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MEMORANDUM

DATE: April 15, 2013
TO: Groundfish Oversight Committee
FROM: Groundfish Plan Development Team (PDT)
SUBJECT: **EGB Reporting**

1. The Groundfish PDT held two conference calls to evaluate whether there is evidence of misreporting of cod in the U.S./Canada area. Participating in the calls were Tom Nies and Fiona Hogan (NEFMC), Dan Caless, Sarah Heil, Melissa Hooper, and Michael Ruccio (NMFS NERO), Chad Demarest and Paul Nitschke (NMFS NEFSC), Sally Sherman (Maine DMR), and Steve Correia (Massachusetts DMF). Michael Palmer (NEFSC) also participated.

2. In February, NERO was alerted to possible misreporting of cod in the U.S./Canada area. The concern is that fishermen may be catching cod in the EGB area but reporting it as WGB cod. NERO asked the PDT to look for evidence that this is occurring; this request was later tasked to the PDT by the Groundfish Committee. Because the EGB cod ACL is low, misreporting fish caught in that area as WGB might help sector vessels avoid a possible closure of the area due to exceeding the sector's ACE. This activity reportedly may have increased as a result of the adoption of sectors. The PDT found this was a difficult question to answer with any certainty because of the limitations in the data. Data that is collected must be used to infer activity that may not be observed or documented. In addition, while some examinations may show a difference in catches between various trip categories, they do not identify a specific reason and there can be multiple explanations that could explain the differences.

Background

3. Recent U.S./Canada quotas for EGB cop have been low, and the quota will decline to less than 100 mt in FY 2013. A summary of recent U.S./Canada quotas and catches is provided below (Table 1). In FY 2013, the total U.S> Quota will decline to 96 mt. Given the low quotas, there may be an incentive to misreport the cod catch by area in order to prevent exceeding a sector's ACE for EGB cod, which would close the area to additional fishing activity. This might prevent a sector from harvesting EGB haddock.

4. A measure in FW 42 specified that all the cod caught on trips that fished any part of the trip in SAs 561 or 562 would be attributed to EGB cod for quota monitoring purposes. The table below applies this approach to the reported kept catches (live weight) on groundfish fishing trips for FY 2009 – 2011 (Table 2). Note that this does not include discards or catches by other fisheries. As can be seen from the table, since FY 2010 there has been an increasing amount of cod that is reported caught in other areas on trips that reported fishing in the EGB area. While on

the surface this trend may appear consistent with misreporting, there may be other reasons as well. With the wide-spread adoption of sectors, differential cod trip limits in the GOM and GB areas, differential DAS in the inshore GOM, and the DAS transit time bonus for fishing only in the EGB area were eliminated, making it more attractive to keep cod from multiple areas on the same fishing trips. The trend is also consistent with the declining EGB cod quotas and (through FY 2012) the stable, or increasing, WGB cod quota.

5. The analyses performed by the PDT (with the assistance of NERO and Mike Palmer of the NEFSC) are listed below. Each will be briefly discussed in this memo.

a. An analysis of catch by area using VTR reported positions, VMS-positions, and observer reported positions to allocate catches to area. Only trawl trips that could be matched to all three data sources were used.
b. An analysis of catch by area using VTR reported positions and VMS reported positions to allocate catches to area. All trawl trips that could be matched to a VTR and VMS were used.
c. Trends in reported catches by area, as determined by the VTR, to determine if there have been obvious changes in reported fishing activity by area.
d. Trends in reported catches by area on observed trips, to determine if there have been obvious changes in reported fishing activity by area on observed trips.
e. Observer coverage by area, to determine if there is evidence that vessels do not fish in the EGB area when an observer is onboard.
f. Frequency of reported fishing activity in the EGB and WGB area on observed and unobserved trips, as a second examination of whether there is evidence vessels do not fish in the EGB area when an observer is onboard.
g. Reported catches on observed and unobserved trips to the U.S./CA area, to determine if there is evidence of different behavior on those trips.
h. Catch rates of cod and haddock on observed trips in the U.S./CA area, to investigate whether different catch rates between the WGB and EGB area might be an additional incentive to misreport cod catches.
i. For observed trips, the statistical area for the starting and ending locations of trawl tows catching cod or haddock.
j. For individual permits, a comparison of the frequency of trips to the EGB and WGB areas and the observer coverage in the EGB area.
k. A review of leasing activity for evidence of an incentive to misreport EGB cod.

VTR/VMS/Observer Comparisons

6. For GARM III, Mike Palmer and Susan Wigley of the NEFSC developed a program that compares the allocation of catch to stock area using three different sources for determining the location of the catch: observer data (end of tow), reported VTR position, and an algorithm that categorizes VMS positions as either fishing or no fishing locations, and uses that information to allocate the catch from the trip to stock area. These tools have been used in several assessments to verify the accuracy of the VTR stock allocation method that is typically used to assign catches to stock area. At the request of the PDT, Mike expanded his analyses to compare the allocation of cod to the GOM, EGB, and WGB stock areas. His full report is attached and is not described further in this memorandum (enclosure (1)).

7. There are a few nuances of the analyses that are worth noting that were further explored by the PDT. In the VMS algorithm the catch of the trip is assigned to stock area based on the time spent fishing in the area, and this assumes that catches rates do not differ between areas. Second, the comparison of the VMS to observer data can only be done for trips that the VTR attributes to bottom otter trawl gear, because many trips that are observed using the Ruhle or separator trawl do not accurately record this on the VTR. These two factors could introduce errors in the VMS catch allocations.

8. The author of the paper noted that while there are differences between the VTR and VMS allocation approaches, given their comparative performance relative to the observer-based allocation and other analyses conducted that there was no concrete evidence to state that "gross misreporting of EGB cod is occurring". Some PDT members, however, were troubled by the trend in the differences between the methods. If the differences are compared over time, there is an increasing difference in the EGB area where the VTR allocation is smaller than the VMS allocation (Figure 1). Interpreting these differences is difficult. It could be because the assumption that catch rates do not differ between areas is no longer valid (for example, because vessels incorrectly report using bottom otter trawls in the EGB area when in fact they are using selective trawls). Interpretation is also problematic because the analyses showed that on observed trips the VTR allocation more closely matched the observer allocation, suggesting that the VTR approach may be a better method than the VMS. Alternatively, it could be that VTRs are more accurately completed on observed trips, though analyses in the paper suggest this is not the case.

VTR and Observer Trip Distribution

9. The PDT speculated that if misreporting is occurring and the frequency of misreporting has increased over time, it may be manifested in changes in the reported spatial distribution of trips. Further, presumably there may be differences in the distribution of VTR trips when compared to the distribution of observed trips if vessels were to stop fishing in the EGB area when carrying an observer. Two data sources were examined for evidence that his has occurred: VTR and observer data. Several different analytic techniques were used. In this discussion, a sub-trip is the part of a trip that occurred in a defined area; a trip that fished in two different areas would generate two sub-trips, for example.

10. The distribution of observer coverage is shown in **Table 3**for sub-trips that reported keeping cod, haddock, or yellowtail flounder. The coverage rate on trips that reported keeping cod or haddock increased from FY 2010 to FY 2011.While there are differences between areas and years, there does not seem to be a consistent indication that observer coverage is lower in the EGB area.

11. The first analytic approach compared the distribution of reported fishing locations on groundfish fishing trips by statistical area. The number of trips, and reported kept catches of cod by area were graphed for the years 2008 through 2012. Only trips that reported keeping cod were included. The analyses are in enclosure (enclosure (2)). The observed and total number of sub-trips keeping cod from the U.S./Canada area do not show large changes in distribution over this four year period, with the exception of 2010 when there was a decline in SA 561. In FY 2011, the percentage increased back to levels seen in the first two years examined.

12. A second analytic approach examined the reported fishing locations for groundfish fishing trips as recorded in the DMIS database to determine if there were differences in reported

locations between observed and unobserved trips. This was done for trips that reported keeping cod, haddock, yellowtail flounder, or winter flounder (enclosure (3)). The analysis was performed in two ways: first, all sub-trips were analyzed that fished in either or both the WGB and EGB areas; second, only trips that fished in both areas were analyzed by area.

13. When all trips are examined, the results show that there are statistically significant differences in the areas where YTF was reported kept in both years and areas when using bottom otter trawls, and in both years in the EGB area when using a separator trawl. Cod differences are noted in the EGB area in FY 2011 when using a bottom trawl, and in WGB in FY 2011 when using a separator trawl. When only trips that fished in both areas are examined there are fewer differences noted. In EGB using a bottom trawl, differences are noted for cod in FY 2011 and YTF in 2010. When using a separator trawl, differences are noted in the EGB for YTF in FY 2010 and winter flounder in 2011. These analyses suggest that the differences are more common for YTF rather than cod.

14. The PDT next analyzed whether the reported kept catch differed between observed and unobserved trips within a year/gear/area combination (enclosure (4)). For this analysis a non-parametric Kruskal-Wallis test was used to test for significant differences in the reported kept catches of cod or haddock. The test was run two ways – for all trip sin the area, and for only those trips that reported keeping cod. For all trips using bottom trawls, differences were noted for haddock in the WGB area in FY 2010 and FY 2011, and for cod in the EGB area in FY 2011. For trips using the separator trawl, differences were noted in the WGB area in 2011 for haddock and in the EGB area in FY 2011 for cod. For only those trips that kept cod, differences were noted in the WGB area in FY 2010 and FY 2011 for cod when using a bottom trawl, and in the WGB area in FY 2011 for cod when using a separator trawl.

15. The PDT found it difficult to interpret these results. There would seem to be little incentive to misreport GB haddock, yet differences between observed and unobserved trips were noted in some analyses. The differences detected for kept cod when using bottom otter trawls in the EGB area in FY 2011 would be consistent with the misreporting hypothesis but a definitive reason for the differences cannot be assigned.

Catch Rates on Observed Trips

16. If catch rates between areas are different it could explain why the VMS allocation algorithm did not perform as well as the VTR allocation approach. It may also provide evidence that there may be incentives for misreporting (in addition to low quotas). This was examined by comparing catch rates through the use of box plots (enclosure (5)). For the calendar years 2010 – 2012, observed catches per tow and catch per hour were plotted for cod and haddock, by stat area and by gear. The ratio of haddock to cod was also plotted. This was done for bottom otter trawls and separator trawls.

17. The results were mixed, and in all cases there was considerable overlap in the distribution of the data. For bottom otter trawls, in 2010 and 2012 the catches per tow and catches per hour of cod were similar in SA 522 and SA 561, while in 2011 the catches per tow and per hour were lower in SA 522 than SA 525. The catches of haddock per tow and haddock per hour were higher in SA 561 than in SA 522 in 2010 and 2011, but were similar in 2012. For observed separator trawl tows, cod catches per tow were lower in SA 561 than in SA 522 in 2010, slightly higher in 2011, and lower again in 2012, while catches per hour were similar in all three years.

For separator trawls, the catches of haddock per tow and haddock per hour seem to vary from year to year. For bottom otter trawls, the ratio of haddock to cod was higher in SA 525 than in SA 561 in all three years, while for separator trawls it was lower in 2010 and 2011.

18. These results indicate that the assumption of constant cod catch rates across statistical areas that is used in the VMS allocation algorithm may not be valid in all cases. With respect to SA 561 and 522, the two areas that produce most of the kept cod from the US/CA area, the cod catch/tow or catch/hour vary from year to year but the distribution shows considerable overlap. Cod catches/tow and catch/hour in SA 525 and 562, however, often are lower than in the other two areas and depending on the distribution of fishing effort may cause errors in the VMS allocation algorithm. There is a suggestion in the data that the differences between 525/562 and 525/561 increased between 2010 and later years.

Observed Tow Start and Ending Locations

19. Another possible explanation for differences between the VTR and VMS allocation methods would be if fishermen modified the way they reported the area fished when completing VTRs. There is some evidence this may have occurred. After sectors were initiated, fishermen realized that observers used the ending tow location to determine the statistical area fished. Many fishermen began using the same criteria on their VTRs, even though this is not consistent with the published VTR directions. Observed trawl trips (otter trawl, separator trawl, and Ruhle trawl combined) were examined to compare the statistical area for starting and ending tow locations. There is evidence that the percent of observed tows that start and end in SA 561 or 562 has declined from 2008 to 2012, while in SA 522 and SA 525 it has remained relatively constant (Figure 2).

20. An additional analysis that used observer data examined whether more tows are straddling the boundary between the EGB and WGB areas. The starting and ending tow locations for each tow were plotted, the distance measured between the tow was calculated, and then the portion of each tow in the EGB or WGB areas was determined. While it should be clear that tows are not in straight lines, this approach uses the observer data to approximate the length of the tow. If anything, this likely is biased low, as any deviations for a straight line would result in a longer estimate of tow length. Since the observer records the ending location at the statistical area for the tow, the cod catch on these observed trips can be allocated two ways: based on the ending location, or based on the proportion of the tow length each area. This analysis suggests a change in 2012, with the result that attributing the catch based on the end of the tow results in lower estimate that allocating the catch based on the length of the tow in the EGB area.

21. These results may partially explain the differences between the VTR/VMS/observer allocation methods, and may explain why the observer and VTR methods are more similar in recent years. The magnitude, however, does not seem large enough to fully account for the allocation method differences.

ACE Lease Activity

22. One incentive for misreporting EGB cod would be to take advantage of differential ACE leasing prices between EGB and WGB cod by reporting fishing in the area with the lower ACE lease value. This was examined through modeling the ACE leasing market (enclosure (6)). EGB cod lease prices have increased during the period FY 2010 – 2012, while WGB cod prices have

fallen in half. If the price accurately reflects the importance of having GB east cod for fishing in that area, it may be reasonable to impute an incentive to misreport and avoid that price. However, this does not appear to be exactly what's going on. Overall utilization rates are low for both GB cod stocks, currently at 27% for GB east cod. There's no price squeeze, as volumes are also down of late. The large prices paid earlier in FY12 were for relatively low. The extremely low utilization may in itself be indicative of misreporting, but the lack of binding quota in the east makes quota values an unlikely driver for this.

Observer Activity on Individual Vessels

23. The PDT examined individual vessel fishing activity to determine if there is widespread avoidance of the EGB area when an observer is assigned. For this analysis, the location of fishing activity is based on the VTR. The examination focused on trawl trips and pooled all three bottom trawl gear types together. The bubble plots in Figure 3 provide the comparisons. While there are vessels that took EGB trips without an observer, the number of EGB trips was always less than 10. There does not appear to be a difference between FY 2010 and FY 2011.

Conclusions/Discussion

24. Table 4 summarizes the results of the various analyses. After reviewing the analyses, the PDT concluded that there is some evidence that there are differences in fishing behavior between the EGB and WGB areas, and between observed and unobserved trips. The analyses do not identify a specific cause, and while some of the results may be consistent with the hypothesis that misreporting is occurring, others are not. The PDT concluded that the analyses were inconclusive in determining if misreporting is occurring. It is not possible to quantify the how these differences may affect catch estimates for EGB cod.

25. With the small quotas for EGB cod and the fact that if a sector exceeds its ACE for this stock it may lose opportunities to target GB haddock or other stocks, the incentive to misreport is clear. Misreporting only 20,000 pounds of EGB cod could result in about a 10 percent overage of the EGB cod quota in FY 2013. There are administrative tools that might reduce any intentional or unintentional reporting errors. For example, the VTR directions could be re-emphasized, vessels that do not report fishing in more than one statistical area could be identified and contacted to urge compliance, and reporting requirements for fishing in the U.S/Canada area could be strengthened. The FW 42 provision for quota monitoring might help reduce the possibility of an overage of the EGB quota but would still rely on accurate reporting of fishing locations by fishermen. Further development of catch allocation methods that do not rely on self-reported fishing locations would also be helpful.

Attachments:

(1) “A preliminary evaluation of Atlantic cod misreporting in the Eastern Georges Bank United States/Canada Resource Sharing Area”. Michael Palmer, NEFSC, March 26, 2013.
(2) Analysis of VTR and Observer Data for the PDT
(3) Reported locations of groundfish trips for the PDT
(4) Reported Cod and Haddock Catches on Observed and Unobserved Trips
(5) Observed catch rates of cod and haddock in the US/CA area (box plots)
(6) ACE Lease Price Differentials Between George’s Bank East and West Cod

Table 1 - U.S. Catch from Shared Stocks (mt).

Cod				
Fishing Year	**TAC**	**Catch (% of TAC)**	**Catch**	**Discards (% of catch)**
2004	300	59%	177	23%
2005	260	94%	244	64%
2006	374	90%	335	50%
2007	494	64%	315	67%
2008	667	75%	501	15%
2009	527	89%	467	35%
2010	338	75%	254	6%
2011	200	82%	165	20%
2012[1]	162	28%	44.9	53%

Haddock				
Fishing Year	**TAC**	**Catch (% of TAC)**	**Catch**	**Discards (% of catch)**
2004	5,100	21%	1,060	18%
2005	7,590	8%	589	12%
2006	7,480	9%	671	37%
2007	6,270	5%	307	46%
2008	8,050	20%	1,649	4%
2009	11,100	14%	1,563	1%
2010	11,988	16%	1,882	1%
2011	9,460	11%	1,078	5%
2012[1]	6,880	5%	318	20%

Yellowtail Flounder				
Fishing Year	**TAC**	**Catch (% of TAC)**	**Catch**	**Discards (% of catch)**
2004	6,000	98%	5,852	8%
2005	4,260	88%	3,760	9%
2006	2,070	89%	1,851	29%
2007	900	109%	981	39%
2008	1,869	82%	1,531	28%
2009	1,617	109%	1,770	31%
2010	1,021	79%	810	16%
2011	1,458	76%	1,106	14%
2012[1]	564	52%	294	51%

[1] Fishing Year 2012 catch estimates are based on data reported through April 4, 2013.

Table 2 – Reported catches of cod (live weight, pounds) on groundfish trips that fished any part of the trip in the Eastern US/CA Area. (Source: DMIS)

	FISHING_YEAR		
AREA	2009	2010	2011
0	597		0
464	0	1,320	1,071
465		0	
511		0	
512		0	1,297
513		1,149	19,235
514		83,214	129,925
515	16,910	42,242	57,128
521	5,532	244,868	440,913
522	52,414	681,332	1,256,330
524	877		
525	20,570	181,560	220,106
526		0	998
537	0	0	0
539		866	
541		0	
552		0	
561	637,116	458,177	250,716
562	166,847	69,743	37,825
621	3,820		
Total	904,682	1,764,472	2,415,545
Percent of cod attributed to EGB that are from EGB 561/562	89%	30%	12%

Table 3 – Observer coverage rates for observed trips landing cod, haddock, yellowtail flounder and total landed fish for 2010 and 2011.

