1.0 FLATFISH BYCATCH SAVINGS

1.1 Background

The Council has identified the creation and modification of flatfish accountability measures as a 2017 work priority. Currently, the scallop fishery has sub-ACLs and AMs in place for three flatfish stocks managed through the groundfish FMP: Georges Bank yellowtail, SNE/MA yellowtail, and Southern windowpane flounder. The Council has recommended that a scallop sub-ACL for Northern windowpane be established through Framework 56 to the Northeast Multispecies FMP, with the development of accountability measures for this stock in the next available scallop action. Existing scallop fishery AMs vary by permit category and gear type. The Scallop AP, Committee, and full Council have expressed interest in redesigning the AMs for GB yellowtail flounder and SNE/MA yellowtail flounder to make AMs as consistent to the extent feasible with gear modification AMs for southern windowpane flounder (Council Motion #4a, June 22, 2016). The Scallop Committee reaffirmed its interest in exploring the use of gear modifications at its March 30, 2017 meeting in Providence, Rhode Island.

The Scallop PDT has explored spatial and temporal trends of bycatch interactions by the scallop fleet with the ultimate goal of identifying appropriate times and locations where the use of a gear restricted area (GRA) would be most impactful on bycatch reduction and least impactful on scallop fishery operations. To date, the time and location of bycatch interactions by the scallop fleet have been described in terms of observed d/K values (ratio of discarded flatfish to the weight of kept scallops); previous d/K analysis presented to the PDT investigated the identification of bycatch 'hotspots' that could be candidate areas for a GRA at both the ten-minute square and statistical reporting area (SRA) level.

While the PDT has acknowledged the utility of identifying monthly bycatch 'hotspots', it has also noted that high observed d/K values do not necessarily reflect a time and place where the level of fishing would be impactful to the flatfish sub-ACLs in place for the scallop fleet. For example, the observed Georges Bank yellowtail and N. windowpane d/K ratios are relatively high in February, but the proportion of scallop landings from the open portion of GB are relatively small at this time of year (Figure 3). Therefore, though bycatch rates are relatively high, the estimated weight of flatfish caught by the scallop fleet in February is fairly low because it is proportional to the landings during that month. Additionally, in light of practicality and enforceability constraints of implementing a GRA at the ten-minute square or statistical reporting area level, the PDT has directed AM development towards the broad stock level (i.e. Georges Bank, Southern New England/Mid-Atlantic).

The PDT discussed the time series of observer data being used to estimate monthly d/K ratios (2006-2016), and noted that management strategy and variation in the status of flatfish stocks may impact bycatch in the scallop fishery, particularly for yellowtail flounder. Identifying a time series of observer data that is representative of recent management and flatfish stock status is important in the development of accountability measures.

The following points summarize the PDT's recommended scope of AM development (from June 18, 2017 meeting):

1. Focus on applying the 5-row apron with 1.5:1 hanging ratio as gear modification for AM.
2. Use the GRA "savings" values from the 2012 CFF study comparing 5-row apron to 8-row apron and 1.5:1 hanging ratio as upper bound of gear modification savings.
3. For Northern windowpane and GB yellowtail, apply GRA starting with the GB yellowtail broad stock area (SRA 522, 525, 561, 562).
4. For SNE yellowtail, focus on areas west of 71°W (same a Southern Windowpane AMs area).
    a. Consider the range of SNE YT – what is the southern extent of its range?
5. Focus on open area (not access area) for GRAs.
6. All bycatch of GB YT in FY 2017 is coming from CAII. Consider a delay in the opening as reactive AM (time/area closure).
7. As a starting point, consider prohibiting trawl gear in certain areas.

The methods described below are outlined in two sections: section 1.2 details the approach taken to identify years of observer data which are most representative of recent management and bycatch interactions by the scallop fleet; and section 1.3 explains how observer and dealer data were used to estimate the bycatch savings gained using a GRA consistent with the current S. windowpane AM (5-row apron).

1.2 Normalized monthly d/K, GB yellowtail and N. windowpane

Observed hauls from open-area trips within the GB yellowtail stock area (SRAs 562, 561, 522, and 525) were compiled by month and year across the time series (FY2007-2016). For each month of each year, flatfish d/K values were calculated using:

$$\frac{d}{K}$$

Where d = observed weight of discarded and kept flatfish (lbs) and K = observed weight of kept scallops (lbs). Previous examples referred to K as the dressed weight of kept scallops. Here, to be consistent with d/K methods employed by GARFO and NEFSC, K refers to the round weight of kept scallops.

