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Exploring local fishery management through cooperative acoustic surveys in the Aleutian Islands

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ABSTRACT

An alternate management system is introduced which uses seasonal and spatially explicit multi-species quotas generated from small-scale cooperative fishery acoustic surveys to manage the Aleutian Islands walleye pollock (*Gadus chalcogrammus*) fishery while limiting impacts on the endangered Western stock of Steller sea lions (*Eumetopias jubatus*). This is a novel collaboration among scientists, industry, and Alaska Natives considering a cooperative management approach. The proposed system integrates the catch monitoring and accounting systems already in place in the federal groundfish fisheries off Alaska with cooperative acoustic survey biomass estimates to facilitate more refined spatial and temporal fishery management decisions. Conditions were examined under which such a system could operate successfully and results from field work conducted to assess technical requirements were discussed. During field trials biomass estimates from each survey were produced within 24-h of survey completion. This suggests spatial abundance estimates can be available in a timely manner for managing local fisheries. The proposed management system was found feasible and relatively easy to initiate because of highly motivated and cooperative industry partners, a well-established mechanism for setting allowable catch limits, and a robust catch accounting system already in place. In addition, high quality commercial echosounders required for this system are currently used by industry and, with proper controls on calibration and survey design, produce biomass estimates of sufficient quality. The application of this approach beyond this case study is also discussed for managing fisheries worldwide where fine temporal and spatial scale management could benefit the conservation of other protected species.

1. Background

In 2004 the Aleutian Islands (AI) walleye pollock (*Gadus chalcogrammus*; hereafter pollock) quota for the AI area was allocated to the Aleut Corporation through an amendment to the Magnuson-Stevens Fishery Management Act (MSA) [1]. Under the Alaska Native Claims Settlement Act of 1971 (US Public Law 92–203) the Aleut Corporation (see www.aleutcorp.com) was created to represent the interests of the native Aleuts and their descendants and pursues beneficial economic and cultural projects in the region. The allocation of pollock was meant as a means to spur development of a commercial fishery based on Adak Island to take advantage of the infrastructure at the decommissioned Adak Naval Station. During World War II the Aleut people were relocated from the Western and Central AI to camps in Southeastern Alaska. Although Aleuts were allowed to return to some of the islands after the war, Adak Island remained under United States military control until 1997. Resettlement of Adak did not began until 1998 when the Island and accompanying infrastructure was acquired by the Aleut Corporation from the United States Navy and United States Department of Interior in exchange for other lands in the region held by the corporation.

In 2005 the Aleut Corporation allowed two catcher-processor trawl vessels to fish the AI pollock allocation. However, the 2005 AI pollock fishery was a failure with only 109 t of the 15,500 t allocated quota being harvested by the directed fishery. The failure of the fishery was mainly due to the majority of pollock habitat in the AI area near Adak Island being closed to pollock fishing (Fig. 1).

The North Pacific Fishery Management Council (NPFMC) imposed spatial restrictions on the pollock fishery in the AI to protect potential prey fields for the endangered western stock of Steller sea lions (*Eumetopias jubatus;* hereafter W-SSL). The entire SSL population (eastern Russia, across Alaska, and south along the coast of North America to central California) declined by 75% between 1976 and 1990, and in 1990 was listed as threatened range-wide under the Endangered Species Act of 1973 (US Public Law 93–205; hereafter ESA). In 1997, NMFS recognized eastern (California north through

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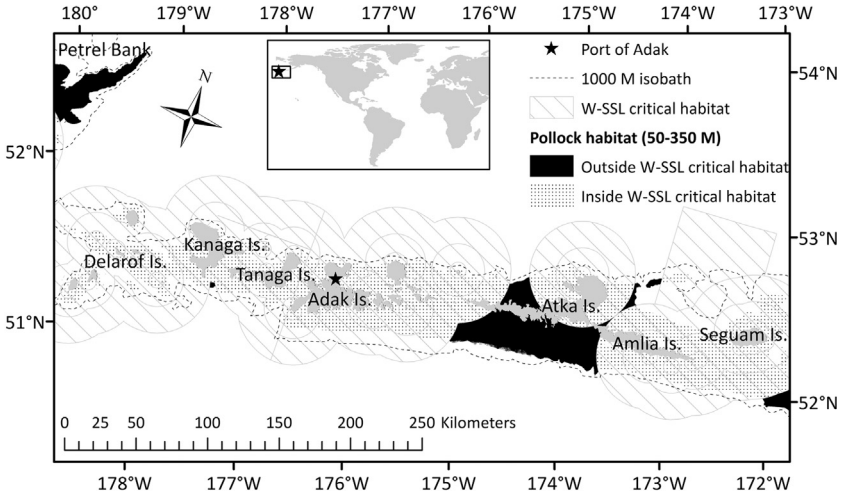

Fig. 1. Map of the central Aleutian Islands showing designated Western stock of Steller sea lion (W-SSL) critical habitat (hatched) and pollock habitat inside (stippled) and outside (black) of W-SSL critical habitat in 2005. Inside W-SSL critical habitat was the area closed to fishing in 1999.