Cod	2010	2011
522	33	34
525	29	31
561	27	33
562	26	45
Haddock		
522	32	36
525	31	30
561	23	30
562	23	38
Yellowtail Flounder		
522	39	39
525	32	33
561	33	33
562	27	42
Total Landed Fish		
522	32	34
525	30	32
561	23	30
562	25	40

Table 4 – Summary of analytic results

Analysis	Is there evidence of differences by area?	Is there evidence of differences between observed/unobserved trips?	Is there evidence that differences changed over time?
Allocation by VMS/VTR/Observer	Ambivalent	Mixed	Yes
VTR Trip Distribution	Yes	No	No
Observer Trip Distribution	Yes	No	No
Observer Coverage Rates	Yes	NA	No
DMIS Trip Area Distribution	NA	Mixed	Mixed
DMIS Catch Distribution	NA	Mixed	Mixed
Observed catch rates	Yes	NA	Yes
Observed tow start and end locations	Yes	NA	Yes
EGB/WGB fishing and observer assignment	Mixed	Mixed	No
Leasing Activity	Yes	NA	Yes

Figure 1 – Comparison of relative differences between VTR and VMS allocation methods in Palmer (pers. comm. 2013).

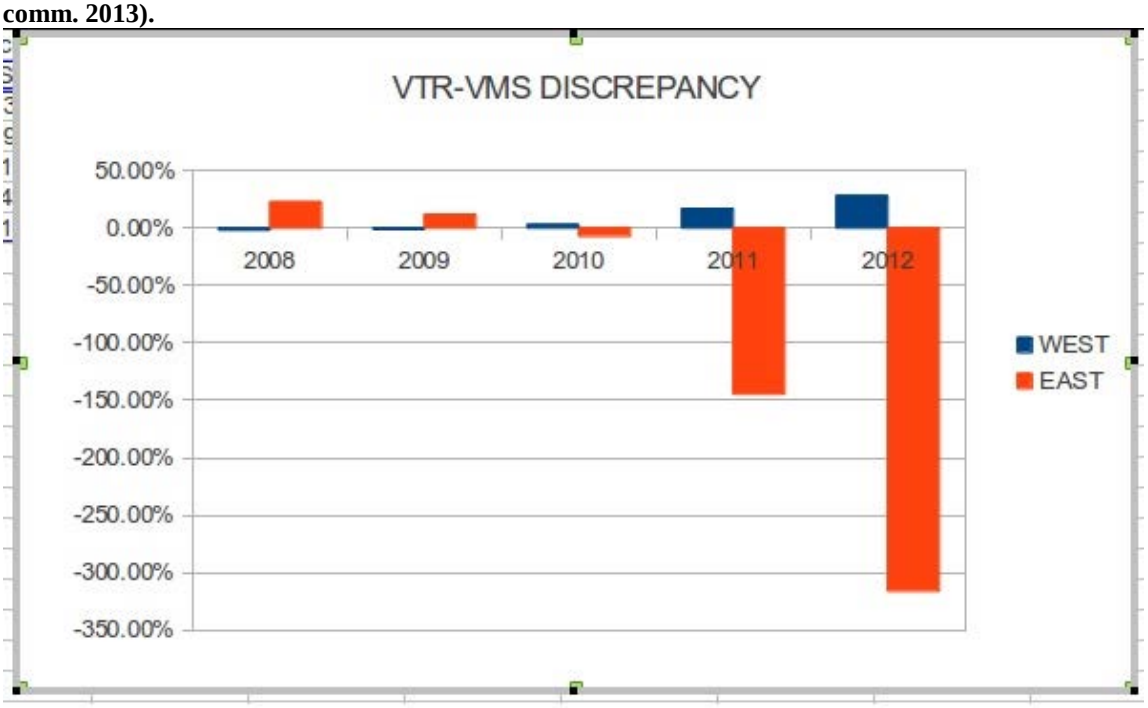


Figure 2 – Percent of observed trawl tows catching cod or haddock that start and end in the same statistical area (ending locations in the US/CA area only)

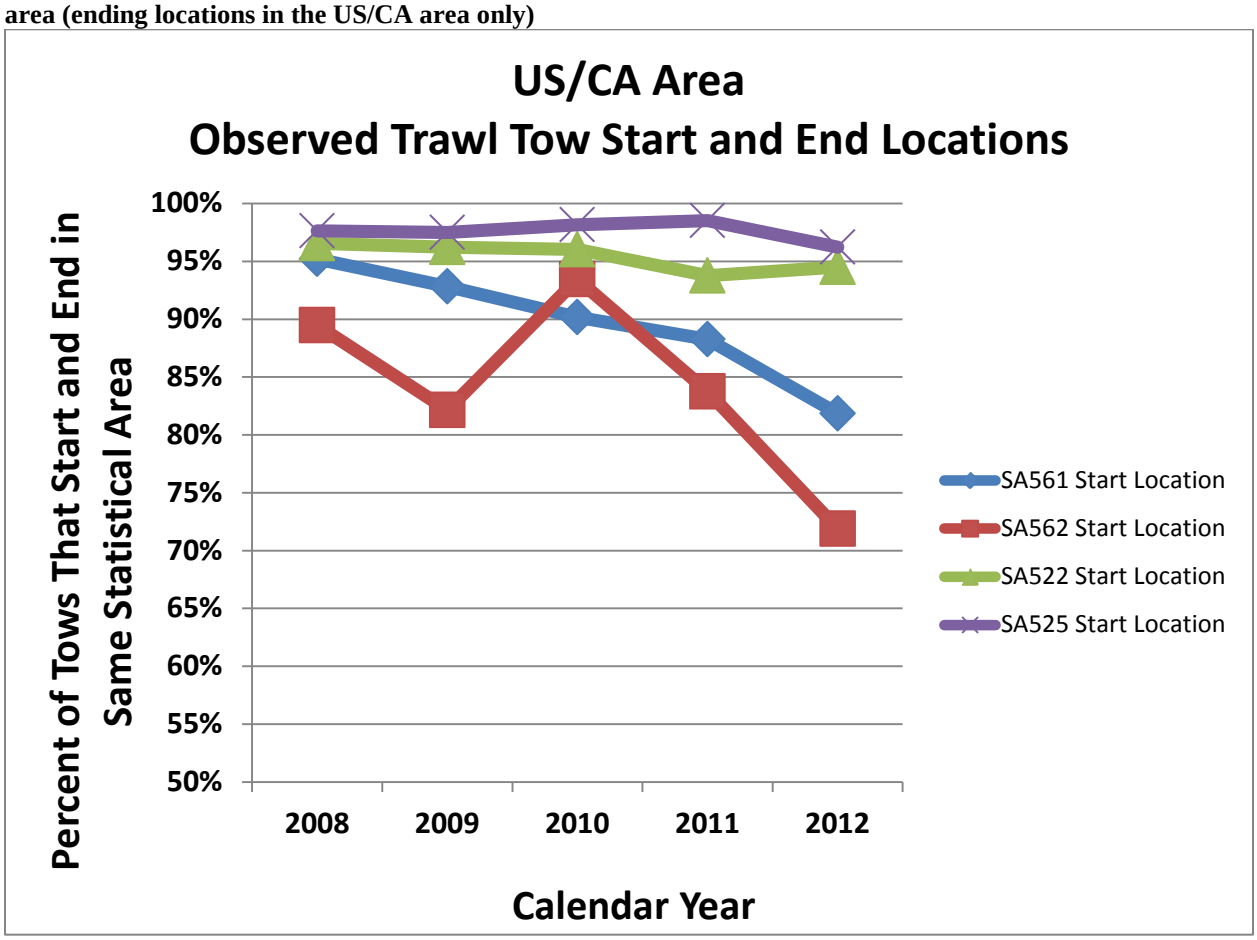
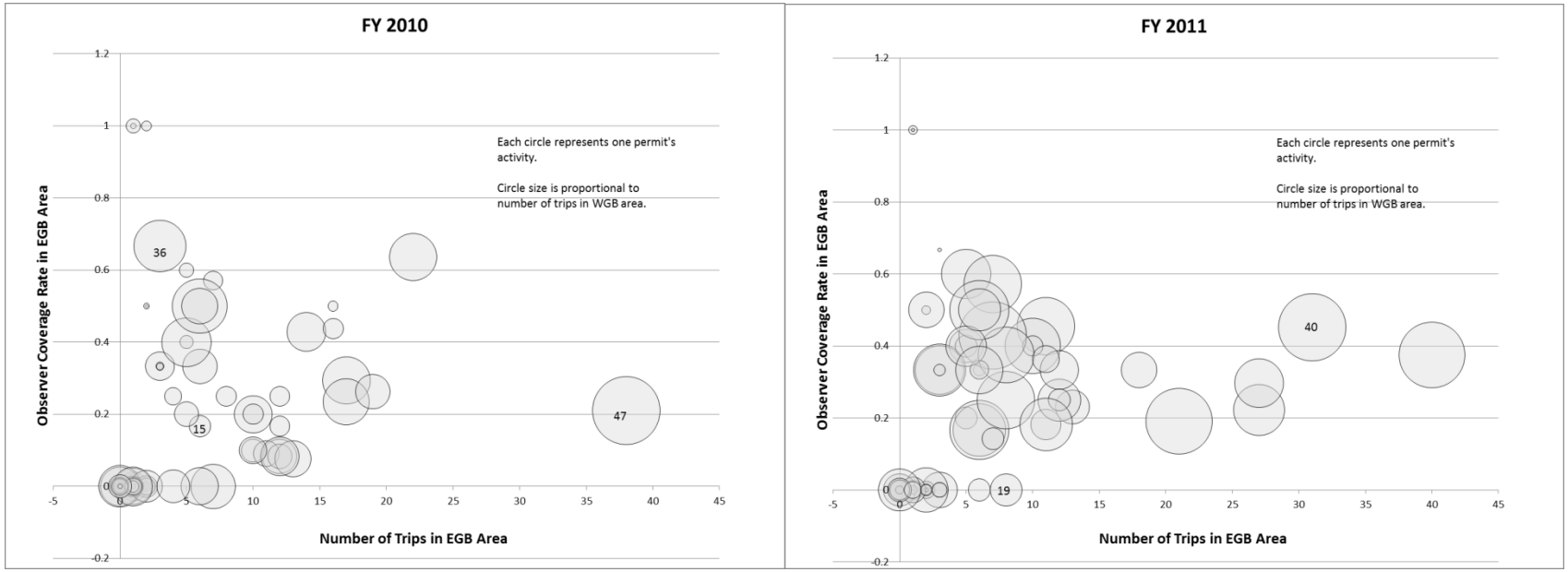


Figure 3 – Summary of number of trips in EGB area, EGB observer coverage rate, and number of trips in WGB area for trawl trips. Each circle represents one permit's activity over the course of the fishing year. Circle size represents the number of trips in the WGB area, with example values shown to illustrate the scale.



Enclosure (1)
A preliminary evaluation of Atlantic cod misreporting in the Eastern Georges Bank United States/Canada Resource Sharing Area

Michael Palmer
Population Dynamics Branch
Northeast Fisheries Science Center
Last update: March 26, 2013

Overview

Recently there have been public claims that landings of Eastern Georges Bank (EGB) Atlantic cod (*Gadus morhua*) sub-stock are being misreported as Western Georges Bank (EGB) cod landings (Cape Cod Times; March 7, 2013). These claims are similar to those made in 2012 regarding the misreporting of the Gulf of Maine cod stock landings (GOM) as Georges Bank landings (Gloucester Times; February 3, 2012). Catches of all federally regulated species are allocated to stock area based on the fishing location reported on the Vessel Trip Reports (VTRs). It has been well documented that erroneous reporting of VTR location has lead to errors in the stock area allocation of many of the Northeast Region's multi-stock species (Palmer and Wigley 2007, 2009, 2012). While the impacts on cod stock area allocations have been shown to be small (≤ 5%; Palmer and Wigley 2012), previous analyses have not examined the impacts at units smaller than stock area.

The Georges Bank stock area is divided into two sub-stocks, EGB and WGB, with each sub-stock subject to a separate quota. The EGB stock is part of the United States/Canada Resources Sharing Area (US/CN) meaning that the stock is co-managed by both the United States (US) and Canada (CN). Erroneous reporting of EGB cod as WGB cod by the US fleet could negatively impact the international resource sharing agreement. This analysis applies Palmer and Wigley (2009) the method that is documented in on a sub-stock basis to evaluate whether there is evidence to support the claims of EGB cod misreporting between 2010 and 2012.

Methods

A summary of the methods is provided below. A full description of the method and an evaluation of performance and detection errors is contained in Palmer and Wigley (2009 and 2012). Unlike the Palmer and Wigley (2009 and 2012) analyses, this analysis divides the Georges Bank stock into the EGB (statistical areas 561and 562) and WGB sub-stock areas (statistical areas 520s, 530s, 540s and 600s).

VTR logbook trip, gear and species catch data were extracted from the VTR logbook reports from calendar years 2008 to 2012. The analytical datasets were post-processed to remove any overlapping trips (i.e., trips taken by the same vessel with a date of sail occurring before the date of landing of a previous trip). Overlaps occur because of VTR reporting and/or data entry errors. This process resulted in the removal of < 2.5% of the total annual reported VTR trips. Of the remaining trips, only those trips where at least one of the eight study species were reported as retained catch were retained in the dataset (Atlantic cod, haddock, yellowtail flounder, winter flounder, windowpane flounder, monkfish, silver hake, and red hake). Because the focus was on assessing the impact of statistical area misreporting on the proration of commercial landings, discards were not included in these analyses. All species weights were converted to live weight

in kilograms (kg) using standard species conversion factors established by the Northeast Fisheries Science Center (NEFSC). The VTR dataset was further restricted to include only the four major gear types responsible for species landings in the region: fish bottom otter trawl (OTF), scallop dredge (DRS), sink gillnet (GNS) and benthic longline (LLB). VTR species landings were then assigned to a stock area based on the statistical area (CAREA) fished reported on the logbook.

All available VMS data were extracted from the VMS database for each vessel and assigned to the appropriate VTR trip by matching on the vessel and assigning all VMS point locations with dates between the VTR date of sailing and date landed to the respective trip. Summaries of the number of VMS-VTR matched trips by year are included in Table 1. The average vessel speed was calculated by dividing the haversine distance (Sinnott, 1984) by the time difference between consecutive VMS positions.

Based on an analysis of the frequency distributions of VMS-recorded speed by gear type and an evaluation of detection error (Palmer and Wigley 2012) the following speed windows were used as indicative of fishing activity:

- Otter trawl: 2.0 – 4.0 knots
- Scallop dredge: 2.5 – 6.0 knots
- Sink gillnet and benthic longline: 0.1 – 1.3 knots

All positions identified as fishing locations were assigned to a National Marine Fisheries Service (NMFS) statistical area. A VMS-based allocation algorithm was devised using the statistical areas fished from the VMS data to re-allocate VTR-reported landings to stock area. Fishing activity was assigned to stock area based on the species landed and statistical area in which the fishing activity was occurring. The time spent fishing in each stock area was estimated as the sum of fishing activity blocks occurring in each stock area. The duration of one activity block is contingent on the VMS polling frequency which is variable, but generally once per 30 minutes for scallop vessels and once per hour for groundfish vessels. Total VTR trip landings for each species (*s*) were allocated to stock area (*k*) based on the ratio of time spent fishing in each stock area as determined from VMS locations (Equation 1).

$$(1) \qquad \hat{L}_{sk} = \left(\left(\sum l_{si}\right) + l_{sk}\right) \bullet \left(\frac{t_k}{\left(\sum t_i\right) + t_k}\right)$$

where:

$\hat{L}_{sk}$ = VMS prorated trip landings for species *s*, stock *k* (kg)

l_s = trip landings for species *s* in stock area, *k*, as derived from VTR reports (kg)

l_i = trip landings for species *s* in stock areas *i*, where $i \neq k$, as derived from VTR reports (kg)

t_k = time spent fishing in stock area, *k*, as derived from VMS positional data (days)

t_i = time spent fishing in stock area *i*, where $i \neq k$, as derived from VMS positional data (days)

The VMS-based allocation method assumes a constant species catch-per-unit-effort (CPUE) at all fishing locations (i.e., species catch is distributed only as a function of the time spent fishing in each stock area). This assumption neglects species habitat preferences (e.g., sediment

composition, water depth and temperature, etc.) which would result in species being more likely to be caught in some locales and not others.

In the northeast US, at-sea fisheries observers are coordinated by the NEFSC's Northeast Fisheries Observer Program (NEFOP). Beginning in May, 2010 at-sea monitors (ASMs) were also deployed in the groundfish fishery. Both NEFOP and ASM observed trips were combined and collectively referred to as 'observed' trips. This is a departure from previous iterations of this work which had only included NEFOP observer data. All observed trips which could be matched to the list of VMS-VTR matched trips were extracted from the observer database. Matches were established using the vessel, date of sailing and date landed as reported on the VTR; trips with multiple matches were removed from the analyses. For all matched trips the associated haul duration, statistical area fished, species and retained catch weights were also extracted; retained catch weights were converted to live weight in kilograms (kg) using standard NEFSC conversion factors. Summaries of the number of matches by year are included in Table 1.

The results of the VMS-based allocation were compared to landings allocation derived from both observer and VTR data sources to assess the relative accuracy of the VTR-based allocation and determine if the VMS-based algorithm resulted in improved estimates of landings by stock area. VTR and observed species landings were prorated by assigning landings to stock area based on the reported statistical area. All comparisons were performed through an examination of the percent allocation to stock area as opposed to absolute landings because percent allocations derived from the traditional VTR source are used to allocate the amounts of commercial landings as determined through dealer weighout data. The same analysis was performed on the larger VMS-VTR matched data set.

Several additional analyses were incorporated into this updated analysis which were not included in previous versions. Most notably:

- Compare VTR statistical area reporting trends to VMS estimates of statistical area fished on both observed and unobserved trips. Previous work has not examined if reporting behavior was affected by whether the vessel was carrying an observer or not. Historically, the VMS estimates of statistical area fished have agreed well with observer-based estimates for both single area trips (88.0-93.2% agreement) and multi-area trips (62.7-75.2% agreement). VTR reported statistical area tends to have a higher agreement on single-area trips (94.3-96.9% agreement), but much lower agreement on multi-area trips (5.3-16.7% agreement). The differences are primarily due to the tendency of the VMS-based method to over-estimate the number of statistical areas fished on single area trips and the high occurrence of under-reporting of the statistical areas fished on VTRs for multi-area trips (Palmer and Wigley 2012). By comparing VTR-reporting trends to VMS-based estimates of statistical areas fished on both observed and unobserved trips we can gain a better understanding of a vessel's reporting behavior when not carrying an observer. This analysis will be particularly helpful with respect to reporting multi-area trips since this is an area that has traditionally exhibited poor vessel compliance with respect to VTR reporting.

