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Draft Supplemental Environmental Impact Statement

Management of the subsistence harvest of northern fur seals on St. George Island, Alaska

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For

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Lead Agency:	**National Oceanic and Atmospheric Administration** **National Marine Fisheries Service** **Alaska Region** **Juneau, Alaska**
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Abstract: The National Marine Fisheries Service (NMFS) proposes to improve the management of the subsistence harvest for the Eastern Pacific stock of northern fur seals (*Callorhinus ursinus*). NMFS, in conjunction with the Pribilof Island Aleut Community of St. George Island, Traditional Council, is proposing new management measures that (1) provide harvest flexibility, (2) use both Alaska Native and scientific experience to develop best harvest practices, and (3) create firm regulatory measures to conserve the fur seal population and maintain sustainable subsistence harvest on St. George Island consistent with the community's subsistence needs. NMFS and the Traditional Council would continue to co-manage the harvest consistent with new regulatory controls to reduce the accidental killing of females, reduce localized harvest pressures, and prohibit harvest at small breeding areas. The new subsistence management regime would maintain the existing range of permissible subsistence harvest, allow a portion of the harvest to be comprised of young of the year male fur seals consistent with traditional practices, reduce impacts to females, reduce harassment to non-target seals, and schedule harvesting to promote scientific coordination and monitoring.

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Executive Summary

This Supplemental Environmental Impact Statement (SEIS) supplements the Final Environmental Impact Statement for Setting the Annual Subsistence Harvest of Northern Fur Seals on the Pribilof Islands (NMFS 2005). NOAA's National Marine Fisheries Service (NMFS) decided to prepare this SEIS because the proposed action makes substantial changes to the action analyzed in the 2005 EIS. The action analyzed in the 2005 EIS was setting the annual Pribilof Islands northern fur seal (*Callorhinus ursinus*) subsistence take ranges as required by regulations. The 2005 action was limited to the subsistence take of sub-adult male seals. The action established the subsistence take range for St. Paul Island at 1,645 - 2,000 seals and the subsistence take range for St. George Island at 300-500 seals. The 2005 EIS concluded that subsistence harvests within these ranges would have minimal effect on the northern fur seal stock and meet the documented subsistence needs of the Pribilovians on St. Paul and St. George Islands. In September 2006 the Pribilof Island Aleut Community of St. George Island, Traditional Council (Council) petitioned NMFS to change the northern fur seal subsistence harvest regulations to allow them to renew a harvest of up to 150 male young of the year fur seals as part of the permissible take of 300-500 seals annually. The proposed action would revise the harvest regulations consistent with the Council's petition.

The purpose of the proposed action is to conserve northern fur seals and manage the subsistence harvest of fur seals on St. George Island for their long-term sustainable use for purposes of cultural continuity, food, clothing, arts, and crafts. This proposed action is necessary to fulfill Federal trust responsibilities under the Marine Mammal Protection Act (MMPA) and Fur Seal Act (FSA). These trust responsibilities include the conservation of northern fur seals and the regulation of the subsistence harvests by Alaska Natives when the species used for subsistence purposes is listed as depleted under the MMPA. The proposed action would change the management of the subsistence harvest on St. George Island in response to the three significant aspects of the Traditional Council's petition: (1) allow for the taking of male young of the year northern fur seals during a separate autumn season of each year within the already established upper harvest level of 500 fur seals; (2) reduce the harvest concentration at designated breeding areas or hauling grounds on St. George Island; and (3) eliminate obsolete requirements for subsistence harvesters to cooperate with scientists during the subsistence harvest. The proposed action would also incorporate new conservation controls intended to reduce female harvest mortality, prohibit harvests at breeding locations when the most recent pup production estimate has fallen below a level which can sustain a harvest, reduce concentration of harvest effort at locations closer to the village or road access, and encourage the development of best harvest practices through the co-management structure. The proposed action does not change any restrictions related to the subsistence harvest of northern fur seals on St. Paul Island.

NMFS manages the subsistence harvest of northern fur seals in the Pribilof Islands under Federal regulations (at 50 CFR 216.71-74) established under the FSA and the MMPA in 1985. Under these regulations, harvests on the islands of St. Paul and St. George are managed independently, and the taking of northern fur seals for subsistence purposes is restricted to a season from June 23 to August 8 each year. Experienced sealers using the traditional harvesting methods are allowed to harvest from two of the nine available haulout areas on St. George Island. Neither haulout area may be harvested more than twice per week.

St. George Island is a remote island located in the Bering Sea where residents rely heavily on a subsistence lifestyle for food and basic resources for the creation of authentic native handicrafts. Alaska Natives from St. George Island have a long history of harvesting fur seals for subsistence purposes, prior to and after the United States' purchase of Alaska in 1867. St. George residents participated in commercial harvests of fur seals on behalf of the U.S. on St. George from 1868 to 1972. From 1973

through 1975, the U.S. prohibited the St. George commercial harvest of fur seals for their pelts in order to conduct research on the population dynamics and effects of harvesting. From 1973 to 1984, NMFS continued and expanded fur seal studies on the Pribilof Islands. Because the U.S. government had prohibited the seal harvest on St. George since 1973, they provided some excess fur seal meat to St. George residents from the St. Paul commercial harvest. Between 1976 and 1979, NMFS allowed the subsistence harvest on St. George to occur at limited locations. From 1980 to 1984, NMFS allowed St. George to conduct an annual subsistence harvest every Tuesday and Friday beginning July 8 until 350 seals had been harvested from Northeast hauling ground. In 1985, NMFS implemented an emergency subsistence harvest rule which changed the harvest management. Chapter 4 provides additional background information on historic subsistence harvest and management.

The Council submitted a tribal resolution on September 28, 2006 to NMFS indicating the community was allowed by the Federal Government in the past to harvest male fur seal young of the year in the autumn for subsistence purposes, and requested that NMFS change the subsistence harvest regulations to allow residents of St. George the opportunity to meet their traditional subsistence need. On April 23, 2010, NMFS published a notice of receipt of a petition (i.e., the tribal resolution) from the Council to revise the subsistence regulations for St. George Island to allow taking male northern fur seal young of the year during an autumn season (75 FR 21233). NMFS received no comments on the notice. Subsequently, NMFS worked with the Council to clarify the petition to define the second harvest season from September 16 to November 30, to discuss young of the year harvest methods and areas, and to outline the process to proceed with rulemaking. NMFS held scoping meetings in St. George and Anchorage, Alaska to consider possible harvest alternatives to the alternative proposed by the Council. The alternatives considered during scoping included a no action alternative as well as the alternative to harvest male young of the year during the autumn at all known and accessible resting areas and expand the available sub-adult male harvest locations to include those locations where seals were harvested commercially from 1876-1972. During the 60-day public comment period, NMFS received scoping input during the St. George Island community meeting and two letters supporting the Council's petition for traditional cultural and customary use of marine mammals by Aleuts (NMFS 2012). NMFS received no scoping input during the public meeting in Anchorage (NMFS 2012).

The Pribilof Islands and the surrounding Bering Sea marine environment support high concentrations of marine mammals, seabirds, fish, and invertebrates. All of these marine resources are used for subsistence purposes by residents of the Pribilof Islands. Subsistence resources are utilized as they are seasonally available, and often have complex spiritual and cultural underpinnings regarding when and how resources are collected and used. Pribilovians consume more fur seal meat than any other subsistence resource, and other species are not available at the same time to replace fur seals as a food source. NMFS has not identified any other resources that would be impacted by the alternatives due to (1) fur seals occupying consistent habitat where other species are seldom found and (2) the selective harvest methods used. The subsistence harvest occurs on land, using commercial harvest methods developed during more than 80 years of management and monitoring by the U.S. government. This analysis focuses on the potential impacts to northern fur seals and St. George residents subsisting on northern fur seals.

