Agreement on the Conservation of Albatrosses and Petrels

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Recent U.S. experience with electronic monitoring, seabird monitoring, and incorporation into standard management protocols

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SUMMARY

Electronic monitoring (EM) projects underway in Alaskan fisheries include development of protocols or systems which improve species identification, development of additional system automation, and maintaining or improving compliance with seabird bycatch mitigation measure regulations. One method that is being trialed in a longline fisheries to identify the species of incidentally caught birds involves vessel crew voluntarily holding the bycaught bird up to a camera for several seconds. To date, there is only one instance of this request having been carried out, which suggests that other procedures should be developed in consultation with vessel crew and enforcement personnel. Alternatively, a technological approach could be used for species identification. Progress has been made on automated image processing algorithms for species identification and length measurement, through the use of training datasets of fish images collected from the fishery. Currently, these machine learning algorithms can identify 43 groundfish species with 94% accuracy and collect length measurement that is within 1 cm of actual length. This functionality is being extended to seabird species. The use of EM to monitor compliance with deployment of streamer lines is also being studied, on large and small vessels. The initial results indicate a lower success rate (92%) when monitoring smaller vessels.

1. INTRODUCTION

The Seabird Bycatch Working Group has been considering since at least 2013 the potential use of electronic monitoring (EM) on fishing vessels as a tool for monitoring seabird bycatch or compliance with seabird bycatch mitigation measures. During SBWG7, several papers regarding electronic monitoring were considered, building upon prior discussions related to the development of best practice guidelines for the use of EM for seabird bycatch and/or the use of seabird bycatch mitigation measures. SBWG7 made several related recommendations, which were endorsed by AC9, outlined in items i-viii of Section 14 of **AC9 Doc 10 Rev 1**. Work

has been underway in U.S. fisheries that is relevant to item vii of these recommendations, which is:

> Protocols for the identification of seabirds to species level should be developed and applied, where practicable. Such protocols may include, but are not limited to, retaining the carcass or taking a sample of the feather or muscle for post-trip analysis, requiring the crew to hold the seabird in front of an electronic monitoring system camera to facilitate species identification by video footage review. The protocol should incorporate those detailed in ACAP's 'Seabird Bycatch Identification Guide' where relevant.

This paper provides an update on the work described in SBWG7 Inf 19 (Electronic monitoring in fisheries of the United States) that involved protocols to identify species using EM on the fixed gear small-boat groundfish and halibut fisheries in Alaska. A newer protocol under development is also described. This protocol is expected to allow for the identification of bird species using a combination of video monitoring and the latest developments in computer vision.

2. BACKGROUND AND CURRENT EFFORTS

In Alaskan longline fisheries, the observer program was restructured so that, beginning in 2013, observers were deployed to vessels in the halibut fishery. Also, with elimination of a vessel length threshold, observers are now being deployed on longline catcher vessels less than 60 ft length overall. This has increased observer coverage in Southeast Alaskan waters, an area which had been mostly unobserved prior to 2013. Subsequently, a number of longline fishery associations have been promoting the idea of using electronic monitoring on their vessels as a replacement to on-board observer monitoring. A great deal of work ensued, and the North Pacific Fishery Management Council, the body responsible for managing fisheries off the coast of Alaska, created the Electronic Monitoring Working Group to address these issues and determine how best to provide EM as an option for monitoring a particular vessel, while also producing data that can be used in the overall management processes employed for the fishery. Background information is available at the North Pacific Fishery Management Council website (see https://www.npfmc.org/tag/em/).

Projects were started which deployed EM systems to Alaska longline catcher vessels. Focal areas included development of protocols or systems which improve species identification, development of additional system automation, and maintaining or improving compliance with seabird bycatch mitigation measure regulations.

Compliance with mitigation measures had been studied on larger vessels (over 55 ft length overall) and have previously been reported in Ames et al. (2004) where EM showed presence/absence of compliance on all trips. That study suggested minor changes to the gear that would allow evaluation of performance measures defined by Washington Sea Grant (Melvin et al., 2001). For the 2016-2017 work currently underway, on smaller vessels that have mitigation measure options other than paired streamer lines, EM may not be as effective for monitoring compliance. During the 2016 season, EM was used to confirm deployment of seabird deterrents (streamer lines) for 77% of trips, none were used in 14% of trips, and in 8% of trips the presence or absence could not be determined (Smith et al, 2017). The results will be further analysed, focusing on the ability of EM to identify required performance measures on a haul by haul basis, but this initial report indicates a lower success rate (92%) when monitoring smaller vessels. And, although this success rate is lower than the previous study it should also be compared to rates reported by observers.

