Environmental Assessment for Issuance of Permits to take Steller Sea Lions by harassment during surveys using unmanned aerial systems

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Location: Coastal waters of Alaska, Washington, Oregon and California

Abstract: The National Marine Fisheries Service (NMFS) proposes to issue permits to take Steller sea lions for research, including during surveys using unmanned aerial systems (UAS). The effects of various research methods on Steller sea lions were evaluated in a Programmatic Environmental Impact Statement on the Steller Sea Lion and Northern Fur Seal Research Programs (PEIS; NMFS 2007). That PEIS included analysis of the effects of aerial surveys using manned aircraft and did not consider the effects of UAS because they were not a proposed survey method at the time the PEIS was prepared. This EA supplements the analysis in that PEIS to evaluate the effects of takes by surveys using UAS. It also evaluates new information on the status of the species as it relates to the effects of permit issuance.

CONTENTS

ACRONYMS and ABBREVIATIONS

ADFG	Alaska Department of Fish and Game, Division of Wildlife Conservation
AOC	Aircraft Operations Center (of NOAA)
ASLC	Alaska SeaLife Center, Seward, Alaska
CITES	Convention on International Trade in Endangered Species
COA	Certificate of Authorization
dBA	Decibels Adjusted
eDPS	Eastern Distinct Population Segment (of Steller sea lions)
ESA	Endangered Species Act, as amended
F/PR1	NMFS Office of Protected Resources, Permits Division, Silver Spring, Maryland
FAA	Federal Aviation Administration
ft	feet
hp	Horsepower
IUCN	International Union for Conservation of Nature
kt	knots
m	meter(s)
m/s	meters/second
MMPA	Marine Mammal Protection Act, as amended
NMML	NMFS National Marine Mammal Laboratory, Seattle, Washington
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
PBR	Potential biological removal
PDMP	Post-delisting Monitoring Plan (for the eDPS)
PEIS	Programmatic Environmental Impact Statement, NMFS (2007)
RPAS	Remotely Piloted Aircraft Systems
s	second(s)
SAR	Stock Assessment Report (for marine mammals)
SEA	Supplemental Environmental Assessment
UAF	University of Alaska Fairbanks
UAS	Unmanned aerial systems
UAV	Unmanned aerial vehicles
US	United States
VTOL	Vertical Takeoff and Landing
wDPS	Western Distinct Population Segment (of Steller sea lions)

1.0 Purpose and Need for Action

1.1. Background

In May 2007, the National Marine Fisheries Service (NMFS) completed a Programmatic Environmental Impact Statement on the Steller Sea Lion and Northern Fur Seal Research Program (PEIS, NMFS 2007). The PEIS evaluated potential environmental impacts of NMFS awarding federal funds and issuing permits for research on Steller sea lions and northern fur seals throughout their ranges in the United States, including Alaska, Washington, Oregon, and California.

The PEIS preferred alternative (alternative 4) includes all research activities needed to address all information objectives identified for both species of concern. It limits issuance of permits to levels of take that would not exceed an "acceptable" level of serious injury and mortality associated with research activities. The threshold is based on a metric for fishery-related mortality that is defined in the MMPA: the Potential Biological Removal (PBR). Under the preferred alternative, the total number of research-related serious injury and mortality across all permits cannot exceed 15% of PBR for a stock.

Subsequent to issuance of a Record of Decision (ROD) on June 18, 2007, NMFS issued 11 permits under section 104 of the Marine Mammal Protection Act and section 10(a)(1)(A) of the Endangered Species Act to take Steller sea lions (and northern fur seals) during conduct of research. Those permits were valid through August 1, 2009. NMFS limited the duration of these permits to less than the five-year maximum allowed by regulation because we determined a program review was warranted to develop policy and guidance to improve implementation of the Steller sea lion and Northern fur seal research programs. In the ROD, NMFS indicated that the implementation of the Preferred Alternative would be limited in duration to three summer field seasons between June 2007 and August 2009.

In October 2008, a NMFS-convened expert panel provided a report summarizing their review of the permitted research program and recommendations for process improvements (Bowen et al, 2008). In August 2009, NMFS issued a new ROD that again selected the Preferred Alternative from the 2007 PEIS, and incorporated implementation of recommendations from the panel's report. NMFS then issued 12 permits valid through August 31, 2014, for research on Steller sea lions and northern fur seals.

The majority of permits for research on Steller sea lions and northern fur seals have been on the same issuance and expiration date cycle because they were processed under the PEIS. They are also logically grouped together for consideration of cumulative impacts because they are for the same species, in the same geographic locations, using the same basic research protocols at the same general times of year.

Of the 12 permits issued in 2009, the permit holders of six have requested new permits to continue research of the same nature, with some modifications. One such modification is the use of unmanned aerial systems (UAS) as an alternate or additional platform for conducting aerial surveys and visual observations of Steller sea lions. Of all the research protocols proposed, use of UAS was not contemplated in the PEIS because it was not an available technology for wildlife research when the PEIS was prepared.

The issue for permitting UAS versus manned aircraft for surveys is that UAS can or must (depending on the type of system and location used) be flown at altitudes substantially below those evaluated for manned aircraft. Because the PEIS did not contemplate effects of aerial surveys at the lower altitudes proposed, and because use of UAS in wildlife research has become an emerging technology since completion of the PEIS, NMFS determined that an analysis of impacts of UAS on Steller sea lions and northern fur seals was warranted

From the batch of permits expiring in August 2014, NMFS has received the following permit applications for research on Steller sea lions and northern fur seals:

- File No. 18528, from the NMFS National Marine Mammal Laboratory for research on Steller sea lions in the wild, including use of UAS
- File No. 14327, from the NMFS National Marine Mammal Laboratory for research on northern fur seals in the wild, including use of UAS
- File No. 18537, from the Alaska Department of Fish and Game, for research on Steller sea lions in the wild, including use of UAS
- File No. 18438, from the Alaska SeaLife Center, for research on Steller sea lions in the wild
- File No. 18272, from the Alaska SeaLife Center, for research on Steller sea lions in the wild
- File No. 18534, from the Alaska SeaLife Center, for research on captive Steller sea lions at their facility. Note that this permit, which has no impact on Steller sea lion or northern fur seals in the wild, was issued on June 3, 2014, and is not part of the proposed action. It was received during the same permit renewal cycle as the applications for research in the wild because the project was initially funded and permitted at the same time as those other projects.

1.2. Purpose of the Proposed Action

In response to receipt of applications, NMFS proposes to issue five permits for takes of Steller sea lions and northern fur seals in the wild directly by and incidental to scientific research. The MMPA and ESA prohibit takes of marine mammals, threatened and endangered species. The purpose of permit issuance is to exempt takes resulting from research that meets statutory issuance criteria, including being consistent with the purposes and policies of the MMPA and ESA regarding conservation of the species.

The permit applicants propose takes by research methods ranging from aerial surveys and remote observations to captures of free-ranging animals for attachment of scientific instruments and collection of various tissue samples and measurements. With the exception of conducting aerial surveys via UAS, the proposed research methods are considered consistent with the scope of methods evaluated in the PEIS.

1.3. Need for the Proposed Action

The need for issuance of permits is in response to receipt of applications for permits submitted to NMFS. Section 104 of the MMPA states that NMFS may issue a permit for scientific research purposes to an applicant who submits information indicating that the taking of marine mammals is required to further a *bona fide* scientific purpose. Similarly section 10(a)(1)(A) of the ESA indicates NMFS may issue permits to take species listed as endangered for scientific purposes. When NMFS receives a permit application it must

review the request, determine whether the proposed activities meet issuance criteria, and make a decision regarding permit issuance.

The applicants' specific needs to take marine mammals and endangered species (which prompted their permit requests) are outlined in their applications on file with NMFS. Under the MMPA, applicants must demonstrate that taking a marine mammal is necessary to further a bona fide scientific purpose. The MMPA defines bona fide as scientific research on marine mammals, the results of which: likely would be accepted for publication in a refereed scientific journal; are likely to contribute to the basic knowledge of marine mammal biology or ecology; or are likely to identify, evaluate, or resolve conservation problems.

1.4. Scope of Environmental Assessment

The decision before NMFS is whether the takes as proposed by the permit applicants satisfy statutory and regulatory issuance criteria. In deciding to issue a permit, NMFS may impose mitigation, monitoring, and reporting requirements deemed necessary to ensure the permitted taking of marine mammals and ESA-listed species is consistent with the purposes and policies of the MMPA and ESA.

This EA evaluates potential impacts from issuance of the permits proposed by the applicants, and a reasonable range of alternatives. NMFS decision regarding permit issuance is in direct response to an application for the activities as proposed by the applicant. It is not reasonable to consider issuance of permits for activities other than those proposed in the applications, or to consider issuance of permits to entities that did not submit applications.

The action area for the PEIS included the entire ranges of Steller sea lions and northern fur seals in United States (US) waters and on the high seas, including coastal Alaska, Washington, Oregon, and California. The PEIS describes affected resources in the action area, including the status of Steller sea lions, northern fur seals, and other marine life potentially affected by permit issuance. The PEIS description of the action area and affected environment are hereby incorporated by reference. This EA updates information on the status of the species that is relevant to potential impacts of the proposed action.

NMFS concluded that issuance of permits under the preferred alternative in the PEIS in general, and at the proposed levels of taking in the initial 11 permits in 2007, and the 12 new permits in 2009, would not result in significant adverse impacts on any component of the human environment. In most cases, the effects were limited to adverse impacts on the marine mammals that were the subject of the taking. With the exception of specified numbers of incidental mortality, the effects on marine mammals were found likely to be minor, transitory, and recoverable with no significant impact on the populations or species. The taking of marine mammals during permitted research was not likely to adversely affect any other component of the human environment. The PEIS description of research methods and analysis of potential impacts are hereby incorporated by reference.

