Agreement on the Conservation of Albatrosses and Petrels

**Seventh Meeting of the Seabird Bycatch Working Group**

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# Electronic monitoring in fisheries of the united states

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## ABSTRACT

In several fisheries managed by the National Marine Fisheries Service, electronic monitoring (EM) has been implemented to meet particular goals of collecting fisheries-dependent information but none of the systems so far have included components specifically related to seabird bycatch. Pilot testing has been carried out to electronically monitor seabird interactions with third-wire cables on trawl vessels and to examine the feasibility of monitoring the use of seabird avoidance devices and seabird mortality in the Pacific halibut longline fishery. In that study, correct species identification from the EM system varied between ca 10% and 76% based on frame rate and other attributes. In a recent effort to implement EM for the fixed gear small-boat groundfish and halibut fisheries in Alaska, the pre-implementation plan for 2016 includes an objective to monitor seabirds and to monitor compliance with seabird mitigation measures. To improve the accuracy of seabird identifications additional measures are being required. If birds are caught, vessel operators will hold incidentally caught seabirds up to the camera for 2 to 3 seconds and ensure that images of certain key parts of the animal, such as the beak, are captured by the cameras to allow for species identification. Project staff hope to identify what length of imaging time is best for this identification. This paper briefly describes past studies and recent EM efforts within U.S. fisheries that relate to seabird bycatch to inform discussions within the Seabird Bycatch Working Group meeting on electronic monitoring.

# Monitoreo electrónico en pesquerías de los Estados Unidos


## RESUMEN

En varias pesquerías ordenadas por el Servicio Nacional de Pesquerías Marinas, se ha implementado el monitoreo electrónico (ME) para alcanzar determinados objetivos en materia de recopilación de datos que dependen de las pesquerías, pero hasta ahora, ninguno de los sistemas han incluido componentes específicamente relacionados con la captura secundaria de aves marinas. Se han llevado a cabo pruebas piloto para monitorear electrónicamente las interacciones de las aves marinas con el tercer cable de los barcos arrastreros y para examinar la viabilidad de monitorear el uso de dispositivos de disuasión de aves marinas y la mortalidad de aves marinas en las pesquerías de palangre del Pacífico dirigidas al halibut. En dicho estudio, la identificación correcta de especies mediante el sistema de ME oscilaba entre un 10 % y un 76 %, aproximadamente, en términos de atributos como el número de imágenes por segundo, entre otros. En un esfuerzo reciente por implementar el sistema de monitoreo electrónico para los caladeros y las pesquerías de halibut de Alaska donde operan barcos pequeños con artes de pesca fijos, el plan previo a la implementación en 2016 incluye el objetivo de monitorear las aves marinas y la observancia de las medidas de mitigación de captura secundaria de aves marinas. Para mejorar la precisión de las identificaciones de aves marinas se está exigiendo la observancia de medidas adicionales. Si hay aves que son capturadas incidentalmente, los operadores de barcos las tomarán y las sostendrán delante de la cámara durante 2 o 3 segundos hasta asegurarse de que ciertas partes fundamentales del cuerpo del animal, como el pico, hayan sido capturadas por las cámaras para poder identificar a qué especie pertenecen. Los integrantes del proyecto esperan poder determinar el tiempo de exposición necesario para que la captura de imagen posibilite la identificación. El presente informe describe sucintamente los estudios anteriores y los esfuerzos recientes en pos del uso del monitoreo electrónico asociado a la captura secundaria de aves marinas en pesquerías de los EE. UU. La finalidad de este informe es aportar información sobre el monitoreo electrónico para las discusiones que se desarrollen dentro del Grupo de Trabajo sobre Captura Secundaria de Aves Marinas.

# Surveillance électronique dans la pêche aux États-Unis


## RÉSUMÉ

Dans plusieurs pêcheries gérées par le National Marine Fisheries Service, la surveillance électronique (EM) a été mise en œuvre pour atteindre des objectifs spécifiques en matière de collecte d'informations basé sur la pêche, mais jusqu'à présent, aucun système n'inclut d'éléments relatifs à la capture accessoire d'oiseaux marins. Un essai pilote a été réalisé afin de mener une surveillance électronique des interactions des oiseaux de mer avec les funes des chalutiers et en vue d'examiner la possibilité de surveiller l'utilisation de dispositifs d'évitement et la mortalité des oiseaux marins dans la pêche palangrière de flétan du Pacifique. Cette étude indique que l'identification correcte d'espèces du système d'EM varie d'environ 10 % à 76 % en fonction de la fréquence des images et autres caractéristiques. Le projet de 2016, préalable à la mise en œuvre du système de surveillance électronique pour la pêche de flétan et du poisson de fond sur petite embarcation fixe en Alaska, a parmi ses objectifs la surveillance des oiseaux marins et le contrôle du respect des mesures d'atténuation des captures. Afin d'identifier plus précisément les oiseaux de mer, des mesures supplémentaires ont été demandées. Si des oiseaux sont capturés, les opérateurs de navire doivent tenir les oiseaux pris accidentellement devant une caméra pendant 2 ou 3 secondes et veiller à ce que les images de certaines parties essentielles de l'animal, notamment le bec, soient bien filmées pour permettre l'identification de l'espèce. Le personnel du projet espère déterminer la durée idéale de la séquence vidéo nécessaire à cette identification. Le présent document décrit brièvement les études antérieures et le récent travail de surveillance électronique relatif à la capture accessoire d'oiseaux marins dans la pêche américaine en vue d'éclairer les discussions concernant la surveillance électronique lors de la Réunion du Groupe de travail sur les captures accessoires d'oiseaux marins

