

Analyses of Groundfish Monitoring for Amendment 23

Groundfish Plan Development Team

Council Staff

**Council
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1a- Modeling discard incentives for Northeast Multispecies (Groundfish) stocks

Questions:

For which stocks and years may illegal discarding have been incentivized on unobserved trips 2007-2017?

What are indicators of discard incentives?

Approach:

Model – based approach to examine the incentives to discard any given stock on a particular trip

Discards incentives are modeled as a function of the cost of landing, the cost of discarding, ex-vessel price, and quantity caught of the stock

PDT Conclusions

Stocks landed with a positive discard incentive may indicate bias in the total catch estimate for that stock.

In general, yellowtail flounder and cod stocks have the highest modeled discard incentives over time, but these are highly variable on a year to year basis. All three (Georges Bank, Southern New England/Mid-Atlantic, and Gulf of Maine) yellowtail flounder stocks had higher discard incentives in earlier years (2010, 2012).

Both (Gulf of Maine and Georges Bank) cod stocks had higher discard incentives in recent years (2015-2017).

Stocks with consistently low discard incentives include those with relatively low quota price to ex-vessel price ratios, including pollock, redfish, and Georges Bank haddock.

PDT Conclusions

Quota prices as a ratio of ex-vessel price drives modelled discard incentives. This ratio is the strongest theoretical predictor of bias.

Utilization (catch: annual catch limit) is weakly related to quota price and varies by stock.

The model can only identify when landings or trips comply with the discarding prohibition, even when it may not be economically rational to do so. The model cannot quantify the proportion of trips or catch that does not comply with the discarding prohibition.

More precise estimates of quota prices will enhance the ability to model discard incentives under current conditions.

There may be other social, cultural, or normative factors that may influence individuals' decisions to comply with discard rules that we do not account for in this analysis.

1b- Evaluating the Observer Effect for the Northeast U.S. Groundfish Fishery

Questions:

Does data generated on observed fishing trips reflect the activities of the whole fleet?

Are estimates generated from these data unbiased?

Approach:

Method – exact matching analysis to compare the same vessel behavior on sequential trips, from 2007- 2018

Metrics examined (standardized) - trip duration, kept catch, total revenue, kept groundfish, kept non-groundfish, groundfish average price, opportunity cost of groundfish quota, and the number of groundfish market categories included in kept catch

PDT Conclusions

This analysis demonstrates that fishing vessels in the Northeast multispecies (groundfish) fishery alter their behavior in response to human observers (distinct from selection bias/observer deployment effects). The analysis documents a consistent pattern of different fishing behaviors when an observer is on board.

PDT Conclusions

Data generated on observed trips are not representative of the whole fleet.

Generally, the most pronounced effects are seen across trip duration, kept catch, kept groundfish, and trip revenue.

Observer presence has the smallest effect on the number of groundfish market categories and non-groundfish average prices, but even in these instances differences are observed.

The data show a trend for three key metrics, in almost all circumstances, such that when an observer is onboard, vessels appear to:

1. Retain fewer fish,
2. Fish for less time and,
3. Obtain lower revenues.

PDT Conclusions

Persistent differences such as higher average groundfish prices with an observer on board (trawl vessels) and emerging differences like a greater number of market categories retained with an observer (gillnet vessels) indicate that the composition of catch on observed trips is different than unobserved trips.

1d- Comparison of sector vessel landing effort ratios between observed and unobserved trips by gear and broad stock area

Question:

Can observer effects be detected in landing effort ratios at the level of broad stock areas?

Approach:

A comparison of allocated groundfish stock landings to effort ratios was done between observed and unobserved trips by broad stock area and by gear type (gillnet and trawl gear), using Kept all (Kall) and days absent (DA).

PDT Conclusions

Discrepancies exist between observed and unobserved trips, when comparing landing to effort ratios. Differences in the landing ratios between observed and unobserved trips suggest that observed trips are not representative of unobserved trips. This analysis assumes there are no observer deployment effects.

PDT Conclusions

For the Gulf of Maine broad stock area, this analysis demonstrates there were slightly more cod landings seen on observed trips relative to unobserved trips despite incentives to avoid cod on observed trips due to low ACLs from 2015 to 2017. This difference was consistent across effort metrics (Kall and DA) and gear types.