Alternatives

The alternatives considered include the following:

Alternative 1 *(Status Quo): Maintain existing management of the northern fur seal harvest on St. George Island (seasonal, age, sex, and location restrictions in 50 CFR 216.72).*

NMFS restricts the current subsistence harvest to sub-adult male fur seals 124.5 cm or less in length, and prohibits any taking of adult fur seals or pups. The regulations also prohibit the intentional (but not accidental) taking of sub-adult female fur seals. Federal regulations at 50 CFR 216.72 require NMFS to publish estimated harvest ranges for meeting the subsistence needs of each island every three years, and establish the period between June 23 and August 8 of each year, during which fur seals may be taken for subsistence purposes. For St. George, the current harvest range is 300-500 seals which can only occur two times per week at Northeast and Zapadni hauling grounds (see Figure 1).

Alternative 2*: (Preferred Alternative) Modify the management to allow for a regulated harvest of male northern fur seals to meet the subsistence needs described in the petition of the Pribilof Island Aleut Community of St. George Island, Traditional Council, and implement new conservation controls.*

Alternative 2 would modify the current harvest management regime to (1) create a second harvest season in the autumn for taking up to 150 young of the year male northern fur seals, such that the total allowable harvest range of 300-500 fur seals does not increase, (2) add a new conservation control to prevent more than three females from being killed during the harvest, (3) add a new conservation control to allow harvests only at those breeding areas capable of sustaining a harvest, and (4) encourage the development of best harvest practices within the co-management structure to minimize sub-lethal effects to seals not harvested.

Alternative 3*: Modify the management to allow for a regulated harvest of male young of the year northern fur seals and no harvest of sub-adult male northern fur seals and implement new conservation controls allowing up to ten female fur seals to be killed.*

Alternative 3 would modify the northern fur seal subsistence harvest to (1) create a harvest season in the autumn for taking of up to 500 young of the year male northern fur seals, (2) reduce the subsistence harvest of sub-adult male northern fur seals to zero, (3) add a new conservation control to prevent more than 10 females from being killed during harvest, (4) add a new conservation control to allow harvests only at those breeding areas capable of sustaining a harvest, and (5) encourage the development of best harvest practices within the co-management structure to minimize sub-lethal effects to seals not harvested.

Alternative 4*: Modify the management to allow for a regulated harvest of male northern fur seals to meet the subsistence needs described in the petition of the Pribilof Island Aleut Community of St. George Island, Traditional Council and implement new conservation controls allowing up to twenty female fur seals to be killed.*

Alternative 4 would modify the northern fur seal subsistence harvest to (1) create a second harvest season in the autumn for taking of up to 50 young of the year male northern fur seals, such that the total allowable harvest range of 300-500 fur seals does not increase, (2) add a new conservation control to prevent more than 20 females from being killed during harvest, (4) add a new conservation control to allow harvests only at those breeding areas capable of sustaining a harvest, and (4) encourage the development of best harvest practices within the co-management structure to minimize sub-lethal effects to seals not harvested.

Major Conclusions

This SEIS analyzes the direct, indirect, and cumulative impacts of four alternatives for managing the subsistence harvest of northern fur seals on St. George Island. It provides recent information on the population status and the effects of harvesting either 50, 150, or 500 male young of the year fur seals out

of the previously evaluated harvest range of 300-500 fur seals (NMFS 2005). The SEIS analyzes the effects of not concentrating the harvest in one season or location. NMFS considered the level of impacts of the lethal effects of the harvest as well as any potential sub-lethal effects (i.e., changes in behavior or reproduction that are not directly fatal). The preferred alternative would result in the death of up to 500 fur seals for subsistence purposes, of which up to 150 would be male young of the year and up to 350 would be male sub-adult fur seals. If harvesters accidentally kill female fur seals during the harvest, those deaths would count against the total quota of 500, and the preferred alternative would terminate the subsistence harvest if three females are killed. The preferred alternative would use the pup production and trend information at each breeding location to evaluate the statistical probability of pup production falling below a level that is necessary for long-term stability.

The analysis also demonstrates that none of the alternatives would result in sub-lethal effects that would cause a population decline. NMFS defines sub-lethal effects as any potential direct effects that do not cause death. Such sub-lethal effects may include changing activity patterns, departure from land into the water, being herded inland by harvesters and not being selected for harvest, or injury ultimately resulting in a reduction in reproductive rates. Sub-lethal effects occur incidental to the harvest and affect those fur seals not harvested. Non-harvested fur seals are affected sub-lethally as a result of changes in behavior or displacement from habitat due to harvest harassment which uses energy otherwise used for growth, reproduction, and survival. Alternative 3 would result in the highest harvest of young of the year and may expose the highest number of seals to sub-lethal effects of any alternative. Alternative 3 would result in the exposure of up to a few thousand seals to sub-lethal effects that we estimate may be equivalent to between 0.15 and 4.5 additional mortalities. By comparison, the preferred alternative would result in the equivalent of less than one death due to sub-lethal effects. Given the very small level of anticipated sub-lethal effects under any of the alternatives, the analysis focuses on the direct lethal effects on the northern fur seal population. We have no evidence or indication that subsistence harvests of up to 500 male fur seals, less than 4 years old and distributed in time and space as described in any of the alternatives, would have any detectable effects on the reproduction rate or sustainability of the St. George fur seal population.

None of the alternatives would change the process for setting lower or upper harvest limits based on the subsistence needs of St. Paul and St. George as described in 50 CFR 216.72(b). Currently, NMFS reviews the harvest regulations every three years and sets the harvest limits based on the communities' reported subsistence need. This would remain the same under any the proposed alternatives.

	Alternative 1, Status quo	Alternative 2, Preferred	Alternative 3	Alternative 4
Direct / Indirect Effects				
Mortality *Sub-adult males*	Mortality of up to 500 sub-adult male fur seals	Mortality of up to 350 sub-adult male fur seals	No sub-adult males will be harvested.	Mortality of up to 450 sub-adult males
Young of the year males	No young of the year harvest	Mortality of up to 150 young of the year male fur seals	Mortality of up to 500 young of the year male fur seals	Mortality of up to 50 young of the year male fur seals
Females	No limit on sub-adult female mortality, Adult female mortality prohibited	Mortality of up to 3 female fur seals (adult, sub-adult or young of the year)	Mortality of up to 10 female fur seals (adult, sub-adult or young of the year)	Mortality of up to 20 female fur seals (adult, sub-adult or young of the year)
Effect on population relative to other Alternatives	Minor to moderate effect relative to potential biological removal (PBR) and greater effects than other alternatives	Minor to moderate effect relative to PBR, greater effects than Alt. 3, less than Alts. 1 and 4	Minor to moderate effect relative to PBR, least effects of all alternatives due to higher natural mortality of young of the year compared to sub-adults	Minor to moderate effect relative to PBR, less effect than Alt. 1, greater than Alts. 2 and 3
Geographic Extent	Moderate, concentrated at Northeast and Zapadni hauling grounds	Minor, harvest is distributed equally among all breeding grounds	Minor, harvest is distributed equally among all breeding grounds	Minor, harvest is distributed equally among all breeding grounds
Sub-Lethal Effects	~1,025 sub-adult males exposed to effects	2,000 to 17,000 fur seals exposed to effects	2,000 to 55,000 fur seals exposed to effects	1,500 to 6,000 fur seals exposed to effects
Conservation Objectives	Continued contribution towards conservation objectives, less than Alts. 2, 3, and 4	Continued contribution towards conservation objectives	Continued contribution towards conservation objectives, less than Alts. 2 and 4	Continued contribution towards conservation objectives
Subsistence	Reduced flexibility and opportunity	Beneficial effects relative all other alternatives	Beneficial compared to Alt. 1, less than Alts. 2 and 4	Beneficial compared to Alt. 1, less than Alt. 2 greater than 3
Co-Management	Adverse effects	Beneficial effects relative to all other alternatives	Beneficial effects, less than Alts. 2 and 4	Beneficial effects, less than Alt. 2, more than Alt. 3