The 2007 PEIS evaluated impacts on the human environment from issuance of permits for takes resulting from a broad range of research methods, including everything proposed in the six pending applications except harassment from UAS. This EA describes use of UAS for aerial surveys of Steller sea lions and evaluates potential impacts from permitting the takes of marine mammals that would result from those surveys.

2.0 Alternatives Including the Proposed Action

NMFS has preliminarily determined that each of the applications satisfies issuance criteria under the MMPA and ESA. We did not consider alternatives in which only some of the permits were issued because the decision to issue a specific permit is based on whether NMFS finds the issuance criteria under the MMPA and ESA have been met. Similarly, we did not consider alternatives in which the permits varied in their terms and conditions. The terms and conditions in permits for research under the MMPA and ESA are a combination of those that are required by statute or regulation for any permit, and those deemed appropriate for the species or type of research protocols. To the extent that the species are the same and the research methods are the same or analogous, all permits would contain the same conditions.

2.1 Alternative 1 - Status Quo

Under the Status Quo alternative, NMFS would issue permits for activities that were considered in the PEIS and have been previously permitted. NMFS would not issue permits that allow takes of marine mammals during use of UAS as proposed by the applicants because the PEIS did not contemplate surveys at the altitudes proposed.

In the case of the pending permit applications, NMFS would issue permits for takes as requested by the applicants with the exception of operating UAS at altitudes below 500 feet as evaluated in the PEIS. This effectively precludes use of UAS for the proposed research under those permits because the Federal Aviation Administration (FAA) prohibits operation of the types of UAS proposed above 400 feet.

2.2 Alternative 2 - No Action

Under the No Action alternative, NMFS would not issue the requested permits. Without a permit to exempt the takes resulting from research, conduct of the research would be in violation of the MMPA and ESA. It is therefore reasonable to assume the proposed research would not take place.

2.3 Alternative 3 – Including Takes from Surveys by UAS

Under Alternative 3, NMFS would issue the five permits requested, including takes that may result from surveys by UAS. Two permit applicants propose to add the use of UAS to supplement and replicate the use of manned aircraft to survey and photograph Steller sea lions at certain locations: NMML (File No. 18528) and ADFG (File No. 18537).

2.3.1 Unmanned Aerial Systems Protocols for Use

The principal UAS proposed for use is an APH-22 hexacopter (though other types of rotary-wing or fixed-wing UAS may be used depending on availability, funding and logistics), which is 1.8 ft in diameter (between motor centers) and carries a Canon EOS-M camera with a 22 mm lens (or similar), and has a total weight of 3.5 lbs (Figure 1). This UAS can be

launched from a ship, but more likely, a suitable ground-based launch site downwind and away from the animals would be used.

The APH-22 has a 30-minute flight duration, so flights would likely be no longer than 20 minutes to allow for battery reserve. Photos would be taken every 2 seconds during the flight, which will provide considerable overlap. The UAS pilot would attempt to fly the UAS in a manner to reduce the potential for disturbance based on local conditions and input from observers.

UAS pilots undergo substantial training and are qualified to safely operate UAS in US airspace. For approval to operate a UAS, the Federal Aviation Administration (FAA) National Policy requires that a Certificate of Authorization (COA) be issued which includes training and operational requirements. For the UAS pilot in command these requirements are: a) completion of the FAA Private Pilot ground instruction course; b) passing the Airman's Knowledge Exam, and c) holding a 2nd Class Airman Medical Certificate. To operate UAS on NOAA missions, the NOAA Aircraft Operations Center (AOC) requires completion of UAS manufacturers training, and NOAA Fisheries VTOL training. For Steller sea lion field operations, the COA restricts UAS to a maximum altitude of 400 ft while remaining at least 500 ft below a cloud ceiling.

The permit applicants want to use this new technique to supplement their current methods. A suite of aerial, vessel, and land-based methods are used by the applicants to survey Steller sea lions to estimate population abundance and trends, survival and reproductive rates, and long-term movements, all critical information needs identified in the Steller Sea Lion Recovery Plan (NMFS 2008) and the Post-delisting Monitoring Plan for the eDPS (PDMP, NMFS 2013) to facilitate management actions. In the case of Steller sea lions within the endangered wDPS, NMML has been unable to survey rookeries and haulouts in a 300-mile stretch of the Aleutian Islands during the breeding seasons of 2009-2012 using a manned aircraft due to bad weather, fog, and lack of landing sites due to runway repair activities. The availability of alternate means (e.g., ship- or land-based UAS) to photograph sea lions at such locations will greatly improve their ability to get complete counts, improve human safety, and meet management responsibilities.

2.3.2 Summary of Applications for Permits

File No. 18528. The applicant proposes to conduct research on the Western distinct population segment (wDPS) and Eastern distinct population segment (eDPS) of Steller sea lions in Alaska, Washington, Oregon, and California to measure population status, vital rates, foraging ecology, habitat requirements, and effects of natural and anthropogenic factors pursuant to fulfilling the NMFS' legal requirements under the MMPA and ESA. Annually in the wDPS, up to 66,000 Steller sea lions may be exposed to aerial surveys by manned or unmanned aircraft, 7,000 to rookery-based activities, and 10,500 to other incidental activities. Up to 595 Steller sea lions could be captured, with up to 345 having blood, skin, and swab samples collected, 395 hot-branded, and up to 145 blubber biopsied, 345 vibrissa removed, and 320 subject to stomach intubation. Instruments will be attached on up to 45, and 245 would receive a non-permanent mark if not hot-branded. Annually in the eDPS, up to 46,000 sea lions may be exposed to aerial surveys, and 13,100 to incidental activities. Up to 40 adult males could be captured, and have blood, hair, and skin samples collected, hot-brand and flipper tags applied, and have an instrument attached. Up to 200 pups would be captured,

hot-branded flipper-tagged, swabbed, and skin biopsied, with 50 also having blood and hair samples collected. Non-target species that may be taken incidentally include northern fur seals (*Callorhinus ursinus*) in Alaska, California sea lions (*Zalophus californianus*) and northern elephant seals (*Mirounga angustirostris*) in Washington, Oregon, and California, and harbor seals (*Phoca vitulina*) in all states. Samples may be exported and re-imported. Authorization for annual unintentional mortality of 5 SSL from the Western DPS and 9 SSL from the Eastern DPS is requested.

File No. 18537 (ADFG). This application supports continuation of ADFG's long-term Steller sea lion (SSL) research program. The applicant requests takes during research activities that incorporate improved methodology based on previous work authorized under permit no. 14325 and subsequent modifications, including: incidental disturbance during aerial, skiff- and ground-based count and brand resight surveys; captures supporting marking, external instrument attachment, and physiology, toxicology, feeding ecology and health sampling; and permanent marking of pups and older age classes for describing vital rates and intra-/inter-Discrete Population Segment (DPS) movement. The applicant also requests takes by incidental disturbance of northern fur seals (*Callorhinus ursinus*), California sea lions (*Zalophus californianus*), and harbor (*Phoca vitulina*), spotted (*Phoca largha*), ribbon (*Histriophoca fasciata*), ringed (*Pusa hispida*) and bearded seals (*Erignathus barbatus*) are also requested due to proximity of isolated individuals to the study area. Authorization for annual unintentional mortality of 5 SSL from the Western DPS and 10 SSL from the Eastern DPS is requested.

File No. 14327 (NMML). The applicant is requesting a five-year amendment to permit no. 14327. The permit was issued on August 17, 2009, for takes related to investigating population status and trends, demographic parameters, health and condition, and foraging ecology of northern fur seals (Callorhinus ursinus) in U.S. waters, including rookeries and haulouts in California and Alaska. Research on the San Miguel Island stock involves: capture, restraint, sampling, and incidental disturbance. Research on the Eastern Pacific stock involves: capture, restraint, sampling, and incidental disturbance. The permit also authorizes research-related mortality of fur seals from the San Miguel Island Stock and the Eastern Pacific stock. Western DPS Steller sea lions and California sea lions may be harassed annually incidental to the research.

A five-year amendment is requested to continue the long term monitoring and assessment of Northern fur seal population and demographic parameters; health and disease trends; and foraging habits and ecology. Specifically, the requested amendment will: add new methods (aerial surveys) and authorize associated incidental disturbance; edit methods (tag resighting observations) and authorize increased associated incidental disturbance; authorize existing procedures (nasal, vaginal, and fecal swab sampling) for/at other existing projects/locations; authorize new procedures (ocular swab and vibrissae sampling); add new species (harbor seals) and authorize their disturbance incidental to northern fur seal research activities; and, modify protocols (tooth extraction, pup production estimates). The permit amendment would allow 22 research-related mortalities per year from the Eastern Pacific Stock and 14 from the San Miguel Island stock.

File No. 18438. The Alaska SeaLife Center (ASLC) requests a five-year permit to conduct Steller sea lion population monitoring and health, nutrition, and foraging studies to provide data on pup and juvenile survival, reproductive rates, diet, epidemiology, endocrinology,

immunology, physiology, ontogenetic and annual body condition cycles, and behavior. Individual sea lions may be taken by the following means with maximum number of takes per year in parentheses: disturbance associated with capture, observational studies, and material/scat/carcass collection (14,000); capture, restraint, and sampling (200); and remote biopsy (150). Captured sea lions will undergo morphometric measurements, blood and tissue collection, digital imaging, hot-branding, body condition measurement, whisker, hair, and milk sampling, temporary marking, and ultrasound exams. Individuals will be taken from the Gulf of Alaska and Aleutian Islands. Marine mammals that may be incidentally disturbed include harbor seals and California sea lions. The applicant requests research-related mortality of up to 4 Steller sea lions per year from the western DPS.

