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Can observer sampling validate industry catch reports from trawl fisheries?

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ABSTRACT

Stock assessment scientists and fishery managers operate under the necessary assumption that the identities of species and quantities of catch from industry landing reports are known without error. To evaluate this assumption, we compared industry-generated reports of landed catch to independent observer estimates. An observer sampling design for shore-based processing plants was developed and implemented at four plants in Kodiak, Alaska. A total of 13 deliveries from three fisheries were examined. Observers were able to track different portions of the catch and treat them as strata from which to randomly sample or completely enumerate. Differences between observer- and industry-derived species proportions were negligible when measured across the entire study, but differed by fishery. Industry weight in the shallow-water flatfish fishery exhibited a small negative bias not related to processor or species type. Weight differences in complete enumerations for big (*Beringraja binoculata*) and longnose skates (*Raja rhina*) were of similar magnitude but in opposite directions, leading to the conclusion that the identification of these species is confused since there is no detection error. Where observers needed to sample, they were able to detect most species in open access fisheries, with a resolution comparable to that of the industry, and were more likely to detect skates than industry. However, in the cooperative rockfish fishery, where tighter controls on the dockside sorting of fish by plant staff are in place, industry reports had enhanced detection of rare species relative to observer sampling. Notwithstanding, differences between data sources remained substantial in strata where the observer sampled even after considering rarity. The results here highlight the utility of using third-party verification to improve data quality of self-reported data, and identified the logistical, database, and analytical challenges to effectively monitor fishery quotas.

1. Introduction

The waters of Alaska support some of the most important fisheries in the United States, and the groundfish fisheries of the North Pacific enjoy a reputation as among the best managed in the world (Worm et al., 2009). In the last national assessment of commercial landings, Alaska led the U.S. in terms of landed volume (2.63 million metric tons) and landed value (USD 1.7 billion; NMFS, 2013a). The management of the federal fisheries that take place off the coast of Alaska is under the jurisdiction of the National Marine Fisheries Service (NMFS). The NMFS employs a variety of management techniques that are specified in fishery management plans to ensure the orderly prosecution of fisheries (Fina, 2011). Total allowable catch (TAC) limits are imposed on fishers under various limited entry strategies that require near real-time catch information for quota debiting at the level of the fleet, cooperative, and even the individual fisher. The effective management of fishery resources under output controls such as catch quotas requires that retained and discarded catch are accurately quantified (Pope, 2002).

Abbreviations: CMCP, Catch Monitoring and Control Plan; CV, catcher vessel – a fishing vessel that delivers catch to a shore-based processing facility; FMA, Fisheries Monitoring and Analysis Division, Alaska Fishery Science Center, National Marine Fisheries Service, NOAA; MSA, Magnusson–Stevens Fishery Conservation and Management Act; Observer Program, North Pacific Groundfish and Halibut Observer Program.

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In-season quota management in Alaska relies on catch estimates generated from an extensive observer program and industry reports. Federally-trained observers are deployed into North Pacific fishing operations according to regulations and an annual deployment plan (e.g., NMFS, 2013b). Observers provide independent, reliable, and verifiable catch information, data concerning seabird and marine mammal interactions with fishing gear, and biological data (e.g., species composition, weights, and tissue samples) that are important for researchers. Industry reports submitted to the NMFS include daily production reports from vessels that process their own catch while at-sea (i.e., catcher processors, or CPs) and landing reports from shoreside processing plants who receive deliveries from catcher vessels (CVs) that do not process their own catch. Industry production reports contain the amount of product of each species produced by the CP each day. Industry landing reports include the weight of each species, its disposition or product produced, the amount of catch taken from each fishery management area (location) and the type of management program the trip was operating under (e.g., cooperative or non-cooperative). To ensure effective quota management (Branch and Hilborn, 2008), much of the catch information from observers is available in near real-time (e.g., daily or at the end of a trip, depending on the type of vessel), industry production reports are submitted daily, and industry landing reports are generally completed within days of the delivery.

The extent to which observer and industry sources are used in total catch accounting varies by vessel type and observer coverage (see Cahalan et al., 2010, 2014 for details). Since 2013, all CPs with two exceptions have operated under complete observer coverage and observer data are used exclusively to estimate total catch in such situations. For catcher vessels, the industry landing report is used for retained catch, and discarded catch is estimated by applying discard rates from available observer data to that retained catch. For total catch estimation to be unbiased where there is less than complete observer coverage requires that (1) the deployment of observers is representative and (2) industry landing reports are accurate. The representativeness of observer deployment is evaluated annually by the NMFS (e.g., Faunce et al., 2014), while the accuracy of industry landing reports has rarely been investigated.