The preferred alternative has been developed in consultation with the Council and local subsistence users over the past 7 years. The preferred alternative would provide flexibility for the Council and NMFS to co-manage the subsistence harvest of male sub-adult and young of the year fur seals. The preferred alternative would allow the Alaska Native residents of St. George Island the opportunity to meet their subsistence needs to obtain fresh meat and natural resources for handicrafts from September 16 through November 30 each year in addition to the current harvest period from June 23 to August 8. The magnitude of effects from the proposed modified subsistence harvest is considered minor to moderate in comparison to the level of potential biological removal (PBR) calculated for the St. George fur seal population. An exclusively male subsistence harvest affects the population directly by removing seals. These effects are not significant because of the natural excess of males in the population (i.e., more males than necessary for reproduction) and the high natural mortality of seals prior to reaching adulthood. Furthermore, the effect on overall population growth from allowing a young of the year harvest as part of the harvest limit of 300-500 fur seals would actually be less than what is currently allowed for sub-adult males because a large proportion of male young of the year pups die from natural causes before they become reproductively mature. Thus, young of the year males have less influence on future population growth than sub-adult males. For example, at least 70% of young of the year do not survive to age 2 when they would become available for harvest as sub-adults under the status quo. The subsistence harvest will disturb unharvested seals at the harvest locations, but such effects are expected to be short-term changes in behavior.

The harvest of female fur seals, whether or not they are sexually mature, may have direct population-level adverse effects (see Section 3.7.1.1 for additional detail). Alternatives 2, 3, and 4 contain measures intended to limit the accidental mortality of females, thus ensuring sustainability of the population and continued subsistence harvest for future generations. Under Alternatives 2, 3, and 4 the harvest would be suspended if two, nine, and nineteen females, respectively, are accidentally taken during the annual harvest. NMFS would review the circumstances of the female deaths and could reinstate the harvest if, in consultation with the St. George Council, NMFS can determine measures to be implemented to improve detection and avoidance of females. If a third, tenth, and twentieth female is killed under Alternatives 2, 3, and 4, respectively, NMFS would terminate the harvest for the remainder of the year. The Council and NMFS would coordinate through the MMPA co-management process to identify best harvest practices to detect females as well as reduce effects on unharvested seals based on experience of the subsistence harvesters. While the subsistence harvest is a critical component of maintaining the traditions and culture that help define Alaska Native St. George residents, the Council has agreed that the most conservative approach in the Preferred Alternative to suspend (2 female mortalities) or terminate (3 female mortalities) the harvest is consistent with their petition and conservation of the fur seal population. Alternative 1 does not contain conservation measures that suspend harvest if sub-adult females are accidentally taken. Therefore, there is greater potential for females to be killed under the status quo than under any of the other alternatives.

The Alaska Native residents of St. George rely on a traditional subsistence lifestyle, consuming fur seals, sea lions, sea birds, fish, and berries, and utilizing the non-edible portions of marine mammals to create handicrafts (Veltre and Veltre 1981). The Council has indicated to NMFS that subsistence resources are not exchangeable on an equivalent basis. Each of these resources represents a significant seasonal contribution to the diet of local residents such that one cannot replace another. No subsistence resources provide an equivalent to other resources to meet cultural or dietary needs of St. George community residents. Sea birds and their eggs are consumed in the spring when they arrive, followed by fish as weather allows, and then fur seals are available. Fur seal availability on land declines to zero as they begin their winter migration and sea lions become increasingly available for consumption in the autumn, winter, and spring. NMFS's conclusion here regarding the importance of these subsistence resources is consistent with analyses described in the Steller sea lion and northern fur seal research Programmatic

Environmental Impact Statement (PEIS) (NMFS 2007b), and the northern fur seal harvest quota EIS (NMFS 2005).

While the analysis concludes that Alternatives 1 through 4 would have an insignificant impact on the eastern Pacific stock of northern fur seals, Alternative 2 is most consistent with the Council's petition and best balances meeting the subsistence need with conservation of the population. Alternatives 2 and 4 would improve the management of fur seals on St. George by increasing the opportunities to co-manage the subsistence harvest, allowing residents of St. George to reinitiate the important subsistence practice or harvesting young of the year, and increase the availability of fresh fur seal meat outside the current summer harvest season. Alternative 3 would allow residents of St. George to reinitiate a young of the year harvest, but would shift the availability of fresh fur seal meat outside the current summer harvest season to an autumn season from September 16 through November 30. Alternatives 2, 3, and 4 would improve the efficiency and duration of the harvest by creating a more cooperative partnership between scientists conducting fur seal research and harvesters collecting subsistence resources. The current regulatory requirements can result in delays in butchering and stunning while harvesters wait for scientists to collect some types of samples. The Council has asked that NMFS consider that co-management, if implemented as intended and currently operating, creates a partnership where subsistence needs during the harvest should be of equal priority rather than secondary to data collection for scientific investigations.

Areas of Controversy and Issues to be Resolved

The current subsistence harvest level of northern fur seals on the Pribilof Islands is not considered controversial, and neither are the proposed changes to the harvest regime. NMFS held two separate public comment periods on the measures described in the Council's petition. No comments were received during the public comment period to indicate there is a perception that the subsistence harvest of young of the year northern fur seals on St. George is adverse or that the issue is controversial. Conservation measures have been included in Alternatives 2, 3, and 4 to mitigate possible impacts on female fur seals and other unharvested seals, which include development of best harvest practices.

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1 Introduction

NOAA's National Marine Fisheries Service (NMFS) was petitioned by the Pribilof Island Aleut Community of St. George Island/Traditional Council (Council) to authorize the subsistence harvest of 150 young of the year male northern fur seals (*Callorhinus ursinus*) within the current harvest level of 500 established by NMFS (77 FR 6682; February 9, 2012). NMFS published a Federal Register notice (75 FR 21243; April 23, 2010) under the Administrative Procedure Act (APA) of the receipt of a rulemaking petition and opportunity for public comment. No public comments were received during the 60-day comment period. NMFS Alaska Region is conducting this National Environmental Policy Act (NEPA) analysis for management of the subsistence harvest of northern fur seals consistent with the petition and to support the regulatory revisions to allow St. George residents to meet their traditional subsistence needs by obtaining fresh meat and natural resources for the creation of handicrafts.