File No. 18272 (ASLC). The applicant requests a five-year permit to continue Phases 2 and 3 of a 3-phase project to determine reproduction, survival and depredation in Steller sea lions in the western Aleutian Islands (WAI) in relation to the eastern Gulf of Alaska (eGOA). Phase 1 was a 12-year collaborative effort that included life history transmitter (LHX) tag development, refinement of capture, holding and surgical implantation techniques specifically for Steller sea lions, extensive physiological and behavioral impact assessments and ultimate deployment of LHX tags in 36 individuals. Applicants propose to deploy second generation implanted Life History Transmitters (LHX-2 tags) into pre-reproductive female western Steller sea lions in the eGOA (Phase 2) and WAI (Phase 3). LHX-2 tags record data throughout the host's life, record parturition events in females, and after death of the host and extrusion from decomposing, dismembered or digested carcasses transmit stored data via satellite. Phase 2 objectives are to (1) validate LHX-2 temperature-based parturition detection against direct visual observations; (2) add to the eGOA sample size for animals greater than or equal to 3 years old to increase the statistical power of a regional comparison to the WAI; (3) facilitate the transition to remote LHX tag deployments in the WAI by validating less invasive surgery enabled by smaller LHX-2 tags and by commencing ship-board surgeries immediately after capture. Phase 3 will quantify survival, depredation and reproduction in the WAI to determine: (1) do survival and predation schedules differ between stable and declining regions?; (2) does age at primiparity differ between regions? (3) do birth rates differ between regions? The applicant requests authorization for up to two research-related mortalities of Steller sea lions per year from the western DPS.

3.0 Affected Environment

Chapter 3 of the PEIS describes the geographic scope of the action area and the biological, physical, social and economic resources in the action area. That description is hereby incorporated by reference. In addition to the Steller sea lions and northern fur seals that are the subject of the proposed research, the action area is home to numerous other marine mammals, some of which may be incidentally disturbed by the research. There are also seabirds in the action area that may be incidentally disturbed.

3.1 Location

The addition of UAS as a technique to survey Steller sea lions would be conducted throughout the range of the Steller sea lion in the United States, including Alaska, Washington, Oregon, and California. The other research is proposed throughout the ranges of Steller sea lions and northern seals as described in the PEIS.

3.2 Status of Affected Species

Steller sea lion population status was reviewed in the PEIS, and is updated here. Population trends in Alaska have shown substantial regional variation during 2000-2012, with the western Aleutian Island area declining at about 7% per year, but increases in the western and eastern Gulf at 4% per year or more (Johnson and Fritz 2013), with population estimates for the Alaska portion of the western stock to be 58,334-72,223 animals, with a minimum population estimate of 45,916 animals and a potential biological removal (PBR) level of 275 animals (Allen and Angliss 2012). The western stock is listed as depleted under the MMPA, endangered under the ESA and by the IUCN, but not listed under CITES.

The eastern stock steadily increased at about 4% per year during 1979-2010 (NMFS 2013) with 61,146-78,886 animals in the eastern stock (including British Columbia), and a PBR of 2,378 animals (Allen and Angliss 2012). The eastern stock as a DPS (which includes sea lions in Southeast Alaska, Washington, Oregon, and California) was recently delisted from threatened status under the ESA (NMFS 2013). The stock was designated as "depleted" under the MMPA and classified as "strategic" (Allen and Angliss 2012) at the time of the original ESA listing. Removal from an ESA listing status may also result in a change of status under the MMPA, which is scheduled to be reviewed by the Alaska Scientific Review Group in 2014.

Northern fur seal population status was reviewed in the PEIS. A 2012 stock assessment report by NMFS updates the status of the Eastern North Pacific Stock. The northern fur seal was designated as depleted under the MMPA in 1988 because population levels had declined to less than 50% of levels observed in the late 1950s (1.8 million animals; 53 FR 17888, 18 May 1988) and there was no compelling evidence that carrying capacity (K) had changed substantially since the late 1950s. The Eastern Pacific stock of northern fur seal is classified as a strategic stock because it is designated as depleted under the MMPA. This stock will remain listed as depleted until population levels reach at least the lower limit of its optimum sustainable population (estimated at 60% of K; 1,080,000).

A 2010 stock assessment report by NMFS updates the status of the San Miguel Island northern fur seal stock. This stock although smaller than the Eastern North Pacific stock, is not considered to be "depleted" under the MMPA and is not listed as "threatened" or "endangered" under the ESA. Based on currently available data, the estimated annual level of total human-caused mortality and serious injury (1.2) does not exceed the PBR (324). Therefore, the San Miguel Island stock of northern fur seals is not classified as a "strategic" stock. The minimum total fishery mortality and serious injury for this stock (0) is not known to exceed 10% of the calculated PBR (32.4) and, therefore, appears to be insignificant and approaching zero mortality and serious injury rate. The stock decreased 80% from 1997 to 1998, began to recover in 1999, and is currently at 77% of the 1997 level. The status of this stock relative to its Optimum Sustainable Population level is unknown, unlike the Eastern Pacific northern fur seal stock which is formally listed as "depleted" under the MMPA.

Phocid seals, including ringed, ribbon, bearded, and spotted seals, were not reviewed in the PEIS, nor was the status of harbor seals. Since completion of the PEIS, the status of some seal species in the area has changed. Most notably, ringed seals and bearded seals

comprising the Alaskan stocks are now both listed as "threatened" under the ESA. Because some of the new permit applications request takes of these species incidental to research on Steller sea lions, this EA briefly summarizes their status.

Bearded seals
The Alaska (Beringia DPS) stock of the bearded seal (*Erignathus barbatus nauticus*) was listed as a "threatened" species under the Endangered Species Act (ESA) on February 26, 2013 (77 FR 76739). Bearded seals are the largest seal in the Arctic and are commonly found with drifting sea ice rather than pack ice. There is only one recognized stock in the U.S., the Alaska Stock, distributed over the continental shelf of the Bering, Chukchi, and Beaufort Seas. A reliable population estimate for this stock is currently considered not available, but could range from 125,000 to 155,000 animals; its population trend is unknown. Threats to bearded seals include bycatch in fishing gear, and they are harvested annually by Arctic natives for subsistence. Bearded seals are potentially vulnerable to loss of sea ice due to climate change.

Ringed seals
On February 26, 2013 (77 FR 76706), the Arctic (*Phoca hispida hispida*); Okhotsk (*Phoca hispida ochotensis*); and Baltic (*Phoca hispida botnica*) subspecies of the ringed seal was listed as a "threatened" under the ESA, while the Lagoda (*Phoca hispida lagodensis*) subspecies of the ringed seal was listed as "endangered." Ringed seals are the smallest and most common seal in the Arctic and are associated with ice floes and pack ice. There is only one recognized stock in the U.S., the Arctic Stock, though a reliable minimum population estimate for this stock cannot presently be determined because current reliable estimates of abundance are not available. The population trend for this stock is unknown. Loss of sea ice due to climate change is potentially the most serious threat to ringed seal populations. Other threats to ringed seals include predation by polar bears (ringed seals are the preferred diet of polar bears) and bycatch in fishing gear, and they are harvested annually by Arctic natives for subsistence.

Spotted seals
The Southern (*Phoca largha*) DPS of the spotted seal was listed as a "threatened" species under the ESA on November 22, 2010 (75 FR 65239). Spotted seals are distributed along the continental shelf of the Bering, Chukchi, and Beaufort seas, and the Sea of Okhotsk south to the western Sea of Japan and northern Yellow Sea. There is only one recognized stock in the U.S., the Bering Stock, though a reliable minimum population estimate for this stock cannot presently be determined. The estimated size of the spotted seal population is 59,000 animals, which includes animals from all three DPSs. The population trend for this stock is unknown. Loss of sea ice due to climate change is potentially the most serious threat to spotted seal populations. Other threats to ringed seals include bycatch in fishing gear and annual subsistence harvesting by Alaskan natives.

Harbor seals
Harbor seals are not listed as, or proposed to be listed as, depleted under the MMPA, or threatened or endangered under the ESA. The three stocks of harbor seals in Alaska have a total population estimate of 180,017 seals state-wide. The Southeast Alaska and Bering Sea

stocks are stable or slightly increasing. The Gulf of Alaska stock is small compared to its abundance in the 1970s and 1980s and may be continuing to decline.

NMFS has new genetic information on harbor seals in Alaska which indicates that the current division of Alaskan harbor seals into the Southeast Alaska, Gulf of Alaska, and Bering Sea stocks needs to be reassessed. NMFS, in cooperation with partners in the Alaskan Native community, is evaluating the new genetic information and will be making a joint recommendation regarding revised stock structure.

4.0 Environmental Consequences

4.1 Effects of Alternative 1 – Status Quo

The effects of the status quo would be the same as those of the Preferred Alternative in the PEIS. NMFS would issue all five of the requested permits for takes of Steller sea lions and northern fur seals during the same research protocols evaluated in the PEIS and at the same or lower levels of take. There would be no permits for takes by surveys from UAS.

The total number of permits proposed, and the levels of take that would be exempted, are less than what was considered when permits were issued in 2007 and 2009 under the Preferred Alternative in the PEIS. The possibility of additional permits for increased takes that would return research effort to levels of the past six years exists because the Preferred Alternative allows for greater levels of effort and numbers of permits. However, NMFS has no pending applications beyond the five described in section 2.3.

Implementing the Preferred Alternative from the PEIS was predicted to contribute to both immediate and long-term needs for conservation and management of the species. The magnitude of sub-lethal effects on productivity of the subject species was unknown, and the effect of mortality and serious injury related to permitted research alone was predicted to be minor. The direct and indirect effects on other resources in the action area were predicted to be negligible. The discussion of direct and indirect effects are hereby incorporated by reference.

4.2 Effects of Alternative 2 – No Action

The effect of the no action alternative, in which NMFS does not issue new permits and research that would result in takes of Steller sea lions and northern fur seals is not likely to be conducted, would be the same as the effects of the No Action Alternative in the PEIS. The discussion of effects from the PEIS is hereby incorporated by reference.

