather conditions, safety hazards, length of continuous fishing effort, and sorting and discarding methods used by the crew.

Tally/Basket Count Method

Ideally, the observer picks through the entire pile of catch on deck and sorts to species level. The observer determines total amount of each species by counting baskets (or animals or totes, depending on size and frequency of the species and type of container used).

In Open Areas, the observer weighs at least three baskets of scallops in the shell per watch. The average weight per basket is recalculated every watch, generally every 8-12 hours. To determine the total weight in a tow, the observer multiplies the average weight of the weighed baskets in the watch by the total number of baskets in the tow. This value is recorded on the haul log as an estimated weight, with a weight type category “round” (in-the-shell).

In Closed Areas, the observer weighs at least one basket of shucked scallop meats per watch. The crew shucks the scallop sample, rather than the observer shucking the scallops, so that the sample is representative of how the industry dresses scallops. Only one basket of shucked samples is weighed, to minimize inconvenience to the crew. The average weight per basket is recalculated every watch, generally every 8-12 hours. To determine the total weight in a tow, the observer multiplies the weight of the weighed basket in the watch by the total number of baskets in the tow. This value is recorded on the haul log as an estimated weight, with a weight type category “dressed” (meat-weight).

Volume to Volume Ratio Method

Large catches and short tows might prevent an observer picking through the entire catch, using the tally/basket count method to determine weights for every species. In those cases, the observer first removes critically important or rare species (e.g. yellowtail flounder) if possible, and directly determines actual total weights for those species. The observer then estimates the total volume of the remaining pile, and extracts a volume-based subsample. The observer estimates the total volume by determining the area and depth of the pile. The observer is instructed to determine the area based on the shape of the pile, which, in the scallop fishery, is commonly an oval or half-oval. The observer then extracts a random subsample of the pile

using a standard orange basket. The subsample should be at least 20% of the total volume, to increase representativeness. Volume of the subsample is estimated by multiplying the number of baskets in the subsample by the volume of a basket (1.47 ft²). The total volume of the catch is divided by the total volume of the subsample (to obtain the “sample weight multiplier”). The observer then records the weight of each species in the subsample by disposition (whether it was kept or discarded and discard reason). Those weights are then multiplied by the sample weight multiplier to provide an extrapolated total weight for each species (by disposition) for the tow.

Observers may use this method for the entire catch or just discards. In some cases, the crew may shovel the entire catch into bushel baskets. The observer then counts the total number of mixed species bushels and uses that as a basis for calculating total volume.

Cumulative Sum Method

During a deckloading period, when catches from multiple tows are piled on top of each other in rapid succession, the observer may obtain a total cumulative actual weight of yellowtail flounder from the combined tows. The amount of scallops would be determined by using the tally/basket count method. The observer would then divide the total weight equally among all the participating deckloaded tows, to obtain an estimated weight per tow of the kept and/or discarded scallops and yellowtail flounder.

CHANGES IN NORTHEAST FISHERIES OBSERVER PROGRAM SCALLOP FISHERY CATCH ESTIMATION PROTOCOLS, 2006-2008

The following is a brief summary of the scallop catch estimation and subsampling protocols in place during fishing years 2006, 2007, and 2008.

2006 Catch Estimation Protocols

Before June 2006, observers were instructed to obtain actual weights for yellowtail flounder as a priority when on an Access Area trip. Observers were instructed to use the tally method if they could not obtain actual weights of yellowtail flounder. Observers were also instructed to estimate weights of scallop catch using the basket count method. In June 2006, before the opening of the Nantucket Lightship Access Area, a briefing packet was sent to observers providing further guidelines on the volume to volume method. Additionally, a catch estimation worksheet (see below) was created to provide documentation of the observer’s subsampling work and catch estimation methods employed for all observed hauls. The worksheet was implemented on a voluntary basis during the 2006 fishing year.

2007 Catch Estimation Protocols

In January 2007, once the catch estimation worksheet had been field tested and refined, the observer program manual and biological sampling manual were updated and sent to all certified NEFOP observers. The catch estimation worksheet was added to the manual at this time. Documentation of sampling methods was required, and a trial period for mandatory completion

meshes long in the twine top, how the twine top is hung (i.e. diamond, square, etc.), the number of rings (or its equivalent) on which the twine top hangs, and the number of rows of rings in the apron.

Bycatch Monitoring and Reporting

Real-time Data Collection

When a scallop access area is scheduled to open, observers are contacted to review data collection protocols, subsampling methods, and priorities for that particular time and area. This information is also sent to observers via a formal memo that is available on the NEFOP website for reference. Within 24 hours of an access area trip landing, trip and catch data including the weights of yellowtail flounder kept and discarded and weights of scallop meat (kept) are uploaded via a hand-held computer and transmitted electronically via a secure website to the Northeast Fisheries Science Center. These data are reviewed the same day that they are uploaded, and checked for outliers. The data are compared to the Vessel Monitoring System (VMS) data to ensure that both the observer and the captain have documented and declared the same VMS codes. Yellowtail flounder catches are reviewed, and trips that have high catches (greater than 10 lbs) are flagged for further and immediate review. The preliminary data are sent electronically to the NERO within 12 hours of the observer upload. The trip data (paper logs) are sent by the observer to the NEFSC within 72 hours of the trip landing and are then compared to the uploaded data. Additionally, the scallop and yellowtail flounder catch weights are reviewed for transcription or calculation errors, and trends in catch rates. Reports to the NERO indicate preliminary unchecked data and preliminary checked data with a distinct font color.

