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Can EM Support Compliance With Landings Obligations?

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Introduction

The utility of electronic monitoring (EM) to support compliance with landings obligations is examined by drawing from the experiences of a seven year program using EM to enforce full catch retention compliance in the US shore-based Pacific whiting fishery. This high volume spring/summer mid-water trawl fishery operates off the coasts of Washington, Oregon and northern California, with about 35 vessels making day trips and delivering to landing plants. Total removals are estimated from landed catch and no discards are permitted, a regulatory setting similar to the EU landings obligations. While the results were previously reported in the individual annual fishery reports, this paper compiles the results of the seven-year operational EM program in order to examine changes in the fishery and monitoring program over time, to show how program effectiveness was a result of both the technology and program operations, and to summarize the lessons learned, with the aim of evaluating the merits of the program and providing insights that would assist in other fisheries where EM is being considered.

Methods

EM was compulsory on all fishing vessels from 2004 to 2010; each vessel carried an EM system (control centre, up to four CCTV cameras, GPS, winch and hydraulic sensors) that operated continuously while the vessel was at sea. Sensor and image data was collected and analyzed to determine fishing time and location and monitor catch stowage operations to monitor full retention compliance. EM data reviewers estimated discard quantities using volume-density estimation methods. As well, information was recorded on EM data quality and program delivery costs.

Results and Discussion

Over the seven-year monitoring program, the fishery ranged from 24 to 180 days duration, 500 to 1,300 vessel sea days, and 40,294 mT to 972,677 mT total catch. EM data collection success across these years exceeded 98% sensor data for all but one year, image data over 95% for five of seven years, and sensor and image data 99% for the last two program years. Early monitoring results yielded a clearer understanding of fishing practices, providing a framework for more practical regulations on permissible levels of 'operational discarding'. The EM program provided increased transparency which was a contributing factor to the marked decline in at sea discards over the seven year period. In particular, vessel specific information showed that the majority of the discard problem could be attributed to a small minority of the fleet, and that many vessels could successfully participate in the fishery with little or no discards. In 2005, nearly all vessels discarded, with most discarding 1.5% or more of their catch. Over time, the discard levels declined with increasing numbers of vessels showing very low levels of discard. By 2010, a third of the fleet had no observed discards, and among those vessels with discards, all but three discarded less than 0.6% of their total catch.

EM results were compared closely with vessel log data. Estimates of discard quantity were correlated but highly variable and it was not possible to attribute error as both were estimates. Most challenging to estimate were events where discarding occurs directly from the net without coming aboard. The level of alignment between EM and vessel logs with respect to recorded discard events improved over time and we suggest using EM to audit vessel logs as a possible future program design.
EM data loss was closely monitored, particularly after a 2007 incident involving large discard quantity of widow rockfish. Data loss occurring during catch stowage operations was a particular

concern because of the potential opportunity to discard unwanted sensitive species. In 2010, data loss during these critical periods was estimated at 0.5% of the total fishing events for the year. We examined monitored landings data to estimate the potential missed catch from EM data loss and determined the maximum possible level to be less than 1% of the Annual Catch Limit for all sensitive species except widow rockfish and POP (5% and 3%, respectively). Hence, the data loss occurring in most program years would not pose a resource risk caused by unaccounted for catch but the results underscore the need to ensure that EM data loss is monitored and actively managed.

The program was co-funded by industry and NMFS, and the 2007-2010 average annual cost was $6.03 per mT, $254 per sea day, or 3.6% of the landed catch value, or 30% of the industry funded component of an at-sea observer (agency costs not included). The EM costs reflect the total program cost, including program planning, equipment provision, field data collection and all the steps required to produce a finished data set. The costs are also reflective of a mature program where start-up costs such as data-base development, program design, and infrastructure development have already taken place. EM equipment provision and field service were the largest cost component, over twice the data analysis and reporting component. The uncertain tenure led to higher EM equipment costs as most participants chose to lease rather than purchase.

Cost effectiveness of EM as compared to observers comes down to an assessment of the resource risk associated with potentially less granularity of EM data versus more detailed observer data at considerably greater cost. Given that EM was lower in cost and that the incidence of discarding was reduced to a low level, EM was considered a more cost-effective method for this fishery.

The report summarized a number of lessons learned that would be applicable to the application of EM in any fishery:

- EM based monitoring should not be considered a "plug-and-play" alternative to observer programs as each has their own opportunities and challenges.
- The utility of EM for collecting fisheries data relies on a careful design process that integrates the EM technology, the vessel specifications, and specific on board catch handling and EM system duty of care requirements.
- EM programs are much more than the underlying technology. The majority of cost is with the service components and thus, a structured program design approach is needed.
- Successful use of EM often depends upon integration with other data collection processes and information sources. Data integration opportunities should be considered in the design process.
- Stakeholder engagement is an essential ingredient to EM program success. This should occur at a variety of levels in order to improve the program, optimize operations, and effect change.
- A key risk to EM is the hidden bias that can result from strategic intentional data loss (i.e., turning the system off to avoid recording). While some data loss is to be expected in any monitoring program, effective measures are needed to control, monitor and manage the level of missing data.
- EM technology will change over time and the program design needs to be flexible to include change, where appropriate.
- Effective EM programs require control measures through governance, regulations, incentives or disincentives. Instruments such as an EFP are particularly effective as they can be easily modified during the early stages of program implementation.
- EM programs take time to implement and a multi-year time horizon is needed to establish operations and infrastructure, and offset start up costs. Uncertainty of program tenure will slow the process and reduce cost efficiencies that can be achieved with EM approaches.