The subsistence harvest of northern fur seals on the Pribilof Islands is governed by regulations established under the Fur Seal Act (FSA) and Marine Mammal Protection Act (MMPA). Section 105(a) of the Fur Seal Act (FSA) authorizes the promulgation of regulations "with respect to the taking of fur seals on the Pribilof Islands…as [the Secretary] deems necessary and appropriate for the conservation, management, and protection of the fur seal population." 16 U.S.C. § 1155. Additionally, the Secretary of Commerce may enter into co-management agreements with Alaska Native Organizations under Section 119 of the MMPA to conserve and provide for the subsistence uses of marine mammals . NMFS works with the Council, guided by a co-management agreement (2001), to cooperatively implement subsistence harvest monitoring programs, marine debris clean-up, fur seal entanglement response, and fur seal habitat monitoring as resources allow. NMFS terminated the harvest on St. George in 1973, reinstituted a limited subsistence harvest in 1976, promulgated emergency subsistence harvest regulations in 1985, and finalized a new set of subsistence harvest regulations in 1986 (51 FR 24828, July 9, 1986). The subsistence harvest regulations remain the basis for managing and restricting the harvests of northern fur seals by the Pribilovians. These regulations require NMFS to publish estimated subsistence needs every three years, limit the harvest to sub-adult male fur seals 124.5 cm or less in length, limit the locations from which fur seals may be harvested on St. George Island during the breeding season from two non-breeding areas known as Northeast and Zapadni hauling grounds, and establish a period between June 23 and August 8 of each year during which fur seals may be taken for subsistence purposes.

The Council submitted a resolution on September 28, 2006 requesting that NMFS change the regulations to allow St. George residents to meet their customary and traditional subsistence needs. The Council submitted a letter dated April 8, 2010 requesting that NMFS allow subsistence harvests for sub-adult male fur seals at hauling grounds in addition to Zapadni and Northeast to ensure their ability to meet their subsistence needs during the breeding season. NMFS considered these, together with subsequent harvest reports submitted by the Council, to constitute a formal petition for rulemaking under the APA. In its resolution, the Council noted that the community was historically allowed by the Federal Government to take young of the year fur seals in the autumn for subsistence purposes. This is confirmed in government records from 1870-1980 when the harvest of young of the year was legal. The average annual harvest of young of the year on St. George Island was 1,477 from 1870-1890. The harvest of young of the year is prohibited in the current regulations. The likelihood that the current harvest regulations would not meet the subsistence needs of the residents of St. George Island was acknowledged by NMFS in July 1985 (50 FR 27814) and again in May 1986 (51 FR 17896). The Council requested NMFS to modify its regulations to allow the harvest of 150 male young of the year fur seal annually to meet the subsistence needs for the community of St. George Island. The upper level of the annual harvest need for 2011-2013 period for St. George is 500 seals (77 FR 6682; February 9, 2012), and would remain unchanged.

Residents of St. George Island face high and increasing costs for home heating fuel, electricity, gasoline, imported food, and other imported goods, and rely on subsistence resources as their only fresh meat source. This underlies the need to provide greater harvest management flexibility in the seasonal and geographic aspects of the harvest to meet the community's subsistence needs.

Northern fur seals occupy broad and predictable sections of the coast from May through December, which include breeding (often called "rookeries") and non-breeding (often called "hauling grounds") areas. All adult and young of the year fur seals occupy the rookeries during the breeding season. Adult fur seals generally occupy the same habitat on land during the breeding season (late June through August) and non-breeding season (September through early December). However during the breeding season territorial adult male fur seals force the sub-adult male seals from the breeding areas into hauling grounds, where the young males rest and socialize. During the non-breeding season all fur seals intermix and occupy both rookery and hauling grounds. As a result, after August all males, females, and young of the year occupy overlapping areas that were previously segregated by adult male territorial behavior. The complexity of fur seals' seasonal habitat use necessitates sufficient restrictions to ensure the harvest regulations adequately protect female fur seals from being accidentally harvested, and to keep important habitats occupied by adult fur seals during the breeding and non-breeding seasons from being disturbed any more than practical while allowing harvesters to meet their subsistence needs. As the fur seal population on the Pribilof Islands has continued to experience declines over the past 40 years, the smallest breeding areas may become so small that social and behavioral aspects of fur seal breeding ecology may become unpredictable. We do not know whether northern fur seals experience such unpredictability in breeding ecology, but we suspect, in theory, such minimum population sizes exist, and have included measures to address this in the preferred alternative.

During the early 1900s, prior to the signing of the Fur Seal Treaty, the Pribilof population of northern fur seals was smaller than it is today, and the population recovered. In fact, the population sustained an average harvest of 2,744 males on St. George during the first ten years after the Fur Seal Treaty was signed and the average number of pups born during the same 10-year period was 18,924. During this period 14.5% of the annual production was harvested. In comparison, the current subsistence proposal would authorize the harvest of up to 3% of annual production (500/16,184). Harvesters accidentally killed an average of 2 females per year from 1911-1920 on St. George, and along with the male harvest the population grew at an annual rate of about 9%. Therefore, NMFS concludes that the small subsistence harvest proposed in any of the alternatives would not limit the population from growing. NMFS determined it is prudent to protect small breeding areas because no extinct breeding areas on the Pribilof Islands have been recolonized since the population was reduced in the early 1900s. Northern fur seals exhibit strong site fidelity (Gentry 1998, Baker et al. 1995) and as a result are susceptible to overharvest of females at any given location. The behavioral tendencies of northern fur seals (Gentry 1998) create a situation where harvesting from small breeding areas could affect the local population; however the restriction of harvest to those breeding areas with pup production estimates and trends capable of sustaining a harvest addresses this theoretical concern.

1.1 Purpose and Need for Proposed Action

The purpose of the proposed action is to conserve northern fur seals and manage the subsistence harvest of fur seals on St. George Island for their long-term sustainable use for purposes of cultural continuity, food, clothing, arts, and crafts. The proposed action would change the management of the subsistence harvest on St. George Island in response to the three significant aspects of the Traditional Council's petition: (1) allow for the taking of male young of the year northern fur seals during a separate autumn season of each year within the already established upper harvest level of 500 fur seals; (2) reduce the

harvest concentration at designated breeding areas or hauling grounds on St. George Island; and (3) eliminate obsolete requirements for subsistence harvesters to cooperate with scientists during the subsistence harvest. The proposed action would also incorporate new conservation controls intended to reduce female harvest mortality, prohibit harvests at breeding locations when the most recent pup production estimate has fallen below a level which can sustain a harvest, reduce concentration of harvest effort at locations closer to the village or road access, and encourage the development of best harvest practices through the co-management structure.

This proposed action is necessary to fulfill Federal trust responsibilities under the MMPA and FSA. These trust responsibilities include the conservation of northern fur seals and the regulation of the subsistence harvests by Alaska Natives if, as is the case for northern fur seals, the species used for subsistence purposes is listed as depleted under the MMPA. NMFS's federal trust responsibilities under the MMPA and FSA include (1) the conservation of the eastern Pacific stock northern fur seals to ensure that any subsistence harvest does not adversely affect the northern fur seal population, (2) the regulation of the subsistence harvests by Alaska Natives given that the species used for subsistence purposes is listed as depleted, and (3) the recognition of the nutritional and cultural needs of Alaskan Natives on St. George Island to the fullest extent possible consistent with applicable law.