NEFOP Website Reporting

Website reporting of observer summaries began in July 2007 with the opening of the Nantucket Lightship and Closed Area I access areas (<http://www.nefsc.noaa.gov/femad/fsb/>). The NEFOP website includes summaries of predicted effort, assigned and achieved coverage rates, and number of trips accomplished by access area (including open area limited access effort). These reports are used in real-time assessments of observer coverage and to forecast the need for observer placement. During an opening of a scallop access area that has a yellowtail flounder bycatch total allowable catch (TAC), weekly summaries of number of trips, total number of hauls, number of observed hauls, observed yellowtail flounder discards, and kept scallop meat weights are documented. Also posted in 2008 were plots of weekly yellowtail flounder catches by haul, distinguishing limited access and general category trips, to further provide stake-holders with real-time information. In 2008, the 2007 yellowtail catch plots were also posted for comparison between years.

Extrapolation of the Observed Bycatch Data

The estimate of yellowtail flounder discarded in scallop access area fisheries is based on discard rates calculated from the ratio of observer-reported yellowtail flounder discards to scallops kept on observed trips.

For the first 35 days of the fishery, all observed trips sailing during the 35 days are used to calculate the discard rate. The discard rate used is the sum of the observer-reported yellowtail flounder discards on the trips divided by the sum of the observer-reported scallops kept on the trips. The 35 day period is intended to include enough observed trips to provide a reliable discard rate estimate while taking into account potential monthly seasonal changes in the rate.

After the first the 35 days, a rolling discard rate is calculated. Each day, any new observed trips sailing that day are added and observed trips sailing 36 days previous are dropped. Then yellowtail flounder discards are summed and divided by scallops kept for all observed trips sailing during the previous 35 day rolling period to estimate a discard rate for that day. Again the 35 day period is intended to include enough observed trips to provide a reliable discard rate estimate while taking into account potential monthly seasonal changes in the rate.

Different discard rates are calculated for different scallop access areas including Nantucket Lightship, Closed Area 1 Access Area, etc. For each area there are two rates calculated, one for limited access trips and one for general category trips. The limited access and general category discard rates are multiplied by their respective scallop landings as reported daily through VMS catch reports for the scallop access areas to estimate total yellowtail discards.

The above calculations use scallops landed in meat weights and yellowtail flounder in live (round) weight. The discard rate is the live weight of yellowtail flounder discards divided by the meat weight of scallops kept, which is then multiplied by meat weight of access area scallops kept as reported on VMS catch reports to result in estimated live weight of yellowtail flounder discards of the scallop fleet in the access area.

VMS-reported scallops kept differ slightly from dealer-reported scallops landed. Dealer reports are considered the more reliable measure of fleet scallop landings since they are weighed and the dealer data are audited. To convert VMS to dealer-reported scallop landings, the previous year's access area scallop trips in the two systems were linked and the ratio of the sum of dealer scallop landings to the sum of VMS scallops kept was calculated. This is the ratio used to convert VMS-reported scallops kept to dealer-reported scallops landed on access area scallop trips. The yellowtail flounder discard rate is applied to dealer-equivalent scallops landed after conversion from VMS-reported scallops kept. This results in an estimate of access area yellowtail flounder discards in dealer-equivalent live weight. Based on fishing year 2006 trips this dealer-to-VMS scallop ratio was 1.01 for limited access scallop landings and 1.00 for general category scallop landings on access area trips.

Yellowtail flounder kept on access area scallop trips also contributes to the access area yellowtail catch TAC. Scallop trips in the access areas report yellowtail flounder kept daily in a similar manner to northeast multispecies trips into the U.S./Canada Management Area. These VMS-reported yellowtail kept amounts are then converted to dealer-equivalent live weight using the same dealer-to-VMS ratio as for northeast multispecies trips. The conversion was calculated in the same manner as for scallops kept described above; the previous year's northeast multispecies VMS catch reports of yellowtail flounder kept were linked to dealer reports and the ratio of the sum of dealer yellowtail flounder landed (in live weight) to the sum of VMS-reported yellowtail flounder kept was calculated. This results in an estimate of yellowtail flounder kept in dealer-

equivalent live weight. Based on fishing year 2006 trips this dealer-to-VMS yellowtail flounder ratio was 1.07 for northeast multispecies trips and this conversion was applied to VMS-reported yellowtail flounder kept on scallop access area trips.

