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Alaska Fisheries Science Center Coordinated Seabird Studies Strategic Plan 2022-2026

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Alaska Fisheries Science Center
Coordinated Seabird Studies Strategic Plan 2022-2026

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Executive Summary

Coordinated Seabird Studies (CSS) at the Alaska Fisheries Science Center (AFSC) promotes the collection and use of seabird data in an ecosystem-based fisheries management framework (EBFM). The CSS Strategic Plan outlines recommended research, service, outreach, and publication priorities over the next 5 years 2022-2026 based on advice from 37 colleagues within and outside of NOAA (Appendix 1). Given the cross-division and cross-disciplinary nature of the CSS at AFSC, we organize activities under five broad goals:

CSS Goal 1: Monitor, assess, and respond to seabird bycatch trends.

CSS Goal 2: Co-create and implement mitigation measures to reduce seabird bycatch.

CSS Goal 3: Integrate and synthesize seabird data for ecosystem-based fisheries management efforts.

CSS Goal 4: Contribute to, and summarize basin-wide seabird trends in support of EBFM.

CSS Goal 5: Represent CSS initiatives and results nationally and internationally.

As the AFSC adapts and updates science objectives based on a changing local-to-global seascape, CSS recognizes similar challenges related to seabirds. The following challenges relate specifically to seabird bycatch and seabird as indicators in fisheries management:

CSS Challenge 1: Changes in the timing, distribution, and abundance of seabirds and their prey.

CSS Challenge 2: Changes in the timing and distribution of fishing effort.

CSS Challenge 3: Changes to fishing gear and/or fishing methods.

Contents

Glossary of Terms

AFSC | Alaska Fisheries Science Center (AFSC)

AI | Aleutian Islands

AKRO | Alaska Regional Office (AKRO)

EBFM | Ecosystem-Based Fisheries Management (EBFM)

EBS | Eastern Bering Sea (EBS)

FTE | Full-time Equivalent (FTE)

FMA | Fisheries Monitoring and Analysis Division (FMA)

GOA | Gulf of Alaska (GOA)

CE | Conservation Engineering

CRF | Cooperative Research Funds (CRF)

CSS | Coordinated Seabird Studies (CSS)

CSWG | Circumpolar Seabird Working Group (CSWG)

MML | Marine Mammal Laboratory (MML)

NMFS | National Marine Fisheries Service (NMFS)

NOAA | National Oceanic and Atmospheric Administration (NOAA)

NPFMC | North Pacific Fishery Management Council (NPFMC)

NSP | National Seabird Program (NSP)

RACE | Resource Assessment and Conservation Engineering Division

REEM | Resource Ecology and Ecosystem Modeling Program

USDOC | U.S. Department of Commerce

USFWS | U.S. Fish and Wildlife Service

USGS | U.S. Geological Survey

WSG | Washington Sea Grant

1. Introduction

The Alaska Fisheries Science Center's (AFSC) Coordinated Seabird Studies (CSS) began in 2003 in response to the need for the National Marine Fisheries Service's (NOAA Fisheries) involvement in seabird-focused work on fishery interactions and seabirds as ecosystem indicators. A decade earlier, the North Pacific Groundfish Observer Program (now the North Pacific Observer Program) incorporated seabird-fishery interaction monitoring into its standard duties and procedures for observers (Appendix 2). Following three takes of the endangered short-tailed albatross (*Phoebastria albatrus*) reported by observers, 1995-1998 (USFWS 2008), the AFSC and its partners initiated one of the largest seabird mitigation studies in the world which resulted in a majority of the Alaska demersal longline fleet voluntarily adopting seabird mitigation recommendations two years before they became official regulation in 2004 (WSG 2016). A range of emerging research issues (e.g., effectiveness of electronic monitoring, seabird diet and body condition metrics derived from standard necropsies) contributed to the need for personnel dedicated to addressing and responding to seabird-fishery interactions and a host of ongoing standard operations and time-bounded projects (Table 1).

The strength of these efforts were reconfirmed with the creation of the NOAA National Seabird Program and signing of a formal Memorandum of Agreement with the U.S. Fish and Wildlife Service (USFWS). Framing of the strategic national plan (USDOC 2019) relies heavily on the success of current and prior work accomplished in Alaska.

Given the successful set-up and growth of CSS, 1993-2021 (Appendix 2), the next generation of CSS presents equally challenging and exciting initiatives. In the creation of the CSS Strategic Plan, we satisfy three important objectives:

- Enumeration of past successes.
- Projects/roles to be continued, with strong internal and external support.
- Prioritized new initiatives possible through strengthened internal collaboration.

1.1 Alaska Fisheries Science Center Strategic Science Plan

The AFSC Strategic Science Plan (USDOC 2021) guides the Center's science activities, 2023-2027, under Organizational Excellence Commitments 1 and 7; Science Goals 1 and 2:

- Organizational Excellence Commitment 1: Continue to foster an AFSC culture that values and practices transparency, engagement, accountability and respect.
- Organizational Excellence Commitment 7: Continue to develop and promote stakeholder partnerships and collaborations.
- Science Goals 1: Monitor and assess fish, crab, and marine mammal populations, fisheries, and marine ecosystems.
- Science Goals 2: Investigate, model, and predict ecosystem and climate impacts on living marine resources.

Key to all these commitments and goals is the production of sound science for decision-making and responsiveness to stakeholders. The CSS Strategic Plan highlights concordant activities raised by stakeholders (Appendix 1).

1.2 National Seabird Program Strategic Plan

Based on the 2019 Memo, "Memorandum on the Appointment of new NMFS National Seabird Coordinator" the primary goals of the National Seabird Program (NSP) is to a) address seabird bycatch (through monitoring, estimating, and mitigation), and b) to promote the use of seabirds as ecosystem indicators. The NSP Strategic plan (Ballance et al. 2019) expands these two primary goals into five strategic initiatives, 2020-2024, across all NOAA regions:

- Monitor and estimate seabird bycatch.
- Mitigate seabird bycatch.
- Strengthen key partnerships.
- Promote seabirds in advancing ecosystem-based fisheries management.
- Elevate awareness of and support for the NSP.

Within the NSP Strategic Plan, each strategic initiative includes 3-9 associated goals and milestones, which the CSS Strategic Plan references for all activities (see Section 3: CSS Strategic Plan Framework).

1.3 Essential Operations and Projects

Table 1 maps the ongoing operational activities and the time-bound projects considered essential for the AFSC through our outreach to a suite of individuals and organizations (Appendix 1). The CSS Strategic Plan adopts a framework in support of two, larger strategic NOAA efforts: the AFSC Strategic Science Plan and the National Seabird Program Strategic Plan (Ballance et al. 2019, see also Section 1.1, 1.2). Activities and foci within the CSS Strategic Plan include standard and essential operational activities and projects. Operations include activities such as contracting, obtaining funding, and those mandated by USFWS Biological Opinions (Table 2); annual bycatch estimates to the FWS and Council; and continuation of long-term datasets. Projects are time-bounded research, monitoring, and mitigation activities where completion of the project advances seabird science, management, and conservation or improves on the results produced from Operations.

Table 1. -- Strategic recommendations for ongoing and proposed seabird science and conservation operations and time-bounded projects for the AFSC with Coordinated Seabird Studies Group leadership, 2022-2026.

Coordinated Seabird Studies Activity	Strategic Plan	Primary partner	Secondary partner
Standard Operations			
Auto notification for seabirds of interest/ESA listed	1.1, 1.3	FMA	FWS, AKRO
Seabird necropsies	1.2	Oikonos	FMA
Seabird food habits	1.2	Walker*	Oikonos
Observer seabird ID and responsibilities training	1.4	FMA	Observers
Seabird bycatch rates and fleet effort reports	1.5	AKRO	FMA
Variances around seabird bycatch estimates	1.5	AKRO	TBD
Necropsy/food habit database promotion	3.1	NSP	USFWS
Longline seabird bycatch rate reports	1.5, 2.1	FMA	AKRO
NORPAC seabird ID database updates	1.1	FMA	Oikonos
Seabird leg band reporting	1.1	USGS	FMA
Trawl seabird mortalities outside sample reports	1.5	FMA	AKRO
Seabirds in ecosystem plans and indicators for ESRs	3.2, 4.4	REEM	AKRO
Assess oceanic food availability via necropsy metrics	4.2	REEM	NSP
Projects			
Seabird response to gear changes	2.3	FMA	AFSC
Vessel-specific research for longline fleet	2.1	AFSC - CRF	Industry
Artificial intelligence for seabird identification	2.2	FMA	CE
EM for addressing seabird interactions	2.2	NPFMC	CE & FMA
Leveraging 3rd wire data and 4th wire video	2.2	Tech Companies	Industry
Public access to necropsy/food habits database	3.1	REEM	AFSC

Coordinated Seabird Studies Activity	Strategic Plan	Primary partner	Secondary partner
Standardize and expand surveys on NOAA POPs	4.3	FWS	RACE & MML
Stationary seabird survey analysis	4.3	RACE	NSP
Pacific basin-wide analysis of albatross bycatch	4.5	NSP	Oikonos
Seabird mitigation measures in trawl fleet	2.2	Industry	CE & NWFSC
Emerging Issues			
Seabird issues in the Arctic	3.2	REEM	CSWG
Seabird issues associated with Aquaculture	2.2	AKRO	NSP
Seabird bycatch in gillnet fleet	1.4	FMA	FWS

* After this document was approved, we report with great sadness and dismay the passing of William A. Walker who led the work on marine bird food habits for the AFSC Coordinated Seabird Studies Group. We are currently working on a number of products from the work completed to date and are evaluating how to carry on the important legacy Mr. Walker created for marine bird food habits studies.

Table 2. -- USFWS Biological Opinions issued, 1989-2021 (see Appendix 3 for full list).

Common name	Scientific name	Fisheries	Region(s)	Original	Updated
Short-tailed albatross	*Phoebastria albatrus*	Groundfish	EBS, AI, GOA	1989	6/2/21
Steller's eider	*Polysticta stelleri*	Groundfish	EBS, AI, GOA	8/27/03	6/2/21
Short-tailed albatross	*Phoebastria albatrus*	Pacific halibut	Alaska	2/1/98	2/16/18
Spectacled eider	*Somateria fischeri*	Groundfish	EBS, AI, GOA	6/2/21	

Operational activities depend on dedicated staff to maintain these standard and essential activities of AFSC seabird work. The success of project-oriented activities often hinges on an influx of internal or external funds, partnerships, and contracted vendors (Table 1). Projects continue to be recognized and referenced as a critical element of NOAA's response to stakeholder needs, changing climate, and ocean food webs (Appendix 1, Table 1). Recognizing the constraints of budgets and time, we identify ways

current and future projects could leverage internal and expertise, stack function, or train students/interns to maximize efficiency (Table 1). Of note is the NOAA Pacific Seabird Necropsy work (Appendix 4). This started as a project, with an expectation of completing the work after a certain time. The results of this project have convinced a wide range of stakeholders that seabird necropsies need to be part of CSS standard operations. As a project, funds were sought annually in support of necropsy activities. Moving this to an operational feature requires a funding approach that identifies dependable funding, within the bounds of what the agency can achieve.

1.4 Management and Leadership

Currently one lead person invests a "full time equivalent" (FTE) of about 0.8 time to manage the CSS, and has leveraged this level of effort to obtain internal and external sources of funding to extend activities (Table 1). Some bottom-up AFSC activities and processes have developed without direct CSS lead involvement, but they could benefit from the lead's coordination and expertise. While the CSS has accomplished a great deal, the full scope of this plan may necessitate increasing dedicated leadership time. Throughout this document, we refer to the CSS Lead(s). We are not *a priori* recommending a single or multiple leadership role for the next phase of AFSC CSS operations. There are both benefits and challenges to either approach and there are several ways of delineating leadership opportunities in support of this strategic plan. Options include a single full time FTE, two or more partial time FTEs of greater than FTE 0.5, or a single full time (or nearly full time) FTE plus part-time (0.25 or less) FTE from other seabird expertise within the AFSC. This is a determination that can be made after adoption of the CSS Strategic Plan, in concert with the AFSC Strategic Science Plan and other initiatives, given available resources.

2. Methods

Between 1 June and 24 June 2021, the CSS Lead (Shannon Fitzgerald) and contractor (Jane Dolliver) solicited for and compiled feedback from 20 listening sessions and written responses from 37 individuals (Appendix 1). Individuals included NOAA colleagues; industry, non-profit, and interagency partners; and current contractors. Additional individuals were contacted May-June 2021, but they could not commit to a 1-hour listening session or provide written feedback within this time window. Compiled feedback was organized under four activities (see **CSS Strategic Framework**) after 12 sessions and revised twice to incorporate the latter 8 sessions, including expanding to five Strategic Framework activities. The CSS Strategic Plan draft was passed to AFSC leadership on 27 September and evaluated in concert with development of the AFSC Strategic Science Plan, which was also under development. Suggested revisions were provided in December 2021, incorporated, and the plan was approved in February 2022.

3. CSS Strategic Plan Framework

Goal 1: Monitor, assess, and respond to seabird bycatch trends (within AFSC Strategic Science Plan Objective 1D: Reduce bycatch by using fishery-dependent bycatch analysis, spatial modeling, data on environmental conditions, and conservation engineering; NOAA National Seabird Program Strategic Initiative 1: Monitor and Estimate Seabird Bycatch)

Focus 1.1: Improve database response and reliability performance -- create automatic notification system for "species of interest" seabird bycatch and collisions, leg bands; improve species identification, generate on-demand by-vessel seabird take summary table.

In at least one instance, the CSS Lead was not aware of a major incidental take of seabird "species of interest" (ESA-listed or USFWS Birds of Conservation Concern (USFWS 2010, 2014, 2020; USDOC 2020)). Currently alerts must be generated individually from in-season debriefers via email or phone. To fill this communication gap and to allow the CSS Lead(s) to keep their finger on the pulse of fishery interactions for seabird species of interest, we recommend setting up an automatic email notification system of *new r*ecords of dead "species of interest" and live and dead "banded bird" records entering the FMA database. This would not replace debriefers' immediate notification of ESA-listed takes to the CSS Lead(s), nor the ESA seabird take process (Appendix 5) but instead would serve as a safeguard/check on the manual notification process. Alerts are the first step in the formation of a formal observer seabird data review process (in consultation with the Alaska Regional Office (AKRO) and USFWS) to facilitate timely verification of records (currently occurring on a semi-annual basis), species identification feedback to observers (occurring only in ESA-listed verifications), and leg band reports to USGS (currently occurring every few years).

In service of Focus 1.1, the CSS Lead(s) would greatly benefit from a database table that can be queried as needed to provide seabird bycatch bound by time and area, vessel, and hook tally. Again, these in-season summaries would not replace/change any aspect of observer debriefing, but would allow the CSS

Lead(s) to keep their finger on any anomalous events and coordinate intra- and inter-agency response to known mortality events (e.g., timely AFSC data to substantiate the shearwater mortality event in 2019, Siddon 2020).

Focus 1.2: Continue systematic retention, necropsy and sampling of seabird bycatch carcasses

The Pacific Seabird Necropsy Program (PSNP, contracted with Oikonos, Appendix 4), is a 14-year, cross-regional effort between Alaska, Hawaii, and more recently the Pacific Northwest. The National Seabird Program (NSP) supplies flow-through funds to maintain operations, with supplement funding from the AFSC and AKRO, as is feasible. Annually, NSP base funds support necropsy of up to 175 carcasses and with options, another 142 necropsies can be accomplished. PSNP is recognized as a national and international "best practices" model for cost-effective, shared services that produce unbiased, high-quality data on bird demographics, body condition, food habits, and pollution at sea. Within listening sessions, collaborators raised concerns about the temporary, year-by-year nature of program's funding and the potential to lose this cross-regional data stream. Currently the CSS Lead handles all project components, including permits, carcass inventory, shipping, contract set up, payments, supply purchases, project communications, and publication authorship. Given budgetary constraints, we recommend some of these duties be incorporated into quarterly student research position(s) for independent study credit at the University of Washington.

