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# Post-breeding season distribution of black-footed and Laysan albatrosses satellite-tagged in Alaska: Inter-specific differences in spatial overlap with North Pacific fisheries

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ARTICLE INFO

*Article history:*
Received 20 May 2008
Received in revised form
1 December 2008
Accepted 7 December 2008
Available online 13 January 2009

*Keywords:*
*Phoebastria*
Longlining
Trawling
Satellite-telemetry

ABSTRACT

We integrated satellite-tracking data from black-footed albatrosses (*Phoebastria nigripes*; $n = 7$) and Laysan albatrosses captured in Alaska (*Phoebastria immutabilis*; $n = 18$) with data on fishing effort and distribution from commercial fisheries in the North Pacific in order to assess potential risk from bycatch. Albatrosses were satellite-tagged at-sea in the Central Aleutian Islands, Alaska, and tracked during the post-breeding season, July–October 2005 and 2006. In Alaskan waters, fishing effort occurred almost exclusively within continental shelf and slope waters. Potential fishery interaction for black-footed albatrosses, which most often frequented shelf-slope waters, was greatest with sablefish (*Anoplopoma fimbria*) longline and pot fisheries and with the Pacific halibut (*Hippoglossus stenolepsis*) longline fishery. In contrast, Laysan albatrosses spent as much time over oceanic waters beyond the continental shelf and slope, thereby overlapping less with fisheries in Alaska than black-footed albatrosses. Regionally, Laysan albatrosses had the greatest potential fishery interaction with the Atka mackerel (*Pleurogrammus monopterygius*) trawl fishery in the Western Aleutian Islands and the sablefish pot fishery in the Central Aleutian Islands. Black-footed albatrosses ranged further beyond Alaskan waters than Laysan albatrosses, overlapping west coast Canada fisheries and pelagic longline fisheries in the subarctic transition domain; Laysan albatrosses remained north of these pelagic fisheries. Due to inter-specific differences in oceanic distribution and habitat use, the overlap of fisheries with the post-breeding distribution of black-footed albatrosses is greater than that for Laysan albatrosses, highlighting inter-specific differences in potential vulnerability to bycatch and risk of population-level impacts from fisheries.



## 1. Introduction

Incidental seabird mortality in commercial fisheries is a global marine conservation concern (Rivera, 2000) and a widespread threat to albatross populations (Croxall and Gales, 1998). Estimates of seabird bycatch rely largely on independent observers, observer coverage varies from nearly complete in some fisheries to total absence in many others.

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doi:10.1016/j.biocon.2008.12.007

Spatial overlap of albatross distributions with commercial fisheries have, therefore, been widely used and endorsed as a tool to assess the magnitude of potential bycatch and to aid in directing mitigation efforts (Prince et al., 1997; Hyrenbach and Dotson, 2003; Cuthbert et al., 2005; Suryan et al., 2007). In the North Pacific Ocean all three albatross species (black-footed, *Phoebastria nigripes*, Laysan, *Phoebastria immutabilis*, and short-tailed, *Phoebastria albatrus*) are incidentally taken as bycatch in commercial fisheries (Robbins and Rice, 1974; Melvin et al., 2006).

Bycatch of black-footed and Laysan albatrosses occurs in demersal and pelagic longline fisheries throughout their ranges, spanning much of the North Pacific north of 20°N during the breeding season (November–June), and north of 30°N during the post-breeding season (July–October) (Robbins and Rice, 1974; Artyukhin and Burkanov, 2000; Cousins et al., 2000; Melvin et al., 2001; Smith and Morgan, 2005). Approximately 990 black-footed and Laysan albatrosses were killed annually between 1994 and 1999 in demersal longline fisheries in the Alaskan Exclusive Economic Zone (EEZ) (National Marine Fisheries Service, 2006b). An additional 2500 albatrosses were taken annually in pelagic longline fisheries in the Hawaiian EEZ during the same time period (National Marine Fisheries Service, 2001). Based on estimates from Hawaiian fisheries, additional bycatch in unobserved pelagic longline fisheries occurring in international waters of the North Pacific may have been responsible for thousands of additional albatross mortalities annually during this time period (Cousins et al., 2000).