- Compare estimates of fishing effort (days fished) from observer data to VTR and VMS on a statistical area basis over time (summarized by year) on the set of VTR-VMS-observer matched trips. Since estimation of effort has historically been problematic for fixed gear (gillnet and longline) and there are a negligible amount of cod landings by scallop dredge, this analysis was restricted to vessels fishing otter trawl and landing > 0 kg of cod. For VTR data fishing effort was estimated as the product of the number of hauls and the tow duration fields. For observer data it

was estimated as the haul/tow duration. VMS days fished was estimated as the time interval between an identified fishing location and next VMS point location (e.g., for vessels experiencing hourly polling each VMS observation constitutes an hourly event so a trip with twelve identified fishing events would have a total of 0.5 days fished for the trip).

- For vessels that were known to be fishing in the Eastern Georges Bank US/CN area a closer examination was conducted on statistical area reporting patterns.
    - First, the VMS-based method was validated against the observer data for all trips where either the VMS data or observer data reported fishing in statistical areas 561 or 562. From this comparison the number of trips were summarized where the two data sources were in agreement that fishing did occur in the EGB US/CN area or where the VMS indicated fishing occurred but the observer data did not (VMS false detection) or the observer data indicated fishing occurred in the EGB US/CN area and the VMS data did not (VMS missed detection).
    - Second, the VTR reporting patterns were examined for all trips where the VMS data indicated fishing occurred in the EGB US/CN area and categorized by whether the trip was observed or not. This provides a summary of VTR reporting accuracy on both observed and unobserved trips specifically for the EGB area.

Results

The 2008-2011 summary statistics (landings, trips, vessels, etc.) reported in this document may differ slightly from those reported in Palmer and Wigley (2012) due to minor changes to the data over time and the incorporation of ASM observer data. The VMS-VTR matched subset used in this analysis contains between 18,329 – 25,128 trips annually from 2008 to 2012 (Table 1). While this is a small fraction of the total 100,000+ VTR trips that are submitted annually, the subset contains 70.8 to 92.1 % of the total VTR reported cod landings from the Northeast Region, with the percentage increasing over time (Table 2). The number of trips used in the VTR-VMS-observer matched validation data set ranged from 670 – 3,071 trips annually (Table 1).

By comparing the VTR- and VMS-based stock allocations to the allocations indicated by observer catch data the relative accuracy of the two allocation methods can be evaluated. The VTR allocations obtained stock allocations closer to the observer-based allocations in 11 of 15 cases examined (5 years x 3 stocks; Table 3). At least on the observed trips, the VTRs are better at determining the stock area compared to the VMS-based allocation procedure. Between 2004 and 2010 the VMS allocation procedure outperformed VTR with respect to GOM/GBK cod allocations in five out of the eight years (2005, 2007 and 2011 were the exceptions; Palmer and Wigley 2012). There does not appear to be a time series trend to the performance, but the differences in the stock allocation percentages between the two methods were generally small with the differences being < 2.0% in all years except 2008 when the two methods differed by 2.1% for the EGB stock allocation (Table 3). The results of these comparisons suggest that when a vessel is carrying an observer, the accuracy of both the VTR- and VMS-based allocation generate stock allocations that are ≤ 5.0% of those from observer catch data. Relative to the observer-based allocations there is a general tendency for both the VTR- and VMS-based methods to under-allocate GOM landings and over-allocate WGB landings, but there is no clear pattern with respect to EGB landings.

The analysis was then expanded up to the full VTR-VMS matched data set. As noted before this data set accounts for >70% of the total cod landings since 2008 and > 86% since 2009 (Table 2). In 2008 and 2009 the VMS-based EGB stock allocations were slightly lower than the VTR-based allocations; however from 2010-2012 the VMS-based EGB cod allocations were consistently higher than the VTR-based allocations (Table 4). The directionality from 2010 – 2012 is consistent with the expectations if vessels were under-reporting EGB cod catch on VTRs as was recently claimed. The difference between the two allocation methods ranged from 0.3 to 7.9%. There do seem to be consistent patterns with respect to stock area allocations such that the VTR-based allocation consistently achieves allocations less than the VMS for the GOM and since 2010 the VMS-based allocation has been greater for the EGB stock allocation. While these patterns are consistent with the claims of misreporting, it is difficult to interpret these findings given that the performance of the VTR-based allocation which, compared to VMS, achieved stock allocations closer to the observer-based allocations. It is possible that the accuracy of VTR-reported statistical area is of lower quality when the vessel is not carrying an observer. It should be noted that while differences do exist, overall the two methods achieve relatively similar stock allocations with the differences in stock allocations < 10% for all but one of the nine cases examined.

The comparison of VTR statistical area reporting practices to VMS-based estimates on both observed and unobserved trips supports previous conclusions that number of statistical areas fished tends to be grossly under-estimated on VTR from trips where fishing occurred in multiple statistical areas (Table 5a and b). When comparing VTR reporting errors on multi-area trips there is some evidence that VTR compliance is slightly improved when the vessel is carrying an observer. Across all years the level of 'Complete' agreement for multi-areas trips is greater when the trip is observed. However, these analyses don't necessarily get at whether this has impacts on the estimated landings of EGB cod. For example a trips where fishing occurred in both statistical areas 561 and 562 but only reported fishing in 561 would show up in this analysis as being only partially compliant, but this would have no impact on the sub stock-level allocation of EGB cod.

To better get at VTR statistical area reporting patterns specific to EGB the performance of the VMS method was first validated using observer data. For trips that were known to have fished in statistical areas 561 and 562 based on either the VMS or observer data, the VMS method correctly determined fishing having occurred in the EGB in 82-98% of the trips examined between 2008 and 2012 (Table 6). The VMS method experienced both false detection error (predicted fishing as having occurred in the EGB area when in fact it didn't) as well as missed detection error (did not predict fishing in the EGB when in fact it had). These errors were ≤ 10% in all but one situation. Overall the VMS method provides a reasonably accurate method for the detection of fishing in the EGB region. Given the validation of the VMS method, it was then raised up to a larger set of VMS and VTR matched trips and the accuracy of VTR reports was evaluated with respect to detection of fishing on EGB on both observed and unobserved trips. Generally there was moderate VMS/VTR agreement of fishing having occurred in the EGB region (63-75%; Table 7). More importantly, there is little evidence that the level of agreement is influenced by carrying an observer. In some years the level of agreement was actually higher when vessels were not being observed (e.g., 2009 and 2012). This indicates that VTR misreporting is not influencing the ability to detect the presence of fishing in the EGB region.

A final analysis was to compare estimates of days fished by each of the three data sources across statistical areas and years to evaluate whether there was the presence of any systematic trends. Over all the reasonably good agreement between the observer-based estimates of days fished and

those from VMS and VTR (Figure 1) with the strong modes centered around zero (differences). A comparison of the days fished by statistical area and year shows that the VMS-based methods consistently estimated fewer days fished per statistical area relative to the VTR (Figure 2). A closer comparison of the VTR-VMS days fished shows the distribution of the differences positively skewed toward higher estimates of days fished based on VTR sources (Figure 3). A summation of days fished with years shows that VMS consistently provides the lowest estimate of days fished, next followed by observer, with VTR methods providing the highest estimate (Figure 4). It's unclear why the VTR consistently provides a higher estimate of the days fished or why the VTR consistently provides the lowest estimate; however in the context of evaluating reporting trends it may not be important. By standardizing the amount of days fished by data source and year (i.e., calculate the proportion of time spent in each statistical area by data source and year) a consistent measure of effort can be extracted that is not influenced by differences in how effort is estimated in each of the data sources. Comparison of the standardized fishing effort by statistical area and year shows no consistent tends. In fact the proportion of effort by statistical area across sources is relatively consistent across statistical areas and years (Figure 5). There is no evidence to support systematic under- or over-reporting of fishing effort in any of the three sources when examined by statistical area and year.

Conclusions

Based on a comparison of VTR, VMS and observer data there is little evidence to suggest that gross misreporting of EGB cod is occurring. While some analyses suggest that VTR-based catches of EGB cod may be lower than estimates achieved using alternate means such as VMS-based allocation schemes there is no evidence to suggestive of systematic reporting errors with respect to EGB cod. While under-reporting of the statistical area fished on VTRs continues to be problematic for trips which fish in multiple statistical areas, there is no concrete evidence that this is having a detectable influence on estimates of (sub) stock-level landings of Atlantic cod in the northeast United States.

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Tables

Table 1. Summary of the Vessel Trip Report (VTR), Vessel Monitoring System (VMS), and Northeast Fisheries Observer Program (NEFOP) 2010 to 2012 data sets, by number of trips and number of vessels.

Year	Category	Number of trips	Number of Vessels
2008	VTR dataset	106,654	2,280
	VTR subset	33,761	1,068
	VMS-VTR matched set	20,897	847
	NEFOP-VMS-VTR matched set	670	323
2009	VTR dataset	105,387	2,154
	VTR subset	31,525	983
	VMS-VTR matched set	25,128	826
	NEFOP-VMS-VTR matched set	1,006	390
2010	VTR dataset	103,608	2,179
	VTR subset	24,447	920
	VMS-VTR matched set	19,648	760
	NEFOP-VMS-VTR matched set	2,415	392
2011	VTR dataset	98,385	2,021
	VTR subset	23,101	844
	VMS-VTR matched set	18,383	680
	NEFOP-VMS-VTR matched set	3,071	379
2012	VTR dataset	93,330	1,951
	VTR subset	23,442	841
	VMS-VTR matched set	18,329	672
	NEFOP-VMS-VTR matched set	2,742	364

Table 2. Summary of the Vessel Monitoring System (VMS) dataset and Vessel Trip Reports (VTR) subset compared to total VTR landings (kg) of Atlantic cod (*Gadus morhua*) from 2010 to 2012.

Year	Total VTR landings (kg)	VTR subset (kg)	Percent of total (%)	VMS matched set (kg)	Percent of total (%)
2008	7,024,035	6,924,462	98.6	4,969,807	70.8
2009	7,213,351	6,987,840	96.9	6,238,260	86.5
2010	6,406,948	6,051,020	94.4	5,597,797	87.4
2011	6,331,797	5,873,507	92.8	5,740,221	90.7
2012	3,360,735	3,142,163	93.5	3,095,742	92.1

Table 3. Comparison of the stock allocations of Atlantic cod (*Gadus morhua*) landings from observer catch data, Vessel Monitoring System (VMS) and Vessel Trip Report (VTR) on matched trips between 2010 and 2012. Values in bold text indicate which allocation source (VMS or VTR) achieved stock allocations closer to the allocations based on observer catch data (*assumed to represent the 'truth' in this analysis*). Negative numbers indicate that the data source (VTR or VMS) underestimated the observer-based stock allocations. **Note that VTR and VMS landings totals may not match exactly due to rounder errors and assignment of landings to unknown areas.*

Year	Stock area	Observed landings (kg)	VTR landings (kg)	VMS landings (kg)	Observer stock allocation (%)	VTR stock allocation (%)	VMS stock allocation (%)	VTR-observer difference (%)	VMS-observer difference (%)
2008	EGB	60,254	47,456	40,004	14.9	13.2	11.1	**-1.8**	-3.9
	GOM	49,689	41,510	45,888	12.3	11.5	12.7	-0.8	**0.4**
	WGB	293,121	271,753	274,826	72.7	75.3	76.2	**2.6**	3.5
2009	EGB	62,830	61,939	54,229	13.2	13.2	11.5	**0.0**	-1.6
	GOM	141,159	123,983	125,335	29.6	26.4	26.6	-3.2	**-3.0**
	WGB	273,591	284,464	291,532	57.3	60.5	61.9	**3.2**	4.6
2010	EGB	38,577	34,498	31,914	3.8	3.8	3.5	**0.0**	-0.3
	GOM	716,906	618,631	617,678	71.0	68.0	67.9	**-3.0**	-3.0
	WGB	254,568	256,284	259,590	25.2	28.2	28.6	**3.0**	3.3
2011	EGB	39,332	27,260	50,356	2.8	2.1	3.9	**-0.7**	1.0
	GOM	979,508	873,733	868,180	70.1	67.0	66.5	**-3.1**	-3.6
	WGB	378,192	403,654	386,106	27.1	30.9	29.6	3.9	**2.5**
2012	EGB	6,910	6,538	17,791	0.9	0.9	2.5	**0.0**	1.6
	GOM	522,350	461,422	461,218	69.1	64.3	64.3	**-4.8**	-4.9
	WGB	226,389	249,801	238,736	30.0	34.8	33.3	4.8	**3.3**

Table 4. Comparison of the stock allocations of Atlantic cod (*Gadus morhua*) landings from Vessel Monitoring System (VMS) and Vessel Trip Report (VTR) on matched trips between 2010 and 2012. Negative numbers indicate that the VTR allocations are less than the VMS-based stock allocations.

Year	Species	Stock area	VTR landings (mt)	VMS landings (mt)	VTR stock allocation (%)	VMS stock allocation (%)	Stock allocation difference (%)
2008	COD	EGB	184	142	3.7	2.9	0.8
	COD	GOM	3,004	3,019	60.5	60.7	-0.3
	COD	WGB	1,778	1,808	35.8	36.4	-0.6
2009	COD	EGB	367	323	5.9	5.2	0.7
	COD	GOM	3,873	3,897	62.1	62.5	-0.4
	COD	WGB	1,997	2,018	32.0	32.4	-0.3
2010	COD	EGB	211	226	3.8	4.0	-0.3
	COD	GOM	3,680	3,717	65.7	66.4	-0.7
	COD	WGB	1,711	1,658	30.5	29.6	0.9
2011	COD	EGB	135	330	2.3	5.8	-3.4
	COD	GOM	3,453	3,624	60.2	63.1	-3.0
	COD	WGB	2,152	1,785	37.5	31.1	6.4
2012	COD	EGB	93	387	2.5	10.5	-7.9
	COD	GOM	2,156	2,275	58.2	61.4	-3.2
	COD	WGB	1,456	1,043	39.3	28.1	11.2

Table 5a. Comparison of VTR-reported statistical area reporting to VMS-based estimated statistical area fished on observed and unobserved trips from 2008 to 2010.

Year	Observer/ ASM present?	Trip category	Number of trips	Agreement level	Number of trips	Percent of total category trips (%)
2008	Yes	Single area	384	Complete	368	0.96
				None	14	0.04
				Partial	2	0.01
		Multi-area	294	Complete	37	0.13
				None	5	0.02
				Partial	252	0.86
	No	Single area	16,456	Complete	15,778	0.96
				None	638	0.04
				Partial	40	0.00
		Multi-area	3,763	Complete	144	0.04
				None	168	0.04
				Partial	3,451	0.92
2009	Yes	Single area	641	Complete	622	0.97
				None	18	0.03
				Partial	1	0.00
		Multi-area	372	Complete	38	0.10
				None	18	0.05
				Partial	316	0.85
	No	Single area	18,695	Complete	17,924	0.96
				None	732	0.04
				Partial	39	0.00
		Multi-area	5,420	Complete	252	0.05
				None	222	0.04
				Partial	4,946	0.91
2010	Yes	Single area	1,903	Complete	1,854	0.97
				None	44	0.02
				Partial	5	0.00
		Multi-area	523	Complete	56	0.11
				None	12	0.02
				Partial	455	0.87
	No	Single area	12,496	Complete	12,018	0.96
				None	453	0.04
				Partial	25	0.00
		Multi-area	4,726	Complete	286	0.06
				None	197	0.04
				Partial	4,243	0.90

Table 5b. Comparison of VTR-reported statistical area reporting to VMS-based estimated statistical area fished on observed and unobserved trips from 2011 and 2012.

Year	Observer/ ASM present?	Trip category	Number of trips	Agreement level	Number of trips	Percent of total category trips (%)
2011	Yes	Single area	2,366	Complete	2,295	0.97
				None	62	0.03
				Partial	9	0.00
		Multi-area	722	Complete	109	0.15
				None	17	0.02
				Partial	596	0.83
	No	Single area	10,538	Complete	9,917	0.94
				None	580	0.06
				Partial	41	0.00
		Multi-area	4,757	Complete	365	0.08
				None	198	0.04
				Partial	4,194	0.88
2012	Yes	Single area	2,166	Complete	2,134	0.99
				None	25	0.01
				Partial	7	0.00
		Multi-area	588	Complete	82	0.14
				None	8	0.01
				Partial	498	0.85
	No	Single area	10,645	Complete	10,177	0.96
				None	429	0.04
				Partial	39	0.00
		Multi-area	4,930	Complete	443	0.09
				None	165	0.03
				Partial	4,322	0.88

Table 6. Comparison of statistical area reporting between VMS and observer data for trips where either the VMS or observer data indicated fishing occurred in the eastern US/CN area (statistical area 561 and 562).

Year	Total trips into US/CN area	VMS and observer in agreement	VMS indicated fishing in US/CN area, observer did not	Observer indicated fishing in US/CN area, VMS did not	VMS/observer agreement rate	VMS false detection rate	VMS missed detection rate
2008	232	212	8	12	0.91	0.03	0.05
2009	279	240	28	11	0.86	0.10	0.04
2010	166	136	13	17	0.82	0.08	0.10
2011	286	281	0	5	0.98	0.00	0.02
2012	206	176	4	26	0.85	0.02	0.13

Table 7. Comparison of statistical area reporting between VMS and VTR data for trips where the VMS data indicated fishing occurred in the eastern US/CN area (statistical area 561 and 562) on both observed and unobserved trips.