A focus of the 2016-2017 work underway includes investigations on how to better automate the EM systems to turn on and off relative to vessel operations. That work will be evaluated and reported in 2018, with recommendations provided.

Given the potential interaction with the endangered short-tailed albatross, species identification of bycaught seabirds in this fishery is an important question, in incorporating EM-based information into the management procedures employed for Alaskan groundfish and halibut fisheries. Current observer-reported data are submitted to NMFS on a real-time basis and used for quota-management, bycatch or area closures, and other aspects that require data be included in standardized electronic processes. For example, NMFS is required to report to the U.S. Fish and Wildlife Service any takes of short-tailed albatross in the fishery within 48 business hours (USFWS 2015). At the end of each year, the Alaska Region Catch Accounting System, which can produce estimates across a wide suite of species on a daily basis, is used to produce estimates of seabird bycatch for entire fleets, areas, or other units (Cahalen et al, 2016, Eich et al, 2016). Any EM system that replaces observer monitoring needs to feed the required data into these automated systems.

It is expected that EM will be able to meet observer equivalencies such as identifying some seabirds simply to a species group (unidentified gull) and other species that have good diagnostic features, such as Northern Fulmar (*Fulmaris glacialis*) or are of special management interests (*i.e.,* the three North Pacific albatross species) to the species level. Earlier studies (Ames et al, 2005) that evaluated species identification capabilities for EM indicated it was not a viable technique to meet overall management objectives for seabird monitoring. In an effort to improve seabird bycatch species identification, vessel crew obligation for the current North Pacific EM program was changed for EM volunteer vessels. Longline vessel crews were asked to hold each bycaught bird up to the haul video camera for a few seconds, providing a clear view of the bird and especially of the head and beak. In 2016, vessel crew took such action for only 1 of 8 seabird bycatch events. Of the 19 seabird bycatch events captured so far in 2017, the video screenshots show only the bird coming aboard at the hauling station. None of the 19 events include a seabird being held to the camera. These screenshots are being evaluated for quality and confidence of the initial species identification, and to date include Black-footed Albatross, Northern Fulmar, and gull species (unidentified). Given the workload of crew at the hauling station it may not be possible for them to pause from handling the catch coming on board in order to provide the additional views that an EM system requires. Other on-board procedures may need to be developed that would fit within the normal work schedule of a haulback but still promote higher confidence in seabird species identifications. Such procedures should be developed in consultation with both longline vessel operators and enforcement personnel, and then made into requirements in regulations if needed. Alternatively, a technological approach, such as what is described below, could be a solution.

3. RESEARCH AND DEVELOPMENT

The Observer Program at Alaska Fisheries Science Center (AFSC) has been conducting research and developing new innovative EM technologies to help address challenges for collecting scientific data to support bycatch estimation, including protected species. Work focuses on development of new camera-based systems, methods, and tools while leveraging the latest development in computer vision to improve system functionality and offering potential solutions.

Recent advances include the use of training datasets of fish images collected from the fishery and during the AFSC groundfish survey to develop automated image processing algorithms for species identification and length measurement. Currently, these machine learning algorithms can identify 43 groundfish species with 94% accuracy and collect length measurement that is within 1 cm of actual length. The AFSC Observer Program is also collaborating with protected species biologists to extend this functionality for identifying bird species from EM system images in the fixed gear longline fishery in the North Pacific. Through the Observer Program, we have collected so far 15 species and more than 250 individual bird carcasses incidentally caught in fisheries. Multiple images of each specimen are being collected using a multi-spectoral camera system. These images will be used as a training dataset to develop automated image processing algorithms for bird species identification through images of either just heads or whole bird carcasses using deep neural network (DNN) learning. We believe that this is a very promising area of research. Further development of automated event-based image capture systems will be critical to improve real time reporting by reducing lag times associated with the current monitoring and post processing methods. This type of monitoring system will provide greater certainty for protected species management and support sustainable fishing practices.

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