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Estimating the magnitude of unreported dealer landings for the northeast large mesh groundfish species from 1996 to 2007

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Abstract
The Northeast Fisheries Science Center's (NEFSC) stock assessments have historically assumed that the landings reported in the dealer weighout database represent a census of total United States (US) landings. In 2009, individual fishermen reviewing the National Marine Fisheries Service's (NMFS) records of vessel groundfish landing histories reported discrepancies between the NMFS record and their paper records. Noted discrepancies suggested that the dealer weighout database may not represent a census of total US landings. By comparing the landings information from the dealer weighout database to the vessel trip report (VTR) database this analysis has attempted to quantify the relative magnitude of large mesh groundfish species missing from the dealer database on an annual basis between the years 1996 and 2007. The results from this analysis suggest that the magnitude may be on the order of hundreds of metric tons per species annually. The magnitude of these missing landings relative to the total species landings varies by species. For the large volume species (Atlantic cod, haddock, pollock, white hake, yellowtail flounder, winter flounder, American plaice, witch flounder, and Acadian redfish), the average percentage of total landings missing was estimated at less than 5%. For the smaller volume species (windowpane flounder, ocean pout, and Atlantic halibut), the percentage of missing landings varied annually and ranged from 0.7% to 88.6%. In general, the percentage of missing landings has decreased over time. The estimated missing landings likely underestimate the true level of landings missing from the dealer data, but do provide information on the relative magnitude.

Introduction

The National Marine Fisheries Service's (NMFS) Northeast Fisheries Science Center's (NEFSC) stock assessments have historically assumed that the landings reported in the dealer weighout database represent a census of total United States landings. In 2009, leading up to the implementation of sector management for the New England groundfish fishery, the NMFS Northeast Regional Office (NERO) provided sector managers with the landings history for each vessel permit currently on their sector roster. Individual fishermen reviewing NMFS record of permit landings history reported discrepancies between the NMFS record and their personal paper records. The discrepancies reported include landings amounts, missing species landings for particular trips and entire trips missing from the dealer data. At that time, the relative magnitudes these types of discrepancies was unknown. Follow-up communication with individual fishermen suggested that the absence of species records and entire trips from the dealer database are the most serious problems.

The assignment of dealer landings to the wrong vessel could cause some of the problems noticed by vessel owners. While this presents a problem for determining landings history for the purposes of sector allocations or quotas, this would not violate the NEFSC's assumption that the dealer data are a census of total landings. However if these observations by the industry were due to the fact that the landings were never reported by the dealer, this could have serious implications for individual stock assessments.

The NEFSC uses dealer reported landings to estimate total species landings as they are presumed to be the most reliable source for total fish landings. Annual species landings are generally lower when calculated from the vessel trip reports (VTRs) compared to the dealer records (Fig. 1). This is due in part because the captains hail weights reported on VTRs are biased low relative to the scale weights recorded by the dealers (Palmer et al. 2007). The possibility that the dealer data are incomplete would violate the assumption that dealer reported landings are a census of total annual species landings. This analysis attempts to quantify the magnitude of dealer data missing for the 12 large mesh groundfish species by comparing dealer landings to the VTR reported landings. The 12 groundfish species investigated are: Atlantic cod, haddock, pollock, yellowtail flounder, winter flounder, witch flounder, American plaice, windowpane flounder, Atlantic halibut, white hake, redfish and ocean pout.

Methods

Dealer and vessel landings information were extracted from the Northeast Region's standard fisheries dependent data collection systems for the years 1996 to 2007. Dealer data were extracted from the CFDETS AA tables (Wigley et al. 2008). The extracted dealer data included only landings of the large mesh groundfish species purchased by federally permitted dealers (dealer permit numbers between 10 and 5000) from known federally permitted vessels (vessel permit numbers of 000000, 190998, and 390998 were excluded). The VTR landings data were extracted from the VESLOG tables. The extracted data set contained the landings of large mesh groundfish species from federally permitted vessels (excluded NY state VTR data with vessel permit numbers > 800000) reportedly sold to federally permitted dealers (dealer permit numbers between 10 and 5000). Because VTR landings lack information on the grade of the landings (whole, gutted, etc.) this analysis used only landed weights rather than attempt to interpret the grade code of VTR reported landings.