Monthly d/K values were then scaled using the z-score standardization approach:

$$z = \frac{(x - \mu)}{\sigma}$$

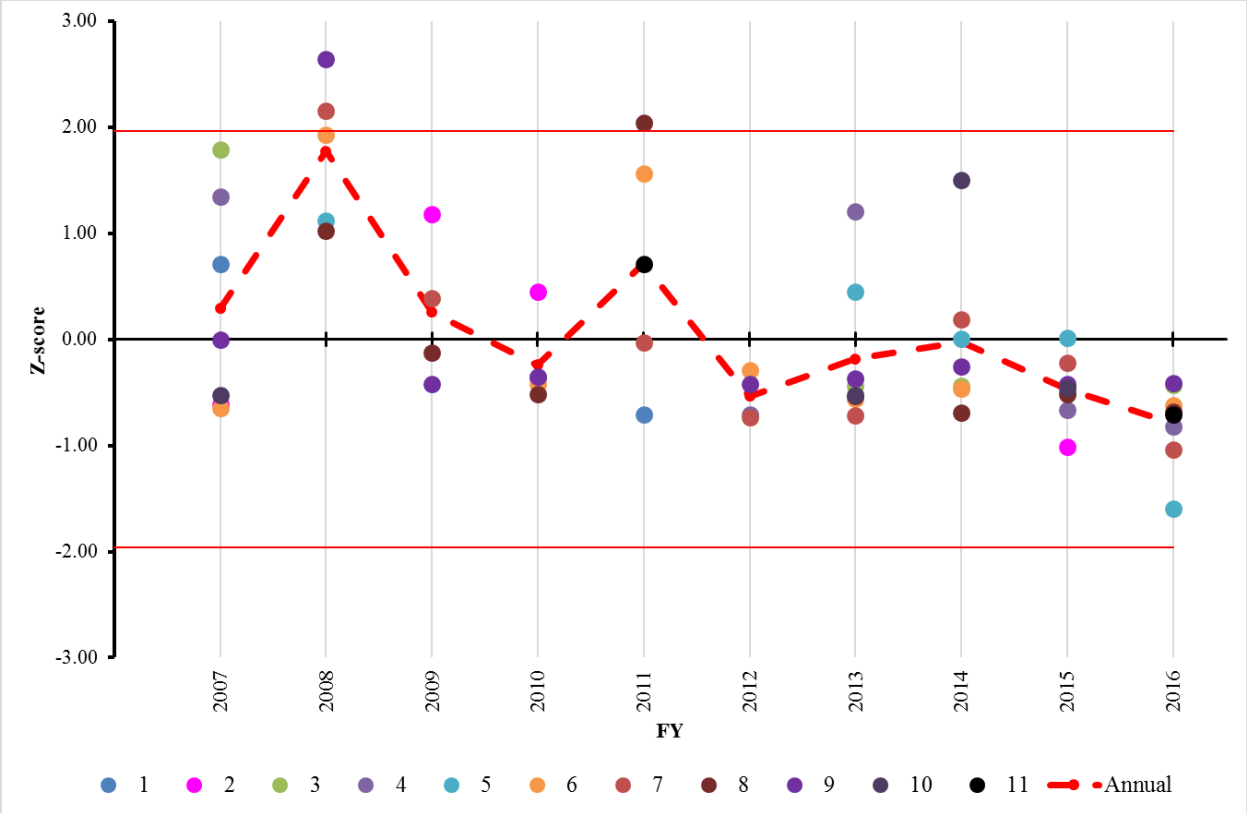
Where x is the monthly d/K value (i.e. September 2008), μ is the sample mean d/K value for a given month across all years of data (i.e. mean d/K of September 2007-2016), and σ is the sample standard deviation.

Figure 1 shows monthly z-scores plotted with the annual average z-score for GB yellowtail; the points are individual z-scores that are color coded to month and the red dashed line shows the annual average z-score. The horizontal red lines represent the critical value of statistical significance for a two-tailed Z-test at $\alpha = 0.05$ ($y = \pm 1.96$). Therefore, points on the figure that are ≤ -1.96 or ≥ 1.96 are considered significantly higher or lower than the mean for a given month across the time series. For example, the z-score for September 2008, 2.64, was greater

than the upper critical value; this means that the d/K value for September 2008 was significantly greater than the mean d/K value for September 2007-2016.