Industry landing reports represent an economically efficient way for the NMFS to obtain retained catch information. Landing reports represent bills of sale in which accurate data has mutual economic benefit to both the catcher vessel selling the catch and the processor buying the catch. However, this mutual benefit is only present when there are no limits to catch. In the case where catch is limited by a quota in real-time, accurate catch information turns from a mutual benefit into a mutual penalty as catch approaches the available quota, since reaching that quota restricts and can even eliminate revenue for the season or year through closure of the fishery (Branch et al., 2006). Thus, there exists the incentive to misreport the identity of a species for which there is only a limited amount of available quota (quota-limited species). This incentive to misreport is exacerbated for those species that fishery managers have designated as "prohibited to directed fishing" or placed in "bycatch only" status; fishery managers prohibit retention of a species once its quota is projected to be reached or is reached. In its extreme case, the serial misidentification of species would result in overharvest of some species while the catch data would reflect a fishery managed within prescribed catch limits. Even in the absence of such drivers there are reasons to test the assumption that landing reports are accurate. For example, when fish enter the processing plant, they are sorted to species (or in some cases species group) and weighed. However, due to the large volume of fish being processed, similar looking species may be sorted together. Although independent audits of industry landing reports appear warranted under these circumstances, the observer program does not deploy observers into shoreside processing plants to generate independent data to verify the accuracy of industry landing reports. Observer methods need to be developed and tested before this activity can be incorporated into the regular activities of the observer program.

Here we examine the effectiveness of using observer data to verify the accuracy of species identification on industry reports of retained catch. Our objectives were to (1) implement and test a sampling design for observers to generate independent estimates of retained catch from fishery landings, (2) compare observer estimates of landed weight and species composition to industry landings reports, and (3) describe the nature of any differences and determine whether observer data could be used to improve the quality of data on industry landing reports. Performing these types of comparisons yields important answers for fisheries managers as to the scale and scope of potential errors in landings data in addition to the potential merits of dockside monitoring with observers. The logistical and design considerations of this study are broadly applicable to other observer programs.

2. Methods

2.1. The fisheries

This was a cooperative research project between the NMFS and fishing industry partners in Kodiak, Alaska. Kodiak consistently ranks among the top five ports in the country for landed volume (~393 million pounds annually) and value (~USD 170 million), and hosts more than ten processing facilities that are supported by a large and diverse fleet of catcher vessels equipped with trawl, pot, longline, and jig gear. Most of the landings by volume that enter the port of Kodiak are from catcher vessels using trawl gear that participate in a variety of federal fisheries.

We conducted this project during 2011 within three trawl fisheries in the Gulf of Alaska that differ in how they are managed: arrowtooth flounder, shallow-water flatfish, and rockfish. Arrowtooth flounder (*Atheresthes stomias*) experienced a substantial biomass increase in the Gulf of Alaska during 1961–2009 and has been managed under its own catch limit since 1990 (Turncock and Wilderbuer, 2011). Shallow-water flatfishes are managed as a complex consisting of northern rock sole (*Lepidopsetta polyxystra*), southern rock sole (*Pleuronectes bilineata*), yellowfin sole (*Pleuronectes asper*), starry flounder (*Platichthys stellatus*), butter sole (*Pleuronectes solepis*), English sole (*Pleuronectes vetulus*), Alaska plaice (*Pleuronectes quadrituberculatus*) and sand sole (*Psettichthys melanostictus*). Although the various species are assessed separately, the complex is managed using a single catch limit (Turncock and A'mar, 2013). The Central Gulf of Alaska rockfish fishery operates under a management program that established cooperatives that receive exclusive harvest privileges for primary and secondary species (Rockfish Program; NMFS, 2013c). The Rockfish Program primary species include northern rockfish (*Sebastes polyspinis*), Pacific ocean perch (*Sebastes alutus*), dusky rockfish (*Sebastes variabilis* and *Sebastes ciliates*), yellowtail rockfish (*Sebastes flavidus*)[1], and widow rockfish (*Sebastes entomelas*)[2]. The secondary species of the Rockfish Program include Pacific cod, rougheye rockfish (*Sebastes aleutianus*), shortraker rockfish (*Sebastes borealis*), sablefish (*Anoplopoma fimbria*), shortspine thornyhead, (*Sebastolobus alascanus*), longspine thornyhead (*Sebastolobus altivelis*) and broadfin thornyhead (*Sebastolobus macrochir*). Unlike the fisheries that are subject to partial at-sea observer coverage, the Rockfish Program operates under greater monitoring requirements in order to accommodate the increased data resolution required to effectively

[2] Removed from Rockfish Program primary species in 2012.