For 2008 in Nantucket Lightship, the first 35 day discard rate for limited access trips was approximately 1.3%. The daily rate ranged from 1.1% to 1.5% through the closure of the fishery on Aug. 4, 2008. This discard rate times approximately 4.7 million lbs of dealer-equivalent scallop landings resulted in approximately 60,500 lb of estimated yellowtail discards from limited access trips. The general category discard rate for the first 35 days was about 0.6%. The rate ranged from 0.6% to 0.8% through the closure of the fishery. This discard rate times approximately 161,000 lbs. of dealer-equivalent scallop landings resulted in approximately 1,070 lbs. of estimated yellowtail discards from general category trips. All trips reported keeping 1,166 lbs. of dealer-equivalent live weight of yellowtail flounder.

Impact of Outliers on the Final Estimate

Observed bycatch data are assumed to be representative of the fleet as a whole. If one out of ten observed trips shows an exceptionally large discard of yellowtail flounder, then it is assumed that one out of ten fleet trips discards this much yellowtail flounder. The discard rate calculated by dividing the sum of yellowtail flounder discards by the sum of scallops kept on observed trips is assumed to be a point estimate of the fleet's yellowtail flounder discard rate.

When FSO notices an exceptional observed trip, they call it to the attention of the observer program for possible review.

FSO has not undertaken a full sensitivity analysis of individual observed trips on the estimated fleet yellowtail flounder discards. However a summary of the impact of individual trips on the 2006 Closed Area II Access Area yellowtail flounder discard estimate was presented to the Scallop Committee on September 13, 2006 (Figure 1). It showed the impact on the discard estimate of removing individual observed trips from the discard rate calculation for each of the 39 limited access scallop observed trips. On average each trip changed the percent of TAC achieved by 2.26% either higher or lower. The standard deviation of percent of TAC changes was 3.17%. For 2008 in Nantucket Lightship there were 35 limited access observed trips used in the discard rate calculation.

Potential Effects of Observer Presence and Yellowtail Flounder Bycatch on Fishing Behavior

If vessel operators systematically change their fishing behavior, effort, and location when observers are onboard, data recorded on observed trips will not be representative of the fishery as a whole. When "observer bias" or the "observer effect" occurs, the catch and bycatch rates of observed trips would deviate from the true typical rates. This is not a desirable effect and one of the most difficult forms of bias to test for. The program tries to minimize the probability of occurrence by using random selection techniques while maximizing coverage of the full fleet, and is further exploring methods to test for observer bias.

Based on industry-funded scallop observer program data, lengths of observed trips were different from lengths of unobserved trips in some areas. (Figure 2). From 2006 to 2008, trips with an observer on board in the Elephant Trunk, Closed Area I, and Nantucket Lightship access areas tended to be longer. In contrast, trips with an observer on board in the Hudson Canyon access area tended to be shorter. Smaller sized scallops found in the Hudson Canyon area may have led to lower catch rates, and so set-aside compensation may not have been attainable to offset the costs of taking an observer in that area. There were no significant differences detected in the yellowtail flounder bycatch rate in relation to the trip length, however. (Figure 3). The absence of significant differences in yellowtail flounder bycatch rates as a function of trip length implies that the overall estimate of yellowtail flounder is unaffected by the reduced average trip length on observed vessels.

The movement of vessels in response to yellowtail flounder catches in the Nantucket Lightship access area was also analyzed (Figure 4). It was hypothesized that scallop vessels would change their fishing location due to yellowtail flounder bycatch, but the hypothesis was not supported by observer data. Distances between tows (end of one tow to beginning of the next) typically ranged between 0 and 3 nautical miles, but did not systematically change depending on the amount of yellowtail bycatch.

The locations of high yellowtail flounder bycatch were then mapped in comparison to locations of high scallop catches (Figure 5). A region of high yellowtail flounder catch was identified in the central part of the Nantucket Lightship access area, generally between the 60m and 70m depth contour lines. This region corresponded to an area of medium to low scallop catch, and was consistent from 2006 - 2008. Vessels with Limited Access permits were more likely to fish in this region, whereas most vessels with General Category permits fished to the northwest (Figure 6). There was no indication that scallop sizes were larger in this region than in the rest of the access area. It is hypothesized that if scallop trips were to avoid this region, the yellowtail flounder catch might significantly decrease without significant changes to overall scallop catches.

Figure 1. Sensitivity Summary. Impact of observer reports on FY06 Closed Area II Limited Access estimated yellowtail discards: 475,460 lb dealer-equivalent weight, 106% of TAC.