NMFS and the Traditional Council co-manage the subsistence harvest of northern fur seals on St. George under the MMPA. Co-management provides the mechanism and process for harvesters to communicate their subsistence needs, and also provides opportunities for scientific collaboration with NMFS. The co-management agreement between NMFS and the Traditional Council was signed in 2001 and includes guiding principles for a partnership with NMFS to provide full participation consistent with the law by the Traditional Council in decisions affecting the management of northern fur seals. Under the agreement, a co-management council comprised of NMFS and Traditional Council representatives is tasked with reviewing the applicable harvest regulations and making recommendations for appropriate changes to NMFS which would allow the Traditional Council to continue their customary and traditional use of fur seals consistent with long-term sustainability for future generations. The co-management council meets twice a year and considers the most recent statistical analysis of the biennial pup production estimates to determine which breeding areas can sustain a harvest. The Traditional Council's petition and this proposed action are a direct outcome of the co- management process. NMFS and the Traditional Council propose to use the flexibility of co-management to utilize both harvester and scientific experience to develop best harvest practices, while creating firm regulatory measures which conserve the fur seal population and sustainable subsistence harvests on St. George Island.

1.2 Description of Action Area

NMFS considers the geographic scope (i.e., the action area) of this EIS to be limited to St. George Island and its immediate surroundings due to northern fur seal site fidelity (repeated return to a site over years), philopatry (returning to the site of birth) and other aspects of their behavioral ecology.

The Pribilof Islands and the surrounding Bering Sea shelf and slope marine environment constitute a large marine ecosystem or domain (NRC 1996). The Pribilof Islands are located in the central Bering Sea, approximately 310 mi (500 km) west of the mainland and 185 mi (300 km) north of the Aleutian Chain. The Pribilof Islands support high concentrations of marine mammals, seabirds, fish, and invertebrates. This biodiversity and biological productivity results from the proximity of the islands to the continental shelf break, particularly nearby canyons, along with the general ecological complexity of the isolated island habitat and its assemblage of nearshore habitats, sea cliffs, beaches, sand dunes and coastal wetlands unique in the Bering Sea.

The Pribilof Island archipelago is made up of two larger, inhabited islands, St. George and St. Paul; two small rocky islets, Otter Island and Walrus Island; and a small rocky outcropping known as Sea Lion Rock. St. George Island is 35 square miles in area, and is the southernmost island, located approximately 15 mi. (25 km) north from the shelf break. St. Paul is 44 square miles in area, and is the northernmost island, situated 47 mi. (76 km) NNW of St. George, and 62 mi. (100 km) from the shelf break. Otter Island is located 9 mi (14 km) south of St. Paul, and Walrus Island about 7 mi (11 km) east of St. Paul. Sea Lion Rock is about a quarter mile offshore of the southern tip of St. Paul.

NMFS considers the northern fur seals breeding on St. George, St. Paul, and Bogoslof Islands as the eastern Pacific Stock, though the subsistence harvest regulations acknowledge the independence of the islands for management purposes. Northern fur seals have colonized only two new central breeding sites (Bogoslof and San Miguel islands) during the past 200 years (Peterson et al., 1968; Loughlin and Miller 1989). Northern fur seals were exterminated from 18 of the 31 central breeding areas found on islands by pelagic sealing at the turn of the 19th century. Only two of those have been recolonized (Busch 1985; Lander 1981) and none have been recolonized on the Pribilof Islands. The reasons for limited northern fur seal colonization and re-colonization stem from their behavioral tendencies. Gentry (1998) described four experiments examining the factors influencing northern fur seal site fidelity and philopatry. This work indicates northern fur seal philopatry occurs due to (1) early life experience, (2) neonates attachment to a site during the first 30 days of life, (3) suckling, and (4) having contact with peers during similar life stages.

A key experiment showed that females will not colonize a site without the presence of other females, and males show up at a site very quickly when females are present (Gentry 1998). Baker et al., (1995) showed that sub-adult northern fur seals show increased precision in their tendency to return to their birth site as they age, and that females land on their natal site at a younger age than males. Gentry (1998) found that female northern fur seals give birth and suckle at sites within 8.3 m of each other along the shore, and less than 1% of 1,541 adult males moved their breeding territories more than 10m during their breeding tenure (Gentry 1998). Baker et al. (1995) examined commercial harvest and female culling program data and found that, for females that were breeding for the first time, 84% were killed at their natal breeding area or adjacent hauling grounds within an island. Baker et al. (1995) reported the homing rate for females taken on the breeding grounds was 92% or greater for all age classes. That is, over 90% of breeding females returned to the site where they were born to breed. These rates may still be underestimates because of the propensity of females to make brief visits to breeding areas other than their parturition site (Gentry 1998).

Baker et al. (1995) reported 73%–84% of 5 year old male fur seals were first captured at their natal breeding area within an island after being tagged as pups. These rates are probably underestimates as well. For sub-adult males captured more than once within a summer, the likelihood of observing an animal at its natal breeding area within an island increased significantly with time between captures. Eleven days or more after the first capture, 100% of 5-year-old sub-adult males were found and recaptured at their natal breeding area within an island.

Population trends by island and central breeding areas show different trajectories and timing of changes in abundance (Johnson et al., 2013), though they are managed as a unit which includes the Pribilof Islands and Bogoslof Island (NMFS 2007a). Gentry (1998) summarized the “tradition” of fur seals using a breeding site as a function of female tendencies towards philopatry, site fidelity, close proximity to other females, and males’ ability to detect females and defend space for breeding opportunities. In addition, fur seals also show separation of marine foraging areas (Robson et al., 2004; Sterling and Ream 2004) suggesting greater independence between the breeding islands and the areas within islands.

NMFS considers this evidence adequate to limit the action area of this analysis of the effects of improving the management and changing the northern fur seal subsistence harvest regulations for St. George exclusively to the natural and human environment on St. George Island (Figure 1).

1.2.1 St. George Island

St. George Island is primarily composed of boulder and cliff-lined coastline with two small sandy beaches. It is the oldest island of the Pribilof Island Archipelago and closest to the continental shelf break and upwelling marine nutrients. St. George has numerous breeding seabird colonies on the cliffs and limited inland locations separate from areas occupied by marine mammals. As many as 2 million seabirds return annually to breed on St. George Island (Byrd et al. 2008). Steller sea lions (*Eumatopias jubatas*), harbor seals (*Phoca vitulina*), and northern sea otters (*Enhydra lutris*) are year-round residents on St. George Island, although few if any confirmed sightings of sea otters have occurred since the mid-1990s. Numerous cetacean species occupy the waters surrounding St. George Island either seasonally or year-round. Northern fur seals are the dominant marine mammals that return seasonally to breed and rest on St. George Island (NMFS 2007a).