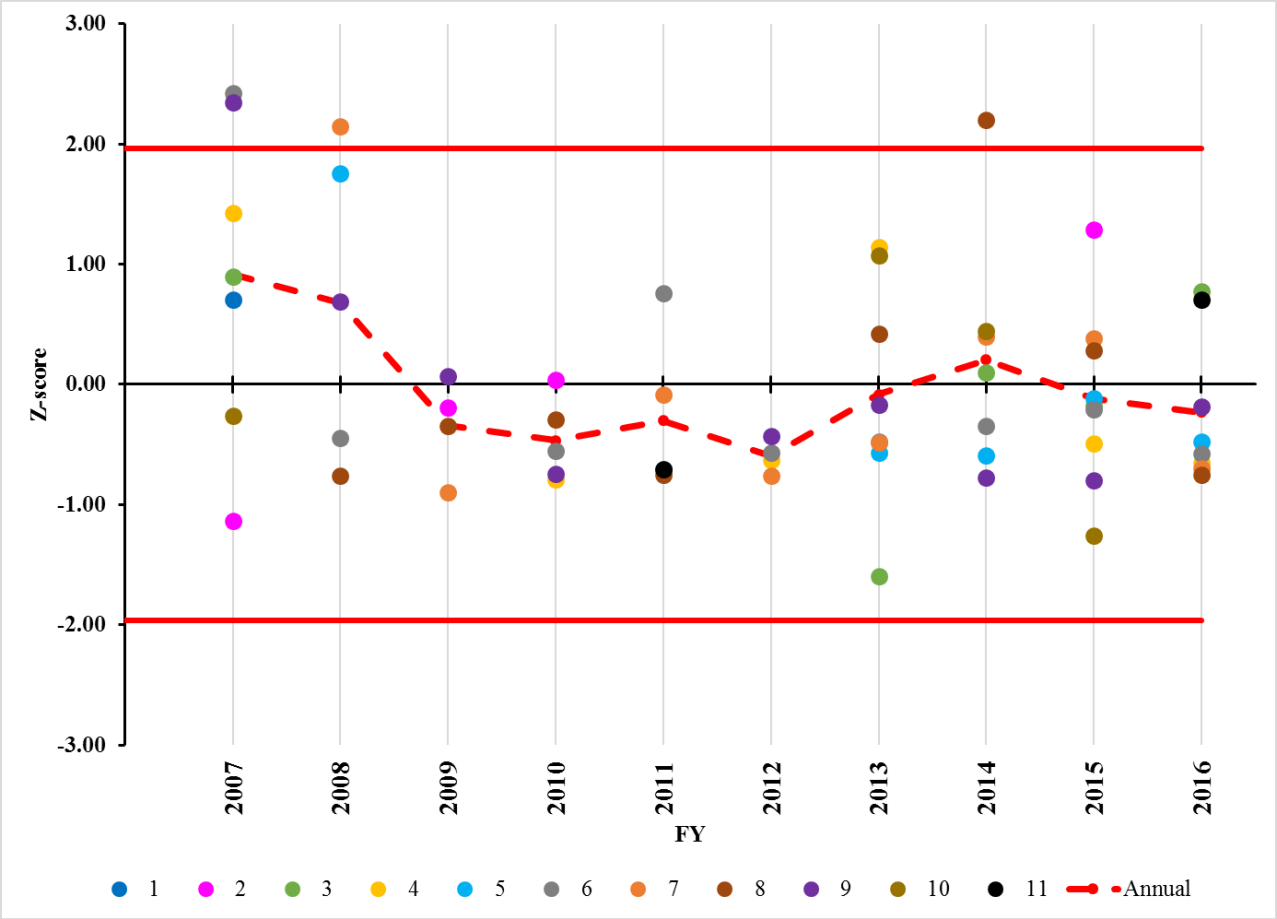
The methods described above were also used for Northern windowpane[1], and are displayed in Figure 2.

Figure 1. Monthly z-scores of GB yellowtail d/K. The dashed red line is the annual average. The horizonal red lines are the critical values of significance for a two-tailed Z-test at α = 0.05 (± 1.96).



[1] Though the Northern windowpane stock area expands beyond SRAs 562, 561, 522, and 525, d/K analysis for Northern windowpane was limited to these SRAs to be consistent with the GB yellowtail stock area.

Figure 2. Monthly z-scores of Northern windowpane d/K. The dashed red line is the annual average. The horizonal red lines are the critical values of significance for a two-tailed Z-test at α = 0.05 (± 1.96).