Year	Observed trip?	Total VMS trips into US/CN area	VMS indicated fishing in US/CN area, VTR did not	VMS indicated fishing in US/CN area, so did VTR	VMS/VTR agreement rate
2008	No	404	151	253	0.63
	Yes	224	60	164	0.73
2009	No	658	225	433	0.66
	Yes	251	91	160	0.64
2010	No	545	175	370	0.68
	Yes	153	44	109	0.71
2011	No	549	181	368	0.67
	Yes	286	71	215	0.75
2012	No	730	204	526	0.72
	Yes	202	62	140	0.69

Figures

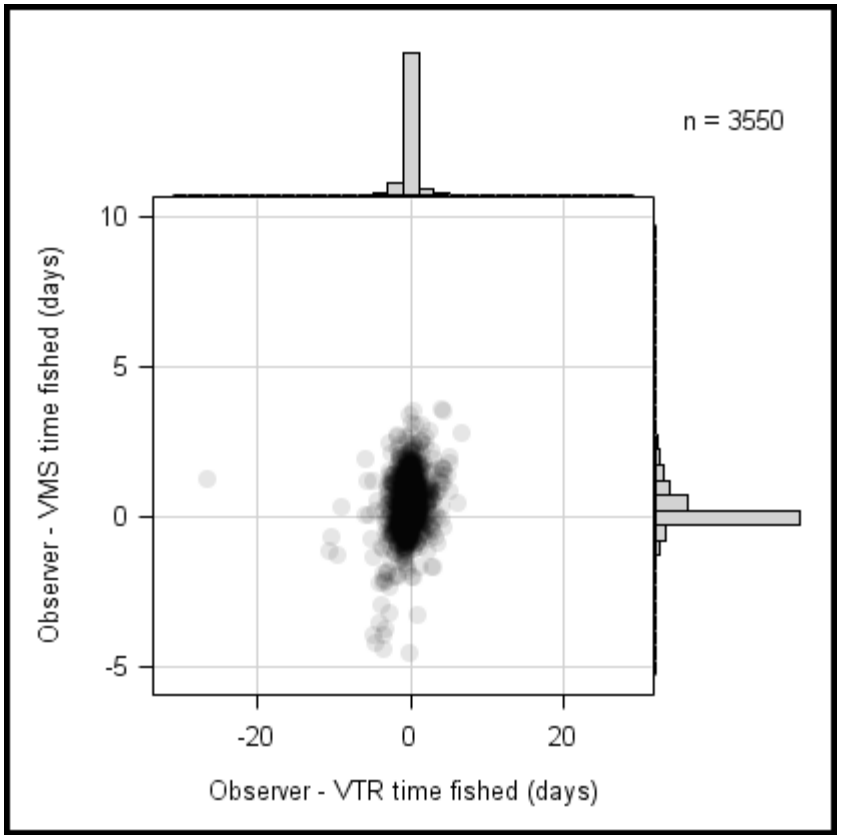

Figure 1. Cross plot of the differences between the estimates of time fished per fishing trip (days) between matched observer and VTR and observer and VMS from 2008 to 2012. Positive values indicate that the observer estimated time fished exceeds VTR and VMS data sources. The secondary axis provides frequency distributions of the x- and y-variables.

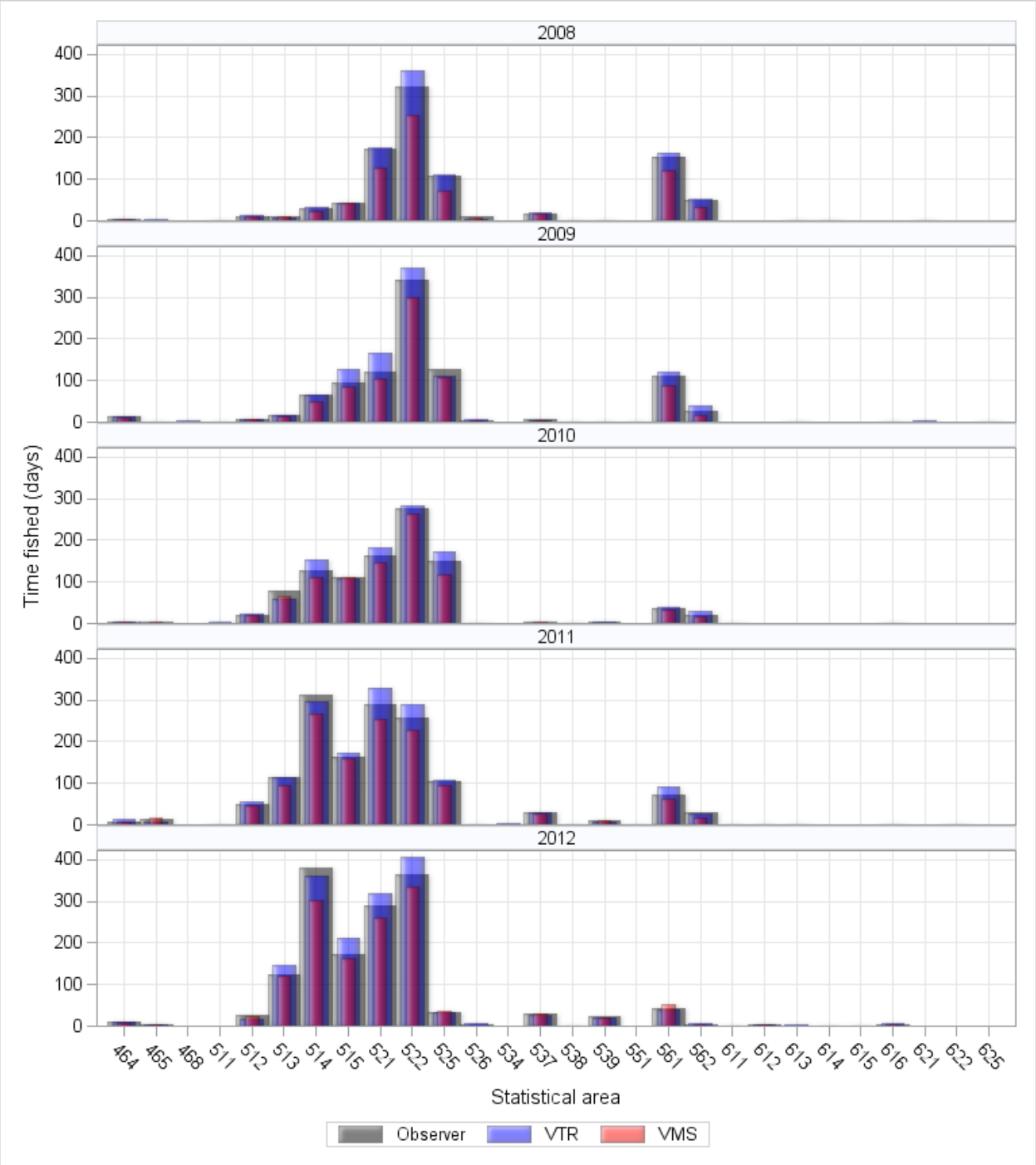

Figure 2. Comparison of the total time fished (days) as estimated using observer, VTR and VMS data sources by year and statistical area. Comparisons are based on a subset of matched trips that fished large mesh (6") otter trawl and landed > 0 kg of Atlantic cod between 2008 to 2012. The number of trips included in the analysis for individual years is as follows: 2008 = 344 trips, 2009 = 455 trips, 2010 = 636 trips, 2011 = 1013 trips, 2012 = 1102 trips.

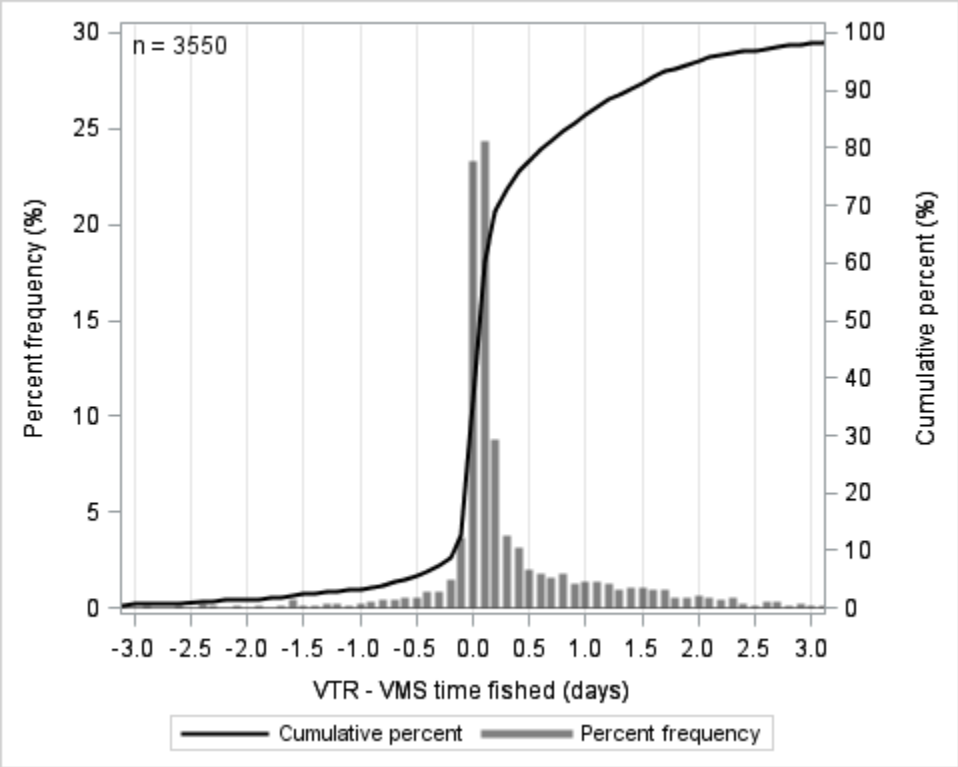

Figure 3. Percent frequency distribution of the differences in total trip fishing time (days) estimated using VTR and VMS data sources from matched trips that fished large mesh (6”) otter trawl and landed > 0 kg of Atlantic cod between 2008 to 2012. The cumulative percent is shown by the solid black line.

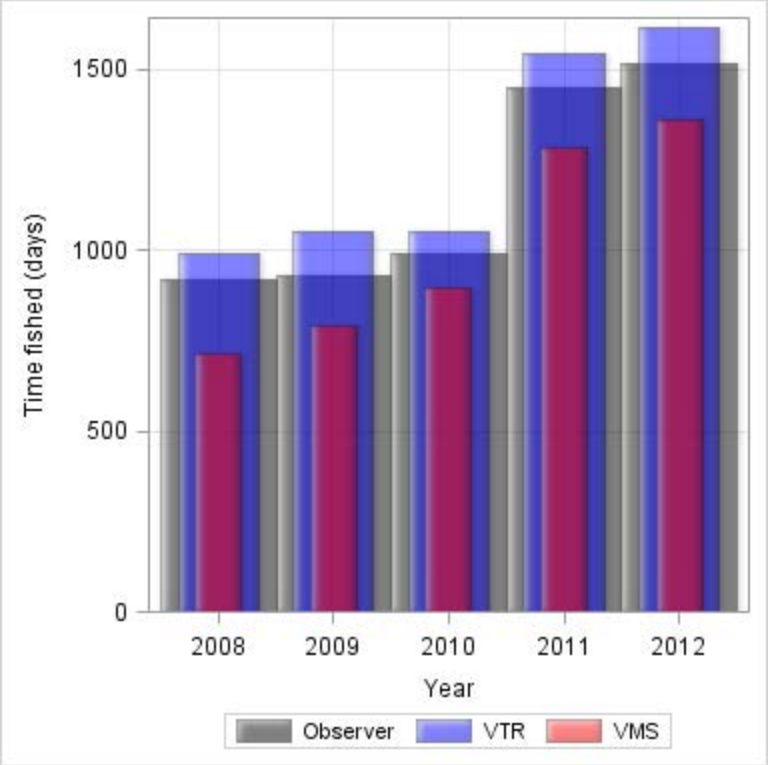

Figure 4. Total time fished (days) as estimated using observer, VTR and VMS data sources by year. Comparisons are based on a subset of matched trips that fished large mesh (6") otter trawl and landed > 0 kg of Atlantic cod between 2010 to 2012. The number of trips included in the analysis for individual years is as follows: 2008 = 344 trips, 2009 = 455 trips, 2010 = 636 trips, 2011 = 1013 trips, 2012 = 1102 trips.

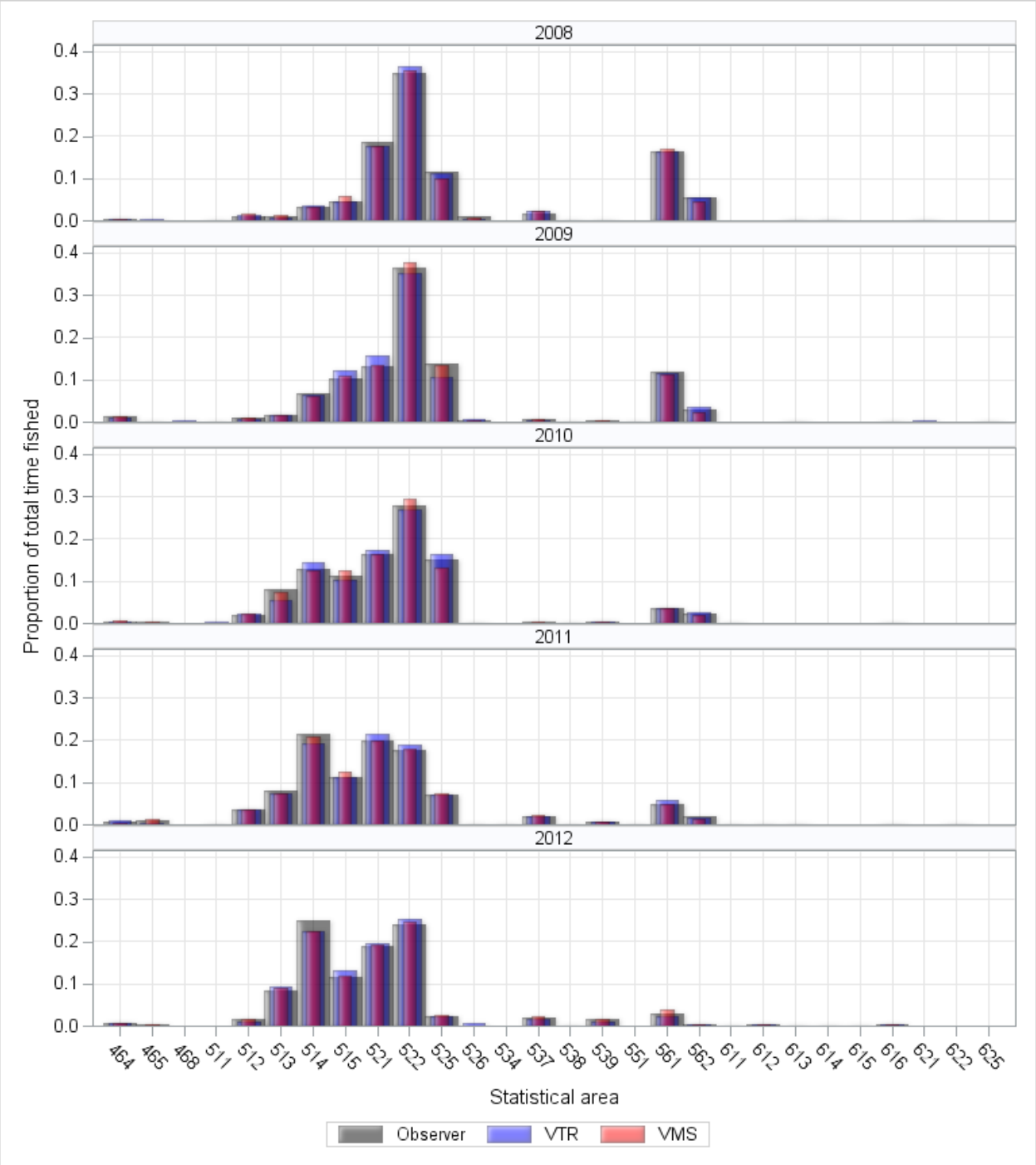

Figure 5. Comparison of the proportion of total fishing time by statistical area as estimated using observer, VTR and VMS data sources for the years 2010 to 2012. Comparisons are based on a subset of matched trips that fished large mesh (6”) otter trawl and landed > 0 kg of Atlantic cod. The number of trips included in the analysis for individual years is as follows: 2008 = 344 trips, 2009 = 455 trips, 2010 = 636 trips, 2011 = 1013 trips, 2012 = 1102 trips.

Enclosure (2)
Analysis of VTR and Observer data for PDT

Methods

VTR and Observer (NEFOP and ASM) data were compared to detect any changes in reporting of cod landings in two stock areas between CY 2008 and 2012. This analysis assumes that behavioral changes can be detected from these data, however, this behavior may be difficult to isolate from the "observer effect" – fishermen altering behavior because an observer is present. The data were selected from the database in two different ways: 1. Vessels landing groundfish in eastern Georges Bank (EGB) statistical areas (SA 561 and SA 562) with fishing also occurring in other statistical areas 2. Vessels landing groundfish anywhere in the U.S./CA area whether or not they specifically fished in EGB. The analysis focused on cod landings from EGB and western Georges Bank (WGB; SA 522 and SA 525) statistical areas.

Sub-trips landing haddock were also examined to determine if any changes could be detected for that stock and if they helped identify any changes observed in trips landing cod.

Observer coverage rates were calculated by species for the same time period.

Results

The number of observed sub-trips, occurring in SA 522 and SA 525, has remained relatively constant throughout the time series (Figure 1). Sub-trips in SA 522 dominate the total number of sub-trips. Observed sub-trips in EGB have varied over time with the highest number occurring in 2011; throughout the time series the number of sub-trips occurring in EGB that also fish in the WGB has largely matched. No large disconnect is apparent that would suggest a decrease in the number of sub-trips fishing in the EGB with an expected increase in WGB sub-trips (Figure 2). The data were calculated as a percentage of the total sub-trips within a year and showed an increase in observed sub-trips that fished in WGB, primarily SA 522; with decreases observed in the other 3 areas (Figure 3). Observed trips in EGB that also fished in WGB indicated a shift in trend from EGB to WGB comprising a greater percentage of trips after 2010 (Figure 4). The number of sub-trips occurring that landed haddock in WGB and EGB show an increase after 2010 in SA 522 but EGB shows a decrease (Figure 5 and Figure 6).

The percent of observed cod landings from WGB increased after CY 2011 as other SAs decreased (Figure 7). In 2012, the percentage of the landings reported in EGB was the lowest in the time series. A shift in EGB reported landings occurred in 2010 after which more cod landings (expressed as a percentage) was landed in WGB (Figure 8).

VTR reports from vessels reporting in WGB remained relatively constant throughout the time series (Figure 9). For vessels reporting fishing in EGB, the overall total of sub-trips has increased over time, largely driven by an increase in trips also occurring in WGB (Figure 10).

When expressed as percentages, annual variability amongst SAs for WGB sub-trips was seen but the proportion of sub-trips reported for each area doesn't vary widely (Figure 11). For EGB trips, the number of sub-trips occurring in EGB has been reduced to a new lower level in 2010 but has remained relatively constant since; an increase in the WGB component is apparent throughout the time series (Figure 12).

Observer coverage rates vary by SA between 2010 and 2011 for all species (Table 1). Coverage rates in EGB are lower than those of WGB in 2010 but this trend is not continued into 2011. The higher rates in 2011 are largely driven by the reduced total number of observed trips occurring in some of the SAs.