Trip Date Sailed	Trip Discard Ratio	Estimated YT Discarded Without Trip (lb)	Difference in Estimated YT Discarded (lb)	Estimated YT % of TAC Without Trip	Difference in Estimated % of TAC
6/15/2006	0.009	478,066	2,607	107%	0.58%
6/15/2006	0.021	475,038	-421	106%	-0.09%
6/15/2006	0.029	472,942	-2,517	106%	-0.56%
6/17/2006	0.006	477,395	1,935	107%	0.43%
6/18/2006	0.052	467,341	-8,119	104%	-1.82%
6/19/2006	0.002	483,486	8,026	108%	1.79%
6/21/2006	0.006	482,403	6,943	108%	1.55%
7/1/2006	0.023	478,474	3,014	107%	0.67%
7/1/2006	0.042	465,432	-10,027	104%	-2.24%
7/7/2006	0.028	475,152	-307	106%	-0.07%
7/13/2006	0.008	496,428	20,968	111%	4.69%
7/24/2006	0.072	463,909	-11,551	104%	-2.58%
7/24/2006	0.073	449,697	-25,762	101%	-5.76%
7/24/2006	0.035	476,025	566	106%	0.13%
7/25/2006	0.036	475,252	-207	106%	-0.05%
7/26/2006	0.018	485,728	10,269	109%	2.30%
8/1/2006	0.001	487,229	11,770	109%	2.63%
8/1/2006	0.135	433,247	-42,213	97%	-9.44%
8/1/2006	0.001	502,136	26,677	112%	5.96%
8/3/2006	0.007	493,415	17,956	110%	4.01%
8/3/2006	0.021	484,121	8,662	108%	1.94%
8/4/2006	0.018	482,995	7,535	108%	1.68%
8/4/2006	0.018	483,903	8,443	108%	1.89%
8/4/2006	0.022	484,781	9,321	108%	2.08%
8/5/2006	0.021	477,253	1,794	107%	0.40%
8/7/2006	0.084	465,822	-9,638	104%	-2.16%
8/8/2006	0.021	484,114	8,654	108%	1.94%
8/16/2006	0.198	447,933	-27,526	100%	-6.15%
8/16/2006	0.080	468,937	-6,523	105%	-1.46%
8/17/2006	0.011	480,757	5,297	107%	1.18%
8/17/2006	0.009	489,398	13,938	109%	3.12%
8/17/2006	0.005	487,485	12,025	109%	2.69%
8/18/2006	0.032	480,571	5,112	107%	1.14%
8/18/2006	0.071	471,796	-3,664	105%	-0.82%
8/19/2006	0.035	478,212	2,752	107%	0.62%
8/21/2006	0.012	480,281	4,822	107%	1.08%
8/21/2006	0.308	441,068	-34,391	99%	-7.69%
8/26/2006	0.199	462,913	-12,546	104%	-2.81%
8/26/2006	0.055	475,381	-79	106%	-0.02%