Normalizing observed monthly d/K values in this manner is useful because it 1) highlights annual trends across the time series (which would have been hidden in previous analysis because data were aggregated from 2006-2016), and 2) provides a visual aid for identifying the extent of observer data which best characterizes current bycatch interactions by the scallop fleet. Figure 1 and Figure 2 suggest GB yellowtail and N. windowpane followed very different annual trends from 2007 to 2011; GB yellowtail z-scores seem to fluctuate sharply during this time while N. windowpane z-scores decrease. Furthermore, monthly z-scores deviated farther from the annual average and the majority of outliers (points $\leq$ -1.96 or $\geq$ 1.96) were evident during this time for both GB yellowtail and N. windowpane.

The trends seen from 2012 to 2016 seem to be similar for both GB yellowtail and N. windowpane; the annual average gradually inclines from 2012 to 2014 and then decreases gradually from 2014 to 2016. Additionally, only one outlier is evident for both stocks during this time (N. windowpane, October 2014). Because of the same general trend and lack of outliers between 2012 and 2016, aggregating available fishery data (i.e. observer and dealer landings) from this time on a monthly basis would best characterize expected bycatch interactions by the scallop fleet in the near future.

1.3 Bycatch savings calculation

A combination of haul level observer data and reported dealer landings from 2012-2016 were used to calculate the upper limit of GB yellowtail and N. windowpane bycatch savings gained by using a GRA in a given month for open-area fishing on Georges Bank. This 'back casting' approach provides the bycatch savings that could have been gained between 2012 and 2016, and assumes these savings values represent the upper limit of what can be expected by using a GRA in the future.

First, observer data and reported dealer landings were aggregated on a monthly basis. Then, the live weight of flatfish discards for each month was estimated by weighting observed d/K values by the dealer reported landings, using the formula[2][3]:

$$\left(\frac{observed\ flatfish\ discards\ and\ kept}{observed\ kept\ all}\right) * \ dealer\ reported\ kept\ all$$

The total weight of flatfish discards was then calculated by summing all monthly flatfish discards. Monthly flatfish discards were then multiplied by the bycatch reduction parameter associated with using a 5-row apron (0.66 for yellowtail, 0.54 for windowpane). Then, bycatch savings gained by using a GRA in a month were calculated by:

$$\frac{total\ \ discards - (discards\ in\ month\ with\ GRA + sum\ of\ \ discards\ in\ months\ without\ GRA)}{total\ weight\ discards}$$

Table 1 and Figure 3 display monthly bycatch savings in relation to the percentage of Georges Bank open-area landings reported in each month.

Points to consider:

- Savings values serve as an upper limit of what could be expected in the future.
- 5-row apron GRA reduces scallop catch by 10%.
- What month (or combination of months) offer(s) the greatest impact on savings and the least impact on fishing behavior?
    - Ex: GRA in April would reduce the overall N. windowpane bycatch by ~9% while impacting only ~6% of overall landings vs. GRA in May would reduce N. windowpane bycatch by ~12% while impacting ~20% of overall landings.