Implementing the No Action alternative in the PEIS was expected to result in minimal contributions to conservation efforts for Steller sea lions and northern fur seals and an increased level of scientific uncertainty over time. There would be no sub-lethal or lethal effects of research on the subject species and no impacts on non-target species or other resources in the action area.

4.3 Effects of Alternative 3 – Including Takes from Surveys by UAS

The effects of alternative 3, in which NMFS issues the five permits requested and includes takes resulting from surveys by UAS would be the same as the effect of the Status Quo of

this EA. The available information on effects of UAS on wildlife suggests impacts would be same as other research methods that were evaluated in the PEIS and permitted since 2007.

4.3.1 Effects of Surveys Using Unmanned Aerial Systems

The use of fixed-wing and rotor-based UAS, also known as unmanned aerial vehicles (UAV) or remotely piloted aircraft systems (RPAS) and commonly as "drones", is relatively new to conservation biology but their use is growing in terrestrial vertebrate studies (Watts et al. 2010, Sarda-Palomera et al. 2012, Anderson and Gaston 2013) and also in marine mammal studies (Koski et al. 2009, Hodgson et al. 2010, Hodgson et al. 2013, Maire et al. 2013; O'Connor and Pomeroy 2013; Goebel e tal. *In review*). Unmanned aerial systems are popular because of their low cost, logistical convenience, and because they cause no visible disturbance for a wide variety of species including elephants, baboons and buffon kob (Vermeulen et al. 2013), rhinoceros (Mulero-Pazmany et al. 2014), Canada Geese and Snow Geese (Chabot et al. 2012), and Black-headed Gulls (Sardà-Palomera et al. 2012).

The use of UAS to survey pinnipeds is still in its infancy, but they have been successfully used to survey Arctic ice seals (Cameron et al. 2009) with no visible disturbance (NOAA 2009), and Antarctic pinnipeds (Goebel, Permit No. 774-1847, Perryman et al. 2013) with no observed behavioral response of Antarctic fur seals, Weddell seals, or leopard seals to a UAS flown above 23 m (75 ft) altitude (Perryman et al. 2013, Goebel et al. *in review*). As the number of studies that evaluate UAS utility and level of impact become increasingly available, it is likely that UAS use will become quite common.

Because the use of UAS as a tool to study marine mammals is recent, their use for Steller sea lion or northern fur seal surveys was not considered in the PEIS, although methods and potential effects on animals for aerial survey and land- or skiff-based observations were considered and the effects were found to be negligible. The use of UAS are to supplement or replace current techniques used to survey Steller sea lions, so do not represent an increase in the scope or magnitude of effects on numbers of animals. Thus, potential effects can be evaluated compared to those of methods previously considered in the PEIS.

The PEIS described methods and potential effects of using manned aircraft for aerial surveys, typically flown at altitudes above 500 feet. Based on observed sea lion responses to aircraft conducting surveys with appropriate mitigation measures, disturbance rates appear to be negligible. While the potential effects to animals from the use of manned aircraft for aerial surveys can be used as an analogy to evaluate potential effects that may occur during the use of UAS, the differences between the two platforms indicate that with appropriate mitigation measures the risk of disturbance by UAS is significantly lower than that posed by manned aircraft. The potential effects on animals from using UAS as a tool to obtain images of previously marked animals can also be compared to current land- and skiff-based methods currently used to obtain those data. Reactions of animals to overhead or nearby objects result from them hearing or observing the object.

Due to the inverse square law, the sound level from an aircraft decreases exponentially in volume (intensity) as the aircraft increases in distance from the listener. Depending on atmospheric and geographic conditions, there is generally a 3 to 7 dBA (with an average of 5 dBA; dBA is a logarithmic unit) decrease in sound level for each doubling of distance, depending on the local topography and vegetation. Thus if an aircraft creates an 85 dBA impact at 1,000 feet, then as a rule of thumb it will create an 80 dBA impact at 2,000 feet or a

90 dBA impact at 500 feet. These are approximate numbers, and geographical features such as hills, cliffs, and adjacent vegetation, as well as strong winds and other ambient noise (e.g., waves along a shoreline) will affect the sound level from an aircraft source.

The type of aircraft is also a factor in how much noise is transmitted to an ear on the ground. For example, a Stinson floatplane with 250 hp Franklin engine at 1,000 feet might typically create an 82 dBA maximum noise level. Even in the most advantageous of conditions (e.g., interfering noise from wind, waves etc), the Stinson would have to be 5,000 to 6,000 feet away to reduce the sound level to be equivalent to the estimated 52 dBA of a DeHavilland Twin Otter aircraft (used for Steller sea lion surveys in Alaska) at 1,000 feet (Figure 2). Thus, while distance is important as an attenuation factor for aircraft noise, the type of aircraft is a more important factor than distance alone.

Noise profiles of a Twin Otter manned aircraft and two UAS (APH-22 hexacopter and the Aeryon Scout quad-copter) are shown in Table 1 and Figure 2. The Twin Otter data were published in van Polanen Petel et al. (2006). The APH-22 sound intensity data were recorded by W. Perryman (NMFS Southwest Fisheries Science Center) on 18 November 2011 in Orchard, Idaho. The University of Alaska Fairbanks (G. Walker, personal communication) measured the noise level of the Aeryon Scout quad-copter during a July 2011 UAF-BP Exploration Alaska experiment in Prince William Sound, Alaska. Mr. Walker also attempted to measure the sound intensity of the fixed wing, single engine Puma A/E plane (10 ft wingspan), which is quieter than the Aeryon Scout quad-copter. The acoustic measuring equipment readings varied with the orientation of the sensor to the wind much more than the presence of the Puma A/E in each direction. To qualitatively evaluate this effect, a flight at 200 ft altitude overhead was recorded on video; two people are talking in normal outside voices 5 ft from each other and 10 ft from the camera, and every word of the conservation is clear, the aircraft can be seen, but no sound from the aircraft is detectable.

Based on the information in Table 1 and Figure 2, the two types of UAS copters tested are both measurably quieter at altitudes greater than 75 ft than the current survey platform (Twin Otter) is at the previously permitted altitude of 700 ft (56 dBA). In addition, both of these UAS at the proposed altitudes are quieter than light ambient sound along the shoreline (1 ft waves, 5-8 kt wind at 54 dBA). The Puma A/E, an example of a fixed wing UAS, is quieter than either of the two copters at ground level, and would thus also likely be quieter at altitude than either UAS copter. UAS noise can rapidly diminish amongst ambient noise over an animal colony; the sound of an APH-22 hexacopter was indistinguishable while hovering at 30 m (98 ft) over a penguin colony (with an ambient noise level of 60-84 dBA; Goebel et al. *in review*).

An aircraft flying over Steller sea lions hauled out on land can cause disturbance due to visual perception of the aircraft. The silhouettes of two different UAS (APH-22 hexacopter, 1.8 ft (22 inches) between opposite motor centers; and a Puma A/E fixed wing, 10 ft wingspan) at various altitudes are compared with the Twin Otter manned aircraft (65 ft wingspan) at 700 feet (the approximate lowest survey altitude) and a Bald Eagle in Figure 3. To a sea lion hauled out on land, the silhouettes of an APH-22 at 19.4 ft, an eagle at 75.4 ft, and a Puma A/E at 108’ are identical in size to a Twin Otter at 700 ft altitude. At an altitude range of 150 and 250 ft, the APH-22 has a silhouette that is between 87% and 92% smaller (e.g., 8-13% the size) than that of a Twin Otter at 700 ft. Similarly, the Puma A/E has a silhouette that is between 28% and 57% smaller than that of a Twin Otter at 700 ft.

During March 2012, NMML in conjunction with the University of Alaska Fairbanks (UAF) used UAS as a trial survey platform for Steller sea lions (Fritz 2012). The NMML/UAF team conducted 39 flights surveying 16 Steller sea lion terrestrial haulouts in the Aleutian Islands (Table 1; Figure 2). Missions were flown under 525 ft in altitude when over land, and on approach to the sea lion haul-outs were generally less than 300 ft in altitude. UAS did not fly directly overhead of haulouts of Steller sea lions. Rather, animals on haulouts were photographed obliquely from just offshore, or were circled if haulouts occurred on small islands. Two types of UAS were tested during this cruise: the Aeryon Scout (Aeryon Labs, Inc.), a small battery-powered quad-copter with a flight duration of 20 minutes equipped with a GoPro high resolution real-time video/still camera on a gimbaled mount; and the Puma (AeroVironment, LLC), a fixed wing (10 ft wingspan) battery-powered aircraft with a flight duration of two hours equipped with real-time video as well as infra-red and visual still photo capability.

The Puma flew nine missions on eight days at nine sea lions sites. This aircraft was hand-launched from the vessel and was retrieved by landing it in the water. The Puma was a useful tool for scouting areas and approaches to animals that were near the research vessel but obscured by small hills. The Puma's infra-red camera located animals at one site that were initially not seen from the vessel. The Puma generally stayed above 200 ft and did not fly directly over animals. During Puma flights, no animal reactions (assessed as increased activity or looking up at the UAS) were observed, and no animals entered the water.

The Scout was the preferred survey platform because of its maneuverability, stability, ability to fly straight into to the wind, and the greater resolution of the camera payload. The Scout flew 30 missions on 10 days at 13 sea lion sites, and was launched from both the vessel and from land. Images obtained from the Scout flights were reviewed in detail to document any potential reaction of Steller sea lions to the presence of the UAS (Table 2; Figure 4). Potential reactions included an animal: a) looking at the UAS, b) moving either potentially directly in response to the UAS or in response to another animal that may have moved or vocalized as a potential direct response, and c) entering the water. While the exact altitude nor the distance offshore of each flight is not known for an associated photograph, observers and photo analysts recorded ranges of low (50-75 ft), medium (75-100 ft) and high (>100 ft) altitude. There were three survey flights by the Scout in each of the three altitude ranges.