Conclusions

This analysis provided no definitive evidence of changes in the number of sub-trips reporting cod landings between EGB and WGB. Annual variability in fishing behavior is most likely the cause of the trends noted in this analysis. The observed number of sub-trips in EGB has remained somewhat stable over time but when expressed as a percentage the number of observed trips has increased in WGB. The trend in VTR reported sub-trips has followed the same pattern. Both the observed and VTR data show an increasing trend in WGB sub-trips, which would not suggest a mismatch between what is happening on observed trips versus what is being reported on unobserved trips. The analysis of observer coverage rates helps explain some of the trends seen in the observed number of sub-trips – some of the decreases noted may result from fewer trips going occurring, however, no conclusive evidence can be derived from the coverage rates as the trend was not consistent in consecutive years. Overall, no definitive conclusion can be made regarding changes in reporting behavior between EGB and WGB.

Table 5 – Coverage rates for observed trips landing cod, haddock, yellowtail flounder and total landed fish for 2010 and 2011.

Cod	**2010**	**2011**
522	32.567	34.4103
525	28.9286	30.625
561	26.8456	32.6633
562	26.1905	45.2381
Haddock		
522	31.7647	35.9511
525	30.7229	29.7297
561	23.4483	29.7297
562	22.6415	37.931
Yellowtail Flounder		
522	39.0756	39.4366
525	31.8681	33.3333
561	32.5301	32.7586
562	27.2727	42
Total Landed Fish	2010	2011
522	31.6865	34.4118
525	30.1703	32.2684
561	23.3333	29.7521
562	25.4237	40.2778

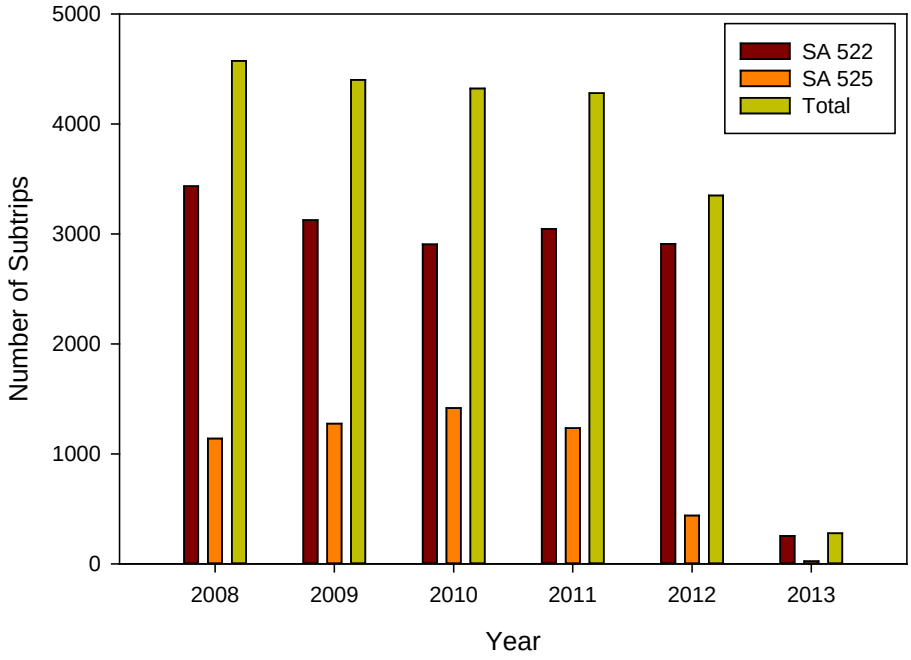

Figure 4 – Total Number of Observed Sub-trips landing cod for Trawl Gear in SA 522 and 525 between CY 2008 and 2013.

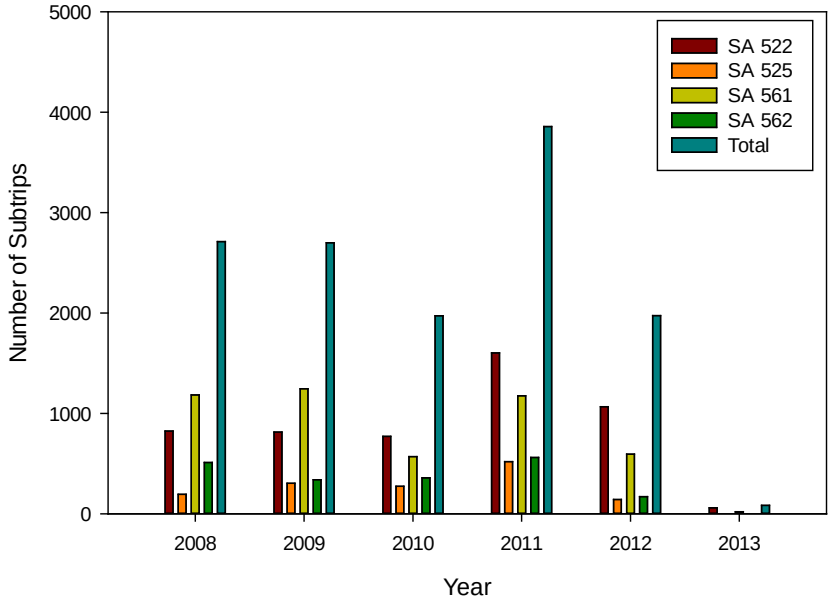

Figure 5 – Total number of Observed Sub-trips landing cod for Trawl Gear in SA 561 and 562 (and SA 522 and 525) between CY 2008 and 2012.

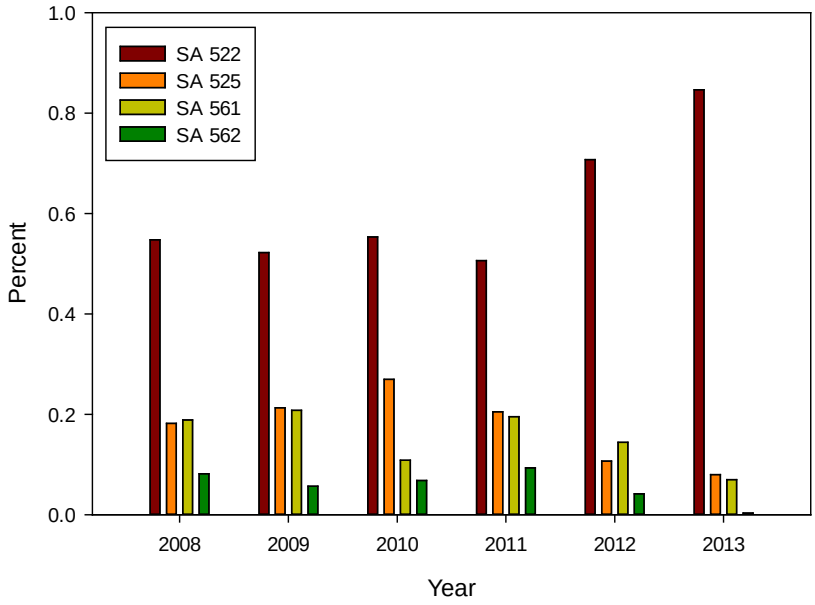

Figure 6 – Observed Sub-trips landing cod in SA 522 and SA 525 (and SA 561 and SA 562) expressed as a percentage of total between CY 2008 and 2012.

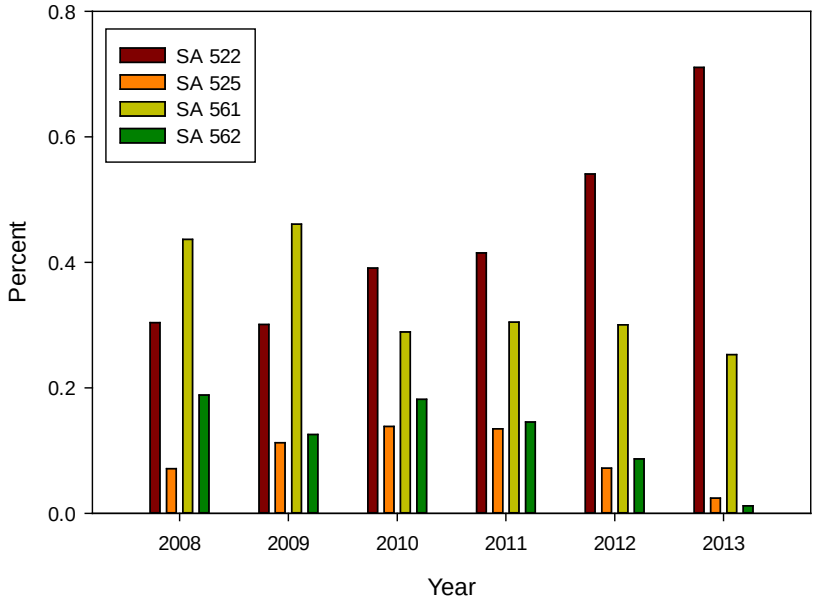

Figure 7 – Observed Sub-trips landing cod in SA 561 and SA 562 (and SA 522 and SA 525) expressed as a percentage of total between CY 2008 and 2012.

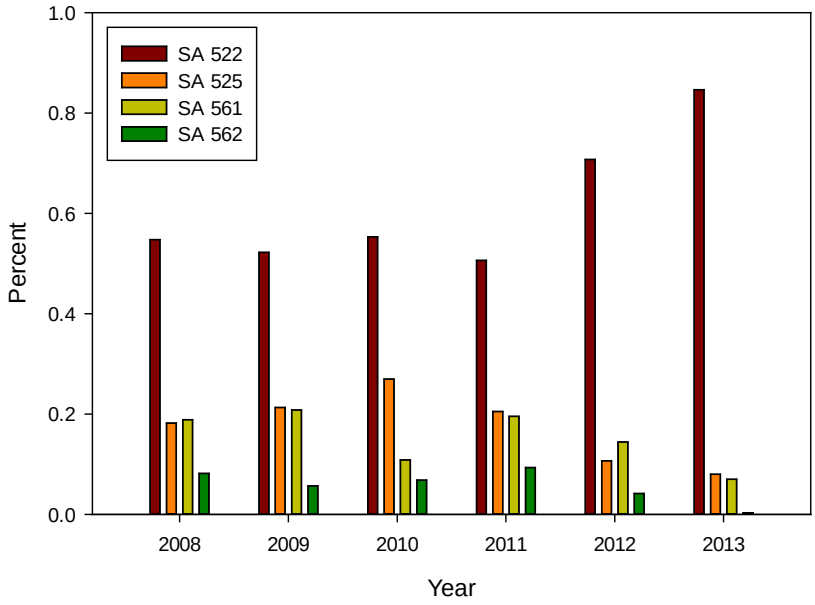

Figure 8 – Observed Sub-trips landing haddock in SA 522 and 525 (and SA 561 and SA 562) expressed as a percentage of total between CY 2008 and 2012.

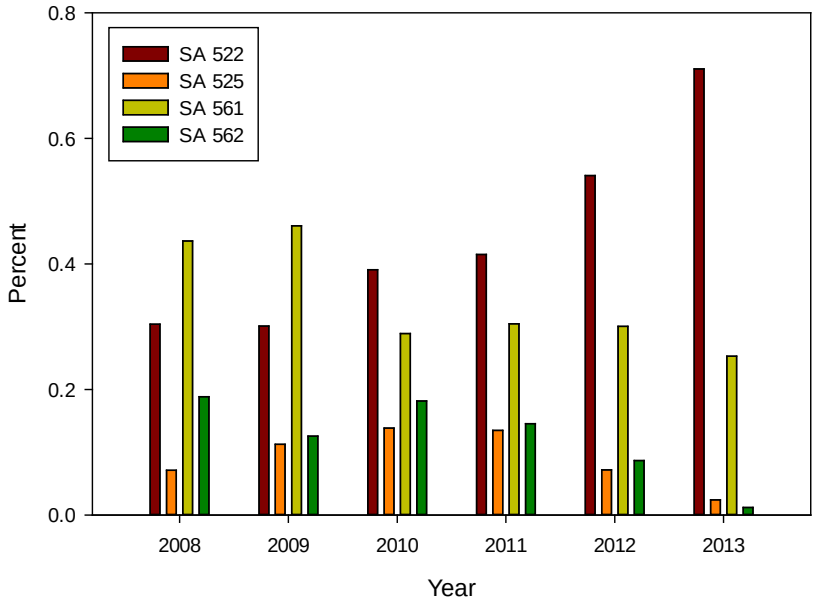

Figure 9 – Observed Sub-trips landing haddock in SA 561 and SA 562 (and SA 522 and SA 525) expressed as a percentage of total between CY 2008 and 2012.

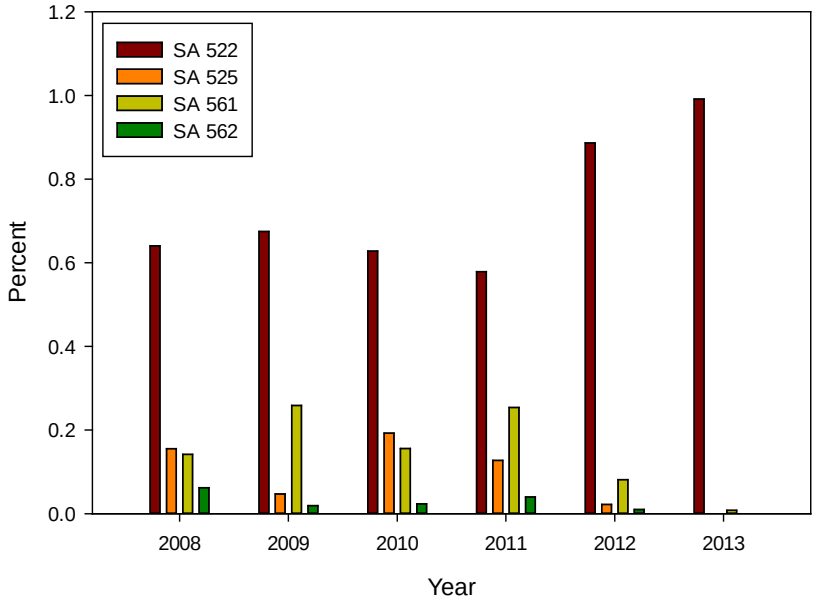

Figure 10 – Observed cod landings from SA 522 and SA 525 (and SA 561 and SA 562) expressed as a percentage of the total between CY 2008 and 2012.

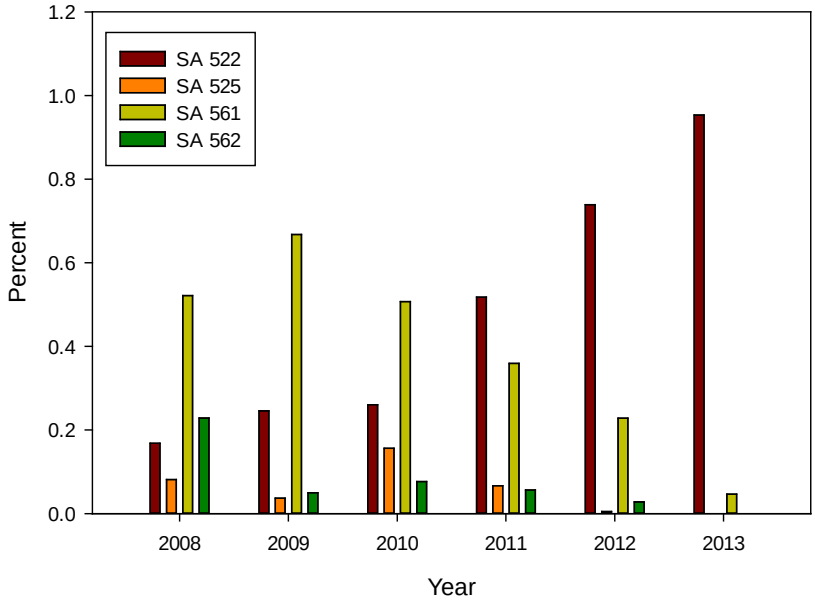

Figure 11 – Observed cod landings in SA 561 and SA 562 (and SA 522 and SA 525) as a percent of the total between CY 2008 and 2012.

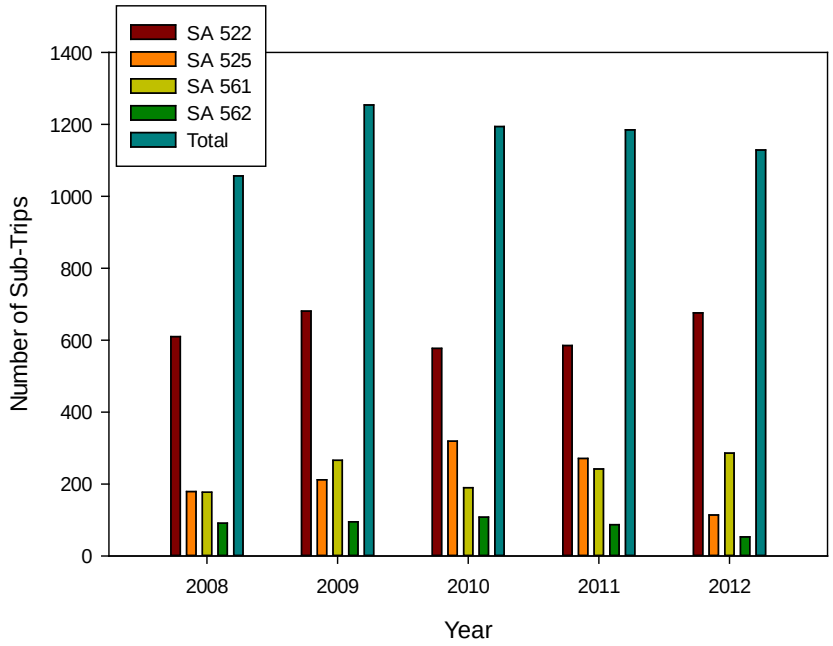

Figure 12 – Number of Subtrips reported on VTR in SA 522 and SA 525 (and SA 561 and SA 562) that landed cod between CY 2008 – 2012.

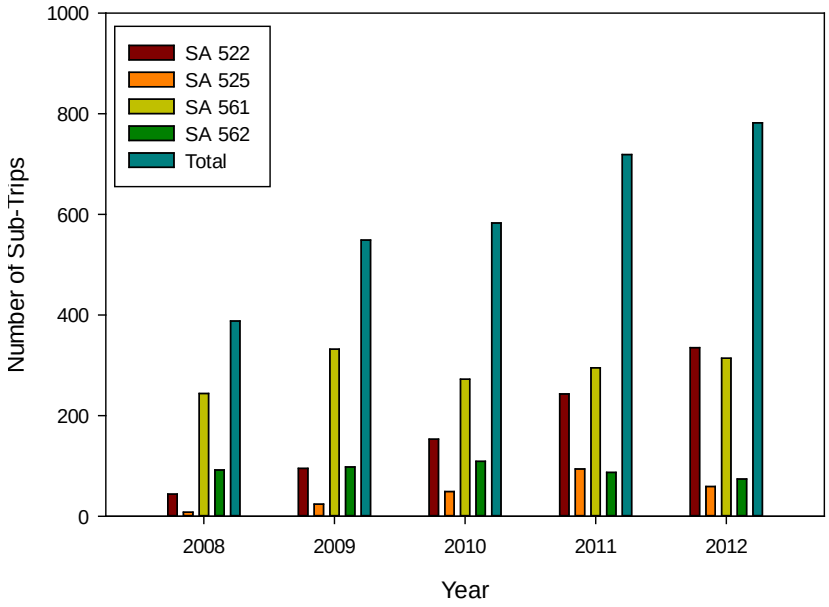

Figure 13 – Number of Subtrips reported on VTR in SA 561 and SA 562 (and SA 522 and SA 525) that landed cod between CY 2008 – 2012.