Focus 1.3: Coordinate identification, reporting and carcass retrieval of ESA-listed seabird species

In accordance with the formal ESA-listed species take process (Appendix 5) the CSS Lead(s) will continue to work closely with the AKRO on any credible ESA-listed species take event, establishing a clear communication chain to all parties. Within this process, the CSS Lead(s) must also obtain and secure confidential evidence, convene a set of experts to validate species identification, arrange and conduct an interview with the observer. The final species determination rests with the AFSC, which issues a formal summary for inclusion in any public notice by AKRO. Given both AFSC and AKRO are key to this response, we recommend an annual reassessment of the process (outside of any ongoing event) to continue to define duties and roles of the two parties.

Focus 1.4: Conduct rigorous, targeted seabird training for new and continuing observers, and staff/contractors aboard NOAA research vessels

Another nationally recognized effort is the rigorous, targeted, and systematic dead seabird identification training conducted by the University of Washington's Coastal Observation and Seabird Survey Team (COASST) staff. Similar, but less expansive than fish identification training (also contracted through the University of Washington), the seabird training combines lecture, call-and-response, paired peer-to-peer learning with museum specimens and finishes with a frozen specimen open-book exam. To document and continue its success we recommend a) establishing a short, optional survey for observers to provide ongoing feedback, b) an annual spring meeting between COASST contractors, and observer staff, and the CSS Lead(s) to provide feedback on the training and updates to the observer manual for the coming year. The coordination each fall among the CSS Lead(s), COASST trainers, and FMA trainers to review the 3-week and 4-day training presentations should continue.

The CSS lead(s) should continue to provide the seabird identification and conservation portion of the annual Environmental Law Compliance training provided to AFSC research cruise participants. The CSS Lead(s) should also maintain a calendar of all NOAA research cruises which could include seabird observer(s) and conduct proactive outreach to advocate for their presence. Those serving as seabird observers (staff, contractors, volunteers) should be trained by the CSS Lead(s) prior to departure. The CSS Lead(s) should assist in making data collection and transfer as easy as possible by procuring appropriate materials for the documentation, storage, and retrieval of rare seabird events and/or takes (e.g., photo ruler, digital camera, USB memory drive, digital recorder).

Focus 1.5: Leverage expertise at the Alaska Regional Office (AKRO) to critically examine seabird bycatch estimation and rates

Since the inclusion of seabird identification in species composition sampling, three statisticians have been involved with the estimation of seabird bycatch from observed hauls (Appendix 2). The current method, via the catch accounting system, made improvements to the timeliness and accuracy (by carcass, not weight) of estimates. Moving the annual estimation process to the CAS system was a recommendation of the Working Session on Seabird and Marine Mammal Bycatch Estimation for Alaskan Groundfish Fisheries (held on 22 June 2009 at the Alaska Fisheries Science Center). Another recommendation was to complete a parallel estimation that provided confidence intervals and would provide an evaluation of how well the CAS provided estimates on rare bycatch. The CAS move was accomplished while funding shortfalls have prevented the latter. Meanwhile, experts within the Alaska Seabird Working Group have requested the CAS estimates include confidence intervals and/or standardization by fishery effort (birds/hooks) (Dietrich et al. 2007, Wolfaardt and Debski 2019). Efforts are underway by AKRO to apply Northwest Fisheries Science Center (NWFSC) Bayesian bycatch estimation techniques to Alaska CAS estimates for multiple species. We recommend AKRO and AFSC a) continue the use of the AKRO CAS system for basic estimation and timely reporting, b) develop new bycatch estimation techniques, statistical methods and analysis at AFSC, with strong input from AKRO and c) leverage the scientific expertise of AFSC to conduct an analysis of bycatch estimation methods across the decades, for dissemination to the National Seabird Program and peer-reviewed publication.

The CSS Lead(s) should also continue and finalize the effort, with FMA and AKRO, to incorporate data being collected by observers on trawl vessel seabird cable strike mortalities into the estimation procedures. There may also be a need to examine eider vessel-collision data and incorporate estimates into annual reporting.

Goal 2: Co-create and implement mitigation measures to reduce seabird bycatch or interactions with aquaculture facilities (within AFSC Strategic Science Plan Objective 1D: Reduce bycatch by using fishery-dependent bycatch analysis, spatial modeling, data on environmental conditions, and conservation engineering; NOAA National Seabird Program Strategic Plan Initiative 2: Mitigate Bycatch)

Focus 2.1: Develop and implement vessel-specific seabird bycatch reduction research program

Previous studies report regional bycatch rates are driven by a small fraction of vessels (Dietrich and Fitzgerald 2010), and encouraged the need for regional-to-national targeted, vessel-specific outreach (Melvin et al. 2019). Combined with the proposed summaries recommended in Focus 1.1, and contingent on additional funding support, the CSS Lead(s) should implement a research project to identify several vessels with worse than average bycatch rates and work with those vessels to determine best practices to reduce seabird bycatch rates. This work would support scientific publications and lead to a co-creation model with the CSS Lead(s), representatives from industry, AKRO, FMA, NMFS Enforcement, and the Resource Assessment and Conservation Engineering Division (RACE) at AFSC to define the process, roles, and products of an outreach program to further reduce seabird bycatch throughout the fleet. This approach has the highest likelihood of further reducing fleet-wide seabird bycatch rates and total estimated seabird bycatch.

Focus 2.2: Create new consortium to leverage expertise of Fisheries Monitoring and Analysis (FMA), Resource Assessment and Conservation Engineering (RACE), and other divisions to apply for and receive funding for emerging issues, special projects, and mitigation trials (e.g., trawl wire interactions, artificial intelligence/electronic monitoring, gillnet fleet in Southeast Alaska, seabird interactions with aquaculture facilities)

For over two decades, AFSC has collaborated with, and benefited from, the expertise of Washington Sea Grant's Marine Fisheries Senior Scientist Ed Melvin (Appendix 2). The exceptional success of seabird mitigation methods trials and industry adoption of these methods continues to be cited as a hallmark achievement, along with several possible application and extension opportunities, worldwide (Appendix 1). Mr. Melvin's retirement-without-replacement in 2019 left a large gap in the field and uncertainty over its continuity.

We propose that select members of the AFSC Bycatch Working Group, which includes the three Divisions that have traditionally worked on mitigation project -- Resource Ecology and Fisheries Management (REFM), Resource Assessment and Conservation Engineering (RACE) and Fisheries Monitoring and Analysis (FMA) – and the Marine Mammal Laboratory (MML) and the Auke Bay Laboratory (ABL), create a consortium around the issue of seabird bycatch mitigation. Thus far, RACE's Conservation Engineering bycatch reduction efforts have been focused on salmon bycatch (Yochum et al. 2021), though the division is a clear partner and link to industry. FMA has partnered with the CSS Lead since the inception of seabird work (e.g. to provide data, observer focus groups, field reports, logistics). FMA has worked closely with AKRO and the North Pacific Fishery Management Council (NPFMC) in support of electronic monitoring of bycatch on demersal longline vessels, and recently initiated a study to assess artificial intelligence (AI) techniques to identify seabirds in a controlled lab setting (Fitzgerald 2019).

Interest in emerging seabird bycatch mitigation and monitoring opportunities remains high (Appendix 1, Eich et al. 2016, Fitzgerald et al. 2017). We recommend the consortium of the CSS Lead(s), RACE conservation engineers, and REFM and FMA biologists to solicit for internal and external funding to address emerging issues via mitigation trials and proof-of-concept special projects including but not limited to the following priorities identified via listening sessions (Appendix 1):

- Build on efforts to document "cryptic" trawl third and fourth wire interactions (Melvin et al. 2011) including improved data collection on frequency, impacts to albatrosses and other species; mitigation trials and techniques.
- Following the success of the proof-of-concept trials, begin electronic monitoring/artificial intelligence trials on longline vessels for accuracy calculations, establishment of fleet-wide recommendations, applications and limitations.
- In partnership with FMA and ADFG, expand observer coverage of gillnet fisheries in Kachemak Bay, Bristol Bay, and southeast Alaska; apply and adapt seabird mitigation techniques from gillnet fisheries in Puget Sound (Melvin et al. 1999) if and where appropriate.

Focus 2.3: Coordinate with the Fisheries Analysis and Monitoring (FMA) Division to accurately record gear modifications or changes in gear type by haul

Alaska fisheries are diverse in their target catch, range, and gear type (USDOC 2020). Local-to-regional changes in fish species' range and abundance, given existing and future fluctuations in ocean temperatures and food availability create complex monitoring and management challenges (Thorson et al. 2019). Currently, observers are deployed on vessels based on vessel activity (catcher, catcher/professor), target catch and gear type, all of which are expected to remain constant across the season (USDOC 2020). We recommend the CSS Lead(s) a) meet annually with industry representatives to keep up with current or pending gear modification(s) and adoption(s) b) work with colleagues in FMA to include 1-2 new data fields for observers to account for inter-haul changes in gear set and haul-back methods (e.g., weighted lines, floated lines, used pots, no augmentation). Together with the FMA and RACE divisions and the AKRO, the CSS Lead(s) should be involved in the development of any by-haul gear type into the analysis of bycatch rates in **Focus 1.5**. It will be especially important to evaluate the effect on albatross bycatch (expected reduction) as Gulf of Alaska vessels change gear from demersal longline to pot.

Goal 3: Integrate and synthesize seabird data for ecosystem-based fisheries management efforts (within AFSC Strategic Science Plan Objective 1B: Conduct marine ecosystem and socioeconomic analysis and assessments to support sustainable fisheries management and marine mammal conservation; NOAA National Seabird Program Strategic Initiative 4: Promote Seabirds in Advancing Ecosystem-based Fisheries Management and Ecosystem-based Management)

Focus 3.1: Include seabird diet and abundance data in ecosystem models and climate projections

The Resource Ecology and Ecosystem Management's (REEM) seabird food habits database (derived from necropsies, see Table 1) and the fish food habits databases exist separately within REEM. At present, the seabird food habits are not incorporated into climate/scenario modeling (e.g., ACLIM ocean forecasts) or part of annual reporting (e.g., Ecosystem Status Reports). With AFSC IT support, the CSS Lead(s) and REEM staff should work to make the seabird diet dataset advertised, updated and available such that

fisheries management actions can be tied to benefits for future fisheries stocks and seabird survival by preferred prey type (e.g., Cury et al. 2011).

At-sea seabird abundance data are catalogued in the USGS North Pacific Pelagic Seabird Database (NPPSD) (1973-2019), but it is not inclusive of all survey effort, does not include point-count surveys, nor is it updated on a specific, annual cycle. The CSS Lead(s) should develop a list of the myriad at-sea seabird data sources in Alaska waters not typically included in the NPPSD (e.g., IPHC Annual seabird point count surveys, opportunities for expanded survey work on NOAA vessels). The CSS Lead(s) should coordinate with the FWS to evaluate and implement seabird abundance survey effort on platforms of opportunity, including the full NOAA fleet and standardized commercial trips. When expertise and funding permit, the CSS Lead(s) should initiate or be co-authors on publications that combine at-sea seabird data sources with fish, fishery, and climate modeling efforts (e.g., Renner et al. 2013). This effort was identified as a high-priority task in the NSP strategic plan.

Focus 3.2: Participate in drafting of the Arctic Regional Action Plan and future Arctic Ecosystem Status Reports

A melting Arctic is expected to create a cascade of changes in the distribution and abundance of fish as well as seabirds (Richter-Menge et al. 2019). We recommend the CSS Lead(s) contribute to the compilation of data sources and gaps, needs and big ideas part of the Arctic Regional Action Plan (draft Arctic RAP in progress, summer 2021). These contributions should incorporate CSS priorities including the initiation of seabird observations on future NOAA Arctic research cruises (similar to **Focus 4.3**) or as part of current marine mammal drone/small boat surveys. The CSS Lead(s), in collaboration with the future ecosystem status report team should assist with the compilation of a) potential Arctic partnerships including tribal subsistence contacts, local and traditional knowledge keepers, USFWS seabird colony data and b) what seabird species are known and/or expected as bycatch and associated metadata (e.g., location, gear, timing, frequency).

Goal 4: Contribute to, and summarize basin-wide seabird trends in support of EBFM (within AFSC Strategic Science Plan Objective 1B: Conduct marine ecosystem and socioeconomic analysis and assessments to support sustainable fisheries management and marine mammal conservation; National Seabird Program Strategic Plan Strategic Initiative 4: Promote Seabirds in Advancing Ecosystem-based Fisheries Management and Ecosystem-based Management)

Focus 4.1: Catalog seabird datasets available within and outside of NOAA; remove barriers to access and inclusion in modeling and reporting efforts

An early shift to ecosystem-based fisheries management is a national and worldwide model for sustainability (Witherell et al. 2000) which incorporates a wealth of direct (e.g., pollock age class information) and indirect indicators (e.g., seabird die-offs) of ecosystem health into quotas of acceptable biological catch (ABC) and total allowable catch (TAC) (DiCosimo et al. 2010). While the strength of these indirect and future, indirect indicators have not been fully assessed and incorporated into stock

assessment models (Townsend et al. 2019), their compilation provides a holistic overview of at-sea conditions within the Ecosystem Status Reports (ESRs). A substantial amount of effort has been spent cataloguing regional seabird productivity and diet data sources for the eastern Bering Sea, Aleutian Islands, Gulf of Alaska Ecoregions (Ferriss and Zador 2020, Ortiz and Zador 2020, Siddon 2020). In future years, the CSS Lead(s) should work with the Ecosystem Status Report teams to develop new indicators and ecosystem linkages for using these compiled data (e.g., linking reproductive success to actual fish availability near colonies, forecasting into the future).

We recommend at a minimum, an index of available data streams for possible inclusion in ESRs, including but not limited to those raised during listening sessions:

- NOAA-AFSC platforms of opportunity (e.g., RACE charters).
- Canadian Wildlife Service: Triangle Island colony data.
- Laskeek Bay Conservation Society: Haida Gwaii data.
- Audubon Alaska: Breeding bird surveys.
- National Parks Service: Yakutat Bay nesting surveys.
- Prince William Sound Science Center: nesting surveys.

Focus 4.2: Assess annual food availability through necropsy metrics (e.g., body condition, stomach contents)

As part of the Pacific Seabird Necropsy Program (PSNP, **Focus 1.2**), AFSC has amassed one of the largest at-sea seabird necropsy metrics databases in the world (Appendix 4). Unlike annual colony data currently used in ESRs (Siddon 2020, Ortiz and Zador 2020, Ferriss and Zador 2020), diet and body condition at-sea provide a more in-depth and targeted snapshot of annual conditions where fishing effort and fish occur. After an extensive design and set up phase, the relational database is expected to be ready for use by autumn 2021. Following this major achievement, we recommend the CSS Lead(s) initiate a) outreach to relevant divisions on its availability, use and limitations b) with relevant co-authors, set timelines for summarizing and including these data in annual ESRs and peer-reviewed publications.

Focus 4.3: Analyze seabird abundance surveys, paired with physical, environmental and fisheries data, from NOAA survey vessels

In an extension of **Focus 2.2 and 3.1**, NOAA and IPHC stock assessment surveys have systematically recorded seabird takes and for some, seabird abundance estimates at haul-back. Thus far, these datasets are underutilized, especially in their contribution to the agency's understanding of factors that contribute to vessel attraction (e.g., physical or chemical ocean profiles, prey availability, vessel activity) and takes under best-case scenario mitigation methods. Some data collections have been discontinued but can be re-initiated. Following compilation (**Focus 3.1**) we recommend the CSS Lead(s) investigate or oversee the investigation of these datasets to identify significant factors influencing seabird take and vessel attraction in a semi-controlled setting.