The numbers of total animals reacting to the UAS were greater at low altitudes (23% of animals) than at either medium (2%) or high (1%) altitudes (Table 2, Figure 4). This was due to relatively high proportions of sea lions that potentially looked at or moved in response to the UAS (21%). Also, only at low altitudes did some sea lions move into the water (at the rate of 2%) potentially in response to the UAS (Table 2, Figure 4). During the six flights at medium or high altitudes, only 10 animals out of a total of 746 counted either looked at or moved potentially in response to the presence of the UAS (1.3%) and none left the haulout and entered the water (Table 2, Figure 4).

The PEIS evaluated potential effects on sea lions by activity based on a proportion of animals exposed that could be expected to react to an activity and result in serious injury or mortality. For aerial surveys flown with a Twin Otter manned aircraft over non-pups during the breeding or non-breeding season, the PEIS estimated that of the non-pups exposed, 5% would become alert, 1% would enter the water, and 0.01% would react strongly enough to become injured (Table 3). For UAS flights in general, based on the data obtained from the

Aeryon Scout photos (Table 2, Figure 4), reactions of sea lions to flights at 75 ft and higher (1.1-1.6% becoming alert, 0% entering the water) are substantially less than are expected to occur from manned aircraft surveys (5% becoming alert and 1% entering the water), and none would react strongly enough to become injured (Table 3). At low altitudes of 50-75 ft, a greater proportion of sea lions become alert to the UAS (20.8%) than to an aircraft at above 500 ft (5%, Table 3). However, because the mortality rate estimated by becoming alert to a survey aircraft in the PEIS is 0%, there is no increased risk of injury or mortality as a result of the greater number of animals reacting in this manner (just more 'takes' for permitting purposes).

At altitudes of 50-75 ft, 2% of the sea lions apparently entered the water due to presence of the UAS, compared with an estimated 1% due to manned aircraft (Table 3). The PEIS assigns an estimated mortality rate associated with entering the water of 0.01%. For an aerial survey using a manned aircraft, this is a rate of 1 potential mortality per 1 million sea lions surveyed, whereas the rate would be 2 potential mortalities per 1 million sea lions surveyed with a UAS at 50-75 ft, a negligible difference. As noted above, there is no potential for mortality associated with UAS flights above 75 ft altitude.

Though the Aeryon Scout did not fly directly over sea lions (as does a Twin Otter), reactions of sea lions to an over-flight by a UAS are not expected to be similar. Because the Aeryon Scout flew near sea lion haulouts outside of the breeding season, there are no data for pup reactions. However as with non-pups, it is expected the amount of potential disturbance by the UAS would be substantially less than that expected from a Twin Otter.

Similarly the PEIS evaluated potential effects on sea lions due to researcher presence in view of animals from skiffs or on land, as would occur while making observations for previously marked sea lions. The PEIS estimated that of non-pups exposed to vessel-based surveys during the non-breeding season, 100% would become alert, 30% would enter the water, and 0.01% would react strongly enough to become injured (Table 3). For UAS flights flown at any of the tested altitude ranges, based on data obtained from the Aeryon Scout photos (Table 2, Figure 4) these proportions are substantially less (Table 3). Thus, all expected reaction rates, and hence disturbance and potential effects on sea lions are substantially less than would occur using a UAS instead of skiff-based surveys for observing marked animals. Because the Aeryon Scout flew near sea lion haulouts outside of the breeding season, there are no data for pup reactions. However as with non-pups, it is expected the amount of potential disturbance by the UAS would be less than that expected from a skiff-based survey.

From the above analysis, operation of UAS near or above Steller sea lions at 50 ft of altitude is likely to result in negligible effects, but this is not necessarily a predictable threshold altitude. Based on other studies using UAS as a method to survey wildlife, the vertical or horizontal distance expected to elicit an animal response varies, and any observed responses so far have been minor (Table 4). When a UAS is flown at altitudes above 100 ft no behavioral responses have been recorded over a broad range of avian or terrestrial and marine mammal wildlife. For UAS at or below 100 ft, whether the presence of a UAS elicits any behavioral response likely depends upon a number of interrelated factors, including the type, size, sound production, and flight behavior of the UAS, factors affecting ambient noise such as wave action, wind speed and direction, and the presence of vocalizing animals, local topographic conditions, and species-level and individual behavioral variation. Pinniped behavioral reactions to UAS flown at 33-75 ft altitude (either overhead or horizontally-

displaced) have been minor, with small proportions of animals moving towards or into the water, becoming alert, or having no observable response (Table 4).

The UAS listed in Table 4 vary in size between 1.4-20 kg, placing them within UAS size-classes ranging from micro/nano (less than 5 kg) to mini/small (mini up to 5 kg, small less than 30 kg; Anderson and Gaston 2013). Thus there are a range of UAS options for researchers within these size classes that can be considered operationally similar for the purposes of this EA analysis.

The addition of UAS as a technique to survey Steller sea lions does not affect this species, or Steller sea lion Critical Habitat, in a manner or to an extent not previously considered. Rather, this technique appears to have less potential adverse impact than the aerial and vessel-based survey methods that were previously considered and approved.

4.4 Cumulative Impacts

Chapter 4 of the PEIS evaluates cumulative impacts of the Preferred Alternative, which includes all of the research methods proposed under Alternative 3 of this EA, with the exception of using UAS. That analysis of effects is incorporated by reference. The impacts of Alternative 3 are expected to be analogous to that of the Preferred Alternative of the PEIS.

The addition of UAS as a method for surveying Steller sea lions would not change the nature of effects for activities considered in the PEIS, and the potential impacts of UAS are likely lower than similar methods considered in the PEIS. Further, the number, scope, and magnitude of permit applications to conduct Steller sea lion research is lower than the levels anticipated by the PEIS, and the potential effects of activities are lower than estimated by the PEIS.

A major cumulative effect of research-related mortality was predicted for the endangered Western DPS of Steller sea lions, assuming a total permitted level of mortality of 15% of PBR (or 29.8 mortalities per year). When that level of permitted mortality is added to other sources of mortality and serious injury for the population, it sums to 104.9% of PBR. The predicted cumulative impact on the Eastern DPS of Steller sea lions, the Eastern Pacific Stock of northern fur seals, and the San Miguel Island stock of northern fur seals was negligible, assuming a total permitted level of mortality of 15% of PBR. The cumulative effects of sub-lethal impacts from research-related disturbance and handling are unknown. The PEIS predicted negligible cumulative impacts on other marine species and resources in the action area from implementing the Preferred Alternative.

Section 4.8.1 of the PEIS described an analytical framework for quantifying the intensity and probability of potential Steller sea lion responses to research activities, with accompanying risks of injury and mortality estimated for each type of research activity. This multistep process categorized potential responses to different types of research activities according to the intensity of an animal's response, because different responses can lead to mortality through a variety of known or suspected mechanisms for potential injury. For each type of research activity, potential mortality was calculated as a function of the mortality risk associated with an individual animal's response. This risk factor was then multiplied by the number of animals exposed to specific types of research under each alternative. Total

mortality was then calculated for all types of research activities for each alternative by adding the estimates from each activity table and for all permit applications. These totals were used to estimate the magnitude and intensity of the potential direct and indirect effects of research on mortality, and were compared to the threshold established in the PEIS Preferred Alternative.

The total potential estimated mortality for the combined permits authorizing Steller sea lion research could not exceed 15% of PBR under the PEIS Preferred Alternative. To quantitatively evaluate among effects of authorizing multiple research permits, the framework in the PEIS provided a means by which the estimated mortality due to research activities could be calculated. The effects of discontinuing this calculation can be considered by a step-down examination of the effects on estimated potential mortality as influenced by: a) the numbers of permits issued and pending (and thus takes permitted), b) numbers of actual takes recorded by permit holders versus the number of permitted takes, and c) whether the estimated effects of research activities on Steller sea lions in the PEIS have changed.

In 2007, nine permits were issued that authorized the direct and/or indirect research-related takes of Steller sea lions in the eDPS. The total potential estimated mortality of the combined research permits in the wDPS ranged between 29.5-30.0 per year over the three-year permit duration, or 13% of the PBR (in 2007 the wDPS PBR=234 sea lions). In the eDPS, the estimated potential mortality among 6 permits was 26.3-27.0 mortalities per year, or 1.4% of PBR (in 2007 the eDPS PBR=2,000 sea lions). These estimates assumed that all work would be accomplished, and all permitted takes utilized. Permit duration was limited to three years.

In 2009, five permits were issued that authorized the direct research-related takes of Steller sea lions in the wDPS, and five others authorized indirect sea lions takes incidental to research on other species. The newly-issued permits were given an expiration date of August 31, 2014. Assuming all permitted takes were exercised, the estimated potential mortality in the wDPS was projected to be at the most 6.4% of PBR (in 2009 the wDPS PBR=253 animals). In the eDPS, four permits were issued authorizing direct research takes, and another 5 authorized takes incidental to research on other species. In combination, the estimated potential mortality was 8.3%-12.4% of PBR (in 2009 the eDPS PBR=1,998 animals).

Since 2009, other permit applications were evaluated that involved potential takes of Steller sea lions incidental to research on other species in both the wDPS and eDPS populations, requiring periodic updates of the estimated potential mortality calculation. For the wDPS this was last done in 2011. Assuming all permitted takes are exercised, the estimated potential mortality in the wDPS was projected to range between 6.4-6.9% of PBR during 2012-2014. There are nine permits that authorize direct or indirect research takes of Steller sea lions in the eDPS through 2014, with associated estimated potential mortality (should all takes occur) in 2013 of 32 animals, or 1.4% of the 2013 PBR, and 16 animals, or 0.7% of the current PBR in 2014 (Fadely 2013).