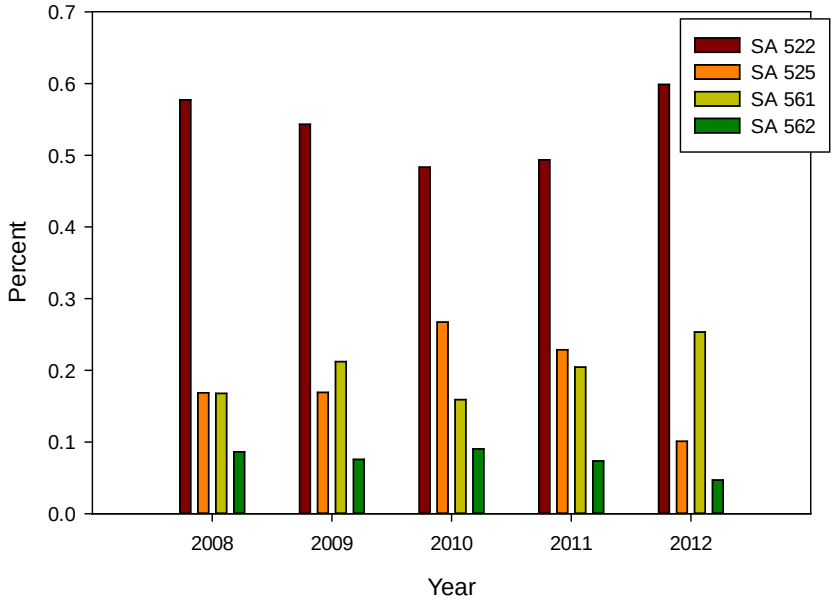

Figure 14 – Total Number of Sub-trips reported on VTR in SA 522 and SA 525 (and SA 561 and SA 562) for trawl gear expressed as a percentage between CY 2008 and 2012.

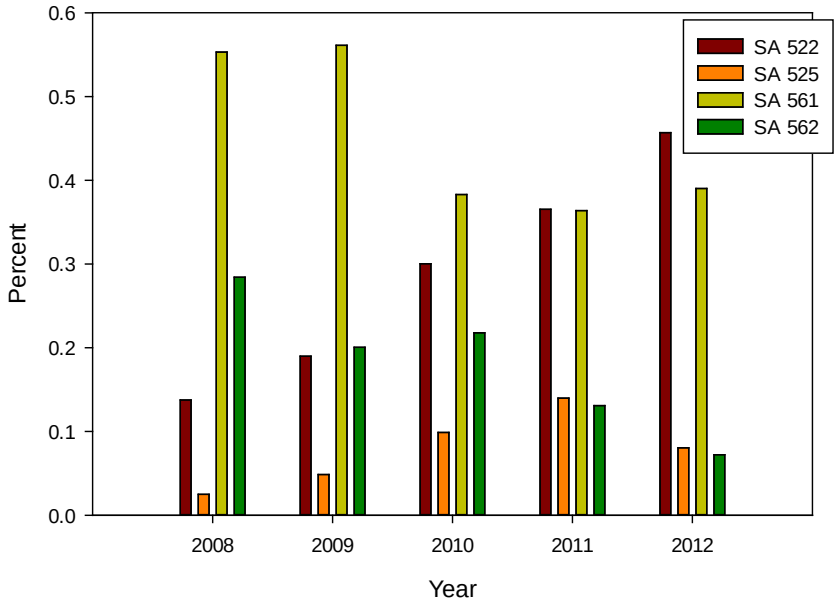

Figure 15 – Total Number of sub-trips reported on VTR in SA 561 and SA 562 (and SA 522 and SA 525) expressed as a percent between CY 2008 and 2012.

Enclosure (3)
Reported Locations of Groundfish Trips in the US/CA Area

Introduction

Concerns have been raised that fishermen may not be accurately reporting the areas that cod and other stocks are caught, particularly in the Eastern US/CA area. The speculation is that cod caught in the EGB area is reported as being caught in the WGB area because of the low quotas for EGB cod.

Reported kept catches of cod, haddock, yellowtail flounder, or winter flounder on sector fishing trips to the U.S./Canada area were examined to determine if there were detectable differences in the presence/absence of these species between observed and unobserved trips.

Data and Methods

The DMIS database for 2010 and 2011 includes information on all sector fishing trips. Data elements available include the sector gear fished, the live weight of kept catch, statistical area fished, and whether an observer was present or not. A simple query (see below) was used to count the number of sub-trips in the eastern GB (EGB) area (SAs 561 and 562) or the western GB area (WGB) (SAs 522 and 525). The query summarized the number of sub-trips by gear code, the presence of an observer, and the presence of cod, haddock, winter flounder, or yellowtail flounder. This first query selects trips that reported fishing in either, or both, areas. The counts were analyzed in a two-way table using a chi-square test and Fisher's exact text for each area (EGB and WGB).

A second query was run that was similar, but selected for trips that reported kept catch from both the EGB and WGB areas (see example script below). The trip counts were analyzed for the WGB and EGB area.

Results

The Fisher's exact test results of the two-way table analysis for trips that fished in either the WGB or EGB areas are summarized in Table 1. Results for the chi-square test can be provided. In both areas, in FY 2010 and 2011 there was a statistically significant difference between the numbers of trips that reported kept catch of yellowtail flounder on observed and unobserved trips that reported using otter trawls (gear code OTF). In 2011 there was a statistically significant difference between the numbers of trips that reported kept catch of cod on observed and unobserved trips in the EGB area when using an otter trawl. When a haddock separator trawl was reported, there were statistically significant differences for cod in 2010 (EGB) and 2011 (WGB), yellowtail flounder in 2010 and 2011 (EGB for both years), and winter flounder (EGB only).

Table 2 summarizes the results for trips that reported kept catch in both areas. There were only two instances using otter trawl gear that resulted in significant differences, both in the EGB: cod in 2011 and yellowtail flounder in 2010. There were three instances when the separator trawl was used, all in the EGB: yellowtail flounder in 2010 and 2011, and winter flounder in 2011.

Discussion

The results for the first query (all trips in either area) when using otter trawl gear or the haddock separator trawl indicate that reported kept catches of yellowtail flounder - and to a lesser extent cod – are different when an observer is present. The fact that reported catches of haddock and winter flounder on these same trips are not different suggest that there is a behavioral change as a result of the presence of an observer that is specific to cod and yellowtail reporting or catching. While the results are consistent with what would be expected if misreporting of yellowtail flounder is an issue, this analysis does not identify a specific cause.

The results for trips that kept catch in both areas are more difficult to interpret. Part of the issue for this particular analysis may be that vessels that correctly report fishing in multiple areas may be more inclined to report catch locations accurately. For trips that reported using otter trawl gear, there is less of an indication that the reported kept catches are different for yellowtail flounder. For trips using the haddock separator trawl, there is an indication that trips in the EGB area are different for yellowtail flounder and winter flounder.

Table 6 – Summary of results for all trips that fished in neither the EGB or WGB areas. Species/gear/year/area combinations where there is a statistically significant difference between presence or absence of the indicated species in the kept catch on observed and unobserved sub-trips. Legend: *: p<=0.05; **: p<=0.01; p>0.05: (). Cells marked NA had too few trips in a gear/catch/observer combination to provide reliable results.

	WGB (SA 522/525)		EGB (SA 561/562)	
	2010	2011	2010	2011
	OTF			
Cod	()(0.822)	() (0.915)	()(0.097)	** (0.004)
Haddock	()(0.467)	() (0.679)	()(0.526)	() (0.824)
YTF	*(0.029)	* (0.040)	**(0.008)	* (0.039)
WFL	()(0.445)	() (0.216)	() (0.869)	() (0.653)
	OHS			
	2010	2011	2010	2011
Cod	()(0.245)	*(0.016)	**(0.009)	()(0.055)
Haddock	()(0.294)	()(1.0)	()(1.0)	()(1.0)
YTF	()(0.199)	()(0.645)	**(0.003)	*(0.024)
WFL	()(0.144)	()(0.356)	()(0.575)	*(0.006)

Table 7 - Summary of results for trips that fished in both the EGB and WGB areas. Species/gear/year/area combinations where there is a statistically significant difference between presence or absence of the indicated species in the kept catch on observed and unobserved sub-trips. Legend: *: p<=0.05; **: p<=0.01; p>0.05: (). Cells marked NA had too few trips in a gear/catch/observer combination to provide reliable results.

	WGB (SA 522/525)		EGB (SA 561/562)	
	2010	2011	2010	2011
	OTF			
Cod	()(0.485)	()(0.7421)	()(0.161)	*(0.0251)
Haddock	()(0.509)	()(0.0522)	()(0.813)	()(1.0)
YTF	()(0.526)	()(0.0694)	*(0.046)	()(0.165)
WFL	()(0.759)	()(0.8961)	()(1.0)	()(0.871)
	OHS			
	2010	2011	2010	2011
Cod	()	()(0.3102)	()	()
Haddock	()	()	()	()
YTF	()(0.560)	()(0.526)	*(0.016)	()(0.056)
WFL	()(0.390)	()(0.759)	()(0.509)	*(0.015)

Enclosure (4)
Reported Cod and Haddock Catches on Observed and Unobserved Trips

Methods

DMIS data was queried for all sector sub-trips that took place in the EGB and WBG areas. Trips were coded for fishing year, area fished, gear, homeport state, presence or absence of an observer, and pounds kept of cod and haddock. The analyses were run two ways. First, all trips (including trips that did not report keeping cod or haddock) were included in these analyses. Second, the analyses were repeated for only those trips that reported keeping cod (of any amount).

For each area and gear combination, a Kruskal-Wallis test was used to determine if the pounds kept of cod or haddock were different on observed and unobserved trips. In this test, the data (in this case, reported kept catches) are converted to ranks and the test determines if the center of the distributions are the same. This test is considered a non-parametric analog to an ANOVA test, but should be noted that it is not testing for the mean of the data. An ANOVA was not used because the data are not normally distributed.

Because of the large number of comparisons, a $p=0.01$ was used to determine that a significant difference existed. Results are summarized in tables below. The statistics program output is provided separately.

While not summarized here, none of the bottom longline comparisons showed significant differences between observed and unobserved trips. There were too few sink gillnet trips in these areas for meaningful comparisons.

Results/Discussion

Table 1 summarizes results for all trips, including those that did not report keeping cod. This may be the most informative analysis, because one way to manipulate cod catch accounting would be to record 0 cod on a trip (or sub-trip) when the observer is not present. There were differences in the reported cod kept on observed and unobserved trips only on EGB trips in FY 2011. This was the result for both otter trawl and haddock separator trawls, but not for trips that reported using the Ruhle trawl (there was a much smaller number of these trips than for the other two gears). There were differences between observed and unobserved trips on WGB in both FY 2010 and 2011 for otter trawl and haddock separator trawl, but not for trips using the Ruhle trawl.

Table 2 summarizes the results for trips that reported keeping cod. There were differences between observed and unobserved trips for reported cod kept in FY 2010 and 2011 in the WGG area for trips using otter trawls, and in FY 2011 in the WGB area for trips using the separator trawl. Ruhle trawls trips are not summarized here because of the small number of trips.

It is difficult to draw conclusions from these analyses on whether misreporting is occurring in the EGB/WGB areas. There would seem to be little incentive to misreport haddock catches in the WGB area, yet the analyses suggest there were differences between observed and unobserved trips for 3 of the 12 gear/year/area groups examined when all trips are analyzed. With respect to cod, there are even fewer significant differences: 2 of 12 when all trips are analyzed, but both occur in FY 2011 in the eastern area. While this might be consistent with a hypothesis that misreporting is occurring, this analysis cannot be used to identify a specific cause.

Table 8 – Results of KW significance tests for all trips (trips with 0 cod are included). p-values shown; values less than 0.01 identified as significant (*).

	WGB (SA 522/525)		EGB (SA 561/562)	
	2010	2011	2010	2011
	OTF			
Cod	- (0.019)	- (0.073)	- (0.026)	* (0.0001)
Haddock	* (0.00)	* (0.00)	- (0.53)	- (0.869)
	OHS			
	2010	2011	2010	2011
Cod	- (0.576)	- (0.047)	- (0.015)	* (0.002)
Haddock	- (0.435)	* (0.006)	- (0.904)	- (0.485)
	OTR			
Cod	- (0.455)	- (0.131)	- (0.180)	- (0.256)
Haddock	- (0.711)	- (0.872)	- (0.180)	- (0.610)

Table 9 – Results of KW significance tests for those trips that reported keeping cod (trips with 0 cod are excluded). p-values shown; values less than 0.01 identified as significant (*).

	WGB (SA 522/525)		EGB (SA 561/562)	
	2010	2011	2010	2011
	OTF			
Cod	* (0.0015)	* (0.00)	- (0.169)	- (0.014)
Haddock	- (0.805)	- (0.637)	- (0.469)	- (1.0)
	OHS			
	2010	2011	2010	2011
Cod	- (0.298)	* (0.010)	- (0.567	- (0.257)
Haddock	- (0.768)	- (0.139)	- (0.703)	- (0.598)

Enclosure (5)
Catch Rates on Observed Tows in the US/CA Area

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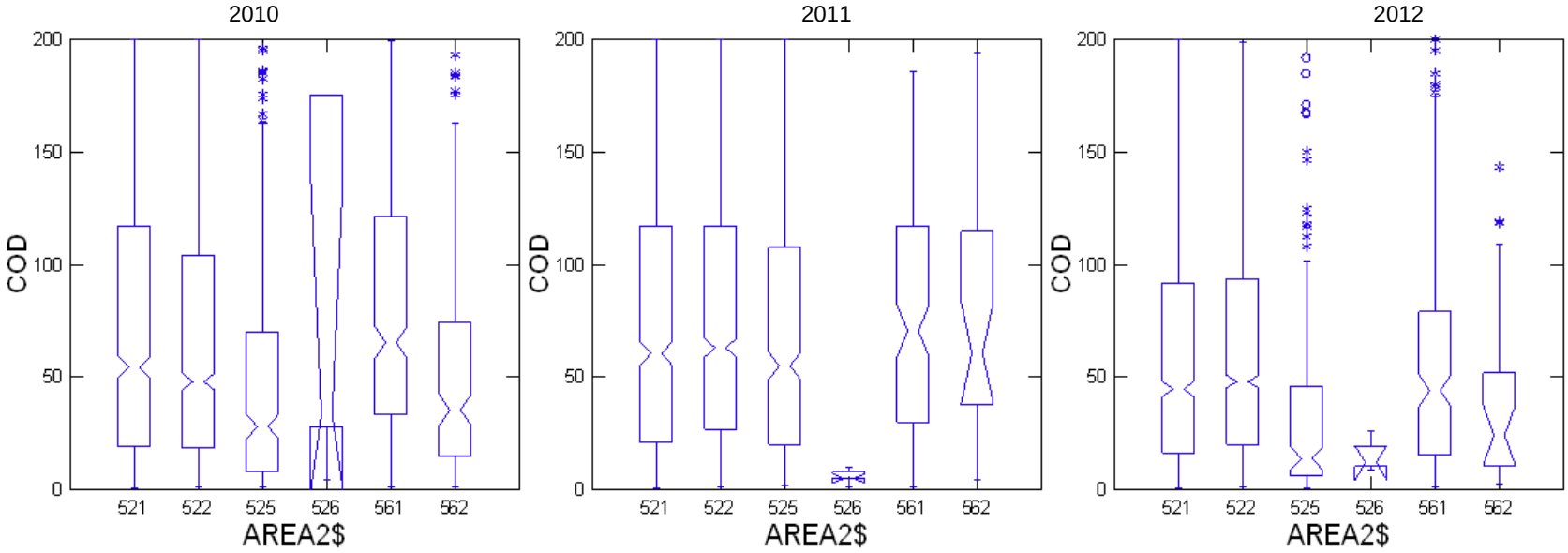