Prior to attempting to match landings between the dealer and VTR data sources, the dealer and VTR landings data were summed across year, time block, dealer permit numbers, and species. The time blocks investigated in this analysis include: annual, quarterly, monthly and weekly. Landings were then matched among the two data sources by joining on year, time block, dealer permit number and species. The matching results were classified into one of three matching categories: (1) landings record exist in both sources, but the magnitude may vary, (2) landings data exist in the dealer data but not in the VTR data; and, (3) landings data exist in the VTR data but not in the dealer data.

The matching success rate is sensitive to the time block used to aggregate the dealer landings. As the time block gets smaller (annual → weekly) the matching success between data sources decreases (i.e., there are more unmatched cells). Table 1 provides an example of this: In this example the landings have been aggregated at monthly time block prior to matching. There is no record of any dealer landings for the months of February, April and May but vessels did report selling to this dealer in these months. As a result there are large amounts of category 3 landings (reported on the VTR but not

recorded in the dealer data). If an annual time block was used to aggregate these landings there would be no category 3 landings for this dealer in 1999; the missing landings would become indiscernible from category 1 matched landings. As the time block is made smaller the amount of perceived missing landings (both category 2 and 3) generally increases (Fig. 2). Conversely, as the time block is made smaller, the level of agreement between matched VTR landings and dealer landings (category 1) decreases (Fig. 3).

The use of smaller time blocks does increase the perceived amount of missing dealer landings; however, the quality of the underlying dealer and VTR data may be insufficient to use weekly time blocks. The matching between data sources is contingent on the reliability of the date sold field as a linking mechanism. It is known that vessels will fill in the landing date in the date sold field but the actual dealer transaction (and subsequent dealer reported date sold) may not occur until the next day. A weekly time block would produce perceived missing dealer landings in the situation where a vessel's reported date sold fell on a Saturday and the dealer did not record the transaction until Sunday or Monday. While this can still occur when using a monthly time block, the frequency of occurrence is much less. Because of the date sold offset between the two data sources and a large fraction of dealer landings with no day of sale information (Table 2) a weekly time block was considered unreliable as a time block for these analyses. There was a small fraction of landings in 1998 with no month information (month = 0), though the total impacts were small: Atlantic cod 1.9 mt, yellowtail flounder 0.7 mt and 0.5 mt of winter flounder. These data were removed from the analysis prior to matching.

To estimate the total missing dealer landings, VTR and dealer landings were aggregated using a monthly time block and then landings were categorized as type 1, 2, or 3 landings. This analysis was concerned only with the identification of type 3 landings (reported on the VTR but not recorded in the dealer data). The type 3 landings were summed by year and species and compared to total species landings to assess the potential relative magnitude of the missing landings.

Results

Annual type 3 landings are presented in Table 3; the amount of landings reported on the VTRs but not recorded in the dealer data varies from 0.2 mt to close to 650 mt depending on the species and year. These amounts are expressed as a percentage of the total annual US species landings used in the most recent stock assessment (Table 4, NEFSC 2008) in Table 5. It should be noted that this comparison uses landed weights as a fraction of live weights. This has the effect of underestimating the percentage of missing landings. For those species typically landed in processed form (gutted, drawn, etc.) the percentages can be multiplied by the landed-to-live weight conversion factors (Table 6) to establish an upper bound on the percentages.

For the large volume species (Atlantic cod, haddock, pollock, white hake, yellowtail flounder, winter flounder, American plaice, witch flounder, Acadian redfish) the average percentage of type 3 landings relative to the total species landings was estimated at less

than 5%. For the smaller volume species (windowpane flounder, ocean pout, Atlantic halibut) the percentages varied annually and ranged from 0.7% to 88.6%. In general, the percentage of missing landings has decreased over time for those species landed in large amounts (Fig. 4a and 4b), however the low volume species (Windowpane flounder, Atlantic halibut, and ocean pout) exhibit very different trends from those of the other groundfish species (Fig. 4c).