For the Offshore Georges Bank broad stock area and Inshore Georges Bank broad stock area (Statistical Reporting Area 521), more haddock are consistently landed on unobserved trips relative to observed trips. The differences in the haddock ratios may have less to do with the influences of haddock which was not constraining but perhaps more a function of other potentially constraining stocks on these trips targeting haddock.

PDT Conclusions

Documented differences in the stock landing to effort relationships reflects differences in discarding of legal sized fish on unobserved trips relative to observed trips.

Interpretation of the magnitude of these differences is uncertain due to the potential inherent biases caused by incentives to avoid limiting stocks on observed trips.

The magnitude of the differences in the landings to effort relationships between observed and unobserved trips is likely not an accurate estimation of the true extent of the potential missing removals.

1c- Predicting Gulf of Maine (GOM) cod catch on Northeast Multispecies (groundfish) sector trips: implications for observer bias and fishery catch accounting

Question:

Is the observed effort representative?

- *Pre-catch behavior* - where, when, how gear is fished
- *Post-catch behavior*- compliance with discarding regulations e.g., retaining legal sized fish
- *Evidence that catch outcomes differ suggests it is not* - e.g., kept groundfish

Approach:

Construct a predictive model from observed trips to compare with unobserved trips, assuming trips occurring closer in space and time are more similar

- Trip attributes: Kept catch (Kall, pollock, haddock, winterfl, yellowtail), Trip length, Space (VTR location), and Time (trip end)
- Vessel attribute: Gear, Vessel Size, and Permit

PDT Conclusions

By modeling patterns of cod catch across space, time, and other attributes of fishing effort on observed trips, predictions of expected catch on unobserved trips were compared to the reported catch on these trips.

For gillnet trips, predicted cod catch was increasingly higher than reported catch from 2013 to 2017. Differences between predicted and reported catch on trawl trips were variable across time without an apparent trend. For both gear types, the proportion of total catch consisting of cod decreased over time, suggesting less targeting.

There is some evidence that the magnitude of unreported cod catch (potentially illegal discarding) could have been >60% of reported catch on unobserved trips.

PDT Conclusions

An important caveat is that conclusions depend on validity of the model structure and predictions. If unmeasured attributes of effort (e.g. tow speed) and/or relationships between effort predictors and catch outcomes differ between observed and unobserved trips, predictions may not be valid. Differences in catch outcomes are assumed to be attributed to post-catch behavior (compliance, or lack thereof, with discarding regulations) and not pre-catch behavior (how the gear was fished).

Results from models for pollock suggested a lack of model fit compared to those for cod, making conclusions equivocal for this species.

Overall PDT Conclusions

All three analyses that compare observed and unobserved trip data conclude that observed trips are not representative of unobserved trips. The dimensions where observed trips differ from unobserved trips include:

- Gulf of Maine cod catch rates,
- Groundfish landings to effort ratios,
- Trip duration,
- Pounds of kept groundfish,
- Pounds of total kept catch, and
- Trip revenue.

Documented differences in the stock landing to effort relationships reflect differences in discarding of legal sized fish on unobserved trips relative to observed trips.

Despite removing Sector IX data from some of these analyses, fishery-wide bias is still demonstrated.

Overall PDT Conclusions

The discard incentive model describes one mechanism to explain differences between observed and unobserved trips: the sector system increases the incentive to illegally discard legal-sized fish on unobserved trips.

Discard incentives have varied across time and stock area. After full sector implementation, the accountability of discards and the application of sector/gear specific discard rates to unobserved trips, together with the potential catch of constraining stocks, increased the incentive to not comply with retention regulations.

Given these conclusions, the current precision standard is not an appropriate method to set at-sea monitoring coverage levels because the assumption that observed trips are representative of unobserved trips is false.

Overall PDT Conclusions

These analyses cannot quantify the differences between observed and unobserved trips in a way that allows for either a mathematical correction to the data or a survey design that resolves bias.

Non-compliance with the requirement to land legal-sized fish of allocated stocks (excluding LUMF) undermines any sampling design and should be addressed.

While direct evidence of the incidence and magnitude of non-compliance is not captured, the documented differences in behavior are substantial enough to warrant concern that non-compliance is occurring, especially in view of incentives to be non-compliant while unobserved.