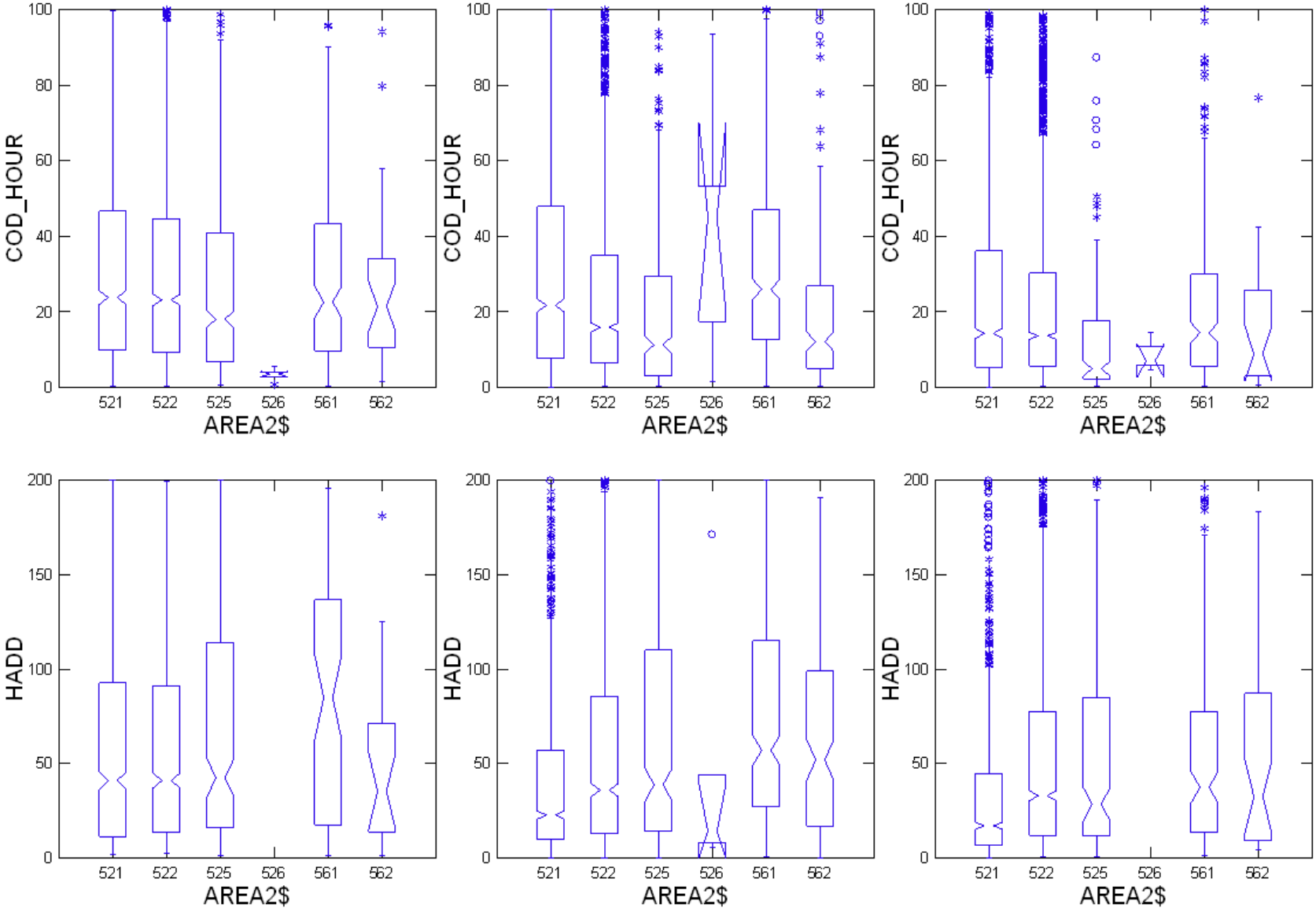
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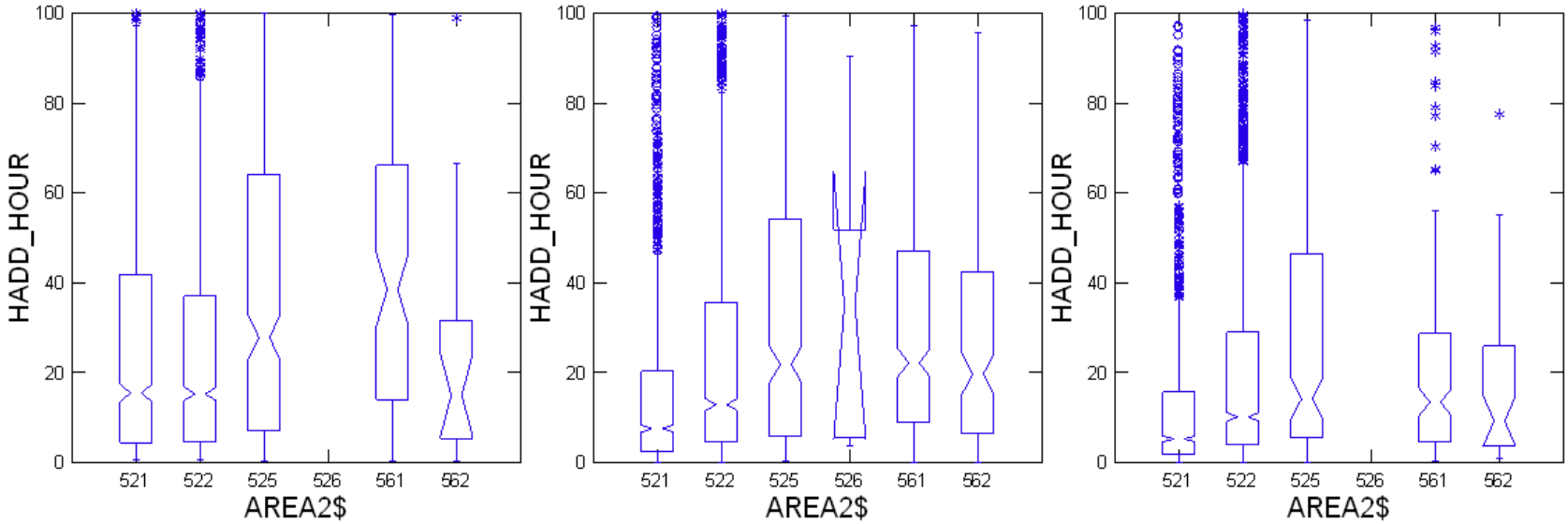
525
526
561
562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522
525
526
561
562
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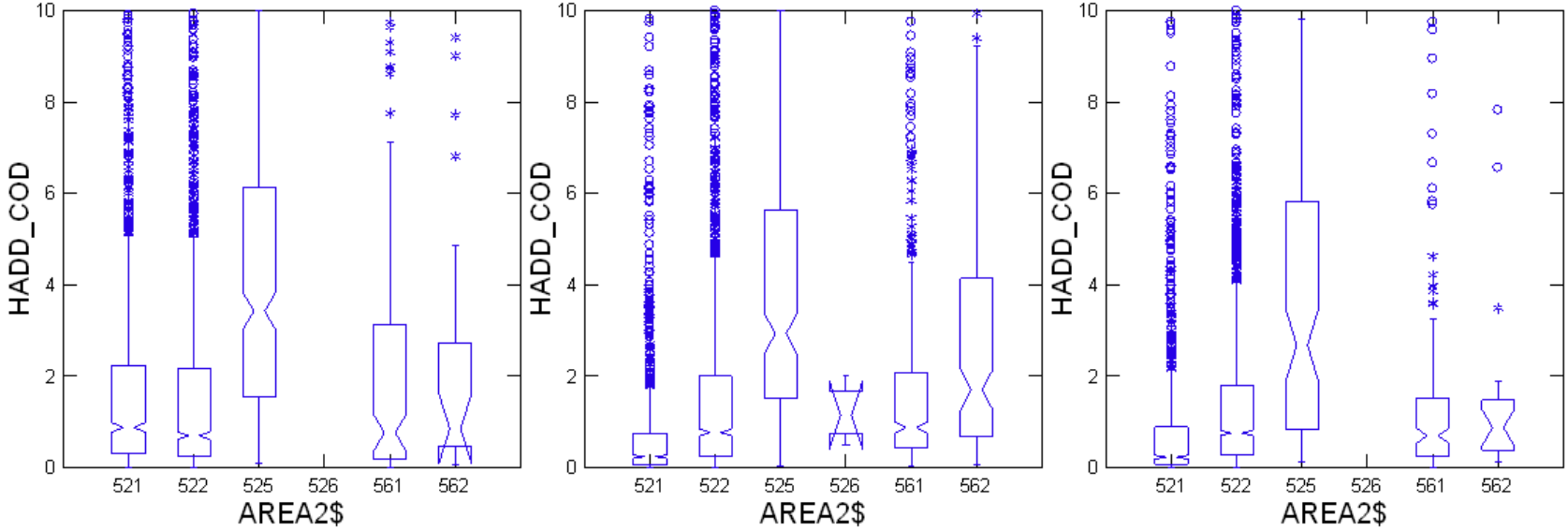
20
40
60
80
100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AREA2$
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522
525
526
561
562
0
2
4
6
8
10

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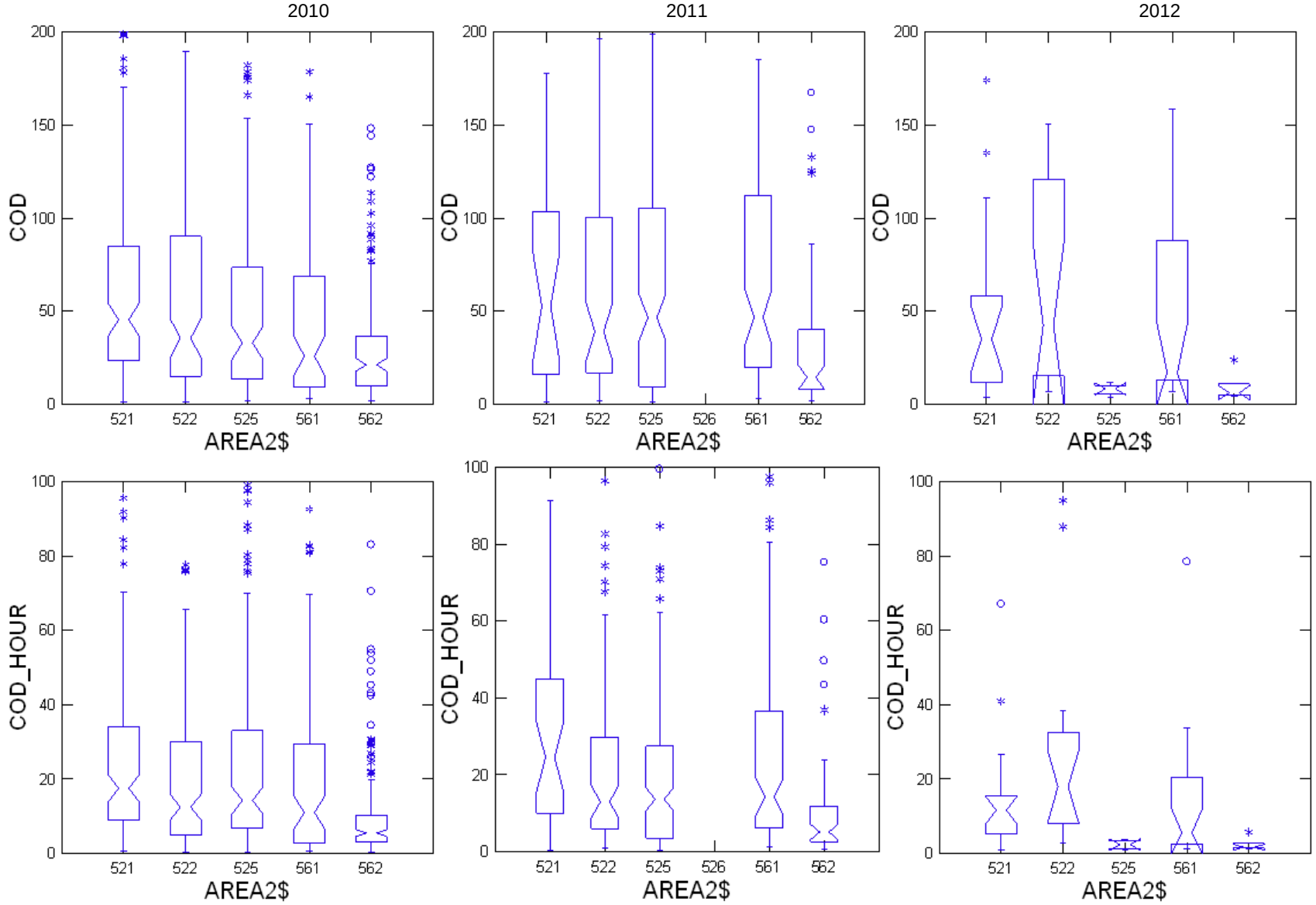

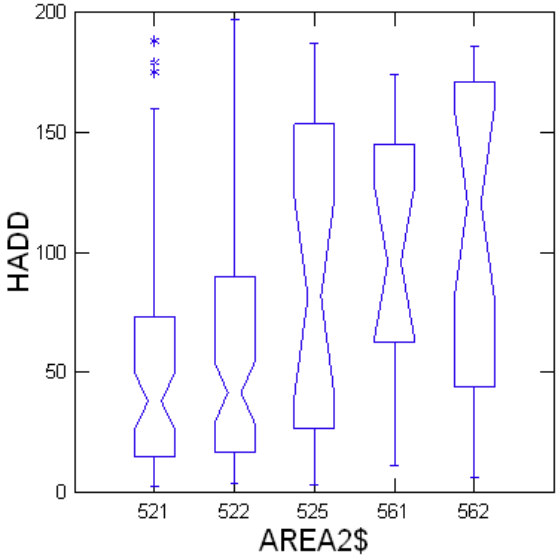
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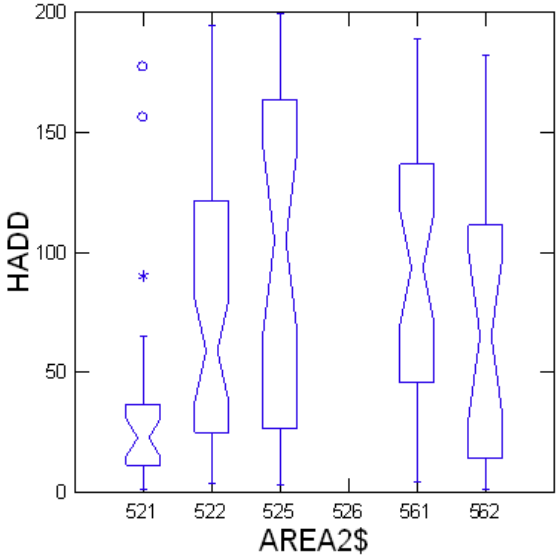
200
150
100
50
0
521
522
525
561
562
AREA2$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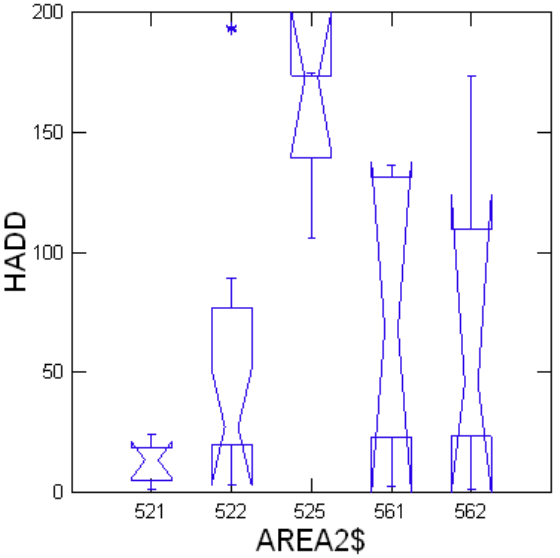
AREA2$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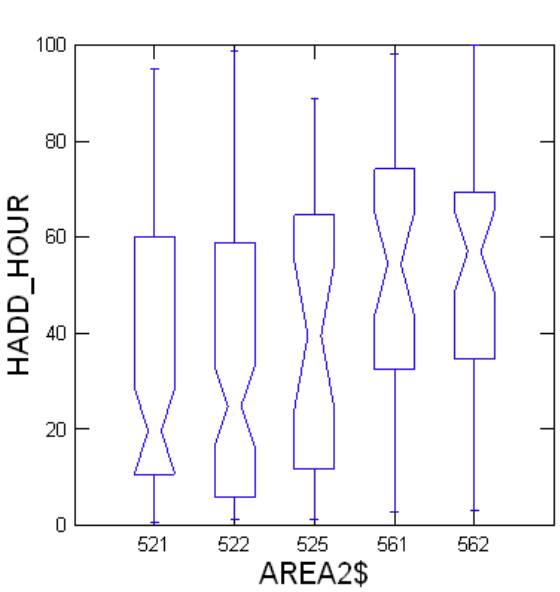
AREA2$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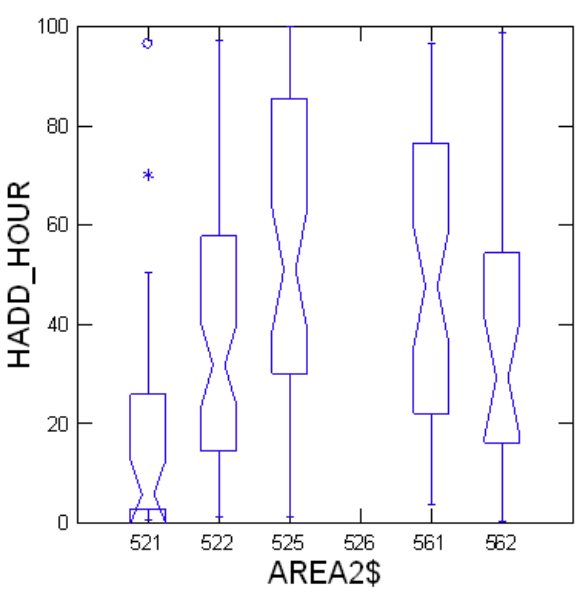
561
562
AREA2$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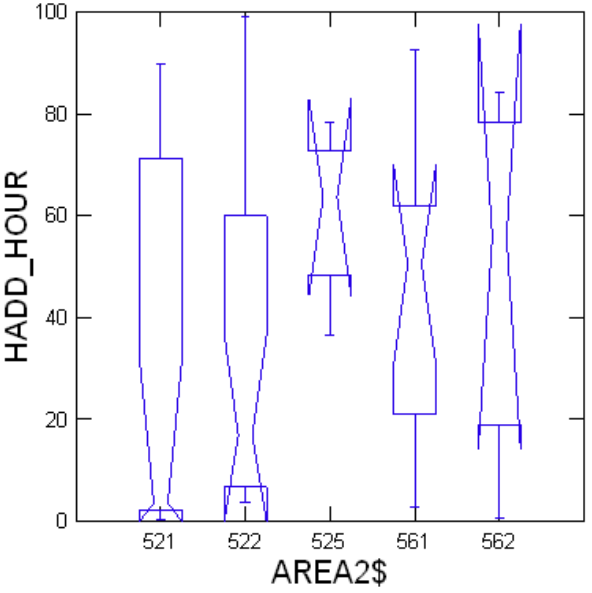
AREA2$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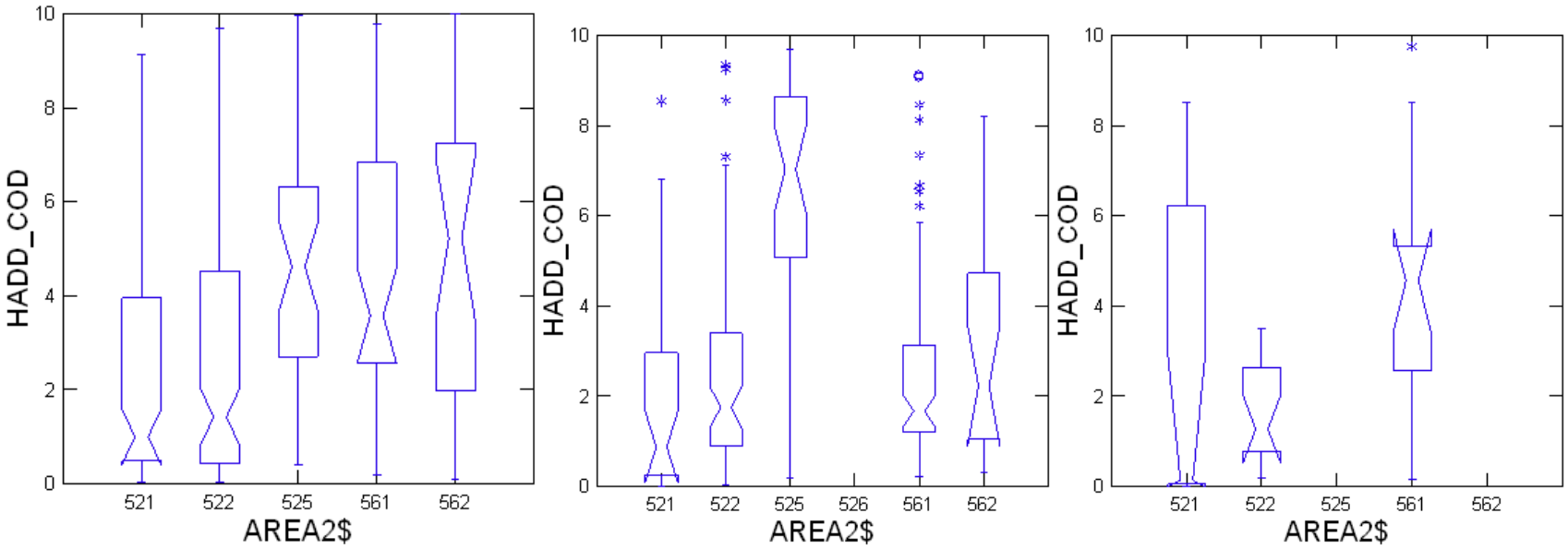
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6
8
10
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522
525
561
562
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AREA2$
0
2
4
6
8
10
521
522
525
526
561
562
HADD_COD
AREA2$
0
2
4
6
8
10
521
522
525
561
562

ACE Lease Price Differential Between Georges Bank East and West Cod

Draft
Updated April 15, 2013

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Introduction

The NEFMC Groundfish Plan Development Team was tasked by the Groundfish Committee to analyze the potential for mis-reporting cod caught in the GB cod east stock area as having been caught in the GB cod west stock area. One incentive for doing so would be to take advantage of differential ACE leasing prices for these two stocks by reporting fishing in the area with the lower ACE lease value regardless of the area actually fished. This analysis will look at the ACE lease market for these two stocks to help inform the incentives that may drive mis-reporting, if in fact it is happening.