Absolute Average: 10,117 2.26%
Standard Deviation: 14,180 3.17%

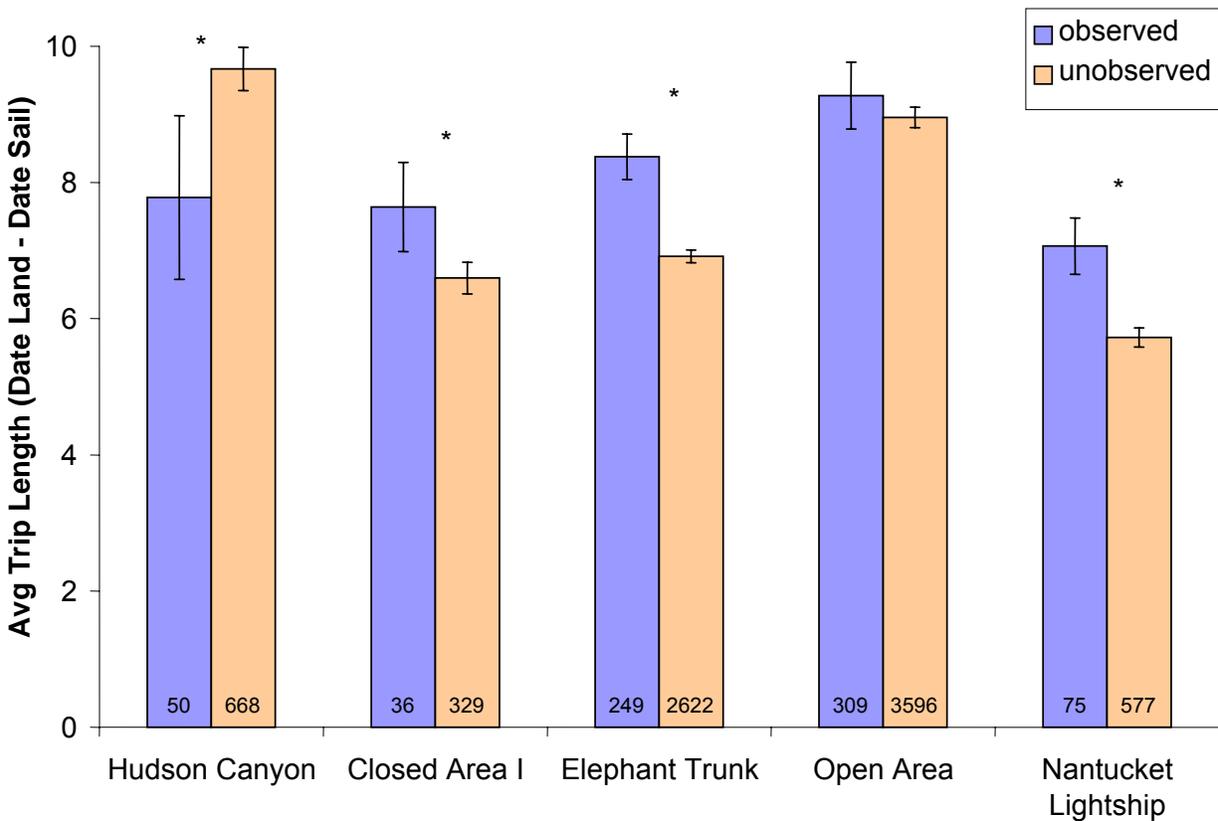


Figure 2. Observer effect on trip length. Only trips on vessels with Limited Access permits between 2006 and 2008 are included. Error bars indicate 95% confidence interval about the mean. Small numbers above x-axis indicate number of trips. Asterisks indicate a significant difference between observed and unobserved trip lengths ($p < 0.05$). Differences were analyzed using a two-tailed t-test assuming unequal variances. Hudson Canyon: trips are significantly shorter with an observer ($t = 2.98$, $p = 0.004$); Closed Area I: trips are significantly longer with an observer ($t = 2.95$, $p = 0.005$); Elephant Trunk: trips are significantly longer with an observer ($t = 8.30$, $p < 0.0001$); Open Area: trip lengths are not significantly different ($t = 1.23$, $p = 0.22$); Nantucket Lightship: trips are significantly longer with an observer ($t = 6.01$, $p < 0.0001$). Trip length is defined as number of whole days from date sailed to date landed.