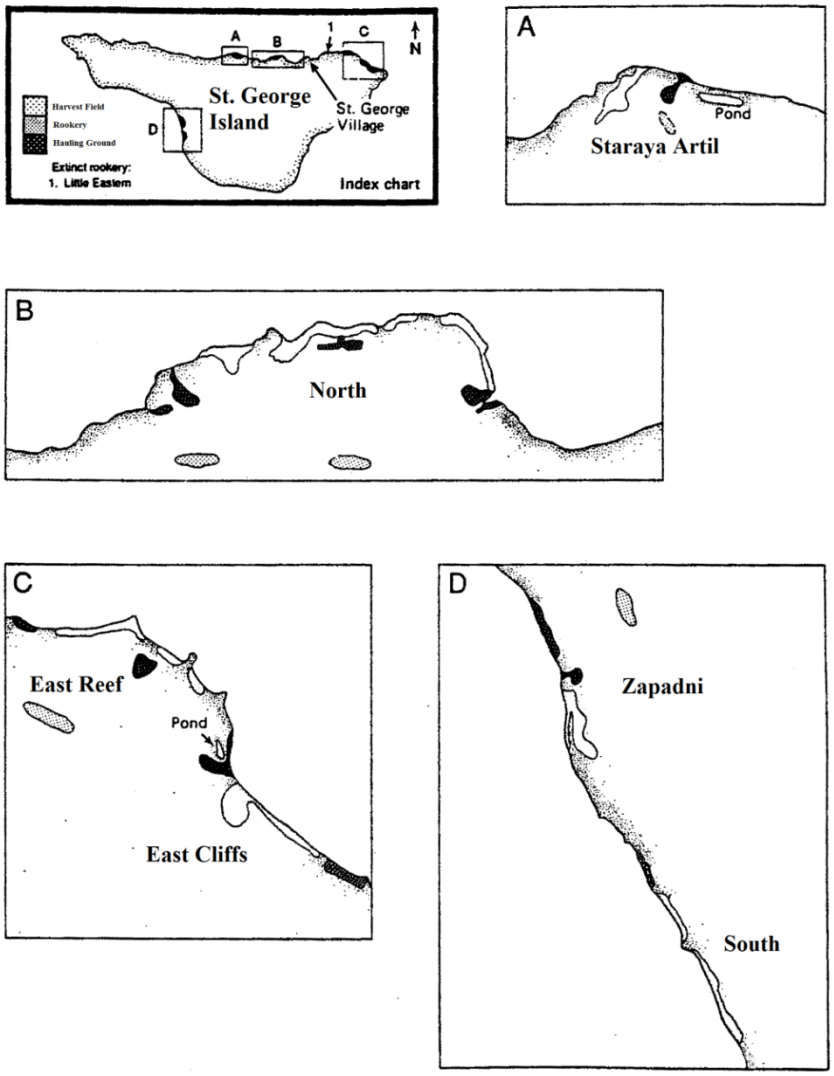

Figure 1 Northern fur seal breeding areas (rookeries) and hauling grounds on St. George Island

1.3 Coordination and Consultation with the Pribilof Islands Subsistence Communities

The harvest process for sub-adult males described herein is the product of over 100 years of refinement of commercial harvest methods and consultations and coordination between NMFS and the local subsistence communities as represented by the tribal governments. This process has continued to evolve and improve over the many years the federal government has been involved with the management of the northern fur seal and administration of the Pribilof Islands. With the adoption of co-management agreements between NMFS and Pribilof tribal governments, the harvest process and operations have continued to improve in spite of significant changes within the natural environment and subsistence communities of the Pribilof Islands.

This action and the subsistence needs described herein are also the result of discussions between NMFS and the tribal government of St. George Island under provisions of the co-management agreement, as detailed below. In addition to the formal meetings, NMFS, St. George Council members, and subsistence users have met numerous times informally every year since the receipt of the tribal resolution initiating this action.

1.3.1 Federal Trust Responsibilities

The concept of "trust responsibility" is derived from the relationship between the Federal government and Indians, first delineated by Supreme Court Justice John Marshall in 1831. The scope of the Federal trust relationship is broad and incumbent upon all Federal agencies. The U.S. Government has an obligation to protect tribal land, assets, and resources as well as a duty to carry out the mandates of Federal law with respect to American Indian and Alaska Native tribes. The unique relationship provides the Constitutional basis for legislation, treaties, and Executive Orders that grant unique rights or privileges to Native Americans.

Executive Order (E.O.) 13084 issued May 14, 1998, requires each Federal agency to establish meaningful consultation and collaboration with Indian tribal governments (including Alaska Natives) in formulating policies that significantly or uniquely affect their communities. Entitled "Consultation and Coordination with Indian Tribal Governments," the order requires agency policy making to be guided by principles of respect for tribal treaty rights and responsibilities that arise from the unique legal relationship between the Federal Government and the Indian tribal governments. Furthermore on issues relating to treaty rights, E.O. 13084 directs each agency to explore, and, where appropriate, use consensual mechanisms for developing regulations.

On November 6, 2000, E.O. 13175 replaced E.O. 13084. The order carries the same title and strengths as the previous order about the government-to-government relationship between the U.S. Government and Indian tribes. E.O. 13175 requires that all Executive departments and agencies consult with Indian tribes and respect tribal sovereignty as they develop policy on issues that impact Indian communities.

Consultation with Pribilof Native communities occurs formally and informally multiple times per year.

1.3.2 Co-Management of Subsistence Harvest of Fur Seals on the Pribilof Islands

NMFS entered into co-management agreements with the Tribal Governments of St. Paul Island and St. George Island under section 119 of the MMPA in 2000 and 2001, respectively. These agreements are

specific to the conservation and management of northern fur seals and Steller sea lions on the Pribilof Islands, with particular attention to the subsistence take and use of these animals. NMFS has worked with both communities to develop and implement subsistence management plans for the purpose of consistency with the 1985 fur seal harvest regulations and their subsequent revisions.

Under the co-management agreements, a co-management council was formed from equal membership by the tribal government and NMFS. The St. George co-management council meets regularly, both formally and informally, to promote open communication and consider development of annual management plans, monitoring programs, and research programs for St. George Island; to annually review the contents, performance, and responsibilities in the agreement; to review and assess progress towards implementation of the agreement; to identify challenges to achieving the purpose of the agreement; to recommend solutions to any identified challenges; to identify future courses of action; and to review applicable laws and regulations governing the subsistence take and use of fur seals and sea lions. NMFS worked with both Tribal Governments on the Pribilof Islands to revise and update the Conservation Plan for the Eastern Pacific stock of northern fur seals in 2007 to reflect the co-management approach to protection, conservation and management of this population. The ongoing development of the co-management relationship and NMFS's continuation of the status quo harvest management (NMFS 2005) likely contributed to the St. George Council's decision to petition NMFS to change the regulations to allow them to meet their subsistence needs.

1.4 Public Involvement

NMFS has published the 3-year estimates of subsistence need three times since publication of the Final EIS in 2005. The 2011-2013 estimate of subsistence need (77 FR 6682, February 9, 2012) was a continuation of the same need established for the 2005-2007 and 2008-2010 periods.

NMFS began scoping for this issue when it received the petition from the St. George Traditional Council proposing changes in harvest regulations to better provide for cultural and traditional practices. On April 23, 2010, NMFS published a notice in the Federal Register and invited public comments on the petition (75 FR 21233)[1]. NMFS receive no public comments during the 60-day comment period.

NMFS also conducted scoping meetings to identify the issues to be analyzed. NMFS circulated notices requesting public input on the proposed changes, and scheduled public meetings in St. George and Anchorage, Alaska. These meetings were designed to (1) be an open, public process for identifying the scope of physical, biological and social environmental issues related to the proposed project that should be addressed and (2) provide people potentially affected by the project an opportunity to express their views and offer any suggestions they may have regarding the project. NMFS used the following techniques for public notice:

- Newspaper advertisements announcing public meetings and comment period;
- Online posting on NMFS website and community calendars announcing public meetings and comment period;
- Announcements via email listservs announcing public meetings and comment period;
- Personal phone calls to stakeholders; and
- Public scoping meetings held on St. George Island and in Anchorage, AK.