Focus 4.4: Leverage AFSC infrastructure and expertise to provide additional ecosystem status metrics

AFSC scientists, and academic collaborators, represent one of the largest consortium of fisheries leaders and experts, worldwide (USDOC 2017). These laboratory and technical equipment resources, taxonomic expertise, and data analysis techniques provide unparalleled service, inside and outside the agency. For example, for the past 3 years, the REFM Trophic Interaction Program (Food Habits Lab) has processed tufted puffin (*Fratercula cirrhata*) diet samples from AMNWR immediately following the summer collection season, in time for inclusion in fall AFSC ESRs. Such partnerships maximize access and availability of data for regional and multi-region use (USDOC 2017, 2019). We recommend that the CSS Lead(s) continue to develop partnerships which leverage AFSC infrastructure and technical expertise that a) extend long-term datasets that would otherwise be curtailed (e.g., samples from Kathy Turco, University of Alaska-Fairbanks), and b) create new datasets with existing and archived samples (e.g., stable isotope analysis of northern fulmar (*Fulmarus glacialis*) feathers, extension of Edwards et al. 2015). All partnerships would be priority ranked for inclusion in ecosystem status reports based on their ability to address AFSC Strategic Science Plan initiatives and Science and Statistical Committee (SSC)-identified linkages between seabird diet, food-web competition, and food availability-mediated seabird bycatch.

Focus 4.5: Conduct basin-wide analyses across regions and countries, for highly migratory species

The unqualified success of the multi-region Pacific Seabird Necropsy Program (**Focus 1.2)** lends itself to broad, Pacific Ocean-wide analyses on species of special concern, with results suitable for publication in high-impact journals (e.g., black-footed albatross, *Phoebastria nigripes*, range-wide expansion of Verán et al. 2007). The National Seabird Program, a multi-region NOAA collaborative, specifically prioritizes the continued collection, use, and publication of observer data, beyond core reporting requirements (USDOC 2019) as does AFSC, for incorporation into region-wider reports and publications (e.g., action plans, ecosystem status reports) (USDOC 2017). We recommend the CSS Lead(s) work with members of the National Seabird Program to publish multi-region necropsy data trends, standardized by fishing effort, for identifying range-wide links between bycatch rates and food availability, and to assess population-level impacts of fisheries interactions across the three regions (e.g., scaled-down version of Anderson et al. 2011).

Goal 5: Present results and represent CSS nationally and internationally (within AFSC Strategic Science Plan Organizational Excellence Commitment 1: Continue to foster an AFSC culture that values and practices transparency, engagement, accountability and respect, Commitment 7: Continue to develop and promote stakeholder partnerships and collaborations; NOAA National Seabird Program Strategic Initiative 3: Strengthen Key Partnerships)

Focus 5.1: Represent the NOAA Fisheries – Alaska Fisheries Science Center at local-to-global scales

The AFSC is a globally recognized leader in collaborative work with industry to develop, test, and implement seabird bycatch mitigation (Melvin et al. 2019), and with trustees to promote the awareness of protected species (USDOC 2016). The national and international community notice the absence of AFSC representation, and the gravitas of its recommendations and promises when addressing emerging conservation concerns within the United States and abroad. We recommend the CSS Lead(s), in collaboration with the National Seabird Program Lead, find a NOAA representative with personal fishing industry experience to serve on the Agreement on the Conservation of Albatrosses and Petrels (ACAP) Bycatch Reduction Working Group. Regionally, the CSS Lead(s) should continue to serve on and attend U. S. Fish and Wildlife Service (USFWS) Recovery Team meetings for the short-tailed albatross, spectacled eider and Steller's eider and the Alaska Seabird Working Group (Appendix 1). The CSS Lead(s) should also re-initiate periodic (annual or biennial) meetings directly with FWS staff to provide a broad-scale review of activities, research efforts, collaborations, and other matters.

Focus 5.2: Produce and present findings annually for leadership, partners and stakeholders

The CSS Lead(s) has a clear coordination and management hand in a variety of tasks, reports, and publications resulting from seabird studies at AFSC (e.g., Dietrich and Fitzgerald 2010, Beck et al. 2020). However, AFSC staff remain largely unaware of these many products and data streams (Appendix 1, Table 1). To elevate the work of AFSC on seabirds we recommend the CSS Lead(s) perform an annual "State of the CSS" for the AFSC Leadership team and provide annual activity reports to the following:

AFSC teams:

- Resource Ecology and Ecosystem Modeling Program (REEM) leadership.
- Resource Ecology and Fisheries Management (REFM) Division leadership.
- Fisheries Monitoring and Analysis Division (FMA) leadership.
- North Pacific Observer Program staff.
- North Pacific Observer Program observers.
- Center-wide informational seminar.

National teams:

- National Seabird Program lead.
- National Observer Program contacts.
- Office of International Affairs and Seafood Inspection contacts.

Present research results at least one of the following professional conferences, annually:

- American Fisheries Society.
- Pacific Seabird Group Annual Meeting.
- World Seabird Conference.
- International Ornithological Congress.
- North American Ornithological Conference.
- International Marine Conservation Congress.
- International Observer Conference.
- International Albatrosses and Petrels Conference.
- Alaska Bird Conference.
- Alaska Marine Science Symposium.
- The Wildlife Society.

Focus 5.3: Serve as the seabird representative on the Groundfish Plan Teams

The North Pacific Fishery Management Council enlists the help of five overarching Plan Teams (Crab, Scallop, Groundfish, Social Science, and Bering Sea Fishery Ecosystem) to provide quarterly-to-annual presentations to update the Council on research and monitoring activities, new and pending Council actions. Leslie Slater, USFWS, served as representative on the Groundfish Plan Team from 2008 to 2017; however, the position has been vacant since then. In consultation and deference to USFWS, we recommend the seabird expert, either from USFWS or the NOAA CSS Lead(s), assume the vacant seat on the Groundfish Plan Team for a) continued inter- and intra-agency integration of seabird-related work and b) to strengthen the CSS Lead(s)' awareness of emerging issues presented to the Council.

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Appendix 1: Listening Session Participant List and Summary.

First	Last	Office/Affiliation	Institution	Session date(s)
Noelle	Yochum	Alaska Fisheries Science Center	NOAA	3/29/21
Mi Ae	Kim	International Affairs and Seafood Inspection	NOAA	6/1/21
Lee	Benaka	National Seabird Program	NOAA	6/1/21
Annette	Henry	SW Fisheries Science Center	NOAA	6/1/21
Jessie	Beck	Contractor/Oikonos	Oikonos	6/2/21
Joe	Krieger	Alaska Regional Office	NOAA	6/2/21
Anne Marie	Eich	Alaska Regional Office	NOAA	6/2/21
Jim	Thorson	Alaska Fisheries Science Center	NOAA	6/2/21
Kathy	Kuletz	Alaska Region, Migratory Birds Mgmt	USFWS	6/4/21
ELizabeth	Labunski	Alaska Region, Migratory Birds Mgmt	USFWS	6/4/21
Rob	Suryan	Alaska Fisheries Science Center	NOAA	6/4/21
Stephani	Zador	Alaska Fisheries Science Center	NOAA	6/7/21
Bridget	Ferriss	Alaska Fisheries Science Center	NOAA	6/7/21
Ivonne	Ortiz	Alaska Fisheries Science Center	NOAA	6/7/21
Tom	Good	NW Fisheries Science Center	NOAA	6/7/21
Jason	Jannot	NW Fisheries Science Center	NOAA	6/7/21
Ed	Melvin	Seabird mitigation research (Retired)	WSG	6/9/21
Neesha	Stellrecht	Fairbanks F&W Conservation	USFWS	6/10/21
Claire	Montgomerie	Fairbanks F&W Conservation	USFWS	6/10/21
Jennie	Spegon	Alaska Region, Ecological Services Mgmt	USFWS	6/10/21
Katie	Ott	Fairbanks F&W Conservation	USFWS	6/10/21
Ron	Felthoven	Alaska Fisheries Science Center	NOAA	6/14/21
Bob	Foy	Alaska Fisheries Science Center	NOAA	6/14/21

First	Last	Office/Affiliation	Institution	Session date(s)
Jeremy	Rusin	Alaska Fisheries Science Center	NOAA	6/14/21
Sea	McKeon	American Bird Conservancy	ABC	6/15/21
Brad	Keitt	American Bird Conservancy	ABC	6/15/21
David	Widenfeld	American Bird Conservancy	ABC	6/15/21
George	Hunt	Science and Statistical Committee	NPFMC	6/17/21
Steve	MacLean	Staff Protected Resource Specialist	NPFMC	6/17/21
Kim	Dietrich	Independent Contractor	--	6/17/21
Kerim	Aydin	Alaska Fisheries Science Center	NOAA	6/22/21
Chad	See	Freezer Longline Coalition	FLC	6/22/21
Brad	Pretfis	FV *Coastal Alaska*	Fisherman	6/22/21
Scott	Hanson	FV *Beauty Bay*	Fisherman	6/22/21
Tiara	Turner	Freezer Longline Association	FLC	6/22/21
Jon	Warrenchuk	Oceana	Oceana	6/23/21
Andy	Whitehouse	Alaska Fisheries Science Center	NOAA	6/24/21

Current and past successes

- Mitigation work (15)
    - **Streamer line work in 2000s**; publications that resulted
    - Agency-industry partnership
    - Co-creation, design, testing, presenting it to the council, getting it in regulations
    - Continued trawl cables mortality work
    - Worldwide leader/force in bycatch reduction
- Liaison with USFWS, **esp. ESA process** (13)
    - Formalization of ESA take process
    - Species identification
    - Paperwork and permitting
    - Shipping
    - Data sharing on vessel collisions
    - NOAA representative at short-tailed albatross recovery team meetings
    - Seabird observers on NOAA cruises, surveyors for USFWS cruises

- Observer Program Liaison (8)
    - **Provide high quality, expansive, standardized training** to largest number of observers
    - Contract with COASST/University of Washington for seabird ID specialists; stable set of trainers
    - Managing data requests to Observer Program
    - Early electronic monitoring (EM) testing and compliance
    - Set up to provide high-quality data and reporting
- Reporting (8)
    - National Bycatch report: inclusion of Alaska rates
    - Agreement on the Conservation of Albatrosses and Petrels (ACAP): inclusion of seabird bycatch and fleet information
    - **Annual bycatch estimates to Council**; good communication with AKRO
- Necropsy program (6)
    - Expansion to Pacific Islands and West Coast
    - Impressive data stream; systematic retention of carcasses
    - Continue to dedicate funds to this effort
    - Grow this effort
    - Publications, papers, presentations produced
- Ecosystem-based fisheries management (EBFM) (6)
    - USFWS seabird data part of ecosystem status reports
    - Use and recognition of seabird data, partnerships with USFWS, COASST to include this
    - Identification of tufted puffin diet data at AFSC
- Collaborations/relationship building (6)
    - **Fishing industry**, esp. work toward solutions with Ed Melvin
    - Science community, esp. Oikonos Necropsy work
    - Ease of working relationships better than at other science centers and regional offices
    - Collection of at-sea seabird data on NOAA vessels and other vessels of opportunity
    - Cooperation on competitive “smart gear” RFP with WWF
    - Communication to industry re: eider Biological Opinion
- Annual Seabird Working Group (3)
    - Continued participation and knowledge sharing
    - Mandated as part of biological opinions; important for cross-agency sharing
- Education/outreach (2)
    - Bering Sea Island Seabird Youth Network bycatch activities
- International work (2)
    - Describing domestic U.S. fisheries, processes
    - Sharing U.S. lessons learned and best practices
    - Groundbreaking work; e.g., electronic monitoring (EM)
- Funding/leverage
    - Support of geneticist position at Auke Bay to work on black-footed albatross
- Climate change research
    - Changing seabird distributions
    - Changing bycatch trends

Perceived shortfalls

- Use of seabird data (13)
    - Seabird takes as indicators in EBFM – **need to create a stronger tie** here
    - Remove barriers to access seabird data; catalog datasets available
    - Lots of interest to use seabirds for a variety of research questions
    - Necropsy program and data could be expanded
    - Using NOAA vessels as platforms of opportunity for seabird sightings and interactions
    - **Include seabird food habits data in modeling efforts**; e.g., ACLIM
- Fisheries monitoring and analyses (11)
    - Adding confidence intervals on estimates for all species (FYI, albatross in progress with NWFSC models)
    - Re-do prior analyses, analyze pre-CAS and post-CAS estimates
    - Report results of electronic monitoring (EM): EM for compliance is great; EM for species identification needs more additional effort, testing, analyses.
    - Stay on top of gear changes, quantify these changes and any seabird mortality impacts; assure observer data assesses gear type by haul, not by boat.
    - Improve observer coverage across all sectors; better assessment of cryptic mortality
    - Testing, development, and implementation of electronic monitoring techniques
    - Create hotspot maps for short-tailed albatross; warning system for avoiding these areas
    - Create way for skippers to report night-time/storm wrecks.
    - Assess full coverage/partial coverage fleets
- Outreach to NOAA-external groups (8)
    - International: **ACAP meetings; no federal rep with bycatch experience on seabird bycatch working group**
    - Advocacy groups: Audubon, American Bird Conservancy. These groups perceive seabird bycatch not appropriately documented/estimated. Continue to host workshops (e.g., cable mortality workshop), write letters, attend and present at scientific conferences (e.g., PSG, IOC), attend workgroups (e.g., albatross working group), host brainstorms/hackathons/think tanks.
    - Vessel-specific outreach in real-time; decide who does this and implement it
    - Stronger participation in Regional Fishery Management Councils
- Communication gaps between AKRO and AFSC (5)
    - Struggle for collaborators to assess divisions, needs of both offices
    - Interaction with USFWS comes across as 2 entities, not one; we should be talking internally and forming an opinion prior to any external conversations
    - AKRO should initiate biological opinions, ask for AFSC for relevant science/data
    - Restructure of Seabird Working Group meeting: allow external members, have lead be outside region, use this to solve problems not give updates
    - Spectacled eider take event notification from AFSC to AKRO
- More resources (2)
    - Easily 100K/year to support projects
    - Too many far-ranging tasks for one person (e.g., from permitting/shipping to analysis and publication)
- Improve collaboration/communication with Industry (2)
    - Methods for bycatch estimation should be public
    - Estimates fail to capture population-level impact(s); Estimates should be broken down by sector/gear type

- Align National Seabird Program with changes occurring in Alaska (e.g., species ranges, habitat changes); provide positive and negative impact of these changes
- Provide flexibility in numbers of takes as populations/ranges change
- Meet fishermen on the docks, come with swag

Future needs

- Publications from special projects (29)
    - **Cryptic mortality in trawl fisheries** – follow-up/update/begin trials for warp cable, third wire, 4th wire interactions, create estimates.
    - Fate of the soft-money, cross-region necropsy program
    - **AI/Electronic monitoring**, mock longline retrieval work – future grant application
    - **AFSC seabird data into EBFM**. Doing the synthesis, tying this to other seabird data in ESRs; develop new indices (e.g., indirect effects of biomass removal on seabirds, trophic flow, leaving "enough" for birds)
    - **Basin-wide analysis of albatross bycatch across Alaska, NW, Hawaii**
    - Update "National Plan of Action for seabirds" to include all gear types
    - **Complete analyses of vessel collisions data**; analyze likelihood of light attraction
    - Analyze existing datasets, e.g. RACE charters, halibut haul-back data
    - Use of eDNA sampling for species and subpopulation confirmation; seabird diet
    - Highlight threats to regional endemics (e.g., red-legged kittiwake)
    - Publish results for low-intensity lasers as seabird deterrent
    - Get observers to collect stomach contents for seabirds
- Bycatch reporting, estimates & regional offices division of duties (19)
    - Bring together multiple regional offices to have dialog
    - Discuss approaches, successes and failures, gaps
    - Really dig into bycatch data, methods; think about merging multi-region data
    - Analyze trends via location and boat ID
    - Continue to stay ahead of policy issues; for example, ship strikes, "cryptic mortality" in trawl fleet, bird aquaculture interaction
    - Create strategy for monitoring and analysis of gillnet fishery in southeast Alaska
    - Stay on top of changes to upcoming reporting changes under MBTA
    - Monitor for U.S. becoming member of ACAP
    - **Stay on top of changing fisheries-seabird overlap in a warming arctic**; rare species sightings via observers
    - Work to create gillnet exclusion zones around seabird colonies; marine protected areas around Aleutians seabird colonies
- Data flow, outreach, coordination (17)
    - Easier access to collection data for contractors
    - Data presentations to Council, to Science and Statistical Committee (SSC), to fleet, to observers
    - Involvement in the Arctic Regional Action Plan; Arctic ESRs
    - Coordinated approach to bycatch across Alaska, Hawaii, West Coast
    - Include British Columbia fisheries monitoring, bycatch information, colony information
    - Proper archiving of AMOP
    - Elevate seabird endangered species issues; e.g., to Council, for NOAA cruise planning
    - **Improve and promote seabird data collection on NOAA cruises**; NOAA involvement with other projects like ARCTIC EIS