## 1. OVERVIEW OF EM IMPLEMENTATION IN THE UNITED STATES

In the United States, commercial and recreational fishing collectively generate approximately $200 billion in sales and support 1.7 million American jobs. The engine that drives these economic benefits is abundant ocean fisheries. A big part of sustainably managing these fisheries is keeping track of fishermen’s catch. More accurate and timely data will benefit NOAA Fisheries fishery stock assessments; improving the information used to manage them sustainably.

Traditionally, NOAA Fisheries relied on a combination of surveys, paper logbooks, and observers to count what fishermen catch and discard. More recently, NOAA Fisheries invested in new digital data collecting technologies. These technologies range from electronic reporting of fishing trip data by fishermen and catch, landings, and purchase data by dealers or processors, to electronic monitoring equipment such as video cameras that capture information on fishing location and catch.

Currently, electronic monitoring (EM) programs have been implemented in 5 U.S. fisheries. The most recent, in 2015, uses on-board cameras to track the bycatch of bluefin tuna on boats in the Atlantic pelagic longline fishery. There are plans to implement up to 6 more monitoring programs over the next 3 years.

In 2014, NOAA Fisheries finalized regional electronic technology implementation plans informed by a series of national-level planning documents. These plans help NOAA Fisheries move beyond pilot projects by identifying, evaluating, and prioritizing implementation of promising electronic technologies in specific fisheries around the country (see http://www.st.nmfs.noaa.gov/advanced-technology/electronic-monitoring/index).

While several EM programs are now in place in U.S. fisheries, the use of EM to monitor seabird bycatch or the use of mitigation measures has only recently begun. NOAA Fisheries has taken a step forward by including the monitoring of seabird bycatch and mitigation measures in a 2016 implementation plan for an Alaskan fishery, described below. Pilot testing and feasibility studies on the use of EM to evaluate seabird bycatch or compliance with mitigation requirements have been carried out in past years. We present a summary of these studies to inform the discussion of the conditions under which EM could be useful in detecting seabird bycatch events or the use of bycatch mitigation measures. We also provide, based on the experience in the United States, several issues that should be considered in the development of an EM program.

## 2. SEABIRD MONITORING USING EM (2016 PROGRAM)

Since 2014 NOAA Fisheries has been working with the North Pacific Fishery Management Council (Council) and the commercial fishing industry in Alaska to integrate electronic monitoring (EM) tools into the North Pacific Groundfish and Halibut Observer Program (Observer Program) for the fixed gear small-boat groundfish and halibut fisheries. The intent is to develop EM technologies to collect data to be used in catch estimation for this fleet. An interim goal of pre-implementation in the small boat (40-57.5 feet length overall) longline fleet in 2016 has been established, focusing on vessels that have trouble carrying an observer due to bunk space or life raft capacity limitations. The primary EM management objective identified by the Council is to estimate at-sea discards of fish and other non-target species. A secondary objective is to determine whether seabird avoidance measures (i.e. streamer lines) are present or absent during setting of longline gear on EM-observed trips, and whether seabirds incidentally caught during longline fishing can be identified.

Goals of the 2016 seabird monitoring program are to: 1) determine presence/absence of mitigation measures; 2) test different triggers associated with the setting of gear to turn the seabird cameras on (instead of having them on all the time); 3) determine if seabird experts can identify the species and verify if the presentation times were acceptable. Vessel operators will be required to hold the seabird up to the camera for 2-3 seconds and ensure that certain key parts of the animal, such as the beak, are captured by the cameras. Vessels participating in the EM program will use EM equipment consisting of a control center to manage the data collection connected to an array of peripheral components including digital Internet Protocol (IP) cameras which, unlike analog closed circuit television cameras, can send and receive data via a computer network and the Internet, a GPS receiver, and gear sensors (hydraulic pressure transducer, drum rotation sensor if appropriate). An additional camera will be installed to determine if seabird avoidance measures required by regulation were deployed during setting of longline gear.

## 3. PILOT/FEASIBILITY STUDIES USING EM TO EVALUATE SEABIRD BYCATCH OR COMPLIANCE WITH MITIGATION REQUIREMENTS

Wallace *et al*. (2013) found that 59 electronic monitoring (EM) pilot studies had been reported in various literature (peer review journals, technical memos, vendor reports). Two of these explored the feasibility of using EM to address seabird/fishery interaction issues and others provided valuable operational insights that could be applied to EM use for seabird/fishery interactions.