[1] Available at http://alaskafisheries.noaa.gov/notice/75fr21243.pdf

The majority of comments received were from discussions during the St. George public meeting on May 27, 2011, in which 14 people attended. No comments were received at the Anchorage public meeting on May 24, 2011, where only one person attended. NMFS received two letters from the Aleutian Pribilof Islands Association and Mr. Larry Merculief of Seven Generations Consulting. Public comments included several detailed remarks emphasizing the cultural and historic context of the requested changes. NMFS prepared a report that reviews the comments received regarding proposed changes to the northern fur seal harvest regulations for St. George Island.[2]

1.5 Cooperating Agencies

The CEQ regulations provide for any State or Federal agency to be a cooperating agency if it has special expertise with respect to any environmental issue to be addressed in and EIS. NMFS considered that additional seabird or seabird egg harvests for subsistence purposes might occur in the absence of fur seal harvests, thus necessitating the expertise of the U.S. Fish and Wildlife Service. The St. George Council assured NMFS that eggs or seabirds are not a replacement for fur seal meat for numerous reasons including, most importantly, their seasonal availability. No agencies have been identified that have special expertise regarding northern fur seals or their subsistence harvest.

1.6 Related NEPA Documents

This SEIS supplements the Final Environmental Impact Statement for Setting the Annual Subsistence Harvest of Northern Fur Seals on the Pribilof Islands (NMFS 2005).[3] NMFS decided to prepare this SEIS because the proposed action makes substantial changes to the action analyzed in the 2005 EIS that are relevant to the environmental effects. The action analyzed in the 2005 EIS was setting the annual Pribilof Islands fur seal subsistence take ranges as required by regulations. The action was limited to the subsistence take of sub-adult male seals. The action established the subsistent take range for St. Paul Island at 1,645 - 2,000 sub-adult male seals and the subsistence take range for St. George Island at 300-500 sub-adult male seals. The 2005 EIS concluded that subsistence harvests within the specified ranges would have a minimal effect on the northern fur seal stock and meet the documented subsistence needs of the Aleuts on St. Paul and St. George Islands.

While this new proposed action does not change the northern fur seal take ranges, it would allow the limited subsistence take of male young of the year and change when and where the subsistence harvests can occur on St. George Island. Therefore, this SEIS focuses on analyzing the impacts of subsistence take of male young of the year, and expanding when and where the subsistence harvests can occur on St. George Island.

This SEIS incorporates by reference information from the 2005 EIS, when applicable, to focus the analysis on the issues ripe for decision and to eliminate repetitive discussions. Relevant information from the 2005 EIS is summarized in the appropriate chapters. This SEIS also contains recent and relevant information on the northern fur seals and subsistence harvests impacted by this proposed action.

Additionally, the Final Programmatic Environmental Impact Statement for Steller Sea Lion and Northern Fur Seal Research (Research PEIS; NMFS 2007b) has detailed information on northern fur seals and

[2] Available at http://alaskafisheries.noaa.gov/protectedresources/seals/fur/analysis/ea0412.pdf
[3] Available at: http://alaskafisheries.noaa.gov/protectedresources/seals/fur/eis/final0505.pdf

human impacts on northern fur seals.[4] This PEIS evaluates the effects of the type and range of research activities that may be exercised in current and future grants. The Research PEIS assesses the direct and indirect effects of various levels of funding and different research techniques on Steller sea lions and northern fur seals throughout the entire range of these species in United States waters and on the high seas, which includes parts of Alaska. The PEIS used a quantitative analysis of the sub-lethal effects of research, which we have also used for this analysis of subsistence harvests. The PEIS sub-lethal effects analysis converts numerous suspected effects into an estimate of probable mortality. By using this conversion we can compare the probability of mortality as a result of sub-lethal effects to the actual mortality of subsistence harvests. The comparison of similar units (mortality) is more informative than a comparison of direct mortality with qualitative measures like reduced energy. The PEIS also assessed the contribution of research activities to the cumulative effects on these species and resources, including effects from past, present, and reasonably foreseeable future events and activities that are external to the research activities.

[4] Available at: http://www.nmfs.noaa.gov/pr/permits/eis/steller.htm

2 Description of Alternatives

The National Environmental Policy Act (NEPA) requires that an EIS analyze a reasonable range of alternatives consistent with the purpose and need for the proposed action. The primary focus of this chapter is to (1) describe the alternatives, (2) compare the alternatives, and (3) discuss the alternatives considered and eliminated from detailed study. The alternatives in this chapter were designed to accomplish the stated purpose and need for the action.

NMFS considered six alternatives and removed two from further consideration. NMFS has not identified any other reasonable alternative that might meet the purpose and need. NMFS is interested in any public comment on this range of alternatives or suggestions of other reasonable alternatives that meet the purpose and need.

2.1 Alternative 1: (No Action) Maintain present seasonal, age, sex, and location restrictions of the northern fur seal harvest on St. George Island

This alternative would continue the current harvest management under federal regulations in 50 CFR 216.71-74. Section 216.71 describes allowable takes of fur seals as those for subsistence uses, and not accomplished in a wasteful manner. Sections 216.72(a & b) treat the islands independently and describe a process for setting the expected annual harvests levels for 3 year intervals. Sections 216.72(c & d) define the season for subsistence taking from June 23 to August 8, and prohibit taking except by experienced sealers using traditional methods of stunning followed by immediate exsanguination and organized drives of sub-adult male fur seals taken no more than twice per week from Northeast and Zapadni hauling ground on St. George (see Figure 1). Sections 216.72(c)(2-4) prohibit the taking of sub-adult males greater than 124.5 cm, adult fur seals, pups, or the intentional taking of sub-adult females. Section 216.72(c)(5) prohibits the taking of seals with tags or entangling debris unless directed by NMFS scientists. Section 216.72(d) allows the Pribilovians to schedule their subsistence harvest so as to minimize the stress to harvested seals and provide adequate advance notice to allow monitoring.

Section 216.72(e)(1) requires the suspension of the harvest when (i) the subsistence needs have been met, (ii) the harvest is being conducted in a wasteful manner, or (iii) the lower end of the harvest range has been met. Section 216.72(e)(2) allows for a suspended harvest under section 216.72(e)(1)(ii) to resume if a remedy to the wasteful manner has been found. Section 216.72(e)(3) limits the duration of a suspension under 216.72(e)(1)(iii) to 48 hours to determine whether a suspension under 216.72(e)(1)(i) must be made or a new estimate of the subsistence need is required. Section 216.72(f) terminates the harvest on August 8 or when a determination under 216.72(e)(1)(i) has been made. Section 216.73 describes the process for transfer or sale of all nonedible byproducts of the subsistence harvest. Section 216.74 requires Pribilovians engaged in the harvest of fur seals to cooperate with scientists engaged in fur seal research on the Pribilof Islands.

NMFS has set the current harvest range for St. George Island at 300-500 sub-adult male seals. Table 1 provides details on the primary features of Alternative 1 in comparison with the other alternatives.

2.2 Alternative 2: (Preferred Alternative) Modify the management to allow for a regulated harvest of male northern fur seals to meet the subsistence needs described in the petition of the Traditional Council and implement new conservation controls.

On September 28, 2006, the Council requested revisions to the current northern fur seal harvest management regulations in order to better meet their customary and traditional subsistence needs. The primary feature of the Council's petition is to legalize a harvest of 150 male fur seal young of the year during an annual autumn season. The preferred alternative does not increase the range of the subsistence need for St. George above the 500 currently authorized. The Council requests removal of the restrictions for harvesting sub-adult males only at Northeast and Zapadni hauling grounds, and revising requirements for data collection and cooperation with scientists. NMFS has defined sub-adults as fur seals less than four years old. This age-class is generally representative of fur seals measuring less than 124.5 cm in length from tip of nose to end of tail that is the basis for the regulatory restriction in the status quo which was meant to ensure the largest high-quality pelt for commercial sale, not the subsistence preference of those Alaska Natives who consume fur seals.