In summary, the number of permits authorizing direct research on Steller sea lions, and the potential impact associated with a fully-realized implementation of the work authorized by those permits, has declined since the 2007 PEIS. Since 2007, the number of permits authorizing direct research takes of Steller sea lions dropped from nine to five (in 2009) in

the wDPS, and six to four (in 2009) in the eDPS. Only four permit applications have been received for Steller sea lion studies that would commence in 2014. In the wDPS, the estimated potential mortality for all permitted research activities as a percentage of PBR dropped from 13% (in 2007) to 6.4% (in 2009), and is currently at 6.4-6.9%. In the eDPS, the number of permits authorizing direct research takes of Steller sea lions dropped from six (in 2007) to four (in 2009), and the estimated potential mortality for all permitted research activities as a percentage of PBR changed from 1.4% (in 2007) to projections of 8.3-12.4% (in 2009), and is currently at 0.7-1.7% (for 2013-2014). All estimates were well under the 15% PBR maximum established by the PEIS Preferred Alternative for both the wDPS and eDPS populations.

The potential estimated mortality calculations assume that all authorized takes are exercised. During the risk analysis of Steller sea lion research activities proposed for new permits in 2009, it became apparent that to better understand potential impacts it is useful to reassess the risk initially estimated in 2007 for authorized research permits, based on subsequent reports of actual takes from available permit reports, and thus assess whether initial assessments accurately forecasted potential impacts to the population. In a review of permits issued in 2007 (Fadely 2009; 2010), it was found that the potential mortality risk estimated from reported takes was much lower than estimates from 2007 based on permit applications for both the western and eastern DPSs. The wDPS potential mortality risk was 90-96% less, and the eDPS risk was 92-98% less than estimated in 2007. For the two reporting periods available at that time, 20 potential mortalities were expected to be observed as a result of anticipated research activities in the wDPS, but based on reported activities the real exposure risk could have resulted in 0.6 observed mortalities, and one mortality was indeed reported. Similarly in the eDPS, 16 mortalities were potentially expected, but the real exposure could have resulted in 1.4 observed mortalities but none were observed. It is clear that the risk to Steller sea lion populations estimated from anticipated research expressed in permit applications was far greater than actually existed or occurred through the first two reporting periods.

The third factor to consider in discontinuing the estimated potential mortality rate calculation is whether the PEIS estimates of risk associated with research activities are still realistic. Since 2007, there have been efforts by researchers to directly measure impacts of their studies on Steller sea lions. Though no formal analysis has been conducted, it appears that risks are at least equal, and in some cases less, than were estimated in the 2007 PEIS. Two of the largest concerns of risks to sea lions involved the capture of adult females with dart-delivered sedatives, and disturbing rookeries to permanently mark pups for vital rates studies.

Among the largest risk factors of concern in the PEIS was the use of remotely-delivered sedatives to capture adult female Steller sea lions, which based on work in the 1990s was estimated to potentially result in a 3.4% observed mortality rate, and 1.1% post-capture mortality rate. During 2010-2012, NMML and ADFG attempted the capture of 17 adult female Steller sea lions in Southeast Alaska and the western-central Aleutian Islands. Of those, 9 were successfully handled and tracked for 19-267 days, with no indication of post-handling mortality based on tracking and resight efforts (the adult female transmitting for only 19 days was observed the next breeding season with a pup). All 8 sea lions that were darted but not handled were followed for up to 145 minutes to determine their responses.

There were four types of responses:

1) Sea lion was darted, entered the water, but then returned to land within minutes with no signs of sedation. In these cases, the dart likely did not deliver the sedative.
2) Sea lion was darted, entered the water and eventually returned to land where the effects of sedation were noticeable, and the sea lions were observed until those effects wore off.
3) Sea lion was darted, entered the water, showed signs of sedation but were able to surface and breathe. These sea lions were followed until signs of sedation discontinued (for up to 145 minutes).
4) Sea lion was darted, entered the water, and reversal agents were delivered via dart into the animal which then recovered and swam away.

In all cases the sea lions that were not darted were confirmed to have survived. While no capture procedure is without risk, currently the mortality rate for the dart-delivered captures (or darted and not-captured) of adult female Steller sea lions is 0%, much less than expected in the PEIS. This is in large part due to the use of better sedatives, which have reversible agents, than were available in the 1990s (Melin et al. 2013).

An analysis of Marmot Island (Alaska) data collected during 2000-2005 compared sea lion counts and behavior between years with and without researcher presence during the breeding season (Fritz et al. 2008; Wilson et al. 2012). During 2000-2005 there were three years with research disturbance and pup branding, and three years with no research disturbance. Count and behavioral data were modeled with and without disturbance as a factor in generalized linear models. Research disturbance was a significant factor in changes to the proportion of female sea lions resting and exhibiting aggression, and to an increase in males that were active for 1-5 days post-disturbance. These were the only adult female and male behaviors affected by research disturbance, whereas changes in pup or juvenile behaviors were unrelated to research disturbance. Any potential impact of research disturbance on attendance patterns was within the range of interannual variability for all age/sex classes, with the exception of territorial males with females during the first two branding years.

In 2007 researchers weighed and measured 50 pups on Marmot Island, but did not conduct branding operations. The Fritz et al. (2008) model was then extended to test this additional year of research disturbance without branding. Similar to findings for the 2000-2005 data, model analyses indicated that in 2007 counts of all age/sex classes were higher following the research disturbance than were predicted had no research disturbance occurred. There was less change in sea lion behavior than in previous years. However, in branding years behavioral and attendance changes were small and temporary, and research disturbances of any kind were well-within the ranges observed in non-research disturbance years.

Since 2007, the amount of takes authorized for research on Steller sea lions has decreased, and along with that decrease the risk to the populations has also declined. The full scope of the research proposed, in terms of takes and thus overall disturbance and impact to Steller sea lion individuals and populations was far less than authorized, and much less than the PEIS preferred alternative, due both to the limited implementation of proposed research and because the effects reported by permit holders were much less than estimated in the PEIS. Thus, discontinuing the calculations of potential estimated mortality during the review process for research permit applications would not be expected to result in an increased risk

to Steller sea lions. Similarly, the levels of research on northern fur seals have remained steady or decreased, while reports of observed mortality were less than predicted by the PEIS.

NMFS regulations implementing the MMPA for issuance of permits require the applicant to demonstrate that their proposed activity by itself or in combination with other activities, will not have a significant adverse impact on the species or stock (50 CFR 216.34). The ESA requires that NMFS find issuance of a permit will not operate to the disadvantage of the species (section 10(d)) and will not jeopardize the continued existence of the species (section 7). In proposing to issue the five proposed permits, NMFS preliminarily determined, based on the information provided in the applications, and the analysis in the PEIS, that they would satisfy these statutory issuance criteria regarding impacts on the species.

5.0 Mitigation Measures

Section 4.7.4 of the PEIS outlines mitigation measures that are standard for permits issued by NMFS for the types of research proposed. That section is hereby incorporated by reference. All permits contain conditions specifying: the numbers and kinds (species, stock, age, sex) of marine mammals that may be taken; the qualifications and responsibilities of personnel operating under the permit; requirements for reporting, notification of field work, and coordination among permit holders. Permits also specify effective dates and terms for modification of the permit.

Permits issued by NMFS under the MMPA and ESA further contain mitigation measures that are specific to the taxonomic groups affected and the methods of research being used. These conditions are considered "best practices" and are often based on the researcher's own descriptions of their protocols. No additional mitigation measures specific to use of UAS for aerial survey are necessary. The mitigation measures standard for surveys by other platforms, as well as general measures for limiting adverse impacts during research, are adequate for UAS.

Given that animal responses to UAS vary due to local conditions and the type of UAS, the most effective mitigation measure to minimize disturbance is the use of an observer to monitor Steller sea lion responses and communicate with the UAS pilot. As this measure is already part of the permit applicants' protocols, there are no additional mitigation measures for the use of UAS as a method to survey sea lions beyond those that are part of the permit applicants' protocols, or that are required by Certificates of Authorization issued by the Federal Aviation Administration.

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7.0 Literature Cited

Allen, B.M. and R.P. Angliss. 2013. Alaska marine mammal stock assessments, 2012. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-245, 282 p.

Anderson, K. and K.J. Gaston. 2013. Lightweight unmanned aerial vehicles will revolutionize spatial ecology. Front Ecol Environ 11(3):138-146.

Bowen, D., L. Gage, D. Goodman, L. Lowry. 2008. Report of the Independent Review Panel on the National Marine Fisheries Service's Implementation of the Permit Program for Research: Steller Sea Lion and Northern Fur Seal Case Study.

Cameron, M., E. Moreland and P. Boveng. 2009. Testing a ship-based unmanned aerial aircraft system (UAS) for surveying the Bering Sea pack ice. NOAA Fisheries Alaska Fisheries Science Center Quarterly Report, April-May-June 2009: http://www.afsc.noaa.gov/Quarterly/amj2009/divrptsNMML4.htm

Chabot, Dominique, and David M. Bird. 2012. Evaluation of an off-the-shelf unmanned aircraft system for surveying flocks of geese. Waterbirds 35.1: 170-174.

Fadely, B., J. Sterling, L. Fritz, M. Lander, M. Rehberg, D. Johnson, L. Rea and T. Gelatt. 2008. Estimating capture and handling mortality risk to endangered juvenile Steller sea lions (*Eumetopias jubatus*). Alaska Marine Science Symposium, January 2008, Anchorage, Alaska. http://access.afsc.noaa.gov/pubs/posters/pdfs/pFadely04_ssl-mortality-risk.pdf

Fadely, B. 2009. Comparison of estimated research mortality risk to Steller sea lion populations based on initial permit applications and subsequent reports during June 2007- August 2008. Memorandum to John Bengtson, F/AKC3, June 16, 2009

Fadely, B. 2010. Closing the loop on research impact monitoring: potential research mortality risk to Steller sea lion populations in Alaska greatly overestimated actual exposure. Alaska Marine Science Symposium, January 2010, Anchorage, Alaska. http://access.afsc.noaa.gov/pubs/posters/pdfs/pFadely05_closing-loop-ssl.pdf

Fadely, B. 2013. Mortality estimate analysis for Steller sea lion takes incidental to research permit application File No. 17845. Memorandum to Kristy Beard, F/PR1

Fritz, L. 2012. By land, sea, and air: a collaborative Steller sea lion research cruise in the Aleutian Islands. NOAA Fisheries Alaska Fisheries Science Center Quarterly Report, January-February-March 2012. http://www.afsc.noaa.gov/Quarterly/jfm2012/divrptsNMML1.htm

Fritz, LW, E Kunisch, K Chumbley and D Johnson. 2008. Effects of research disturbance on behavior and attendance of Steller sea lions (*Eumetopias jubatus*) at a rookery in Alaska. Abstract, Alaska Marine Science Symposium, January 20-23, 2008, Anchorage AK.