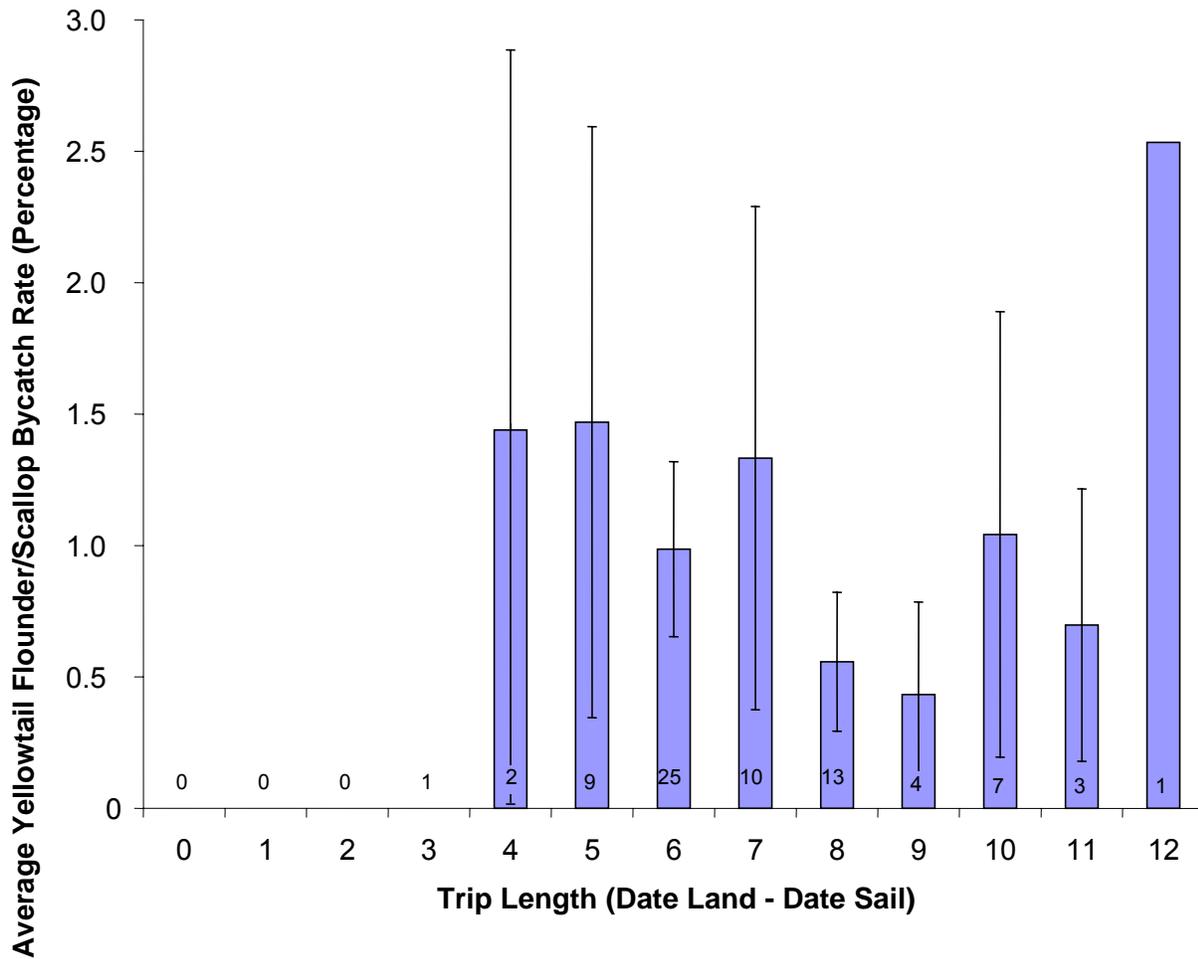


Figure 3. Bycatch rate of yellowtail flounder in the Nantucket Lightship Access Area as a function of trip length. Only trips on vessels with Limited Access permits between 2006 and 2008 are included. Error bars indicate 95% confidence interval about the mean. Small numbers above x-axis indicate number of trips observed. Data were analyzed using a Kruskal-Wallis one-way ANOVA, which indicated no significant relationship between trip length and bycatch rate ($n = 75$, $K = 8.50$, $df = 9$, $p = 0.49$). Trip length is defined as number of whole days from date sailed to date landed. Bycatch rate for each trip is calculated by dividing the total yellowtail flounder live weight by the total scallop meat weight from all the observed tows on a trip (off-watch tows or tows without complete discard information are not included). The bycatch rate is then averaged for all trips with a given trip length.