Ames *et al*. (2005) explored the use of EM for seabird monitoring in the Alaskan halibut demersal longline fishery. At the time, this fishery did not have observer coverage. Study goals were to determine if an EM system could be used for compliance determination and bycatch monitoring. EM systems were placed on vessels to record images of halibut gear being set and the performance of seabird avoidance devices, or streamer lines, during the setting. Vessel and video observations were compared on 106 setting events. The EM video observations proved to be successful in detecting streamer line deployment and relative position on 100% of the daytime sets when two cameras were used. The results of the streamer line performance evaluations suggested that accurate performance recognition was positively related to the increase in image recording speed and the video analysts' ability to distinguish measured interval markings that were attached to the streamer lines.

In this pilot study conducted on halibut demersal longline chartered vessels (Ames *et al*., 2005), previously caught birds were intentionally set on the gear and EM was used to detect the birds on the haulback. Using 63 specimens, the results showed a positive relationship between correct seabird species identification and EM recording frame rates. Accurate species identification varied between ca 10% and 76% based on frame rate and other attributes. At a fast recording rate 91% of birds intentionally set were later identified as a seabird while 64% of these could be identified to the species level.

In 2009, NMFS worked with the Western Pacific Fishery Management Council and a third-party contractor on the testing of electronic monitoring technology on Hawaii's deep- and shallow-set pelagic longline fisheries (McElderry *et al*., 2010). The goal of the study was to evaluate the feasibility of using video monitoring in the longline fleet. EM systems collected data from between three and six fishing trips for three vessels over a six-month period. Observers also monitored the vessels. During that period, there were three seabird captures, with mixed results: one encounter reported by EM and the observer, one reported by the observer but not EM, and one reported by EM but not the observer. The seabird take reported by the observer and missed by EM is most likely due to the seabird being handled outside of camera view.

EM has been used on other gear types to address seabird/fishery interaction issues. A pilot study (McElderry *et al*., 2004) field tested EM equipment on trawl vessels to evaluate whether EM could supplement the on-board observer by recording seabird bycatch on third-wire gear. Observers were fully engaged in other fisheries monitoring responsibilities and could not dedicate effort to third wire monitoring. Bycatch from third wires (and other sources of trawl gear interactions) does not become available to observers as part of their standard species composition sample. Results demonstrated that EM could effectively monitor seabird interactions with trawl third-wire cables. EM provided imagery of sufficient quality to detect the presence, abundance, and general behaviour of seabirds during most daylight fishing events. However, while EM was able to detect third-wire entanglements, it was not possible to determine the cause of these entanglements (which were seen during haul-back). EM was also not useful for seabird enumeration and species identification in this situation. EM would be capable for monitoring the use and effectiveness of trawl third wire mitigation measures.

Cost comparison between monitoring approaches, observers vs EM, is an important consideration. The Ames et al. (2005) study provided two cost comparison scenarios for monitoring the halibut demersal longline fishery, including 100% coverage and coverage at levels equivalent to groundfish longline fishing at the time of the study. In both cases, EM cost less, but other attributes must be weighed in addition to cost as managers make decisions.

These studies have shown the following:

1. Vessel operations: EM can show the vessel's trackline (similar to that produced by vessel monitoring systems) and, under some circumstances, note when the vessel is actively fishing.
2. EM can show the interaction between the vessel and seabirds under different operating conditions.
3. Bycatch mitigation measures: EM performed well in daylight conditions, with some slight modifications to the mitigation gear. EM could be a very useful tool for compliance monitoring.
4. Bycatch monitoring and reporting: Management goals inform the effectiveness of EM for seabird bycatch monitoring. Goals may differ from the need to develop estimates of bycatch at the species level, to estimate by species groups, or just noting presence/absence of seabird bycatch in a fishery. The frequency (rarity) in the catch also affects this attribute. In most cases the goal will be to provide estimates of seabird bycatch. To meet this goal EM must capture effort information, numbers of birds, and support the ability to identify most birds to the species level. Species identification is acknowledged as a problem in the three studies cited here, which point to this as a performance attribute of EM that needs further research and development.

## 4. CONSIDERATIONS FOR IMPLEMENTATION OF EM

From the experience in the United States, there are several topics that should be considered in the development of an EM program.

1) Objective: What are the specific objective(s) or management goals of the EM program? The objective(s) is at the center of development and implementation of an EM program.

For example, objectives related to compliance monitoring will require an EM system that may be very different from one with objectives related to catch monitoring.

2) Operational challenges: To determine and overcome operational issues, plan for a pre-implementation phase where industry, scientists, and managers can work together to address challenges with operationalizing a system.

3) Policy Issues: Policy issues that will be relevant to the operationalization of the EM program include data confidentiality, data storage, and cost sharing (if industry will be expected to pay for some parts of the program).

4) Data integration: How will the new EM data stream be integrated with previous data sets? Will it be able to be used for management purposes?

5) Cost of EM: Several one-time and recurring costs should be factored into carrying out an EM program, such as: hardware components, installation, and maintenance; training on the use of the system; reporting and analysis of data; information technology support; and record-keeping. Will the EM program be cost-effective over the long-term for the quantity and quality of data acquired?

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