Goebel, M.E., W.L. Perryman, J.T. Hinke, D.J. Krause, N.A. Hann, S. Gardner, and D.J. LeRoi. *In review*. A small unmanned aerial system for estimating abundance and size of Antarctic predators. Polar Biology: *in review*.

Hodgson, A.J., M. Noad, H. Marsh, J. Lanyon, E. Kniest. 2010. Using unmanned aerial vehicles for surveys of marine mammals in Australia: test of concept. Final Report to the Australian Marine Mammal Centre. 76 pp.

Hodgson, A., N. Kelly, and D. Peel. 2013. Unmanned aerial vehicles (UAVs) for surveying marine fauna: a dugong case study. PLOS One 8(11): 1-15.

Johnson, D.S. and L. Fritz. 2013. agTrend: An R package for estimating trends of aggregated abundance. Manuscript in review. http://alaskafisheries.noaa.gov/npfmc/PDFdocuments/conservation_issues/SSL/EstimateAbundanceTrends513.pdf

Koski, W.R., Allen, T., Ireland, D., Buck, G., Smith, P.R., Macrander, A.M., Halick, M.A., Rushing, C., Sliwa, D.J., McDonald, T.L., 2009. Evaluation of an unmanned airborne system for monitoring marine mammals. Aquatic Mammals 35, 347.

Maire, F., L. Mejias, A. Hodgson, and G. Duclos. 2013. Detection of dugongs from unmanned aerial vehicles. *In* Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems, Tokyo Big Sight, Tokyo. (*In Press*).

Melin, S. R., Haulena, M., Bonn, W., Tennis, M. J., Brown, R. F., & Harris, J. D. 2013. Reversible immobilization of free-ranging adult male California sea lions (*Zalophus californianus*). Marine Mammal Science, 29(4), E529-E536.

NMFS (National Marine Fisheries Service). 2007. Steller sea lion and northern fur seal research final programmatic environmental impact statement. National Marine Fisheries Service, Silver Spring, MD. http://www.nmfs.noaa.gov/pr/pdfs/permits/eis/fpeis.pdf

NMFS (National Marine Fisheries Service). 2008. Recovery Plan for Eastern and Western Distinct Population Segments of Steller sea lion (*Eumetopias jubatus*). Revision. National Marine Fisheries Service, Silver Spring, MD. 325 pp.

NMFS (National Marine Fisheries Service). 2013. Status Review of The Eastern Distinct Population Segment of Steller Sea Lion (*Eumetopias jubatus*). 144pp + Appendices. Protected Resources Division, Alaska Region, National Marine Fisheries Service, 709 West 9th St, Juneau, Alaska 99802.

NOAA. 2009. Ship-based unmanned aircraft system (UAS) surveys of the Bering Sea pack ice from the NOAA ship *McArthur II* (NOAA cruise: MC2-09-02). 249 pp. http://cires.colorado.edu/science/groups/weatherhead/documents/IceSealMissionFinalReport.pdf

Perryman, W., Ash, LCDR N., LeRoi, D., Gardner, S., Goebel, M. 2013. Evaluation of Small Unmanned Aerial Systems as Tools for Assessment of Krill Predators in the Antarctic-Final

Report, 23. http://swfsc.noaa.gov/textblock.aspx?Division=PRD&ParentMenuId=211&id=18412

O'Connor, L. and P. Pomeroy. 2013. A UAV-based system for capture-mark-recapture of grey seals in the UK. SMRU, Scottish Oceans Institute, University of St Andrews, Fife, UK KY16 8LB.

Sarda-Palomera, F., Bota, G., Vinolo, C., Pallares, O., Sazatornil, V., Brotons, L., Gomariz, S., Sarda, F., 2012. Fine-scale bird monitoring from light unmanned aircraft systems. Ibis 154, 177-183.

van Polanen Petel, T. D., J. M. Terhune, et al. (2006). An assessment of the audibility of sound from human transport by breeding Weddell seals (*Leptonychotes weddellii*). Wildlife Research 33(4): 275-291.

Vermeulen, Cédric, Philippe Lejeune, Jonathan Lisein, Prosper Sawadogo, and Philippe Bouche. 2013. Unmanned aerial survey of elephants. PloS one 8.2 (2013): e54700.

Watts, A.C., Perry, J.H., Smith, S.E., Burgess, M.A., Wilkinson, B.E., Szantoi, Z., Ifju, P.G., Percival, H.F., 2010. Small Unmanned Aircraft Systems for Low-Altitude Aerial Surveys. Journal of Wildlife Management 74:1614-1619.

Wilson, K., L. Fritz, E. Kunisch, K. Chumbly, and D. Johnson. 2012. Effects of research disturbance on the behavior and abundance of Steller sea lions (*Eumetopias jubatus*) at two rookeries in Alaska. Mar. Mammal Sci. 28: E58-E74.

Table 1. Sound intensity measurements (in dBA) of a Twin Otter manned aircraft, an APH-22 hexacopter UAS, and an Aeryon Scout quad-copter UAS. Twin Otter data from van Polanen Petel et al. (2006). APH-22 data from W. Perryman (personal communication, NMFS SW Fisheries Science Center); Scout and ambient data from G. Walker (personal communication, University of Alaska Fairbanks); ambient sound was 10 ft away from the shoreline with 1 foot waves and a light wind (5-8 kts).

	Sound Intensity (dBA)				
			UAS		
	Ambient		APH-22	Scout	
Altitude (ft)	Sound	Aircraft Twin Otter	Video	Still	
10	55				
16					66
20					65
36					61
50			58	60	
52					53
100		68	54	56	
150			50	54	
200			48	50	
500		58			
1500		45			

Table 2. Tabulation of potential responses of Steller sea lions to the presence of the Aeryon Scout UAS during research test flights in March 2012. Altitude ranges: low: <75 ft; medium: 75-100 ft; high: >100 ft. Flushed=moved off land into water; Looked/Moved=looked at or potentially moved but remained on land; Total=sum of flushed and looked/moved; Count=sea lions counted on photographs analyzed.

Site	Altitude Range	Flushed	Looked/Moved	Total	Count
Rat/Krysi	Low	5	91	96	96
Seguam/Finch Point		8	42	50	535
Attu/Cape Wrangell		0	5	5	32
Total		13	138	151	663
Percent of total reactions		2.0%	20.8%	22.8%	
Amchitka/Column Rocks	Medium	0	0	0	9
Salt		0	3	3	175
Amchitka/East Cape		0	3	3	196
Total		0	6	6	380
Percent of total reactions		0.0%	1.6%	1.6%	
Kanaga/Ship Rock	High	0	2	2	163
Seguam/Finch Point		0	1	1	100
Kavalga		0	1	1	103
Total		0	4	4	366
Percent of total reactions		0.0%	1.1%	1.1%	
Total	Med-High	0	10	10	746
Percent of total reactions		0.0%	1.3%	1.3%	
Total	ALL	13	148	161	1409
Percent of all reactions		0.9%	10.5%	11.4%	

Table 3. Comparison of measured non-pup, non-breeding season, proportional Steller sea lion responses to UAS (Aeryon Scout quad-copter) surveys by altitude category (from Table 2) and PEIS estimated proportion of animals affected for aerial (manned aircraft) and vessel (skiff-based) surveys.

Type of effect (sea lion response)	Research Activity		UAS survey altitude		
	Aerial survey	Vessel survey	50-75 ft	75-100 ft	>100 ft
Alert (looked or moved)	5.0%	100%	20.8%	1.6%	1.1%
Entered water	1%	30%	2.0%	0%	0%
Injured during disturbance	0.01%	0.01%	0%	0%	0%

Table 4. Survey of wildlife responses to UAS presence reported in the literature.

Animal	UAS altitude	UAS type	Animal response	Study
Canada Goose Snow Goose	600 ft	CropCam	None	Chabot and Bird 2012
Black-headed Gull	98-131 ft (30-40 m)	Multiplex Twin Star II	None	Sardà-Palomera et al. 2012
Gentoo Penguin Chinstrap Penguin	49-197 ft (15-60 m)	APH-22 hexacopter	None	Goebel et al. *in review*
Elephant Baboon Bufon kob	328 ft (100 m)	Gatewing x100	None	Vermeulen et al. 2013
Rhinoceros	102-784 ft (31-239 m)	Easy Fly St-330	None	Mulero-Pazmany et al. 2014
Dugong	500 ft	ScanEagle	None	Hodgson et al. 2013
Ribbon seal Spotted seal	300 ft	ScanEagle	None	NOAA 2009
Weddell seal Leopard seal	75 ft	APH-22 hexacopter	None	Perryman et al. 2013; Goebel et al. *in review*
Grey seals on haulouts of mostly males	33-131 ft (10-40 m)	Hexacopter	No response at 30 m (98 ft), some heads-up at 20 m (66 ft) range, movement towards water when UAS <10 m (33 ft) above haulout.	O'Connor and Pomeroy 2013
Grey seals adult females on rookeries	33-131 ft (10-40 m)		Awareness (heads-up, pup-checking) at up to 30 m (98 ft) vertical distance, and for an *n*=1 at 10 m (33 ft) moved around pup.	
Antarctic fur seal	75 ft	APH-22 hexacopter	None	Perryman et al. 2013; Goebel et al. *in review*
Steller sea lion	200 ft	Puma A/E	None	Fritz 2012
	>100 ft	Aeryon Scout quad-copter	1% alert	
	75-100 ft		1.6% alert	
	50-75 ft		20.8% alert 2% enter water	

Figure 1. Types of UAS referred to in application. Top: Aeryon Scout being prepared for flight in the wheelhouse of the M/V *Norseman* (*University of Alaska photo*). Middle: AeroVironment Puma AE being prepared for launch (*Keith Cunningham, University of Alaska Fairbanks photo*). Bottom: NOAA APH-22 hexacopter (*Wayne Perryman, NOAA photo*).