    - NOAA could take leading role in pairing north pacific pelagic seabird database (USGS) and NOAA fish survey data
    - Incorporation of abundance and distribution data, migration patterns to all AFSC modeling efforts
- Dedicated seabird person(s) at AFSC (10)
    - Alaska has fewest seabird representatives compared to regions
    - **Needs to be a hand-off/training/onboarding process** to limit institutional knowledge loss; current coordinator is the person who speaks up to say, "we tried that in 1999…"
    - Loss of institutional and discipline-specific knowledge is stronger with Ed Melvin's retirement in 2019 (global seabird bycatch expert, formerly with Washington Sea Grant)
    - Dedicated person with seabird management background, not something they "do on the side"
    - Need official liaison with industry; someone to talk to captains
    - **Need lead for bycatch mitigation work** to follow successes of the last two decades
    - Create 50/50 split between FMA and REFM?
    - Blend funding (e.g., NSF, Federal NOAA initiatives, Gulfwatch, Conservation Engineering) and fortify organizational role
    - Rank priorities and organize them around a set of hypotheses; structure so NOAA FTE work toward high impact projects, publications, expansions, partnerships
- Representation (8)
    - NOAA seabird representative to serve on the council plan team.
    - Participate in spectacled eider recovery team meetings
    - Profile AFSC as world leader at international meetings (e.g., ACAP, albatross and petrels conference, world seabird conference)
    - Take part in the science and statistical committee meetings (SSC)
    - Involvement/awareness in MSC certification
- Funding flow challenges (3)
    - COASST contract – budget misunderstandings between REFM and FMA
    - Seabird necropsy contract
    - REEM "surplus" funds – planning ahead for these
- NOAA Communication and Coordination
    - Tighter coordination with NMML – seabirds are attracted to mammals and vice versa

Appendix 2: History of Coordinated Seabird Studies at the Alaska Fisheries Science Center

Prior to creation of the Coordinated Seabird Studies (CSS) in 2003, the Alaska Fisheries Science Center (AFSC) had been involved in seabird-fishery interaction monitoring and collaboration with the U.S. Fish and Wildlife Service (FWS) for many years. This work began during the 1980s as the AFSC's National Marine Mammal Laboratory (NMML) operated the Dall's Porpoise Observer Program, deploying observers onto the Japanese large-scale drift salmon gillnet fisheries along the Aleutian Islands. Observers noted bycatch of seabirds and NMML provided the FWS with seabird bycatch data. That program came to a close in 1988. In 1989, the High Seas Squid Driftnet Program was created by deploying observers to Japanese large-scale driftnet vessels operating in international waters near the North Pacific Transition Zone (NPTZ). This was a joint Japan-Canada-U.S. effort and involved a team within NOAA Fisheries across several Science Centers and Regions, guided through international agreements by the U.S. State Department. Monitoring the bycatch of seabirds was one of several priorities in this program and NOAA worked closely with FWS staff to ensure accurate species identifications were accomplished. In 1990, within the AFSC, management of the large-scale drift gillnet observer program (targeting squid in the NPTZ, and tuna farther south) was moved from NMML to the REFM-managed groundfish observer program, which had deployed observers first to foreign fishery vessels and then to joint-venture operations between US catcher vessels and foreign processors, until finally providing observers to U.S. domestic groundfish vessels. The large-scale drift gillnet program expanded in 1990, through bilateral or trilateral agreements, to include Japan, the Republic of Korea, Taiwan, Canada, and the United States with U.S. observers deployed to vessels from all three drift gillnet nations. Seabird bycatch data collection was carried out by all nations. Observers from Japan, Canada, and the US also collected seabird specimens for analysis by scientists in either Japan or the US. This was again a strong collaboration between NOAA and the FWS. This program ended in 1993 when the United Nations banned this fishing procedure in International waters.

During the High Seas Driftnet Program years, the collaboration and partnership with the FWS and the U.S. Geological Survey (USGS) was strengthened. These organizations supported Dr. Patrick Gould to provide guidance on observer duties related to monitoring seabirds: complete the seabird training component for all observer training sessions, assist in the debriefing process, participate in the bilateral or multilateral meetings among nations to review data, complete quality control measures, report results, and refine field operations for the next season. Throughout the years of the groundfish observer program, there had been no focus on seabird interactions with monitored vessels. A single code represented all birds as "unidentified bird". Dr. Gould coordinated with Shannon Fitzgerald, who was managing the observer services of the High Seas Driftnet component, and together they developed materials in support of expanded species codes, species ID training, and focused monitoring, leading to the implementation of the first observer special project in 1991. Results were analyzed in 1992 that refined processes for observer training, data quality control, and other features. Beginning with the 1993 groundfish observer deployments, observers now completed a full complement of documentation and recording fishery interactions by seabirds, especially including mortalities.

Seabird identification trainings for groundfish observers were first conducted by Dr. Gould (FWS) and Shannon Fitzgerald (AFSC North Pacific Groundfish Observer Program). Observer training occurred in Seattle, at the AFSC, and at the University of Alaska Anchorage Observer Training center where FWS staff conducted the training. The FWS and AFSC Observer Program staff (Fitzgerald) met annually in the fall to establish protocols and ensure the various individuals from either agency involved in training provided similar training, regardless of the individual or location. When the CSS was created and staffed

by Fitzgerald, transferring from the North Pacific Groundfish Observer program, conducting the training sessions at the AFSC was a responsibility of the CSS. Training of observer candidates and returning observers in seabird identification was a core value of the program as it promoted high quality results in the reporting of seabird interactions with fisheries. The FWS felt this was so important that it was incorporated into the Reasonable and Prudent Measures and Terms and Conditions of the early Biological Opinions on short-tailed albatross (*Phoebastria albatrus,* STAL) (see below). To resolve the competing interests of multiple observer training and briefing sessions provided each year and the need to address many other tasks important to CSS operations, the University of Washington's Coastal Observation and Seabird Survey Team (UW-COASST) was engaged to conduct the Seattle trainings and participate in the annual training updates. UW-COASST had previously worked with NPGOP staff to produce an Alaska version of *Beached Birds*, a field guide designed for identifying dead birds. They were uniquely positioned to provide training on identification of birds in-the-hand after gear interactions. This allowed CSS lead(s) to focus on many other seabird-fishery interaction issues. Eventually, the University of Alaska-Anchorage Observer Training Center ceased operations and all observer training and briefing occurred in Seattle at the AFSC.

The first takes of an Endangered Species Act-listed "endangered" short-tailed albatross occurred in 1995 (two separate events, logged by observers but outside of the composition sample). These takes initiated a series of actions (Appendix 5) including efforts by the demersal longline sector to address seabird bycatch, section 7 consultations between agencies, North Pacific Fishery Management Council (NPFMC) action, rulemaking for first-generation mitigation measures, and subsequent research into seabird mitigation measures using the collaborative approach and led by Mr. Ed Melvin of the Washington Sea Grant Program. The voluntary adoption of the measures recommended from this study (paired and single streamer lines) in 2002 led to a significant reduction in overall seabird bycatch and more than 90% reduction in albatross bycatch. NOAA implemented the requirements for these measures in February 2004. Since then, these measures have prevented the mortality of 675 albatrosses per year despite a 47% increase in fishing effort in 2004-2006 (Melvin et al. 2019).

A series of Biological Opinions (BiOps) have been implemented to address takes of ESA-listed marine birds in commercial Alaska groundfish and halibut operations (Appendix 3). These began with a focus on STAL and the groundfish demersal longline fishery. A BiOp addressing the halibut fishery was added shortly afterwards, and a series of opinions have followed that addressed programmatic/procedural approach, added the threatened Steller's eider (*Polysticta stelleri*) to a BiOp (but did not include an incidental take allowance), made changes to the incidental take allowance for STAL in both numbers and time periods, folded in the trawl fleet (2003), and eventually expanded to include all three ESA-listed marine bird species with known takes in Alaska commercial fisheries. Current incidental take allowances (BiOp, USFWS 2021) are 6 STAL in a 2-year period, 3 Steller's eiders in a 4-year period, and 25 spectacled eiders (*Somateria fischeri*) in a 4-year period. Each BiOp identifies non-discretionary Reasonable and Prudent Measures, Terms and Conditions, and Conservation measures are also noted. All BiOps have required the retention by observers and fishermen of any STAL takes and the recent BiOps require retention of threatened eider species.

Reporting of seabird bycatch estimates is the core of the AFSC's seabird-fishery interaction work. The high-quality data generated by North Pacific Observers provide the basis for this work and quality is directly tied to information in the annual sampling manual, species ID training, seabird responsibilities and priorities, such as takes of ESA-listed species, staff support through trainers, in-season advisors, debriefers, and other elements. The data observers collect provide a wealth of information that has been provided to contractors and interested parties to examine and report on many aspects of seabird-fishery interactions. A basic need that responds to a broad suite of stakeholders is the annual reporting

of seabird bycatch estimates by region, sector, and other parameters. Bycatch estimates were extrapolated from observed catch first by Bob Stern of the USFWS, covering 1993-1998 (Stern et al., 2001). These results generated great interest in annual updates, which the FWS did not have the staff to complete given the many other requirements on their analytical staff. Estimates were then completed by Mike Perez (AFSC-NMML) using methods similar to the annual reporting of marine mammal bycatch (Perez 2006) and covering the period of 1993-2005, when Mr. Perez retired. Analytical staff within the AFSC were not available to take over this work and funding was not available to contract out these analyses. Additionally, the timeline on when annual estimates were needed by stakeholders and management were earlier in the year. A workshop was held in 2009 that recommended changes be made to the Alaska Regional Office's Catch Accounting System (CAS) so that estimates could be generated based on numbers of birds, and that would be included in the standard updates to the CAS for in-season monitoring. Production of the annual report on seabird bycatch in Alaska Groundfish fisheries has been completed by the Alaska Regional Office since 2016, based on observer and commercial fishery data and supported by CAS.

The CSS has been involved in a range of activities related to seabird-fishery interactions, has supported continued development of the National Seabird Program, and has furthered the use of seabirds as ecosystem indicators in Ecosystem-Based Fishery Management. The CSS has developed strong collaborations and serves a broad suite of stakeholders. Just as it was in 2002, the Council must quickly respond to emerging conservation, climate, and ecosystem-based indicators in its management of the Nation's largest fishery. In service to the industry and to the Council, AFSC staff consistently balance the ongoing need for additional data with the costs those data incur. One potential, technological solution in early trials is the use of electronic monitoring (EM) to capture video and artificial intelligence (AI) to automatically detect deterrents deployed and species retrieved (Fitzgerald et al. 2017, Ames et al. 2005, McElderry et al. 2004). These methods are quickly improving and changing the nature of, and access to, seabird observations aboard vessels (USDOC 2019). The CSS has also taken the lead to implement the NOAA Pacific Seabird Necropsy program, a high priority recommendation by the 2007 workshop on albatross conservation (Naughton 2007). With a goal of maximizing the scientific value of birds taken in commercial fisheries in the North Pacific Ocean, three observer programs supply carcasses to this important and world-class effort (Appendix 4). This program involves the AFSC, Pacific Islands Regional Office (PIRO), and Northwest Fisheries Science Center (NWFSC) and is supported with funds from the NOAA National Seabird Program (NSP), Alaska Regional Office (AKRO), and the AFSC.

Appendix 3: Endangered Species Act Seabird Biological Opinions and Related Actions.

Definitions: STAL = Short-tailed Albatross. SPEI = Spectacled Eider. STEI = Steller's Eider.

Year	Title	Take statement	Reasonable and prudent measures	Comment
1989	Biological Opinion on the National Marine Fisheries Service (NMFS) Interim Incidental Take Exemption Program and related fishing activities.	2 STAL annually	Observers trained in STAL ID, minimize entanglement, adhere to marine Plastic Pollution Research and Control Act,	Response to February 27 1989 letter from NMFS to USFWS, on file (?) at USFWS Atlanta Regional Office.
1993	On May 10, 1993, spectacled eiders were listed as threatened throughout their range based on indications of steep declines in the two Alaska-breeding populations (58 FR 27474).			No overlap with groundfish fisheries.
1995	Letter dated February 7, 1995 constitutes amendment to the July 3, 1989 BiOp	1 STAL annually	Collect data on STAL interactions and sightings, marine debris, training observers on seabird species ID, collection of specimens, and outreach to fishing industry.	Reinforced and required measures that NMFS was already implementing
1996	Letter dated June 12, 1996	2 STAL annually	Letter corrected the procedural error, changing incidental take back to 2 birds per year.	
1997	The Alaska-breeding population of Steller's eiders was listed as threatened under the ESA in 1997 due to the contraction of its breeding range in Alaska, resulting in the risk of becoming endangered due to natural and human-caused factors (62 FR 31748).			
1998	Bering Sea/Aleutian Islands and Gulf of Alaska Halibut Fishery Biological Opinion	2 STAL every two years	NMFS shall prepare and implement a plan to investigate all options for monitoring the fishery.	The demersal halibut fishery has no observer coverage at this time.
1999	Biological Opinion of the effects of Hook-and-Line Groundfish Fisheries in the Gulf of Alaska and Bering Sea/Aleutian Islands Areas on Short-tailed Albatrosses (*Phoebastria albatrus*)	No more than 4 STAL in 1999 and 2000	Minimize takes, monitor and report, save specimens, etc.	As response to November 4, 1998 request for consultation

Year	Title	Take statement	Reasonable and prudent measures	Comment
2000	The short-tailed albatross was federally listed as endangered throughout its range, including the United States, on July 31, 2000 (65 FR 46643).			
ca2002	Groundfish trawl fisheries are likely to adversely affect short-tailed albatross opinion	Not applicable	Not applicable	Based on Alaska Regional Office review of STAL sightings and use of LAAL and BFAL as proxies.
2003	Programmatic Biological Opinion on the effects of the Fishery Management Plans (FMPs) for the Gulf of Alaska (GOA) and Bering Sea/Aleutian Islands (BSAI) groundfish fisheries on the endangered short-tailed albatross (*Phoebastria albatrus*) and threatened Steller's eider (*Polysticta stelleri*)	Not applicable	Includes 8 conservation recommendations such as bycatch regulations for the halibut fishery, assessment of trawl 3rd wire bird collisions, encouraging oil and fuel containment practices, education and outreach, continued research on deterrent devices, coordination among FM Councils, and coordination with other federal agencies on groundfish vessel activities.	Deferring incidental take allowance to the Total Allowable Catch consultation.
2003	Biological Opinion on the Effects of the Total Allowable Catch (TAC)-Setting Process for the Gulf of Alaska (GOA) and Bering Sea/Aleutian Islands (BSAI) Groundfish Fisheries to the endangered short-tailed albatross (*Phoebastria albatrus*) and Threatened Steller's eider (*Polysticta stelleri*)	4 STAL every two years: gf longline; 2 STAL total for trawl; no allowable take for STEI	Minimize STAL takes, continue proactive outreach to industry, facilitate collection of STAL spatial and temporal distribution/fishery overlap, monitor and report takes, handle injured birds properly, salvage dead STAL and return to NMFS/FWS	For STEI, only indirect effects are currently anticipated.
2015	Biological Opinion for the Effects of the Fishery Management Plans for the Gulf of Alaska and Bering Sea/Aleutian Islands Groundfish Fisheries and the State of Alaska Parallel Groundfish Fisheries	6 STAL every two years for gf fishery (LL and trawl).	Minimize risk of STAL interactions with hook-and-line fisheries; establish a multi-stakeholder Alaska Groundfish and Short-tailed Albatross Working Group; monitor and report interactions and takes; facilitate salvage of carcasses.	