Methods

The SECTOR database records inter-Sector ACE lease transactions in the TRANFER table. Records include the date of the transaction, the lessee and lessor Sectors, and the ACE stock, poundage and compensation associated with the lease. Based on these price and quantity data, a hedonic price model was used to estimate lease values for all 16 stocks of leased ACE.

ACE leases between Sectors take three forms:

1. Single-stock leases with single-value cash compensation (single stock leases)
2. Multi-stock leases with single-value cash compensation (bundled leases)
3. Single or multi-stock leases with single or multi-stock compensation (swap leases).

This model decomposes the lease arrangements into constituent parts representing the sixteen individual stocks, where a price (P) is a function of various quantities of the sixteen stocks for which ACE is traded.

The model used is a GAM specified as $P = \beta_0 + \beta_1\chi_1 + \ldots + \beta_n\chi_n + \varepsilon$.. The weights, β, are the portion of the total price (P) attributable to each quantity of ACE stock leased (x) and represent the marginal price of the ACE lease. In this case n is the sixteenth ACE stock. Additional variables are added to estimate the contribution of bundled and swap leases, as well as the effects

on prices for ACE leased by Northeast Fishery Sector IV and the State permit banks. To include swap leases in the model, price is set at zero dollars and one side of the swap is assigned negative lease quantities and the other positive quantities. By using swap, bundle and single-stock lease data it is possible to provide a comprehensive estimate of ACE lease values.

Data

The Sector Lease database has 3,512 stock-level trades as of April 15, 2013. 1,829 of these contained price and quantity data useable in constructing a model of prices. 984 of these are basket trades, 112 are fish-for-fish swaps, and 743 are fish-for-cash leases. Over 6 million pounds of GB West cod has changed hands during the first three years of the Sector program. Just over 377K lbs of GB East cod has changed hands during this time. Since July, 2012 only 19.3K lbs of GB East cod have been exchanged.

Figure 16 – Total monthly leases (black) and validated leases used in model estimates (grey). Year is fishing year and month is month of fishing year, where May = 1. Note that Month 12, FY12 is not complete.

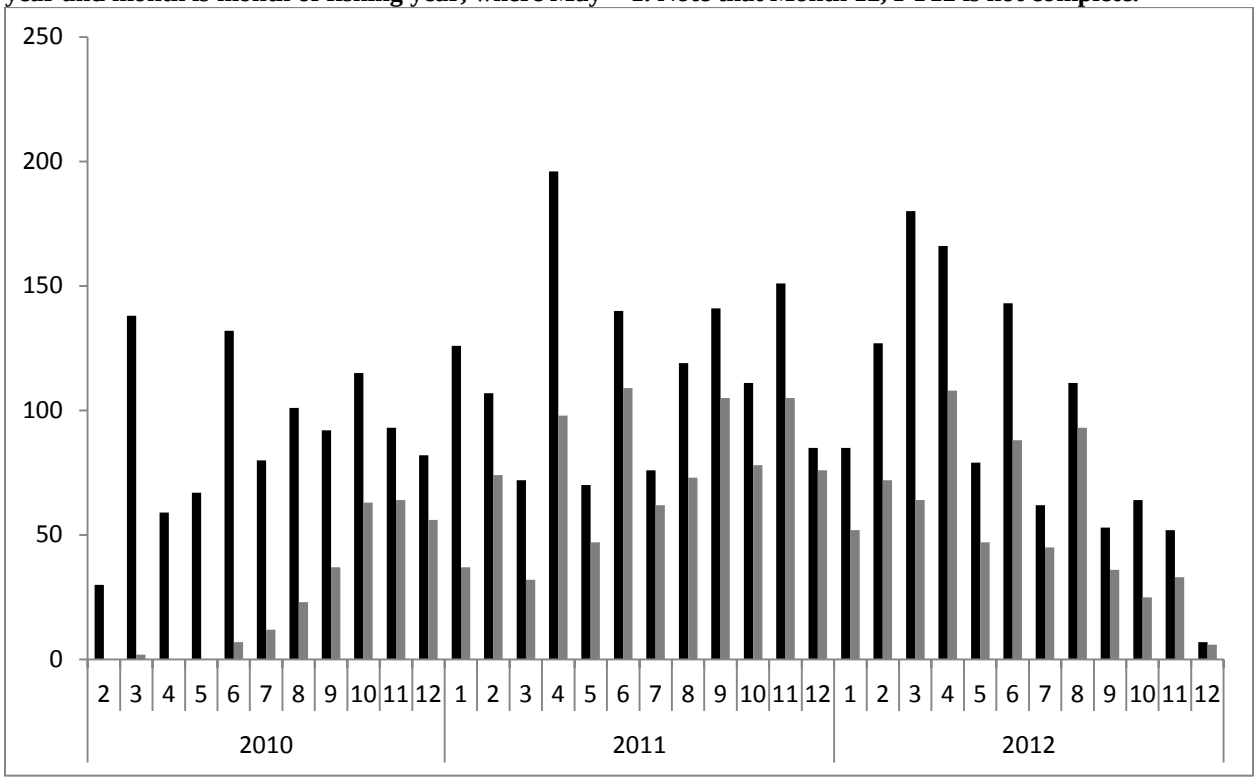

Figure 17 – Composition of validated monthly leases.

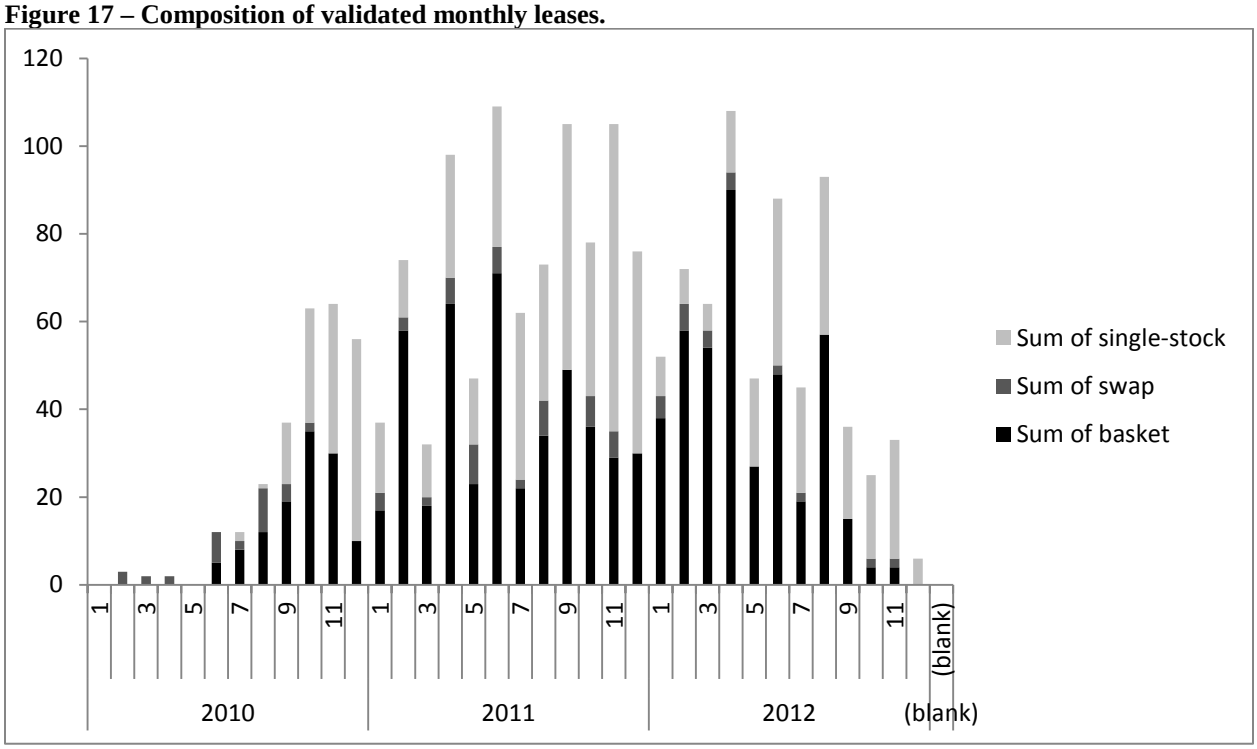

Table 10 – Monthly lease volume (pounds ACE) for validated leases

FY	FY_month	GB_east_cod	GB_west_cod
2010	1	-	-
2010	2	5,000	45,000
2010	3	24,128	360,895
2010	4	1,527	58,418
2010	5	3,714	275,952
2010	6	5,357	402,561
2010	7	9,265	214,479
2010	8	12,523	309,457
2010	9	11,062	165,925
2010	10	7,362	118,525
2010	11	17,441	114,244
2010	12	43,383	58,721
2011	1	37,635	498,273
2011	2	12,852	81,713
2011	3	19,396	159,587
2011	4	10,300	342,855
2011	5	16,653	195,575
2011	6	2,279	432,683
2011	7	662	233,989
2011	8	845	302,927

2011	9	20,216	100,699
2011	10	1,344	61,182
2011	11	6,562	91,537
2011	12	12,622	14,800
2012	1	3,808	187,878
2012	2	57,105	790,081
2012	3	14,741	295,854
2012	4	2,928	110,083
2012	5	566	54,098
2012	6	9,034	70,602
2012	7	192	
2012	8	1,055	103,017
2012	9	1,029	32,620
2012	10	514	42,930
2012	11	4,000	22,406
2012	12		10,000
	TOTAL:	*377,100*	*6,359,566*

Results

Prices are estimated for each year. GB east prices have been rising from $1/lbs to over $2/lbs from FY10-12, while GB west prices have fallen by almost half from $0.85 to $0.44. There have only been three trades of GB east quota since Jan 1. 52 trades total in this FY, 33 were part of a basket trade. The curiously high prices for GB east cod may be driven by low volume sales. There have been few fish-for-cash to help ground truth modeled prices. There appears to be one sector leasing the bulk of the quota in FY12, though a few other sectors have been lessees at similarly high prices this past year.

Table 11 – Parameter estimates from GAM.

model	spec	stock	price	Estimate	StdErr	tValue	Probt
2010	am_plaice	all	$ -	0.3838	1.3912	0.2759	0.7830
2010	cod	gb_east	$ 1.031	1.0308	0.1551	6.6473	0.0000
2010	cod	gb_west	$ 0.848	0.8481	0.0332	25.5213	0.0000
2010	cod	gom	$ 1.062	1.0620	0.0398	26.6922	0.0000
2010	haddock	gb_east	$ -	0.0000	.	.	.
2010	haddock	gb_west	$ -	0.0000	.	.	.
2010	haddock	gom	$ 0.873	0.8728	0.0427	20.4667	0.0000
2010	pollock	all	$ -	0.0000	.	.	.
2010	redfish	all	$ -	0.1381	0.2476	0.5576	0.5779
2010	wh_hake	all	$ 0.375	0.3752	0.0318	11.8049	0.0000
2010	winter_fl	gb	$ -	1.3371	2.8984	0.4613	0.6452

2010	winter_fl	gom	$ -	1.0615	0.6594	1.6098	0.1095
2010	witch_fl	all	$ 1.233	1.2333	0.1666	7.4051	0.0000
2010	yt_flounder	cc_gom	$ 0.531	0.5313	0.1538	3.4549	0.0007
2010	yt_flounder	gb	$ 0.921	0.9213	0.3126	2.9470	0.0037
2010	yt_flounder	sne	$ 0.846	0.8456	0.1785	4.7381	0.0000
2011	am_plaice	all	$ -	0.0638	0.0341	1.8674	0.0624
2011	cod	gb_east	$ 1.250	1.2503	0.1537	8.1342	0.0000
2011	cod	gb_west	$ 0.652	0.6518	0.0133	48.9993	0.0000
2011	cod	gom	$ 1.092	1.0916	0.0187	58.2647	0.0000
2011	haddock	gb_east	$ -	0.0000	.	.	.
2011	haddock	gb_west	$ -	0.0000	.	.	.
2011	haddock	gom	$ 0.414	0.4142	0.0481	8.6103	0.0000
2011	pollock	all	$ 0.053	0.0528	0.0109	4.8560	0.0000
2011	redfish	all	$ 0.247	0.2474	0.0592	4.1808	0.0000
2011	wh_hake	all	$ 0.448	0.4479	0.0213	21.0571	0.0000
2011	winter_fl	gb	$ 0.751	0.7511	0.0681	11.0325	0.0000
2011	winter_fl	gom	$ 0.693	0.6932	0.2379	2.9134	0.0037
2011	witch_fl	all	$ 0.636	0.6357	0.0722	8.8012	0.0000
2011	yt_flounder	cc_gom	$ 0.408	0.4082	0.0574	7.1178	0.0000
2011	yt_flounder	gb	$ 0.241	0.2410	0.0515	4.6822	0.0000
2011	yt_flounder	sne	$ 0.371	0.3711	0.1098	3.3806	0.0008
2012	am_plaice	all	$ 0.107	0.1066	0.0439	2.4283	0.0158
2012	cod	gb_east	$ 2.473	2.4732	0.3816	6.4816	0.0000
2012	cod	gb_west	$ 0.436	0.4358	0.0280	15.5879	0.0000
2012	cod	gom	$ 0.677	0.6773	0.0310	21.8435	0.0000
2012	haddock	gb_east	$ -	0.0000	.	.	.
2012	haddock	gb_west	$ -	0.0000	.	.	.
2012	haddock	gom	$ 0.356	0.3555	0.1315	2.7043	0.0073
2012	pollock	all	$ -	0.0464	0.0237	1.9606	0.0509
2012	redfish	all	$ 0.033	0.0331	0.0120	2.7673	0.0060
2012	wh_hake	all	$ 0.694	0.6944	0.0280	24.8252	0.0000
2012	winter_fl	gb	$ 0.578	0.5778	0.0273	21.1482	0.0000
2012	winter_fl	gom	$ 0.360	0.3596	0.0966	3.7237	0.0002
2012	witch_fl	all	$ 0.695	0.6945	0.0622	11.1706	0.0000
2012	yt_flounder	cc_gom	$ 0.630	0.6304	0.0623	10.1228	0.0000
2012	yt_flounder	gb	$ 1.137	1.1366	0.1190	9.5516	0.0000
2012	yt_flounder	sne	$ 0.718	0.7175	0.0669	10.7235	0.0000

Table 12 – Prices and trade volumes (validated trades only).

		FY_2010		FY_2011		FY_2012	
species	**stock**	**price**	**volume**	**price**	**volume**	**price**	**volume**

am_plaice	all	$	-	799,484	$	-	663,883	$	0.11	1,406,532
cod	gb_east	$	1.03	142,288	$	1.25	156,942	$	2.47	127,868
cod	gb_west	$	0.85	2,146,442	$	0.65	2,820,067	$	0.44	2,081,174
cod	gom	$	1.06	2,115,195	$	1.09	2,761,229	$	0.68	1,667,205
haddock	gb_east	$	-	945,811	$	-	379,447	$	-	1,424,883
haddock	gb_west	$	-	1,787,990	$	-	1,280,964	$	-	3,568,405
haddock	gom	$	0.87	510,807	$	0.41	652,228	$	0.36	320,124
pollock	all	$	-	3,240,773	$	0.05	3,394,683	$	-	3,408,518
redfish	all	$	-	1,139,517	$	0.25	514,264	$	0.03	2,433,387
wh_hake	all	$	0.38	1,409,496	$	0.45	2,332,818	$	0.69	1,717,074
winter_fl	gb	$	-	247,090	$	0.75	468,090	$	0.58	744,609
winter_fl	gom	$	-	78,819	$	0.69	107,651	$	0.36	252,753
witch_fl	all	$	1.23	392,939	$	0.64	710,804	$	0.69	862,177
yt_flounder	cc_gom	$	0.53	376,961	$	0.41	677,170	$	0.63	766,325
yt_flounder	gb	$	0.92	249,780	$	0.24	596,918	$	1.14	197,595
yt_flounder	sne	$	0.85	104,581	$	0.37	330,248	$	0.72	480,023

Discussion

If the price accurately reflects the importance of having GB east cod for fishing in that area, it may be reasonable to impute an incentive to mis-report and avoid that price. However, this does not appear to be exactly what's going on. Overall utilization rates are low for both GB cod stocks, currently at 27% for GB east cod. There's no price squeeze, as volumes are also down of late. The large prices paid earlier in FY12 were for relatively low volumes. The extremely low utilization may in itself be indicative of mis-reporting, but the lack of binding quota in the east makes quota values an unlikely driver for this. If, however, sectors still holding ACE are simply choosing to not lease it at any price (a possibility the data cannot refute, the lack of available quota may be sufficient incentive itself to mis-report fishing locations. A more detailed examination of catch and PSC/ACE allocation data would be needed to examine this possibility.