Overall PDT Conclusions

Revisions to the monitoring program should consider ways to increase compliance or account for non-compliance. Substantially increasing the management uncertainty buffer might account for this non-compliance but would not improve our understanding of true removals and would result in foregone revenue for the fishery. Alternatively, increased monitoring and catch accounting may be one way to increase compliance and may be necessary to provide accuracy of catch.

The analyses support more comprehensive monitoring in the fishery.



Additional Slides

Groundfish Plan Development Team Analysis

1a - Methods to explore discard incentives of groundfish stocks.

1b - Methods to evaluate observer effects in the groundfish fishery.

1c - Methods to predict groundfish catch in the presence of observer bias.

1d - Methods to evaluate groundfish landings ratios.

1f - Groundfish PDT conclusions based on the analyses conducted

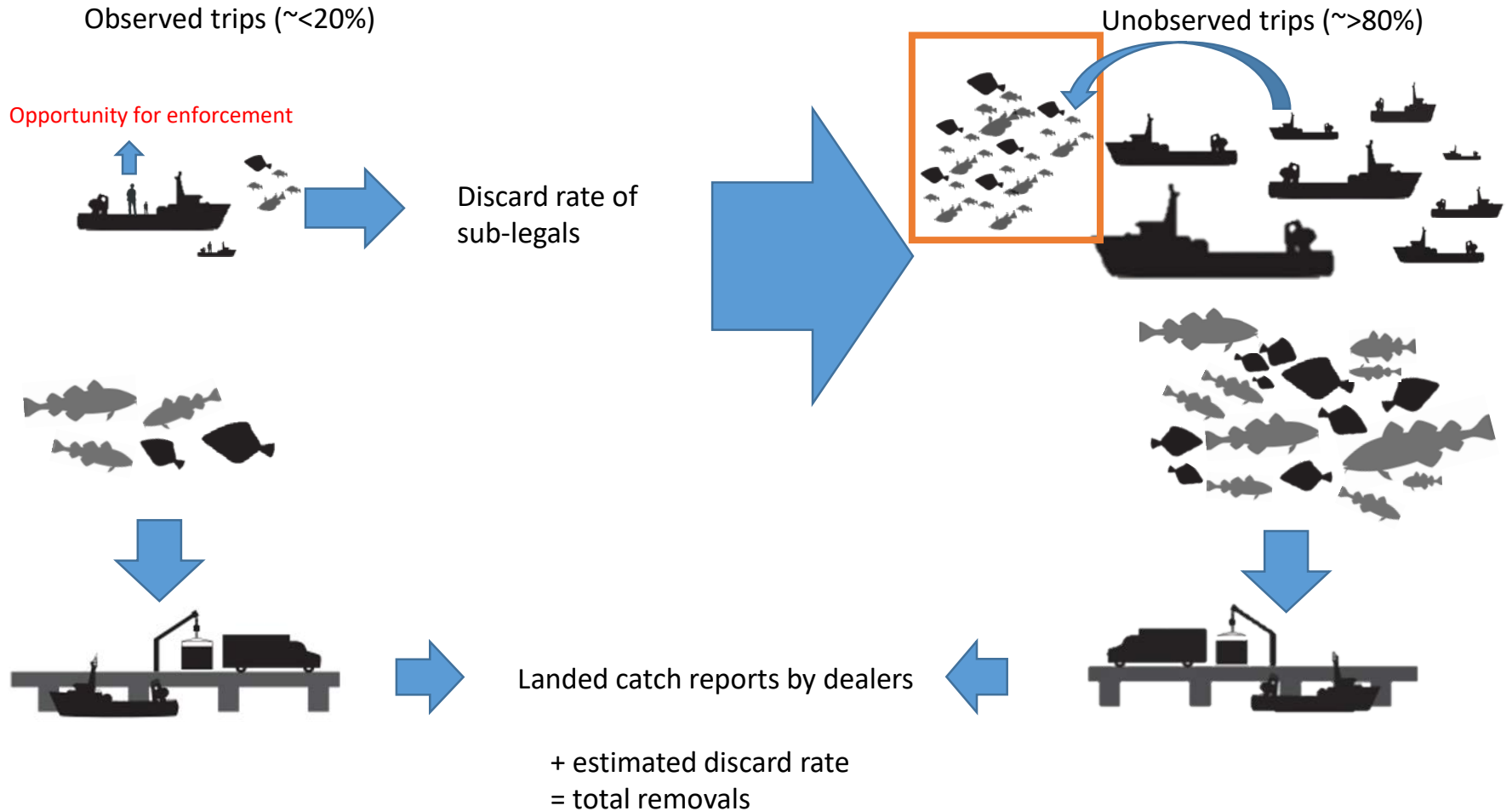
Motivation for the peer review

To ensure that any new and novel analyses of Amendment 23 issues and management alternatives get sufficient independent review.