Year	Title	Take statement	Reasonable and prudent measures	Comment
2018	Biological opinion for the effects of groundfish research surveys by the Alaska Fisheries Science Center in Alaska. Consultation 07CAAN00-2018-F-008.	2 STAL in a two-year period, capped at 3 over five years.	The AFSC must ensure that the effects of their action are commensurate with the analysis contained within this biological opinion. Includes condition to reinitiate if more than 3 takes occurs, and annual reporting. Conservation measures requires use of paired streamer lines in the demersal longline research cruise(s).	All NMFS-Alaska Fisheries Science Center research activities and International Pacific Halibut Commission. Does not address SPEI or STEI.
2018	Biological opinion for the effects of the Pacific halibut fisheries in waters off Alaska on the endangered short-tailed albatross. Consultation number 07CAAN00-2017-F-0358.	2 STAL in a two-year period	Ensure that the effects of NMFS actions are commensurate with the analysis contained within this BO: monitoring, review, reporting, and disposition of specimens. Also, continue the multi-stakeholder Alaska Groundfish and Halibut Seabird Working Group as an advisory body to the NMFS and the USFWS	Commercial, sport, and subsistence Pacific halibut fishery in U.S. Convention waters off Alaska within International Pacific Halibut Commission Regulatory Areas
2021	Biological Opinion on the Proposed Modification of the EPA General Permit AKG524000 for Offshore Seafood Processors in Alaska and on the NMFS Groundfish Fishery for the Gulf of Alaska, Bering Sea, and Aleutians Islands (*Consultation 07CAAN00-2020-F-0349*)	6 STAL in a two-year period; 25 SPEI in a four-year period; 3 STEI in a four-year period.	In consult with FWS, develop and implement strategies to minimize bird collisions; monitor and report all takes and report on efficacy of mitigation measures; convene multi-stakeholder working group to focus on reducing fishery interactions; facilitate handling of injured birds and salvage dead birds from groundfish fisheries.	This is the first BiOp that included both NMFS and the EPA. Many more details on specific actions in the terms and conditions section. Also see conservation measures.

Appendix 4: Seabird Necropsy Program Report 2020

Final Report 2019: Oikonos Ecosystem Knowledge
NOAA Order No. NFFS7200-19-03124 (1305M319PNFFS0475)
Report Period of Performance: Oct. 01, 2019 through Sept. 30, 2020

Nov. 5, 2020

Necropsy findings from Seabird Bycatch in Hawai'i and Alaska Longline Fisheries: Examinations conducted October 2019 – September 2020

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Summary

Seabird bycatch carcasses from fishery operations provide valuable sources of population-level information on demographics, distribution patterns, food habits, and pollution loads. The objectives of this study are to understand demographics of seabirds incidentally caught in U.S.-based commercial fisheries and to maximize scientific sampling from these collections. From October 2019 through September 2020, we examined 320 carcasses collected by the NOAA North Pacific Observer Program in Alaska via the Alaska Fisheries Science Center (AFSC), the Pacific Islands Regional Office Observer Program in Hawai'i, and the West Coast At-Sea Hake Observer Program (A-SHOP) out of Washington and Oregon.

To describe the demographic patterns in mortality of Black-footed (*Phoebastria nigripes*) and Laysan albatrosses (*Phoebastria immutabilis*), and other seabirds collected in longline fisheries, we summarize necropsy findings from the period of performance. Appendices include all samples examined since the beginning of the current collaboration with NOAA Fisheries (September 2007-September 2020; 3,648 carcasses total; Table 5, Appendices A, C).

Biologist Jessie Beck trains a volunteer on necropsy techniques in 2018

Methods

Facility

Necropsies were conducted by Oikonos at the California Department of Fish and Wildlife Office of Spill Prevention and Response Marine Wildlife Veterinary Care and Research Center (MWVCRC) in Santa Cruz, CA, which provides a regional center to study mortality trends in marine wildlife. The program integrates wildlife and pathology experts from MWVCRC with specialists from rehabilitation centers and

beach survey programs to quantify the demographics of marine wildlife affected by disease, oil spills, fisheries interactions, and other mortality events. To better understand population-level trends for migratory species, the center works in collaboration with researchers from outside California.

COVID-19 Safety

For the safety of Oikonos biologists, MWVCRC staff, and volunteers, all necropsies conducted in 2020 were conducted alone by Oikonos biologist Jessie Beck. All safety plans for both Oikonos and MWVCRC were compiled with from March 2020 on, including requesting clearance from facility superiors ahead of time, wearing a mask at all times, and cleaning all surfaces touched. The necropsy lab was thoroughly disinfected between users, with only one user allowed to use the necropsy facility per day. (All personnel photos used in this report are from previous years).

Among the many disruptions caused by the pandemic, fishery observer programs faced enormous challenges to fulfill their mandates. As a result, collection of specimens from all contributing observer programs was temporarily slowed or stopped and no new specimens were received by Oikonos in 2020. Luckily, the program had enough specimens previously stored to fulfill the 2019-20 contract.

Samples Examined

From September 2019 through September 2020, we examined 320 carcasses provided by fisheries observers (317 birds with NOAA funds, plus an additional 3 birds with in-kind funding). NOAA observers collected specimens from the Hawai'i deep- and shallow-set longline fisheries, the North Pacific Groundfish and Halibut fisheries (hereafter Alaska fisheries), and the West Coast At-Sea Hake Observer Program. All the specimens with available data were collected in 2003- 2019. Under our confidentiality agreements, we will work with the AFSC and A-SHOP coordinators at the Northwest Fisheries Science Center to confirm collection data via NOAA Observer Database queries for 388 specimens. Coordinators at the Pacific Islands Regional Office Observer Program provide collection information upon receipt of carcasses and signed confidentiality agreements.

Methods and Data Collected

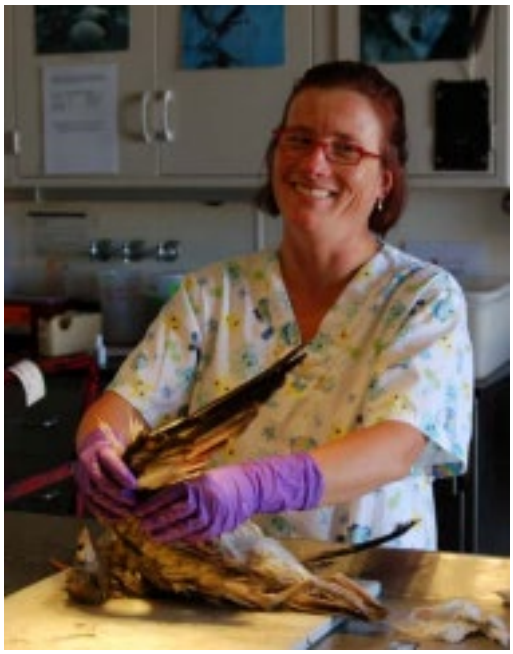
Seabirds were identified to species and necropsied to obtain demographic data including morphometrics (bill, tarsus, and wing length), molt, body condition, age, and sex. Skeletal muscle and stomachs were collected from each carcass. For a subset of albatross specimens, we collected bone and feather samples. All samples were stored frozen at -20°C. Body condition was quantified by assessing muscle and fat using a scoring system of 0 to 3 per van Franeker et al. (2004). The *pectoralis-supracoracoideus* muscle complex was scored from 0 - severely emaciated (muscle significantly below keel-line) to 3 - excellent body condition (muscle at or above keel-line). We scored subcutaneous fat and internal fat from 0 (no fat) to 3 (obese). We determined sexual maturity by quantifying gonad characteristics (length and width, teste color, diameter of largest follicle, and oviduct score) and assessed the presence of the Bursa of Fabricius (present [immature] or absent [adult], Broughton 1994). Since the bursa is thought to atrophy with age and sexual development, we considered birds without bursae to be adult and birds with residual bursae to be immature.

For Pacific northern fulmar (*Fulmarus glacialis rogersii)*, we scored molt and assigned one of four color morphs: light (L), double light (LL), dark (D) and double dark (DD) following Hatch (1984) and van Franeker (2004). Albatross primary feather molt patterns were scored following the British Trust for Ornithology molt codes.

Results of Bycatch Examinations

Species

From September 2019 through September 2020, we examined 317 seabirds collected in Alaska and Hawai'i (Table 1). We also received three specimens from the West Coast At-Sea Hake Observer Program that were examined. We examined five species collected in Alaska waters: black-footed (*Phoebastria nigripes*) and Laysan albatross (*P. immutabilis*), sooty shearwater (*Ardenna grisea*) short-tailed shearwater (*Ardenna tenuirostris*), Pacific northern fulmar (*Fulmarus glacialis rogersii*), and red-legged kittiwake (*Rissa brevirostris*). From the Hawai'i fisheries, three species were examined: the black-footed and Laysan albatrosses, a glaucous gull (*Larus hyperboreus*) and a brown booby (*Sula leucogaster*). The West Coast Hake fishery samples were comprised of two species: black-footed albatross and sooty shearwater.



Volunteer Angie Reed examining molt on a Northern Fulmar.

Demographics

Age and sex patterns of 2019-20 Alaska and Hawai'i samples were mostly consistent with trends from the complete dataset across years (Nevins et al. 2018, Beck and Hester 2019). Adults dominated the seabird bycatch in both Alaska and Hawai'i (Tables 2 and 3). These samples were consistent with the male bias of Laysan and black-footed albatrosses, and northern fulmars in Alaska observed in the full dataset (Tables 3, 4 and 6), while our sample of Short-tailed Shearwaters was biased towards females. Short-tailed Shearwaters also had a weaker bias towards adults (1.8 adults: 1 immature, Table 4). We will continue to investigate this pattern as we incorporate fishery collection data into the dataset.

Samples originating from Hawai'i showed a moderate female bias in black-footed albatross and a male bias in Laysan albatross. We were unable to examine all birds from Hawai'i collected in 2018 and 2019. As a result, more data are needed before trends from these years can be determined. Of the 129 albatross examined from Hawaii in 2019-20, the majority originated from the deep-set longline fishery.

Laysan Albatross

Laysan albatross collected in Hawai'i and examined in 2019-20 were collected from January 2018 through June 2019. Laysan albatross examined during 2019-20 from Alaska fisheries are in the process of having their fishery data queried.

In both Alaska and Hawai'i, Laysan albatross examined in 2019-20 were predominately adults (4 years or older; Tables 2, 3). These results were consistent with previous findings across all years with sufficient sample sizes (2005, 2010-2019) and in both fisheries.

Within the Laysan samples from the Hawai'i fisheries, there was a male bias (60% male, n = 30, Table 2). Male biases were recorded in all years with sufficient samples sizes, with the exception of 2010, when a female bias occurred (41% male) with this year's sample being one of the most equal representation of males and females in the dataset. In Alaska fisheries, Laysan Albatross were overwhelming male (89% male, n = 19, Table 3), which is consistent with the very strong bias towards males in this region's sample seen in previous years (2008-2019, see also Nevins et al. 2018).

Black-footed Albatross

We examined black-footed albatross that were collected from Hawai'i fisheries in January 2018 through June of 2019 (n = 129). Specimens from Alaska will have their collection data queried through NOAA fishery managers.

A high percentage of black-footed albatross samples were adult stage in both Hawai'i (91%, n = 97; Table 2) and Alaska fisheries (2%, n = 37; Table 3). In our entire dataset, we have recorded only 4 immature black-footed albatross from Alaska fisheries between 2007 and 2018, illustrating the strong bias towards incidentally catching adults in these fisheries.

In Hawai'i, we found a female bias in adults examined (35% male, n = 98, Table 2), in line with an overall female bias found cumulatively from 2008 to 2018. Immature birds from Hawai'i did not follow this pattern (63% male) although sample sizes were limiting (n = 8; Table 2). Adult black-footed albatross from Alaska fisheries tended to be male (68% male, n = 13, Table 3).

Northern Fulmars

Northern Fulmars examined in 2019-20 were collected from the Alaska fisheries. In the 2019-20 samples, northern fulmars from Alaska were predominately adult (≥ 3 years, 90% adult, Table 4). Although there has been a male-bias in northern fulmars across all collection years, the strength of the ratios varied inter-annually and seasonally within years (Beck et al. 2020).

In addition, samples from 1,536 northern fulmars caught as bycatch and examined between 2006 and 2018 were analyzed for genetic assignment to a natal colony in Alaska, as part of a North Pacific Research Board. Preliminary results indicate that northern fulmar bycatch is not equally distributed among breeding colonies, and may disproportionately impact certain colonies such as the Pribilof Islands. A manuscript with further analysis is in the process of being submitted to the journal Conservation Letters.

Short-tailed Shearwaters

We examined 90 short-tailed shearwaters from Alaska, whose collection data are in the process of being queried by NOAA-AFSC.

In our samples, we found a bias towards adult short-tailed shearwaters (64% adult, n = 90, Table 4). The bias towards adults in this species is weaker than in other examined procellariid species from Alaska fisheries. In some years, there is no detectable bias between age classes (Beck and Hester, 2019). Among adult short-tailed shearwaters, there was a slight bias towards males (60% male in mature samples, Table 4). In immature birds, the sex ratio was evenly distributed (50% male, Table 4).

Sooty Shearwaters

Three sooty shearwaters were collected in Alaska fisheries and one in the West Coast At-Sea Hake Fishery. In the Alaska samples, 2 of 3 birds were males and all were immature. The Sooty Shearwater from the West Coast was too damaged from the fishery interaction to determine sex and age.

Red-legged Kittiwake

One Red-legged Kittiwake was received this year from Alaska fisheries. Due to the species' limited distribution and small population, the specimen was measured externally but an internal examination was postponed due to interest in additional tissue sampling from Alaska seabird researchers. Necropsy findings for this specimen will be included in our 2021 report.

Brown Booby

A single brown booby was recovered in Hawai'i fisheries and examined as part of the necropsy program. The bird was an adult female in good body condition. This species is considered of Least Concern by the International Union for the Conservation of Nature and is not a commonly caught seabird species in these fisheries.

Stomach Content Analysis

We collected 301 procellariid stomachs during the period of performance (2019-2020). We were unable to collect 17 stomachs due to extensive scavenging. The fishery discards, fleshy prey parts, and prey hard parts will be shipped to William Walker at MML for identification and will be reported separately. Plastics and other debris are currently being sorted, quantified, and weighed with support from Oikonos matching funds. Oikonos is currently collaborating with Drs. Myra Finkelstein (University of California Santa Cruz) and Chris Tubbs (San Diego Zoo) to investigate the sub-lethal effects of plastic on seabirds.

Database

Data were stored and protected as required under the Magnuson-Stevens Fisheries Management Act and as specifically dictated in Oikonos' signed confidentiality agreements with all three NOAA Fisheries science centers that it works with. Collection data from Hawaii fisheries is provided upon specimen shipment. Data managers at the At-Sea Hake Observer Program are in the process of gathering collection data for West Coast specimens. The Seabird Coordinated Studies Group of the Alaska Fisheries Science Center will confirm collection data for 388 specimens currently lacking data from Alaska. To date, managers at AFSC have been able to confirm collection data for 2491 specimens examined in previous years. All available collection data has been incorporated into the joint Oikonos-NOAA Seabird Bycatch Necropsy Database, which has been provided to AFSC through their FTP system.

Conclusions

Seabird specimens from fisheries bycatch in Alaska and Hawai'i waters provide unique samples to examine regional differences among age classes and sexes of albatross, shearwaters, fulmars and other migratory seabirds throughout the North Pacific. Our results identify biases in age and

sex important for understanding demographic vulnerabilities to fisheries bycatch. Although some sample sizes were limited, we found all procellariid species displayed demographic biases. Age- and sex- biases were most apparent in Laysan and black-footed albatrosses, with trends varying by species and fishery region.

