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The design and performance of an automated observer deployment system for the Northeastern United States groundfish fishery

Michael C. Palmer*, Patty Hersey, Heidi Marotta, Gina Reppucci Shield, Sarah B. Cierpich

Northeast Fisheries Science Center, National Marine Fisheries Service, 166 Water St., Woods Hole, MA 02543, United States

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ABSTRACT

Historically, a dock intercept process was used to deploy observers in the Northeastern United States groundfish fishery. In this process, the selection of which fishing trips received observer coverage was manually accomplished using pre-defined specifications established by the National Marine Fisheries Service's Northeast Fisheries Science Center. In May 2010, the management of the northeast groundfish fishery underwent major changes affecting the magnitude and complexity of observer deployment. These changes included: (a) a shift from input controls to a quota based catch-share system; (b) an approximate four-fold increase in the level of observer coverage; and (c) introduction of a new class of trained observers. The manual dock intercept process was insufficient to adequately address these new provisions and an automated observer deployment system, the Pre-Trip Notification System (PTNS), was implemented in the Northeastern United States groundfish fishery on 1 May 2010. The PTNS uses a self-adjusting probability-based, tiered selection process to randomly assign observer coverage across the groundfish fleet on a proportional basis for the purpose of monitoring discards. In this paper, we discuss the general design and performance of the PTNS over the first three years of use with a specific focus the self-adjusting properties of the system, and the impacts of vessel compliance.

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1. Introduction

At-sea fisheries observers have historically been deployed in the Northeastern United States large-mesh groundfish fishery using a dock intercept process. Fishing trips were manually selected for coverage by observer service providers (companies contracted to provide observer coverage) using pre-defined sea day schedules in conjunction with a randomized list of vessels likely to be active in the fishery and personal knowledge of local fleet activity. The sea-day schedules were broadly stratified by month, region and gear type, with target coverage rates designed to meet pre-determined precision requirements for discard estimation (e.g., bycatch estimates with coefficients of variation less than or equal to 30%; Wigley et al., 2007). Since sea-day schedules were established in advance of the fishing season based on anticipated activity, in-season shifts in fishery activity could compromise the efficacy of the specified observer coverage.

In 2010, the management of the northeast U.S. groundfish fishery underwent major changes (NEFMC, 2010), drastically affecting the degree and complexity of observer coverage. These changes included (a) a shift from input controls to a quota based catch-share system managed at the level of fishing sector (similar to harvest cooperatives, Clay et al., 2014); (b) a four-fold increase in the level of observer coverage from approximately 5–8% to 20–30%; and (c) the establishment of a second fishery monitoring program (at-sea monitors, ASMs) that was created in anticipation of a future shift from government-funded to industry-funded monitoring programs. The ASM program was intended to augment the existing observer coverage provided by the Northeast Fisheries Observer Program (NEFOP). Because of the anticipated shift to industry funding the ASM program was designed to operate at a lower cost relative to the NEFOP, largely by reducing the data collection requirements to only those data elements needed to accurately estimate fishery catches.

Deployment of both NEFOP observers and ASMs had to meet the in-season catch monitoring needs of the groundfish fishery catch share program where quota would be tracked by fishing sector, stock area and gear type. There were expected to be 18 active fishing sectors, with the capacity to fish up to five different gears in three different fishing regions for a total of 270 possible sampling strata. In a given fishing year, not all of the 270 strata would be expected to be active since some sectors were likely to only fish

* Corresponding author. Fax: +1 508 495 2393.
E-mail address: michael.palmer@noaa.gov (M.C. Palmer).