Groundfish Plan Development Team

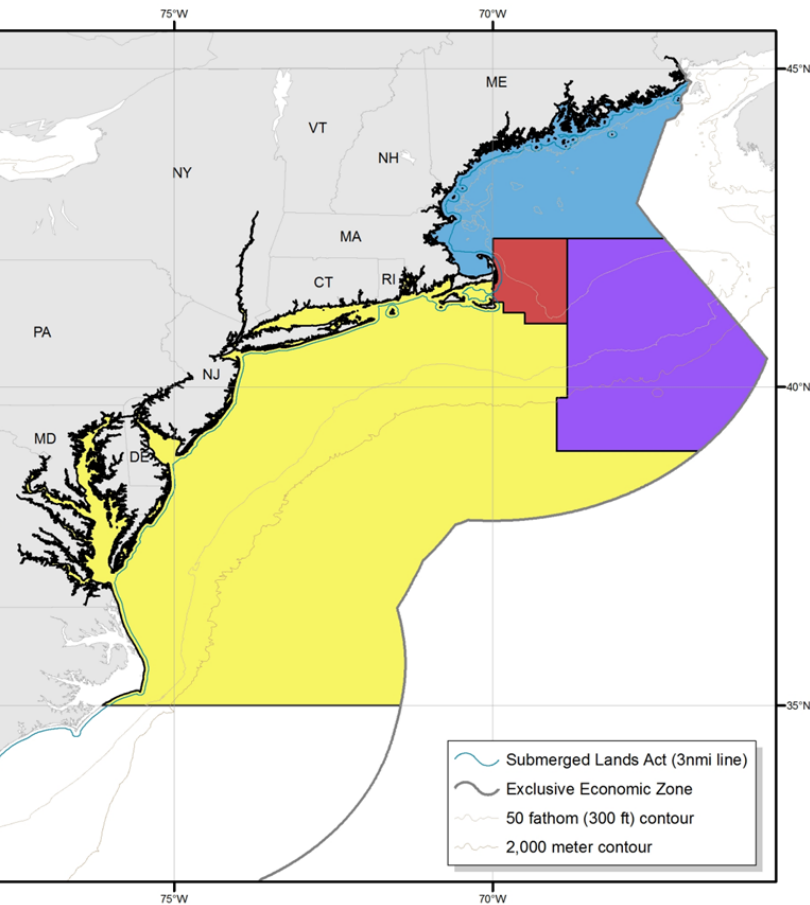
Rationale: Incentives are different when observers are on-board.



Rationale: How do people act differently when an observer is onboard?

- **Hawthorne Effect:** *We act differently when we're being watched*
- **Inconvenience costs:** *Observers incur costs associated with food, slower fish processing and general inconvenience*
- **Within-strata heterogeneity for discard monitoring:** *Fisherman don't want to impart their personal discard preferences on their counterparts*
- **Higher catch rates in areas/at times where more undersized fish are relatively more abundant:** *Fishing shifts from areas of higher juvenile abundance, or vessels use more selective methods/techniques*
- **Binding quota constraints and high-grading:** *Fish are retained that may otherwise be discarded, or certain stocks are avoided altogether when observed*

Rationale: If constraining stocks that produce incentives for observer effects are causing unseen legal size discards on unobserved trips, then this should result in differences in stock landings per unit effort ratios between observed and unobserved trips in a multispecies fishery.



$$Ratio = \sum landing / \sum Kept all$$

and

$$Ratio = \sum landing / \sum days absent$$

Rationale: There are consequences of observations not being representative

- **Pre-catch behavior-** biased estimation of sub-legal discards
- **Post-catch behavior-** Underestimate of total catch
- **Sub-legal discards are small % of groundfish catch-** –e.g., <4% of GOM cod during FY 2011–2017

Trips that are closer in space/time are more similar



Distance



CODGMSS_K > 0