Since 2007, both fisheries caught predominately adult seabirds of all species, with some annual variability in the strength of the biases. This information will be useful for improving models of population-level consequences of mortality from fisheries bycatch. For example, due to the long lived, low fecundity life history employed by procellariid species, mortality of adults have a greater negative effect on population growth than the removal of an equal number of pre-breeding individuals (Crouse et al. 1987, Croxall et al. 1991, Doak et al. 1994). Among different species, variability in sex ratios was more complex and dependent on fishery and season of capture (seasonal results are not summarized in this report). These findings warrant more extensive analyses of demographics and other metrics by year, season, and fishery region.

Outreach and Career Training

We continued our public awareness and youth education efforts focused on seabirds as bio indicators of the level of plastic trash in the North Pacific, informed by fishery bycatch samples and other colony and beached bird program sources. Despite the disruption in classroom-based education for half of this fiscal year due to Covid-19, we adapted curriculum for online learning and responded to educator's requests. With the help of matching funds, 2019-20 highlights included:

- We trained one undergraduate intern on necropsy techniques and prey sorting techniques in before the pandemic prevented us from having multiple people work in the necropsy lab at once.
- School teachers across the country and globe continued to use our free STEM curriculum package called "Winged Ambassadors - Ocean Literacy through the Eyes of Albatross". Based on surveys submitted this fiscal year by educators, the teaching package was used by a minimum of 764 teachers and 19,284 students from six countries (including 29 States in the U.S.). In 2020, we created Google-based online tools where students can contribute data on the prey and plastic items found in real albatross chick regurgitations (https://sites.google.com/oikonos.org/citizen-sciencealbatross-bolus.) Through seeking educator feedback, the next year of this program will further address new learning challenges created by the pandemic such as live virtual workshops, recorded teacher trainings, and short videos in the lessons to engage students learning from home. Matching partners include NOAA, Iolani School, Clif Bar Family Foundation, Kure Atoll Conservancy, and Hawaii Pacific University.

These teaching materials are available free at Oikonos and two NOAA websites:
oikonos.org/education
papahanaumokuakea.gov/education/wa.html
cordellbank.noaa.gov/education/teachers.html

Scientific Presentations

- Jessie Beck, Diana Baetscher, Shannon Fitzgerald, Michelle Hester, Hannah Nevins, and John Carlos Garza. Seasonal At-Sea Distribution of Northern Fulmar Bycatch by Breeding Colony. Oral presentation by J. Beck at the Pacific Seabird Group Conference, Feb. 12 – Feb. 15, Portland, OR.

• Jessie Beck, Michelle Hester, and Shannon Fitzgerald. Summary of Seabird Bycatch Necropsy Program in 2019. Oral presentation by J. Beck to the North Pacific Albatross Working Group at the Pacific Seabird Group Conference, Feb. 12 – Feb. 15, Portland, OR.

Scientific Papers

With additional funding this year for publishing our findings, along with in-kind funding, one manuscript has been approved by AFSC and is ready for journal submission, and we have been able to make significant progress on an additional paper that we plan to have submitted to journals in early 2020. Additionally, two papers utilizing samples from this program were published, including Vokhshoori et al. that was the featured article in Issue 610 of the Marine Ecology Progress Series.

In press

Beck, J., P. E. Michael, M. Hester, H. M. Nevins, E. Donnelly-Greenan, C. Gibble, E.M. Phillips, C. Young, and S. Fitzgerald. 2021. Seasonal variation of Pacific northern fulmar bycatch: Implications for age and sex-specific mortality. Fish. Oceanogr. 30(3): 253-262. doi:10.1111/fog.12518.

In submission to Conservation Letters

Baetscher, D., J. Beck, S. Fitzgerald, M. Hester, H. Nevins, and J. C. Garza. 2022. Genetic assignment of Northern fulmar bycatch reveals disproportionate mortality from Alaska colonies. Evol. Appl. 15(3): 447–458.

Additional papers using samples from this program

Vokhshoori, N.L., M. McCarthy, P. Collins, M. Etnier, T. Rick, M. Eda, J. Beck, and S.D. Newsome. 2019. Expanded foraging range of ancient short-tailed albatross populations into California coastal waters based on bulk tissue and amino acid isotope analysis. Mar. Ecol. Progr. Ser. 610:1-13.

Morra, K., Y. Chikaraishi, H. Gandhi, H. James, S. Rossman, A. Wiley, A. Raine, J. Beck, and P. Ostrom. 2019. Trophic declines and decadal-scale foraging segregation in three pelagic seabirds. Oecologia 189 (2): 395–406.

Acknowledgments

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Fisheries Science Center. Available from Alaska Fisheries Science Center Coordinated Seabird Studies Group. 7600 Sand Point Way NE, Bldg 4, Seattle WA 98115

Citations

Beck, J., and M. Hester. 2019. Preliminary necropsy findings from seabird bycatch in Hawai'i and Alaska longline fisheries: Examinations conducted in 2019-20. Unpublished Report to NOAA Alaska Fisheries Science Center.

Beck, J., P.E. Michael, M. Hester, H.M. Nevins, E. Donnelly-Greenan, C. Gibble, E.M. Phillips, C. Young, and S. Fitzgerald. 2020. Seasonal variation of Pacific northern fulmar bycatch: Implications for age and sex-specific mortality. Fisheries Oceanography, in press. doi:10.1111/fog.12518

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Table 1. - Summary of seabird bycatch specimens examined from September 2019 to September 2020, by fishery region.

Species	Alaska	Hawaii	West Coast	Total
Laysan albatross	19	30	0	49
Black-footed albatross	38	97	2	137
Northern fulmar	33	0	0	33
Sooty Shearwater	3	0	1	4
Short-tailed shearwater	94	0	0	94
Red-legged kittiwake	1	0	0	1
Brown booby	0	1	0	1
Glaucous gull	0	0	1	1
Grand Total	188	128	4	320

Table 2. -- Sex and age (based on presence of bursa) of bycatch in the Hawai'i fisheries examined between September 2019 and September 2020. Age estimates are based on bursa assessment (Absent = adult, Present = immature).

Species	Presence of Bursa	Female	Male	Total
Black-footed albatross	Absent	60	29	89
	Present	3	5	8
Laysan albatross	Absent	11	18	29
	Present	1	0	1
Glaucous gull	Absent	0	0	0
	Present	0	1	1
Brown booby	Absent	1	0	1
	Present	0	0	0
Grand Total		76	53	29

Table 3. -- Sex and age of albatross bycatch in the Alaska fisheries, examined between September 2019 and September 2020. Age estimates are based on bursa assessment (Absent = adult, Present = immature). Specimens with unknown sexes or bursal status were not included here.

Species	Presence of Bursa	Female	Male	Total
Laysan albatross	Absent	2	16	18
	Present	0	1	1
Black-footed albatross	Absent	11	25	36
	Present	1	0	1
Grand Total		14	42	56

Table 4. -- Age differences in small procellariids collected in Alaska, examined between September 2019 and September 2020. Age estimates are based on bursa assessment (Absent = adult, Present = immature. Specimens with unknown sexes or bursal status were not included here.

Species	Presence of Bursa	Female	Male	Total
Short-tailed shearwater	Absent	23	35	58
	Present	16	16	32
Sooty shearwater	Absent	0	0	0
	Present	1	2	3
Northern fulmar	Absent	9	19	28
	Present	2	1	3
Grand Total		51	73	124

Table 5. -- Age differences by sex in specimens collected in the West Coast At-Sea Hake Fishery, examined between September 2019 and September 2020. Age estimates are based on bursa assessment (Absent = adult, Present = immature). Sooty Shearwater too damaged to assess bursa and gonads.

Species	Presence of Bursa	Female	Male	Total
Black-footed albatross	Absent	1	1	2
	Present	0	0	0
Sooty shearwater	Absent	-	-	-
	Present	-	-	-
Grand Total		1	1	2

***Note: Date of collection needs to be cross-checked with original observer data for a number of records before these analyses are finalized. For unrecorded dates, specimen collection notes are being used to query the Observer Database for this information, which will be available for most specimens. This work is currently underway.*

Appendix 4-A --Number of seabird samples of known sex examined from **Alaska** between September 2007 and September 2020 by collection year (n = 2679). Birds without available collection data are in the process of being queried in the Observer Database to fill in the missing information. Species are referred to by their AOU codes, with the exception of UNGU, which indicates unidentified gulls. Birds from a previous study from a 2005 experimental fishery in Alaska were erroneously included in previous versions of this table and are removed here (n = 182).

Species	1995	1996	2000	2002	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	TBD	Total
BFAL	1						4	3	2	3	8	7	4	7	20	6	8	15		41	129
BLKI							1	2		5	1	4	1								14
CANV										1											1
COEI							1														1
COMU						7				3	4	4								3	21
CRAU										1											1
FTSP										1											1
GLGU						2		5	2		4	6									19
GWGU			1			8	7	11	10	12	44	15	3								111
HERG								1													1
HOPU											1										1
KIEI								4													4
LAAL			4				1	14	5	12	21	16	3	21	6	22	4	6		24	159
LHSP						2		1		1											4
NOFU					1	3	53	135	54	114	137	304	129	214	74	243	152	52		63	1728
RLKI							1	2		1										1	5

Species	1995	1996	2000	2002	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	TBD	Total
SBGU							1			1											2
SOSH							1							1						13	15
STSH			1		3	22	23	48	14	16	63	16	55	27		11	20	5		115	439
TBMU		1		1		1	2				2										7
TUPU										1											1
WEGU								2													2
UNGU					2	3	1	5	1		1										13

Appendix 4-B -- Number of seabird samples of known sex examined from **Hawai'i** between September 2007 and September 2020 by collection year (n = 942).

Species	2001	2003	2005	2006	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TBD	Total
BFAL			7	5	8	6	25	14	43	49	36	77	80	77	101	33	25	586
LAAL	2	2	13		6	4	39	36	36	37	9	23	23	25	15	14	24	308
LHSP					1													1
NESH							1											1
SOSH				2	11		1	3	5	7	1	3	2		5		2	42
WISP							1											1
WTSH					1													1
GLGU														1				1
BRBO																1		1

Appendix 4-C -- Number of seabird samples of known sex examined from **West Coast At-Sea Hake Fishery** between September 2017 and September 2020 by collection year (n = 27).

Species	2011	2012	2013	2014	2015	2016	2017	2018	2019	TBD	Total
BFAL	4					2	1	2			9
NOFU					9	3	1	1			14
SOSH			2			1				1	4

Appendix 4-D. Summary of products and collaborations from the Seabird Bycatch Necropsy Program, 2008 – 2021

Jessie Beck: Oikonos Ecosystem Knowledge, jessie@oikonos.org
Shannon Fitzgerald: NOAA, Alaska Fisheries Science Center, shannon.fitzgerald@noaa.gov

Overview

As part of their work on NOAA AFSC's Seabird Bycatch Necropsy Program, Oikonos researchers strive to maximize the value of seabirds collected as bycatch in fisheries through scientific publications, presentations, and collaborating with a variety of partners on new projects utilizing seabird bycatch samples. Researchers also make an effort to share their knowledge and experience through outreach events and education of university and grade school children, and the local public. Below is a summary of scientific projects and products, and outreach and educational activities conducted by Oikonos researchers and collaborators as part of NOAA AFSC's Seabird Bycatch Necropsy Program, from 2008 to 2021.

Scientific Collaborations

- Dr. K. David Hyrenbach (Hawaii Pacific University) and Michelle Hester (Oikonos), "Biological Indicators of Ocean Plastic Pollution," *2010 – present* (Donnelly-Greenan et al. 2018)
- Dr. Myra Finkelstein (University of California Santa Cruz [UCSC]), Dr. Chris Tubbs and Rachel Felton (San Diego Zoo), "Albatross Plastic ingestion and potential for endocrine disruption," *2020 – present*
- Dr. Diana Baetscher (NOAA AFSC), Dr. Scott Edwards (Harvard), Dr. Ken Hayes and Molly Hagemann (Bernice Pauahi Bishop Museum), "A genome scan for adaptive diversity and genetic assignment of fisheries bycatch in the Black-footed Albatross," *2021 – present*
- Drs. Rebecca Lewison and Corey Clatterbuck (San Diego State University), "Halogenated organic compounds in North Pacific Albatross", *2014 – present*
- Hannah Nevins (American Bird Conservancy) and Dr. Gabrielle Nevitt (University of California Davis), "Characterization of the scents of albatross and other procellariiformes," *2019 – 2020*
- Drs. J. Carlos Garza and Diana Baetscher (UCSC), Dr. Eric Anderson (NOAA SWFSC), Dr. Kirsten Ruegg (Colorado State University), Drs. Andy Ramey and Scott Hatch (USGS), Hannah Nevins (Oikonos) "Genetic Stock Identification of Northern Fulmar Bycatch", *2017 – 2019*
- Drs. Won Joon Shim, Sang Hee Hong, Sung Yong Ha (Korea Institute of Ocean Science and Technology), Dr. John Kucklick (NIST) and Stacy Schuur (NIST), "Fulmar Plastics Project," 2017-*2019*
- Dr. Seth Newsome (University of New Mexico Albuquerque), Natasha Vokshoori (UCSC), Paul Collins (Santa Barbara Museum of Natural History), Masaki Eda (Hodukai Museum), "Expanded foraging range of ancient short-tailed albatross (Phoebastria albatrus) populations using stable isotopes," *2014 – 2019* (Vokshoori et al. 2019)
- Drs. Peggy Ostrom and Kaycee Morra (Michigan State University), Drs. Helen James and Anne Wiley (Smithsonian), "Trophic declines and decadal-scale foraging segregation in Laysan Albatross," *2014 – 2018* (Morra et al. 2019)
- Dr. Jan Van Franeker, "Northern Fulmar Plastic Ingestion," *2008 – 2011*
- Dr. Anne Edwards (AFSC NRC Post-doc and University of Washington), Dr. Julia Parrish (University of Washington), John L. Klavitter (USFWS, Midway Atoll NWR), and Mark A. Romano

(USFWS, Portland Field Office), “Foraging strategies of Laysan Albatross using stable isotopes”, 2012-2017 (Edwards et al. 2015)
- Mr. William Walker. Contracted expert on marine mammal and bird food habits. “Use of bycaught birds to determine food habits of North Pacific marine birds -- shearwaters, albatrosses, and Northern Fulmars”. *2008-present* (Walker et al. 2015)
- Dr. Kate Sheehan, Frostburg University, Maryland. “Ecological parasitology, plastics ecology, and their interactions in natural systems.” *2017-present*

Museum Collections

To maximize the value of marine birds caught at sea and returned by observers, the necropsy program offers to collaborate with museums in support of their long-term collections. To date, 108 albatross individuals in good condition were donated post-necropsy to museum institutions including the Smithsonian Institute, University of Wyoming Museum of Vertebrates, University of California Berkeley Museum of Vertebrate Zoology, University of Alaska Museum, and the Peabody Museum at Yale. The program, in collaboration with the USFWS, also delivered two post-necropsy short-tailed albatross carcasses to the Museum of New Zealand, Te Papa Tongarewa for use in developing an international exhibition of the all albatross species. We are currently in consultation with the Museum of North, University of Alaska Fairbanks, to supply a variety of non-albatross species collected by observers. The program is also providing valuable eider specimens to the USFWS.