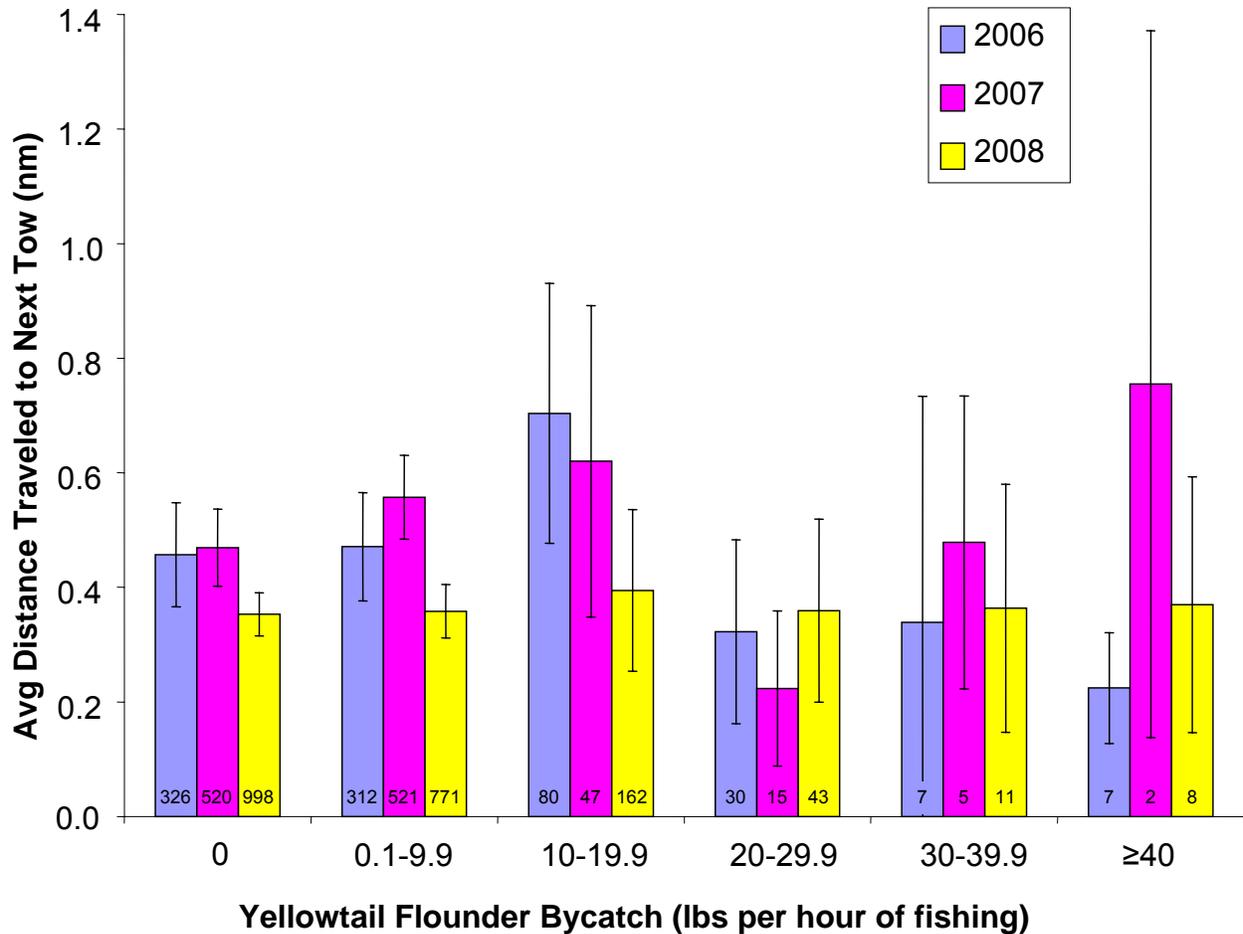


Figure 4. Distance traveled to next tow as a function of yellowtail flounder bycatch, separated by fishing year. Bycatch is calculated as pounds of yellowtail flounder caught divided by fishing duration (haul begin to haul end). Data are from observed trips between 2006 and 2008, and include both General Category and Limited Access vessels. Error bars indicate 95% confidence interval about the mean. Small numbers above x-axis indicate number of tows observed. Data were analyzed using a multivariate ANOVA (factors = year and yellowtail flounder bycatch, binned as above). There was a significant relationship between year and distance traveled ($F = 10.17$, $p < 0.0001$), however there was not a significant relationship between yellowtail flounder bycatch and distance traveled ($F = 1.11$, $p = 0.35$). There was a significant cross effect (year x bycatch, $F = 2.26$, $p = 0.01$), which indicates that the way fishermen react to yellowtail catches changed over the years.

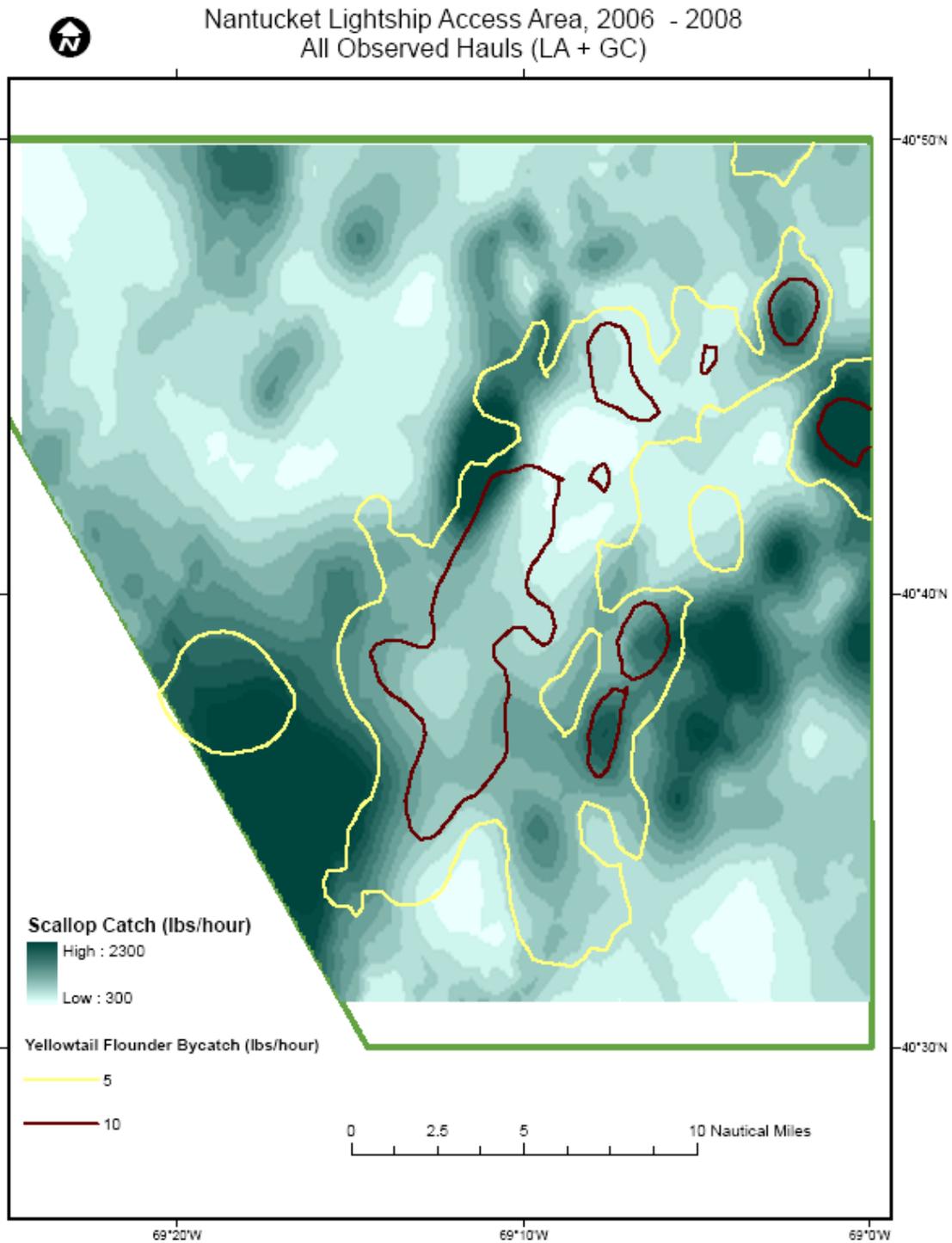


Figure 5. Ordinary kriging analysis was used to show scallop and yellowtail flounder catch rates. Scallop catch rates (pounds per hour of fishing) are shown in green, where darker colors indicates higher catch rates. Areas of high yellowtail flounder bycatch are outlined with solid lines: yellow represents 5 pounds per hour of fishing and red represents 10 pounds per hour of fishing. Blue dashed lines indicate bottom depth contours, in meters. All hauls observed between 2006 and 2008 are included. Maps were created in ArcGIS 9.3 using a spherical model with a major range of 0.096° . 10 hauls are used to calculate average catch rates.