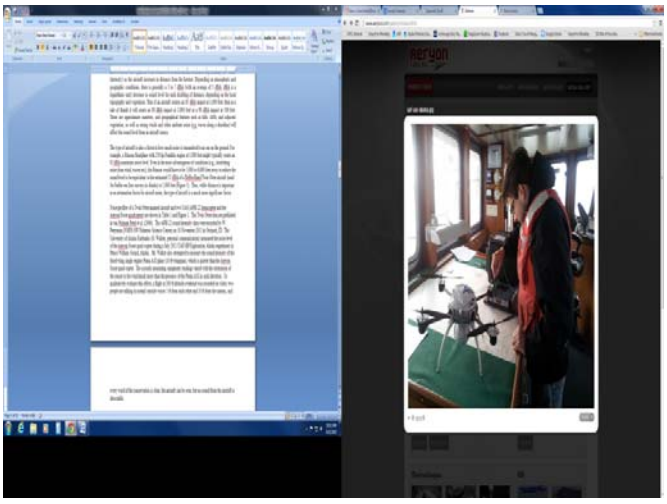

Figure 2. Sound intensity (dBA) of three aircraft at different altitudes. The aircraft are (1) deHavilland Twin Otter DHC-6 manned aircraft; (2) APH-22 hexacopter unmanned aircraft system (UAS) taking video or still images (autofocus camera); and (3) Aeryon Scout quad-copter UAS. Twin Otter data obtained from van Polanen Petel et al. (2006). APH-22 hexacopter data from W. Perryman (NMFS SW Fisheries Science Center). Aeryon Scout and ambient data from G. Walker (University of Alaska Fairbanks).

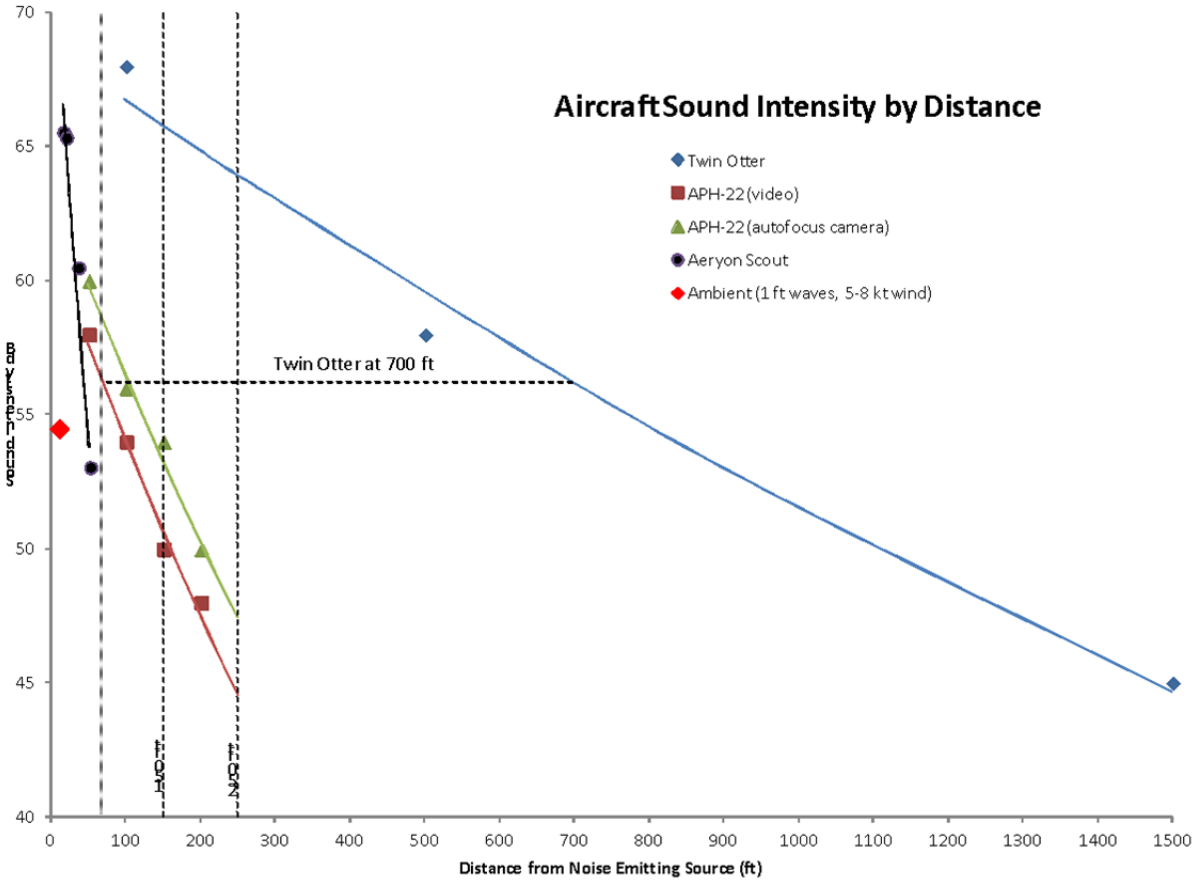

Figure 3. Comparison of silhouettes of Twin Otter manned aircraft (65 ft wingspan), an APH-22 UAS (1.8 ft diameter), a Puma A/E UAS (10 ft wingspan), and a bald eagle (7 ft wingspan). To a sea lion, the silhouettes of an APH-22 at 19.4 ft, an eagle at 75.4 ft, and a Puma A/E at 108’ are identical in size to a Twin Otter at 700 ft altitude. The APH-22 at 150 ft and 250 ft has a silhouette 87% and 92% smaller (e.g. 8-13% the size), respectively, than that of a Twin Otter at 700 ft. The Puma A/E at 150 ft and 250 ft has a silhouette 28% and 57% smaller, respectively, than that of a Twin Otter at 700 ft.

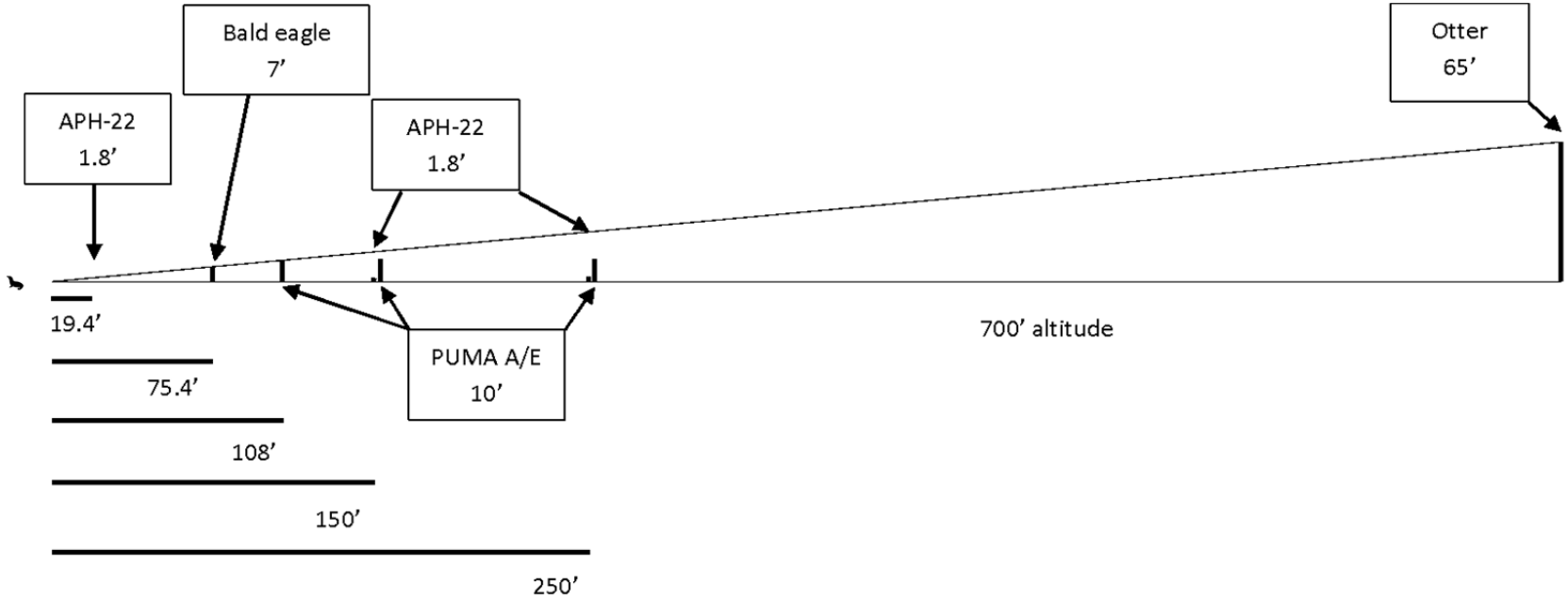

Figure 4. Disturbance rates of Steller sea lions during UAS Scout flights at three altitude ranges. All flights were offshore of animals hauled out on land; no flights were directly over animals on land.