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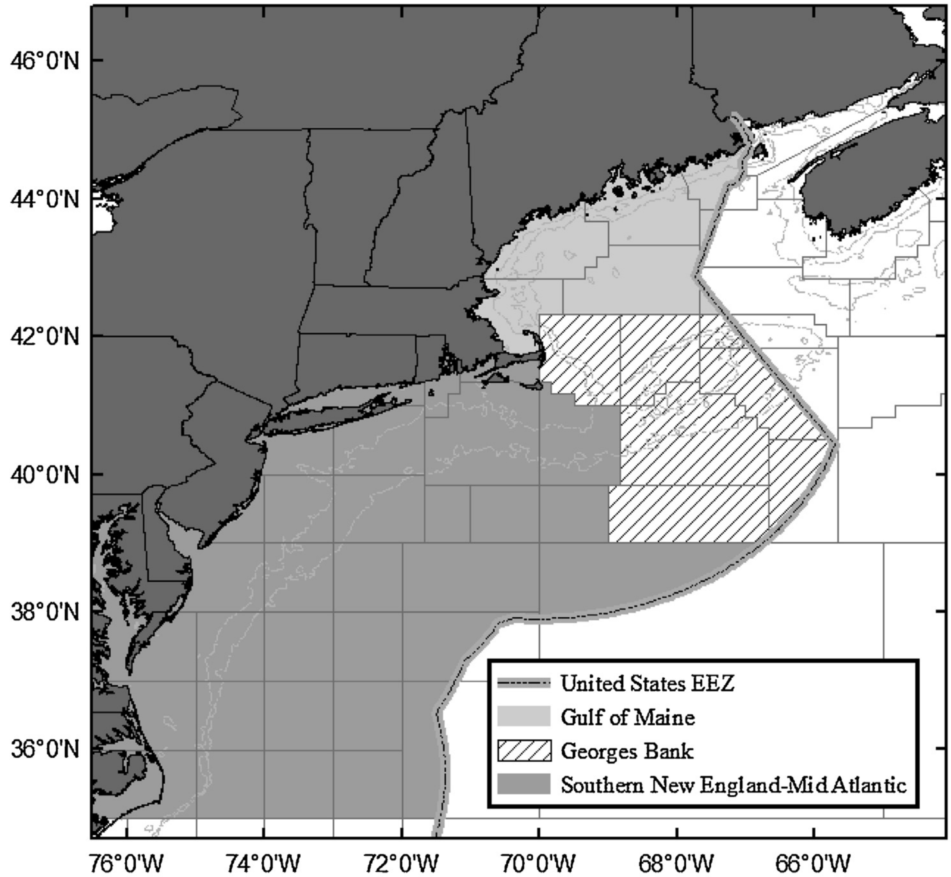

Fig. 1. Map of the offshore waters of the northeast United States showing the three fishing regions within the U.S. Exclusive Economic Zone (EEZ) as defined by the Pre-Trip Notification System. The gridded area delineates the northeast U.S. statistical areas. The 50 m and 100 m bathymetry lines are indicated by thin grey lines.

a single gear type and operate in one region. However, it was not known *a priori* which of the sampling strata would be active. Given the large scale changes to the fishery as a result of sector management, the behavior of the groundfish fleet in prior years would likely be a poor predictor of expected behavior from May 1, 2010[1] and beyond. The efficient and effective support of fine-scale stratification would require the capacity to dynamically identify active strata and deploy observer coverage in these strata in a statistically unbiased manner. This was a marked departure from the sea day schedule approach, in which the stratification scheme was static and the behavior of the fleet was assumed to be similar from one year to the next.

The catch share management system introduced considerable complexity into the manner in which observers would need to be deployed in the groundfish fishery. It was widely recognized that a dock-intercept process would be insufficient to meet the increased demands. A more sophisticated, and dynamic, observer deployment system was needed that would be capable of automatically, and efficiently, allocating observer coverage within the groundfish fishery. The overall purpose of such a system would be to support the stratified random deployment of observers in an unbiased manner in support of groundfish catch monitoring.

With the basic requirements in mind, the National Marine Fisheries Service's (NMFS) Northeast Fisheries Science Center (NEFSC) developed an observer pre-trip notification system (PTNS) that was first deployed in May 2010. While other similar systems have been developed and deployed in North America since 2010 (e.g., NMFS—Alaska Fisheries Science Center developed and deployed their Observer Declare and Deploy System; Faunce et al., 2014) to our knowledge, the PTNS was a first-of-its-kind automated observer deployment system. In this paper we discuss the design and performance of the PTNS over its three year implementation in the groundfish fishery. We focus on this period as it covers the initial design and deployment, system performance review and the subsequent improvements leading to the system currently deployed today. Additionally, we identify areas of possible improvements that would benefit not only the current PTNS, but the design of similar systems around the world.

2. Methods (system design)

Vessels intending to fish in the groundfish fishery are required to notify their intent to take a groundfish trip through the PTNS at least 48 h in advance of sailing. When making an initial trip declaration an authorized vessel representative (e.g., vessel captain, vessel owner, sector manager) must login to the PTNS with the vessel permit number and a personal identification number (PIN). This allows the system to identify the vessel and the groundfish sector to which the vessel belongs. For each trip the following information must be provided: anticipated sail date and time, estimated trip duration, port of departure, the type of gear that will be used on the trip, and the general fishing region (regions shown in Fig. 1). This is the minimum information needed by the PTNS to identify the sampling strata and by the observer service providers to determine whether they have certified observers available to cover the trip.

[1] The northeast United States groundfish fishing year runs annually from May 1 to April 30.