Scientific Presentations

- Jessie Beck, Diana Baetscher, Shannon Fitzgerald, Michelle Hester, Hannah Nevins, and John Carlos Garza. 2020. Seasonal At-Sea Distribution of Northern Fulmar Bycatch by Breeding Colony. Oral presentation by J. Beck at the Pacific Seabird Group Conference, Feb. 12 – Feb. 15, Portland, OR.
- Jessie Beck, Michelle Hester, and Shannon Fitzgerald. 2020. Summary of Seabird Bycatch Necropsy Program in 2019. 2020. Oral presentation by J. Beck to the North Pacific Albatross Working Group at the Pacific Seabird Group Conference, Feb. 12 – Feb. 15, Portland, OR.
- Diana Baetscher, Jessie Beck, Michelle Hester, Shannon Fitzgerald, Hannah Nevins, and John Carlos Garza. 2019. Genetic assignment of Northern Fulmar bycatch reveals contributions from major breeding colonies. Oral presentation by J. Beck at the Alaska Marine Science Symposium, Jan. 22-27, Anchorage, AK.
- Jessie Beck, Diana Baetscher, Michelle Hester, Shannon Fitzgerald, Hannah Nevins, and John Carlos Garza. 2019. Genetic assignment of Northern Fulmar bycatch reveals contributions from major breeding colonies. Oral presentation by J. Beck at the Pacific Seabird Group Conference, Feb. 28 – Mar. 2, Kauai, HI.
- William Walker, Shannon Fitzgerald, Jessie Beck, and Erica Donnelly-Greenan. 2019. Preliminary findings on the diet of Laysan Albatrosses, *Phoebastria immutabilis*, in the eastern Bering Sea and Aleutian Islands region. Poster presentation by S. Fitzgerald, at the Pacific Seabird Group Conference, Feb. 28 – Mar. 2, Kauai, HI.

- Stacy S. Schuur, Shannon F. Fitzgerald, Sung Young Ha, Sang Hee Hong, John R. Kucklick, and Won Joon Shim. 2019. Plastic Ingestion In Northern Fulmars (Fulmarus Glacialis) Captured In Fisheries. Oral presentation by S. Schuur at the Pacific Seabird Group Conference, Feb. 28 – Mar. 2, Kauai, HI.
- Jessie Beck, Michelle Hester, and Shannon Fitzgerald. 2018. Summary of Seabird Bycatch Necropsy Program in 2018. Oral presentation by J. Beck to the North Pacific Albatross Working Group at the Pacific Seabird Group Conference, Feb. 28 – Mar. 2, Kauai, HI.
- Diana Baetscher, Jessie Beck, Eric Anderson, Kirsten Ruegg, Andy Ramey, Scott Hatch, and John Carlos Garza. 2018. Alaskan breeding colonies of Northern Fulmars exhibit extensive gene flow and limited population structure. Poster presentation by D. Baetscher, Jan. 21-26, Alaska Marine Science Symposium. Anchorage, AK
- Ruth Kazmerzak, Shannon Fitzgerald, Suzanne Romain, & Farron Wallace. 2018. Meeting challenges for monitoring seabird bycatch on small longline vessels using electronic monitoring technologies. Oral presentation by R. Kazmerzak at the Pacific Seabird Group Conference, La Paz, Mexico, Feb 21-24, 2018.
- Shannon Fitzgerald, Jessie Beck, Hannah Nevins, and Michelle Hester. 2016. From observers to necropsy: collaborating to document the demography of North Pacific Groundfish Fishery bycatch. Oral presentation at the Pacific Seabird Group Conference, Feb 10-13, Oahu, Hawaii.
- Jessie Beck, Michelle Hester, Hannah Nevins, and Shannon Fitzgerald. 2016. Sex, age and body condition of albatross caught as bycatch in Hawaiian (2010-2015) and Alaskan longline fisheries (2007, 2009-2014). International Albatross and Petrel Conference, Sept. 19-23, Barcelona, Spain. Oral presentation by J. Beck.
- Hannah Nevins, Jessie Beck, and Michelle Hester. 2014. Age, Sex, and Species Composition of Albatross Bycatch examined at MWVCRC, from Hawaiian and Alaskan Longline Fisheries (2005-2014). North Pacific Albatross Working Group, Pacific Seabird Conference, February 19-22, Juneau, Alaska. Oral presentation by H. Nevins.
- William A. Walker, Shannon Fitzgerald, and Erica L. Donnelly-Greenan. 2014. The diet of Northern Fulmars, *Fulmaris glacialis*, in the Eastern Bering Sea and Aleutian Islands region: an exercise in the use of bycaught marine birds in investigations of natural feeding strategy. Pacific Seabird Conference, February 19-22, Juneau, Alaska. Oral presentation by S. Fitzgerald.
- Jessie Beck, Michelle Hester, Hannah Nevins, Erica Donnelly-Greenan, and Shannon Fitzgerald. 2013. Demographics of albatrosses caught as bycatch in Hawaiian (2010-2012) and Alaskan longline fisheries (2007, 2009-2011). Pacific Seabird Group Conference, February 21-23, Portland, Oregon. Poster presentation by J. Beck.
- Jessie Beck, Michelle Hester, Hannah Nevins, and Erica Donnelly-Greenan. 2013. Age, Sex, and Species Composition of Albatross Bycatch examined at MWVCRC, from Hawaiian and Alaskan Longline Fisheries (2005-2012). North Pacific Albatross Working Group, Pacific Seabird Conference, February 21-23, 2013, Portland, Oregon. Oral presentation by J. Beck.
- Shannon Lyday, Dana Ahlin, Michelle Hester, and K. David Hyrenbach. 2012. Developing an ecosystem metric for plastic ingestion with wedge-tailed shearwaters (*Puffinus pacificus*). Pacific Seabird Group Conference, February 7-10, 2012, O'ahu, Hawai'i. Oral Presentation by S. Lyday.
- Jessie Beck. 2012. Seabird Bycatch Necropsy Summary. North Pacific Albatross Working Group, Pacific Seabird Group, Hawai'i, February 2012. Oral presentation.
- Erica Donnelly-Greenan. 2012. Plastic Ingestion in Pacific Northern Fulmars (*Fulmarus Glacialis*) Collected from Beach Surveys in Monterey Bay, California, and Alaska Fishery Bycatch Sources. Monterey Bay National Marine Sanctuary Symposium, Monterey, CA, April 14. Poster presentation.

- William Walker and Shannon Fitzgerald. 2012. Preliminary results on the diets of Laysan and Black-footed albatrosses and the use of fisheries by-caught marine birds in investigations of natural feeding strategy. Pacific Seabird Group Conference, Feb 7-10, Oahu Hawai'i. Poster presentation by S. Fitzgerald.
- K. David Hyrenbach, Michelle Hester, Erica Donnelly, Hannahrose Nevins, Stephanie Avery-Gomm, Holly Gray, and Andrew Titmus. 2011 Plastic Ingestion by North Pacific Seabirds: Progress Review and Future Directions. Fifth International Marine Debris Conference, Hawai'i, March 20 – 25. Oral Presentation by K.D. Hyrenbach.

Workshops

- Workshop on the Factors Influencing Albatross Interactions in the Hawai'i Longline Fishery: Towards Identifying Drivers and Quantifying Impacts, Nov. 7-9, 2017, Honolulu, Hawai'i, Western Pacific Regional Fishery Management Council
- Workshop on Coordination of Seabird Plastic Ingestion Studies with Jan Van Franeker, 2008, Santa Cruz, California.

Scientific Papers

Beck, J., P.E. Michael, M. Hester, H.M. Nevins, E. Donnelly-Greenan, C. Gibble, E.M. Phillips, C. Young, and S. Fitzgerald. 2020. Seasonal variation of Pacific Northern Fulmar bycatch: implications for age and sex-specific mortality. *Fisheries Oceanography*; 00: 1-11. doi:10.1111/fog.12518

Vokhshoori, N.L., M. McCarthy, P. Collins, M. Etnier, T. Rick, M. Eda, J. Beck, and S.D. Newsome. 2019. Expanded foraging range of ancient short-tailed albatross populations into California coastal waters based on bulk tissue and amino acid isotope analysis. Marine Ecology Progress Series, 610:1-13. (Featured article in issue)

Morra, K., Y. Chikaraishi, H. Gandhi, H. James, S. Rossman, A. Wiley, A. Raine, J. Beck, and P. Ostrom. 2019. Trophic declines and decadal-scale foraging segregation in three pelagic seabirds. Oceaologia, 189 (2): 395–406.

Nevins, H.M., J. Beck, P.E. Michael, M. Hester, J. Peschon, E. Donnelly-Greenan, and S. Fitzgerald. 2018. Demographics of Laysan *Phoebastria immutabilis* and Black-footed *P. nigripes* Albatross caught as bycatch in Alaskan groundfish and Hawaiian longline fisheries. *Marine Ornithology* 46(2): 187-199.

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Outreach and Career Training

Curriculum

- School teachers across the country and globe use Oikonos's free STEM curriculum package "Winged Ambassadors - Ocean Literacy through the Eyes of Albatross". This curriculum package uses the stomach contents of seabirds examined in this program to illustrate the threat of marine debris pollution. In 2020, the teaching package was used by a minimum of 764 teachers and 19,284 students from six countries (including 29 states in the U.S.), and has had similar levels of use over the past 8 years. Matching partners include NOAA, Iolani School, Clif Bar Family Foundation, Kure Atoll Conservancy, and Hawai'i Pacific University.

  These teaching materials are freely available at Oikonos and two NOAA websites:

  oikonos.org/education

  papahanaumokuakea.gov/education/wa.html

  cordellbank.noaa.gov/education/teachers.html

- As part of a North Pacific Research Board Grant to investigate northern fulmar bycatch genetics using samples from this necropsy program, Oikonos staff partnered with the Seabird Youth Network to produce several blogs and STEM curriculum for the communities of the Bering Sea. This curriculum was used in "Seabird Camp" by children on St. Paul in the Pribilof Islands and were translated into Russian and used by children in the Commander Islands, Russia. Blogs and curriculum produced for the project can be found at:
  - SYN Northern Fulmar Blog 1: http://seabirdyouth.org/northern-fulmars/
  - SYN Northern Fulmar Blog 2: http://seabirdyouth.org/tracing-northern-fulmars-back-to-their-colonies-part-2/
  - Seabird curriculum: http://seabirdyouth.org/seabirds/
  - A SYN Blog about the curriculum being used in the Commander Islands: http://seabirdyouth.org/commander-islands-nature-and-biosphere-reserve/

Career Training and Educational Presentations

- From 2010 to 2021, a minimum of 30 undergraduate students from University of California Santa Cruz (UCSC), Moss Landing Marine Laboratories, and other universities have been trained in necropsy and stomach-sorting techniques. Of these, 12 students participated in formal professional internships through the University of California Santa Cruz.
- The project hosted one Moss Landing Marine Laboratories master student, Erica Donnelly-Greenan, and trained her in prey sorting and necropsy techniques that she used in her graduate work.

- Oikonos staff have given presentations on seabirds and the Necropsy Program to the following classes:
  - Ornithology, Ecology and Evolutionary Biology Dept., UCSC (2015, 2021)
  - Natural History of Birds, Environmental Studies Dept., UCSC (2019)
  - Ornithology, Cabrillo Community College (2014)
  - Marine Birds, Turtles, and Mammals, Moss Landing Marine Laboratories (2013)

- Casa Di Mir Montessori School, Campbell (2013)
- Ecology, Cabrillo Community College (2012)
- Wavecrest Montessori Junior High School, Santa Cruz (2011)

Appendix 5: ESA-listed Seabird Take Process

NOAA Fisheries, Alaska Fisheries Science Center, Protocol for Encounters with Injured or Dead U.S. Endangered Species Act-listed Marine Bird Species

BACKGROUND

This process was initiated in 1995, when the first short-tailed albatross (*Phoebastria albatrus*) take occurred (outside of the observer sampling period). At the time, the Alaska Fisheries Science Center (AFSC) Seabird Lead position did not exist (see below), and all references to that position were handled by the seabird lead within the Alaska Fisheries Science Center's (AFSC) Fisheries Monitoring and Analysis (FMA) Division's North Pacific Observer Program (North Pacific Groundfish Observer Program, part of the REFM Division, at the time). The process was put in place by the U.S. Fish and Wildlife Service (USFWS) and Observer Program staff working collaboratively, with some input from the Alaska Regional Office's (AKR) Protected Resource Division (PRD) personnel. The formalization of this process resulted in updates to Chapter 16 of the North Pacific Observer Program Sampling Manual, "Bird Sightings and Interactions" and inclusion of 14 essential questions following an ESA take, part "Step 9: Observer Interview" (see below).

SPECIES IDENTIFICATION TRAINING

Basic marine bird identification training is provided for all observer trainees as part of the initial observer certification class (2 hours), and to all experienced observers during an annual briefing (1.5 hours). Marine bird identification training sessions cover the identification of all U.S. Endangered Species Act (ESA)-listed marine bird species in Alaska (Table 1) in detail, with emphasis on diagnostic features to distinguish similar species without having the birds in hand. The training presentation was funded through National Seabird Program funds, and it was co-created by the seabird lead and the University of Washington's COASST program in collaboration with Observer Program and USFWS staff.

Table 1: U.S. Endangered Species Act-listed marine bird species occurring in Alaska EEZ waters.

Common name	Scientific name	Family	ESA Status
Short-tailed albatross	*Phoebastria albatrus*	Tubenose: albatross	Endangered
Spectacled eider	*Somateria fischeri*	Waterfowl: eider	Threatened
Steller's eider	*Polysticta stelleri*	Waterfowl: eider	Threatened

Observers are also provided with *Beached Birds: A COASST Field Guide to Alaska*, for identification of dead bird specimens in hand, including incomplete, wet, or dirty carcasses.

PROTOCOL

Trigger: The Observer notes that a bycatch or collision event of an ESA-listed species (Table 1) has occurred. This can be within or outside the observer sampling period. All known takes of ESA-listed species or possible takes (e.g., "unidentified albatross" or "unidentified eider" flagged by the observer) are handled in the following way.

Step 1: Incident Reporting

The Observer follows instructions in the most current version of the North Pacific Observer Program (NPOP) Observer Sampling Manual.

Briefly, these are:

i. Stop sampling (if taken during a sample period)
ii. Note information asked for in the NPOP Observer Sampling Manual (see: Bird Sightings and Interactions\Recording Bird Data)
iii. Record information in their logbook and deck forms

Step 2: Carcass Retention

2a: Retained carcass.

When the carcass is retained on board (i.e., not dropped off the gear) and available to the observer, the observer prepares the specimen for storage, looks for leg bands, uses the *Beached Birds* field guide to make an identification, takes at least one photo of the front, back, and beak of the bird; and notes diagnostic features for each retained carcass.

Figure 1: NOAA Fisheries guidelines for observer photos: front, back, beak.

2b: Carcass not retained.

If the carcass is not retained on board and therefore not available to the observer, there is a greater likelihood that the observer records the species as unidentified at the group (e.g., “unidentified albatross”) or family (e.g., “unidentified waterfowl”) level. This is also the case for other albatross or eiders not retained. The species- or group-level identification made by the observer depends on clearly seeing diagnostic characteristics, in a matter of seconds, under challenging conditions at sea. In this situation, observers record:

i. All information related to the bycatch or collision incident (e.g., date and time; see: NPOP Observer Sampling Manual Bird Sightings and Interactions\Recording Bird Data for complete list)
ii. Why they were not provided the specimen (e.g., “dropped off hook during gear retrieval, carcass not recovered.”)
iii. Specifically note any diagnostic species identification features they saw (e.g., “bright pink bill and pale back feathers”) in their logbook.

Step 3: Contact with In-season Advisor

The observer communicates the potential ESA-listed species bycatch or collision event to their FMA in-season advisor as soon as they can. This is usually done immediately after they finish recording relevant information in their logbook. Same-day communication to the in-season advisor is required, via shipboard electronic reporting system (ERS).

Step 4: Contact with Seabird Lead

The in-season advisor communicates to their supervisor, who then communicates the possible bycatch or collision event to FMA leadership and to the AFSC Seabird lead (Fig. 2).

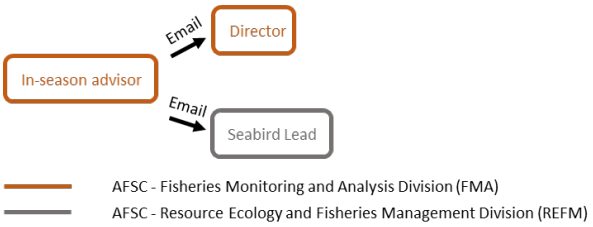

Figure 2: Information flow from in-season advisor to AFSC initial points of contact.