Estimates of seabird mortality in fisheries can vary in their accuracy between gear types. Unlike mortality in longline fisheries that occurs when albatrosses are caught on gear (i.e., hooked) and often times brought onboard with the fishery catch, albatross mortality in trawl fisheries occurs mostly, although not exclusively, as the result of contact with cables associated with the trawl door or net monitoring devices and carcasses are not recovered in the net (Weimerskirch et al., 2000; Sullivan et al., 2006). Consequently, albatross bycatch from trawl fisheries is difficult to quantify. Nevertheless, Laysan albatross mortality has been documented in Alaskan trawl fisheries (National Marine Fisheries Service, 2006b). Limited seabird mortality has been observed in the Alaskan pot fisheries and likely results from collisions with the gear before it is set; no albatross mortality has been reported by observers in these fisheries (National Marine Fisheries Service, 2006b).

Since the late 1990s, industry- and government-led initiatives in Alaska, Hawaii, and Canada have resulted in requirements for seabird bycatch avoidance measures during some longline fishing operations, or as a condition of licensing. Consequently, significant reductions in bycatch of both black-footed and Laysan albatrosses have occurred in the last decade (Melvin et al., 2001; Smith and Morgan, 2005; National Marine Fisheries Service, 2006b). Bycatch of albatrosses in the North Pacific persists, however. Seabird bycatch avoidance measures are not required in a variety of fisheries throughout much of the North Pacific utilized by these albatrosses, compliance with regulations and efficacy of mitigation measures are variable, and levels of bycatch in many fisheries remain unknown. Population level impacts of fisheries bycatch are likely occurring for black-footed albatrosses and may be affecting Laysan albatross populations to a lesser extent (IUCN, 2006; Veran et al., 2007). Despite these concerns, relatively little is known about the spatial overlap between fisheries and the at-sea distribution of these albatrosses, particularly during the post-breeding season.

In this study we used satellite-tracking data from black-footed and Laysan albatrosses captured in Alaska, an area of the North Pacific Ocean where both species are common during the post-breeding season, to evaluate the relative risk of interaction with the dominant fisheries they could encounter. Here, we analyzed the spatial overlap of albatrosses with Alaskan groundfish fisheries, in which albatross bycatch is quantified, as well as albatross overlap with fisheries beyond Alaska, in which bycatch is not well quantified. The objectives of this study were to (1) evaluate potential for interaction between albatrosses and fisheries in the Alaskan EEZ based on spatial overlap by region and habitats used; (2) evaluate albatross distribution with respect to fishing effort occurring outside of the Alaskan EEZ; and (3) evaluate inter-specific differences in overlap with fisheries to evaluate relative risk of interaction during the post-breeding season.

## 2. Methods

### 2.1. *Satellite-tracking of albatrosses*

During August 2005 and July 2006 we captured 41 black-footed albatrosses and 30 Laysan albatrosses at-sea (see Gill et al., 1970 for detailed description of capture methods) near Seguam Pass, Central Aleutian Islands, Alaska (52.08°N, 172.95°W). Only individuals that approached the boat within approximately 10 m were available for capture due to the limited range of our capture technique. If banded albatrosses were present in the group of birds attending the boat they were targeted for capture. We deployed satellite transmitters on a subsample of captured individuals. We visually inspected body feather condition of each captured individual and did not deploy transmitters on individuals whose feather condition appeared poor (i.e., extensive molting, advanced feather wear). We tracked seven black-footed albatrosses (all in 2005) and 18 Laysan albatrosses (2005: $n = 9$; 2006: $n = 9$). Albatross gender was determined from blood samples (ca. 100 μl) collected from the brachial vein (Fridolfsson and Ellegren, 1999). We determined the minimum ages of some tracked individuals (seven black-footed albatrosses and one Laysan albatross) that were previously banded as adults or nestlings using banding records. The reproductive status of tracked birds could not be determined.

We attached transmitters to the dorsal feathers of albatrosses using adhesive tape (#4651, Tesa Tape, Inc., Charlotte, North Carolina; see Wilson et al., 1997 for detailed description of attachments methods). Transmitters (KiwiSat 202, Sirtrack Limited, Havelock North, New Zealand and PTT100s, Microwave Telemetry, Inc., Columbia, MD, USA), including all attachment materials, weighed 40–60 g, <2.5% of each bird's body mass. We received position fixes for satellite-tagged albatrosses from the Argos System (CLS America, Inc., Largo, Maryland, USA) and used the Douglas Argos–Filter Algorithm