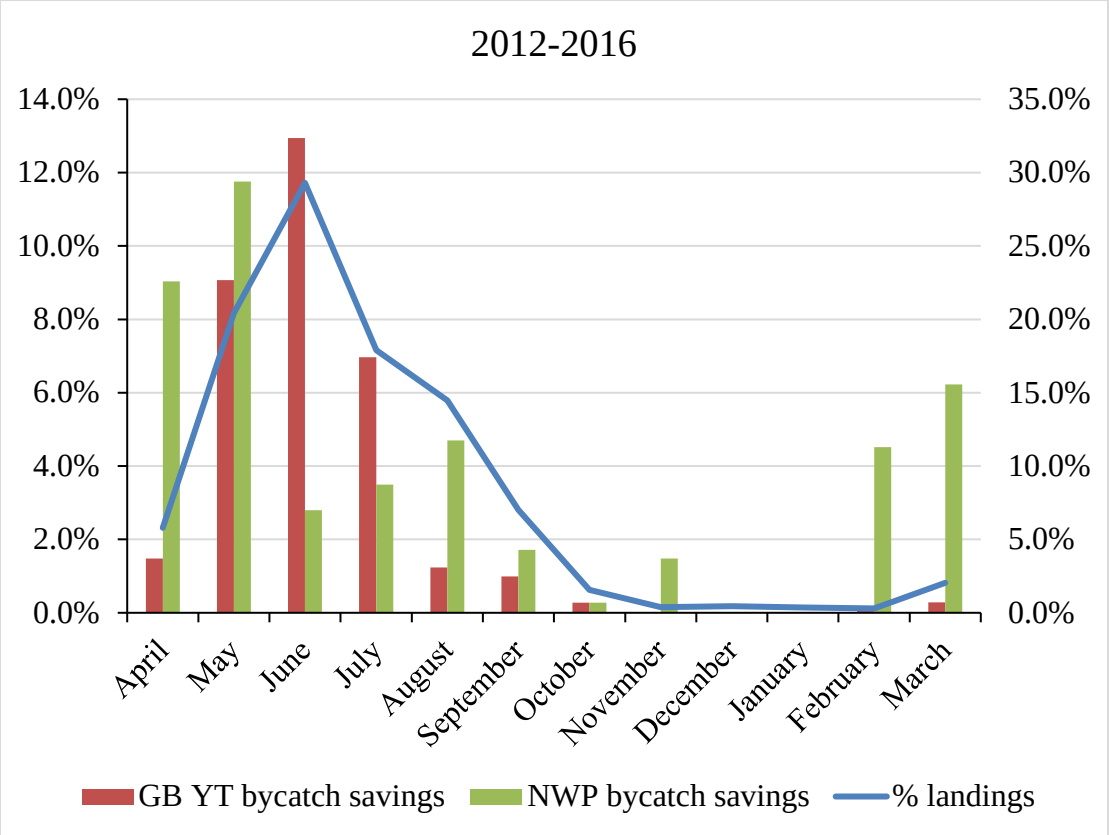
[2] This is a modified version of the formula used by GARFO staff to monitor flatfish discards by the scallop fleet in-season (methods can be seen here).

[3] 'Observed kept all' included only scallops while 'dealer reported kept all' included all landed species. This will likely have minimal impact on calculations because approximately 99% of 'dealer reported kept all' were scallops.

Table 1. GB yellowtail and N. windowpane bycatch savings gained by using a 5-row apron in a month for GB open-area fishing. The percentage of landings from GB open-area fishing in each month is given in the first column. Fishery data used were from 2012-2016.

Month	% landings	GB YT bycatch savings	NWP bycatch savings
April	5.8%	1.5%	9.0%
May	20.4%	9.1%	11.8%
June	29.3%	12.9%	2.8%
July	17.9%	7.0%	3.5%
August	14.5%	1.2%	4.7%
September	7.0%	1.0%	1.7%
October	1.6%	0.3%	0.3%
November	0.4%	0.0%	1.5%
December	0.4%	0.0%	0.0%
January	0.4%	0.0%	0.0%
February	0.3%	0.1%	4.5%
March	2.0%	0.3%	6.2%

Figure 3. GB yellowtail and N. windowpane bycatch savings gained by using a 5-row apron in a month for GB open-area fishing. Bycatch savings are shown on the primary axis and the percentage of landings in a month are shown on the secondary axis.



Closed Area II AA Delayed Opening

The PDT discussed how the majority of GB yellowtail catch so far in FY2017 has come from Closed Area II Access Area (CAII AA). Since such a large proportion of bycatch interactions occur here, it was suggested that a delayed opening to CAII AA could be a candidate reactive AM for GB yellowtail.

Bycatch savings from a delayed opening of CAII AA (Table 2) were calculated by modifying the formula used to previously in this section to:

$$\frac{total\ weight\ of\ discards - weight\ of\ discards\ in\ delayed\ month}{total\ weight\ of\ discards}$$

Note that dealer reported kept all for CA II AA is not available at present. Instead, monthly scallop landings from the GARFO scallop quota monitoring website were used as a proxy. Prior to bycatch savings calculation, reported landings were converted from meat lbs to round weights (meat lbs. x 8.33).

Table 2. GB yellowtail bycatch savings gained from a delayed opening of CAII AA and the monthly proportion of reported landings. Fishery data included are from 2012-2015. Note that the current CAII AA seasonal closure (Aug. 15th – Nov. 15th) was implemented in FY2013.

Month	% landings	GB YT bycatch savings
April	0.6%	0.8%
May	0.8%	0.2%
June	21.3%	9.5%
July	28.7%	14.5%
August	18.5%	18.2%
September	7.4%	29.0%
October	6.1%	9.3%
November	6.9%	6.0%
December	6.8%	6.6%
January	2.2%	5.7%
February	0.5%	0.0%
March	0.3%	0.1%