southeastern Alaska) and western stocks (Russia and central/western Alaska) based on genetics, morphology, and differences in population trend. The ESA status of the eastern stock remained threatened (it has since recovered and was removed from ESA protection in 2013), while the status of the western stock was changed to endangered due to persistent declines: between 1991 and 2000 the stock declined another 40% [2]. While the overall decline of the W-SSL in Alaska stopped in the early 2000s and populations in the Gulf of Alaska and eastern Bering Sea have increased at ~3% y^{-1} through 2016, populations throughout much of the Aleutian Islands continue to decline and the W-SSL population overall is not meeting recovery goals set by the management agency [3]. It is likely that the cause(s) of the initial overall decline are different from those that are inhibiting recovery [2,4,5]. The initial decline prior to ESA listing in 1990 was likely driven by a combination of direct mortality from incidental take in fisheries and both legal and illegal shooting [4,5]. It has also been hypothesized that indirect mortality resulted from nutritional stress related to climate and environmental (e.g. regime shifts) changes and fisheries competition [2,4,5]. The sources of direct mortality were largely controlled following ESA listing [2], yet the W-SSL continued to decline overall for at least another decade or more, and continues to decline throughout much of the AI [6]. As a result, research and management attention has focused on indirect factors that would have more subtle effects on W-SSL reproduction and survival, such as nutritional stress and contaminants [7].

In the United States, the Marine Mammal Protection Act of 1972 (MMPA; US Public Law 92–522) and ESA require federal fisheries managers to consider possible fishery interactions with protected species when developing fishery management plans (FMP). Interactions include both direct takes of the protected species and secondary effects due to the removal or dispersal of prey. AI pollock had been identified as a primary winter prey species for the W-SSL and the NPFMC has regulated the spatial and temporal distribution of the pollock fishery in an attempt to limit competition with W-SSL. In 1998 the NPFMC closed the entire AI management area to directed pollock fishing. In 2005, to allow a pollock fishery by the Aleut Corporation, the NPFMC opened all waters outside of W-SSL critical habitat in the AI to directed pollock fishing. The total area of suitable pollock habitat (defined here as 50 m and 350 m bottom depth) within 250 km of the port of Adak was approximately 14,750 km^2, of this 3416 km^2 was outside of W-SSL critical habitat and opened to directed pollock fishing (Fig. 1).

Another complicating factor limiting the AI pollock fishery is that pollock and Pacific ocean perch (*Sebastes alutus*; hereafter POP) occupy similar habitat in the AI. In 2005 POP bycatch exceeded 50% in the directed AI pollock fishery [8]. In this document bycatch is defined using the definition posited in the Magnuson-Stevens Fishery Conservation Act; bycatch is fish that are harvested in a fishery but which are not sold or kept for personal use. In the AI POP are subject to their own directed fishery, but more importantly, they are bycatch in more valuable fisheries such as Atka mackerel (*Pleurogrammus monopterygius*) and Pacific cod (*Gadus macrocephalus*). The AI POP bycatch quota is set for all non-directed fisheries and 2005 AI pollock fishery was halted by the fishing industry because, if sustained, the POP bycatch levels in the pollock fishery would have threatened to close other fisheries. It was apparent that under the 2005 management framework a successful AI pollock fishery was not possible given the small area of pollock habitat available to the fishers and high levels of POP bycatch encountered outside of W-SSL critical habitat.

2. Real-time local cooperative management

After the 2005 fishing season, scientists with the National Marine Fisheries Service (NMFS) Alaska Fisheries Science Center (AFSC) began working with the Aleut Corporation, local fish processors, and fishers to explore alternative management systems that would provide for an AI pollock fishery, but continue to protect W-SSL. Industry stakeholders wished to conduct the AI pollock fishery in mid-to late-March, when pollock value would be at its peak due to roe content. In 2005 roe wholesale value was ~$13,500 per ton, while whole pollock wholesale value was ~$782 per ton [9]. The Pacific cod fishery was usually closed at this time of year and a March pollock fishery would allow fishers to participate in both the pollock and Pacific cod fisheries.

One of these alternate management systems was introduced which uses seasonal and spatially explicit multi-species quotas generated from small-scale cooperative fishery acoustic surveys [10] to manage the fishery. Fishery acoustic surveys are standardized fish surveys which employ echosounders that use active sound to enumerate fish abundance [11]. If adopted, this management approach would be administered as a sub-allocation subject to all other quotas and limits already in place for the region-wide AI fisheries, except allowing a limited midwater fishery within W-SSL critical habitat. The surveys would be conducted by the commercial fishers, certified by AFSC acousticians, and a multi-species, overall biomass limit would be set for the surveyed area prior to the fishery opening. This management system was thought possible because 1) there is a well-established mechanism for setting allowable catch limits [12], 2) a robust catch accounting system in place [13], and 3) the commercial echosounders used by fishers and the scientific echosounders used by the AFSC to survey pollock are produced by the same company and the echosounder hardware is nearly identical. Data from the commercial and scientific echosounders have been shown to be comparable when the echosounders are properly calibrated and data properly processed [14].