Nantucket Lightship Access Area, 2006 - 2008

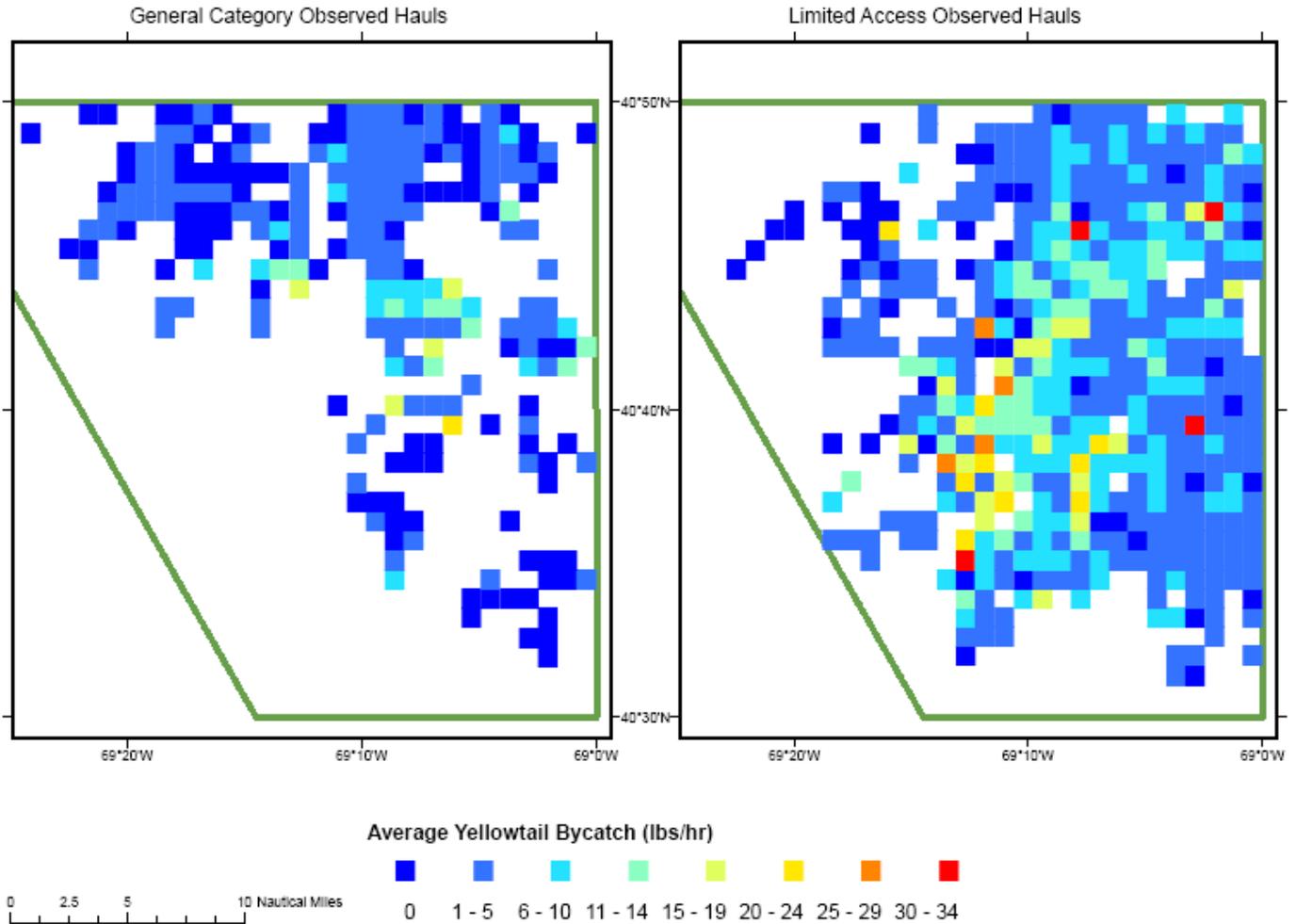


Figure 6. Average yellowtail flounder bycatch rates by permit category. Bycatch rates (pounds per hour of fishing) were averaged over small areas (approximately 30" latitude x 50" longitude). Blue represents low bycatch while red represents high bycatch. All hauls observed between 2006 and 2008 are included. Maps were created in ArcGIS 9.3.