The large differences between VTR and dealer landings could be evidence of systematic non-compliance or data errors that may impede the data matching that is critical to this analysis (e.g., erroneous entry of the dealer permit number in the VTR). Individual seafood dealers were ranked by the amount of category 3 landings (rank of 1 indicating that that dealer had the largest amount of category 3 landings in a particular year). The top twenty dealers in each year are shown in Table 7. There were 10 dealers that were in the top twenty list in at least five of the twelve years examined (Table 8). Dealers with large amounts of category 3 landings may either have been not reporting, or there may have been data errors (either submission or data entry) associated with either the dealer or VTR data. An audit of the original VTR forms and weighout forms could determine the cause of category 3 landings. The original dealer weighout slips are not readily available, but scanned images of the paper VTRs are. A random selection of 200 VTRs were manually audited by comparing the scanned VTR image to the database values. Issues detected were grouped into seven categories and placed in two broad categories (VTR entered correctly, or VTR entered incorrectly). The results of the audit are shown in Table 9. Overall, the majority VTR landings were correctly entered suggesting that dealer non-compliance may be responsible for the category 3 landings.

Discussion

To consider type 3 landings (reported on the VTR but not recorded in the dealer data) representative of the amount of landings actually missing from the dealer data several assumptions must be satisfied. It is critical that the VTRs accurately record the species, species amount, and dealer permit numbers. There is no evidence to suggest that there are systematic issues with the species and dealer identification; however, it is known that VTR reported amounts tend to be less than dealer reported landings (Palmer et al. 2007) with the underestimation somewhere on the order of 10% (Fig. 3). It should be recognized that there is a fraction of landings not reported on VTRs (Fig. 2). If landings are not reported on VTRs and not reported by dealers, it is extremely difficult to estimate this fraction of missing landings. Because the missing landings are estimated in landed weights we can only obtain a range of relative magnitudes for those species frequently landed processed. The lower bound assumes all of the fish are landed whole and the upper bound assumes all are landed processed. This could have the effect of underestimating the amount of missing landings on the order of 10 to 15% (somewhat higher for white hake, Table 6). The absence of a trip in the dealer data will not necessarily show up as category 3 landings in this analysis; only situations where a species has not been recorded in the dealer data for an entire month will show up as category 3 landings; performing this analysis using a weekly time block could raise the

relative magnitudes by as much as 25% (Fig. 2). Given these caveats, the estimates of landings missing from the dealer data are likely low estimates of the true amount.

In the period before dealer electronic reporting (prior to May 1, 2004) it is difficult to determine the exact cause for missing landings. During this time period NMFS port agents keypunched the dealer landings information from paper weighout slips provided by the seafood dealer. It is possible that the weighout slips never existed, was not given to the port agent, or the data were not entered by the port agent. Missing landings are most prevalent from 1996 to 2000 and then generally decrease. It is interesting to note the strong degree of cohesion among the missing landings trends of the flatfish species (Fig. 4b). This likely due to the fact that these species are often caught together and subsequently landed together. This pattern would be expected if entire trips were not reported in the dealer data. Since May 1, 2004 dealer data have been entered electronically by the dealers. During this period the relative amount of missing landings has declined. The exceptions to this trend are white hake, winter flounder and ocean pout; it is uncertain why missing landings increase during this period for these species.

There is a large difference between the relative amounts of missing landings for the high volume species (> 1000 mt annually) compared to the low volume species. Anecdotal information provided by the industry indicates that occasionally when a small amount of a species are landed the landings will be attributed to another species landed in higher amounts to reduce the record keeping burden (e.g. a single windowpane flounder is landed and added to the catch of American plaice to reduce the record keeping burden for the seafood dealer). This is an unlikely explanation for Atlantic halibut because of the price per pound differential compared to other flatfish and likely does not explain non-reporting of ocean pout.

Missing catch has been theorized as one possible cause of retrospective patterns in stock assessments if the relative magnitude of the unreported catch changes over time (Legault 2009). The results presented here suggest that the relative magnitudes of missing catch has changed over time; however, with the exception of the low-volume species the relative magnitudes are smaller than those considered necessary to generate retrospective patterns. However, because the magnitudes presented here are likely low estimates, missing landings could be contributing to some of the retrospective problems present in the groundfish assessments (NEFSC 2008). This analysis could only be performed at the species level due to know area reporting problems in the VTR data (Palmer and Wigley 2007). It is unknown whether the relative magnitudes of missing landings at the stock level are proportional to those observed at the species level.

This analysis was not concerned with the landings history of individual vessel permits. This analysis does show that there are missing landings and this will impact the landings history for some vessels. This issue is outside the scope of the NEFSC, but is something that should be considered by the NERO prior to determining groundfish sector allocations (and to extent to any sector or quota share system).

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