Step 5: Observer and Band Data Review

The AFSC Seabird Lead and FMA staff confer on observer experience and information provided and the Seabird lead engages in Step 6 as appropriate. If a leg band was reported, the AFSC Seabird Lead compares the number against the list of leg bands applied, by species:

i. Short-tailed albatross: banding records from Torishima Island held by the Yamishina Institute for Ornithology. Liaison between AFSC and the Institute is Rob Suryan (rob.suryan@noaa.gov).
ii. Spectacled eider and Steller's eider: Neesha Stellrecht (neesha_stellrecht@fws.gov) as point of contact to Alaska/Canada/Russia collaborators and USGS Bird Banding Lab.

An initial judgment is made as to the likelihood of the event being a bycatch or collision event for the species identified (Figure 3, see note 1).

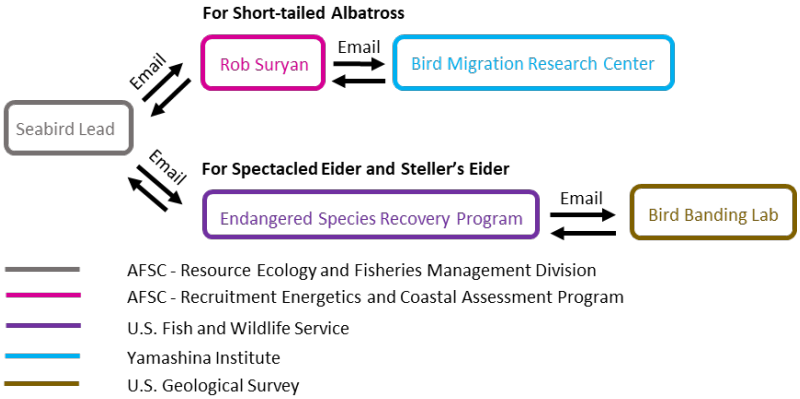

Figure 3: Process to verify banded bird data.

Step 6: Communication Chain

In parallel with Step 5, the AFSC Seabird Lead ensures that appropriate members of the AFSC management and the Alaska Regional Office are informed of this possible event simultaneously, via email (Fig. 4). The Seabird Lead then informs the following:

i. USFWS, Alaska Region, Fisheries and Ecological Services, Anchorage and Fairbanks Offices.
ii. USFWS, Alaska Region, Migratory Bird Management.

The Seabird Lead also informs essential partner agencies, including the seabird points of contact at

iii. The Executive Director of the Industry Association and/or individual vessel owner which represents the vessel involved (see note 2). The ED is informed of the potential bycatch event, including but not limited to: evidence collected and confidence in observer species identification.

Note that for i. and ii. above, signed confidentiality agreements allow these partners to know the vessel name, observer name, exact location, and other relevant information and these agreements prohibit further release of that information. For the last several events, the industry association has already been aware that the relevant species code appeared in its internal weekly bird report (see note 3).

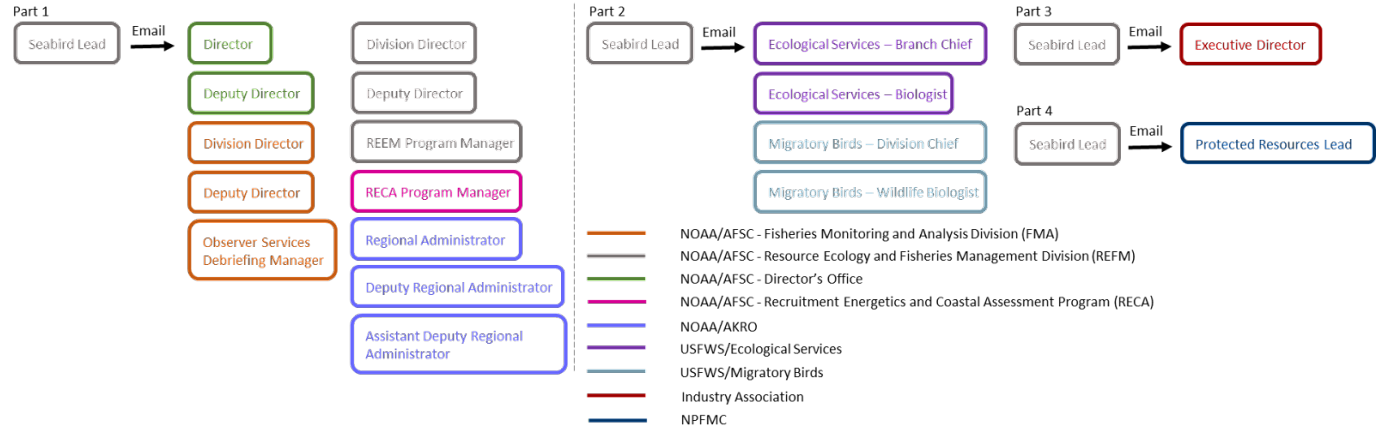

Figure 4: Three-part communication chain initiated by AFSC Seabird Lead.

Step 7: Memo from USFWS

The AFSC salvage permit does not cover ESA-listed species. The USFWS Biological Opinion for all three ESA species requires the retention of these carcasses. The Seabird Lead coordinates with the USFWS Ecological Services Division to receive a memo that covers the retention and transport of the specimen (Fig. 5, see note 4).

Figure 5: Process for retrieving USFWS retention and transport memo for ESA-listed species.

Step 8: Species Validation

8a: Validation with carcass.

If in hand and the leg band number provided by the observer matches a record in a known database (Fig. 2), it is considered a valid identification. Follow-up to receive observer photos is desired, but the event is considered validated and proceeds through to the Observer Interview (Step 9, below). If a leg band is not available or the bird was not banded, the in-season advisor works with the observer to get photos of the carcass sent from the vessel. If photos are not possible, species validation is delayed until the vessel reaches port, the carcass is off-loaded and the Observer has access to internet. In some cases, validation is delayed further until the physical carcass is sent, received, and reviewed by an expert (e.g., Observer Program Debriefer, AFSC Seabird Lead, or USFWS Ecological Services Staff).

Upon species validation, an email or memo (Fig. 6) is provided to the USFWS and the Alaska Regional Office that notes location and other pertinent information (e.g., age, sex). The written information does not name the vessel nor the observer, as it is designed for broader distribution (Appendix 1). Prior to this, the Seabird Lead works with the vessel owner to obtain permission to note the exact location. A record of this permission to release this information is provided to FMA.

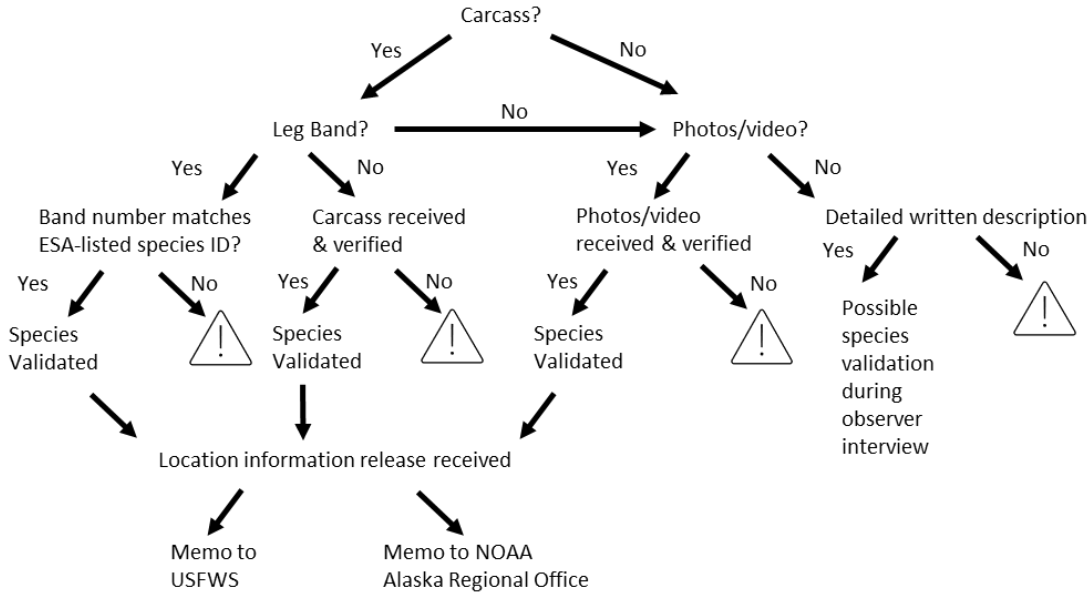

Figure 6: Species validation process contingent on carcass and/or diagnostic photos/video and/or detailed written description.

8b: Validation without carcass.

The species validation process is on hold until the observer returns, and the observer interview can occur (Step 9, below).

Step 9: Outreach to Industry

The Alaska Regional Office provides outreach to the fleet by providing a notice including confirmation the event occurred, event location, and reminder of the importance of using seabird avoidance gear. The AFSC provides support to the AKR to ensure the outreach information is accurate. Examples of these are available from AKR.

Step 10: Observer Interview

The AFSC Seabird Lead convenes an exit interview with the observer. This occurs either during a layover in port or when the observer returns to debrief. The interview includes experts working on ESA-listed bird issues from the AFSC, USFWS, Alaska Regional Office, and select partners who have a current, signed confidentiality agreement (observer name, vessel name, location, deterrent use etc. may be disclosed). This conference call addresses the weather conditions at time of capture, use of deterrents when applicable, other seabird bycatch occurring, and additional questions that the group determines useful. In the case where the observer was unable to retain the specimen, this interview also addresses species identification. The observer is asked what diagnostic features they saw, and then asked for their opinion on a final identification – species level (e.g., “spectacled eider”), group level (e.g., eiders), family level (“duck” or “waterfowl”), or “unidentified bird”. The observer provides their opinion on what

should be entered into the database, and then exits the meeting. The group of experts (see names with (*) in CONTACTS, below) discuss what they have learned, and reviewing all evidence, attempt to reach agreement on the final species identification to be entered in the database. The AFSC Seabird Lead has the final call in this exercise, but generally accepts what the group of experts recommend (see note 5).

CONTACTS

The following people currently serve as points of contact for Protocol Steps 1-9 above. A star (*) indicates the member could serve as an expert during the observer interview (Step 9, above).

NOAA FISHERIES - ALASKA FISHERIES SCIENCE CENTER

Director's Office

Bob Foy, Director, robert.foy@noaa.gov, 907-482-0026

Jeremy Rusin, Deputy Director, jeremy.rusin@noaa.gov, 206-526-4621

Fisheries Monitoring and Analysis Division

Jennifer Ferdinand, Division Director, jennifer.ferdinand@noaa.gov, 206-526-4076

Lisa Thompson, Deputy Director, lisa.thompson@noaa.gov, 206-526-4229

Marlon Concepcion, Observer Services Debriefing Program Manager, marlon.concepcion@noaa.gov, 206-526-4007

*In-season Advisor**

*Observer Debriefer**

Resource Ecology and Fisheries Management Division

Rob Felthoven, Director, ron.felthoven@noaa.gov, 206-526-4114

Stephani Zador, Deputy Director, stephani.zador@noaa.gov, 206-526-4693*

Kerim Aydin, Resource Ecology and Ecosystem Modeling Program Leader, kerim.aydin@noaa.gov, 206-526-4225

Shannon Fitzgerald, Seabird Lead, shannon.fitzgerald@noaa.gov, 206-526-4553*

Auke Bay Laboratories

Rob Suryan, Recruitement, Energetics, and Coastal Assessment Program Manager, rob_suryan@noaa.gov, 907-789-6065*

USFWS – ECOLOGICAL SERVICES

Anchorage Office: Short-tailed albatross

Doug Cooper, Branch Chief, douglass_cooper@fws.gov, 907-271-1467

Jennifer Spegon, Biologist, jennifer_spegon@fws.gov, 907-271-2768*

Fairbanks Office: Steller's and spectacled eider

Neesha Stellrecht, Branch Chief, neesha_stellrecht@fws.gov, 907-456-0297 (work), 907-347-8906 (cell)*

Claire Montgomerie, Biologist, claire_montgomerie@fws.gov, 907-456-0442 (work), 808-756-8398 (cell)

USFWS – MIGRATORY BIRDS MANAGEMENT DIVISION

Eric Taylor, Division Chief, eric_taylor@fws.gov, 907-786-3446

Julian Fischer, Supervisory Wildlife Biologist-Waterfowl, julian_fischer@fws.gov, 907-786-3644
Elizabeth Labunski, Wildlife Biologist-Seabirds, elizabeth_labunski@fws.gov, 907-786-3865*
David Safine, Wildlife Biologist-Waterfowl, david_safine@fws.gov, 907-786-3908

NOAA FISHERIES - ALASKA REGIONAL OFFICE

Administrator's Office

Jon Kurland, Regional Administrator, jim.balsiger@noaa.gov 907-586-7221
Kristie Balovich, Acting Deputy Regional Administrator, doug.mecum@noaa.gov, 907-586-7221
Josh Moffi, Sustainable Fisheries, Ecosystem Branch, joseph.krieger@noaa.gov, 907-586-7650*

NOTES

[1]If initial work with the observer indicates they simply did not see any diagnostic features and could only determine it was an albatross (size and shape), the specimen will be entered into the database as an unidentified albatross. If there were extenuating circumstances (e.g., single low-resolution photo at night), it may be appropriate to take additional steps, including but not limited to informing partners, convening the panel of experts, etc.

[2]Except for the initial bycatch event in 1995, all observed takes of short-tailed albatross over the years have occurred in the freezer longline fleet. The industry association was first the "North Pacific Longline Association," later the "Freezer Longline Coalition".

[3]Spectacled eiders have only been documented as "landings" during storms or "ship strikes" due to light attraction, north of 62°N.

[4]If a carcass was retained, it is "owned" by the USFWS; AFSC will ship it to wherever they direct. The USFWS has chosen to allow for the last few short-tailed albatross carcasses to be sent to the NOAA Pacific Seabird Necropsy Program for full necropsy, and then to an institution at the USFWS' discretion.

[5]In 2014, a potential short-tailed albatross take was not retained but there was video evidence of the bird. The AFSC went through a process of working with NMFS Office of Law Enforcement to obtain the video clip that showed the bird, and then went through a process of working with several seabird identification experts to arrive at a positive species identification of short-tailed albatross.

Sub-Appendix 5.1: Example Memo to Alaska Regional Office and USFWS

ESA Species Incidental Take Event – Short-tailed albatross

27 October 2020

The following describes information related to an incidental take of a short-tailed albatross. The specimen was discovered while the observer was completing their species composition sample during gear retrieval. The specimen was saved by the observer and is currently on board the vessel.

Date of incidental take: Specimen recovered on October 16, 2020 at ca 0700; set began at 1058 on October 15, retrieval ended at 0837 on October 16.

Fishery: Cod demersal longline fishery.

Location: bird recovered during retrieval at approximately 59°41’ N, 173°57’ W

Species ID verification: The observer provided a good description of the bird that included diagnostic features of an immature short-tailed albatross (mostly dark body with a large pink bill). The bird had a metal leg band applied by Dr. Hiroshi Hasegawa, Toho University. NMFS staff contacted the Yamashina Institute for Ornithology that maintains banding records in Japan and verified that the bird was a short-tailed albatross, banded on Torishima Island in April 2018 as a fledgling.

Conditions: The bird was apparently hooked during the day while setting longline gear. The set began in the morning on October 15th. The vessel was using paired streamer lines that appeared to be in good condition. Set was made moving at 7.2 knots with a following wind of 43 knots. Due to the wind speed, one streamer line was pushed off somewhat from the baited hooks. Offal was not being discharged during gear setting. At the time of the set there were a large number of birds in the area. The observer made a rough estimate that there were about 15 short-tailed albatross in the vicinity when the set started.

Gina M. Raimondo
U.S. Secretary of Commerce

Richard W. Spinrad
Under Secretary of Commerce
for Oceans and Atmosphere

Janet Coit
Assistant Administrator
for Fisheries

January 2023

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