In a follow-up letter from the Council to NMFS dated April 8, 2010, the Council asked to harvest male young of the year fur seals during an autumn season to allow tribal members the opportunity to meet their subsistence needs. Finally the Council requests that specific language in the regulations under CFR 216.74 be reconsidered. They feel that the language "data collection needs and other requirements to cooperate with scientists" is no longer applicable due to the co-management agreement.

NMFS and the Council have implemented their subsistence harvest for 30 years under both regulations and informal guidance. NMFS's preferred alternative would create a regulation that balances NMFS's authority to manage fur seals and co-manage subsistence use with the Council to accommodate their petition. NMFS proposes three new conservation controls developed in cooperation with the Council and a provision to enhance co-management. NMFS proposes to add a new conservation control intended to reduce all female harvest mortality by temporarily suspending the harvest when two females of any age have been killed. The basis for this harvest suspension threshold is to set the limit close to zero for conservation reasons but recognizing that accidental female harvest could occur, and that St. George subsistence harvesters have killed two females accidentally only once during their 30-year history of harvests. NMFS would review the circumstances of the female deaths and could reinstate the harvest if, in consultation with the Council, NMFS can determine measures to be implemented to improve detection and avoidance of females. If a third female is killed NMFS would terminate the harvest for the remainder of the year. St. George harvesters have never killed three females accidentally under the subsistence harvest regulations.

NMFS proposes a second new conservation control to prohibit pup harvests at breeding locations determined to be at risk of reaching unsustainable population levels. NMFS has multiple mechanisms to consider and implement this conservation control. NMFS meets with the tribal government twice annually to co-manage the subsistence harvest of marine mammals, and share the latest research results and local observations. NMFS annually counts, reports, and publishes the number of adult male fur seals in the population and the subsistence harvest online. Every two years, NMFS estimates the number of pups born (i.e., pup production) at all breeding areas on the Pribilof Islands. Every three years NMFS would publish the actual harvest, the subsistence needs of the Pribilovians under the 50 CFR 216.72(b), and reconsider any substantial new information. NMFS proposes to use the pup production and trend information at each breeding location to evaluate the statistical probability of pup production falling below a level that is necessary for long-term stability. First, a pup production threshold was established

based on population levels adapted from Olesiuk (2012), and on historic pup production estimates above which the individual breeding areas were still able to recover (Johnson 2014). Pup production trends at each breeding area are then projected ten years into the future to estimate the probability that they will fall below the pup production threshold. Johnson (2014) estimated the range of minimum viable pup production to be between 300 and 600. NMFS used data from the 1912-1922 period and found four rookeries reached this range, three recovered and one of those rookeries did not. The lowest estimate for the extinct rookery was 500 and NMFS will use 500 as the pup production threshold to prohibit harvest until recovery above that level. The ten-year time horizon allows for natural variability of pup production into the future. This will allow NMFS and the Council to implement management actions to ensure breeding locations do not reach population sizes low enough that recovery is highly uncertain. NMFS and the Council will review and update the statistical analysis, as needed, during the co-management meetings and determine the locations where harvests can occur.

NMFS's third new conservation control is intended to reduce the concentration of pup harvest effort, and the possible sub-lethal effects, at locations closer to the village or with easier road access. NMFS proposes to distribute the harvest into three regions (North, East, and South) of fur seal breeding with approximately equal percentage contribution of pup production to the island total. North and Staraya Artil rookeries make up 32.9% of the island population and are adjacent to each other. East Reef and East Cliffs rookeries account for 33.3%, and South and Zapadni rookeries account for the remaining island production (33.7%). Therefore up to 50 male pups will be harvested from each region ensuring that there is no concentration of lethal or sub-lethal effects in particular areas. This conservation control reduces the probability that unknown or uncertain effects of the harvest may emerge that would require the implementation of previous conservation control to protect small breeding areas. Finally, NMFS intends to build on the local involvement of the Council through the co-management process. NMFS, the Council, and subsistence harvesters will annually review and develop best harvest practices to further minimize sub-lethal effects collaboratively within the co-management structure.

To implement this alternative, NMFS would make the following eight revisions to the current regulations at 50 CFR.

(1) Remove parts 216.72 (c)(2) through (c)(5) and renumber them under 216.72(e) to retain the harvest as is for St. Paul Island (item 3 below).
(2) Modify part 216.72(d) to create explicit provisions for St. George Island harvests at all breeding areas to add (d)(1) to define harvest methods with the intent to reduce animal stress, reduce disturbance, and reduce the accidental taking of females during harvest, add (d)(2) prohibiting the harvest of adult male or female fur seals, add (d)(3) to authorize the harvest of up to 150 male young of the year during an additional harvest season from September 16 to November 30 each year and not to exceed 50 male pups to be harvested from each of the three regional pairs of rookeries, add (d)(4) to prohibit taking from any breeding areas when the most recent annual pup production estimate has fallen below levels capable of sustaining a harvest, and add (d)(5) to have the St. George Council consider best harvest practices based on experiences and methods developed to harvest young of the year.
(3) Add part 216.72(e)(1) through (e)(5) to separate and retain the current sub-adult male fur seal subsistence harvest provisions as is for St. Paul Island.
(4) Renumber part 216.72(e)(1)(i) through (e)(1)(iii) to (f)(1)(i) through (f)(1)(iii) regarding the suspension of the harvest, and add (f)(1)(iv) to suspend the harvest if two female fur seals of any age are taken on St. George Island.
(5) Renumber part 216.72(e)(2) and (e)(3) to (f)(2) and (f)(3) regarding review and lifting a suspension issued under (f)(1)(ii) and (f)(1)(iii), and add (f)(4) to review and lift the suspension

issued under (f)(1)(iv) for the taking of two females if a remedy can be identified and implemented to prevent additional taking.

(6) Modify part 216.72(f) to renumber as (g)(1) and (g)(2) regarding the termination of the harvest for the year and add (g)(3) to terminate the harvest under (f)(4) when 3 female fur seals have been killed during the harvest on St. George.

(7) Modify part 216.74 to describe the co-management relationship between NMFS and the Council under Section 119 of the MMPA and efforts by NMFS to partner with the tribal government to consider best harvest practices, harvest data collection, and coordinate scientific investigations.

(8) Add part 216.81(b) to clarify that authorized subsistence harvesters of fur seals are allowed on rookeries from September 16 to November 30.

2.3 Alternative 3: Modify the management to allow for a regulated harvest of male young of the year northern fur seals and no harvest of sub-adult male northern fur seals and implement new conservation controls.

Alternative 3 would modify the northern fur seal subsistence harvest to (1) create a harvest season in the autumn for taking of up to 500 young of the year male northern fur seals, (2) reduce the subsistence harvest of sub-adult male northern fur seals in the summer to zero, (3) add a new conservation control to prevent more than 10 females from being killed during harvest, (4) add a new conservation control allow harvests only at those breeding areas capable of sustaining any harvest, and (5) encourage the development of best harvest practices within the co-management structure to minimize sub-lethal effects to seals not harvested. NMFS would revise the regulations to better characterize the co-management relationship between NMFS and the Council to promote the conservation of fur seals as identified in the co-management agreement. If Alternative 3 is selected, NMFS would make specific necessary regulatory changes similar to those described above for the preferred Alternative 2, but consistent with the measures described in this paragraph.

2.4 Alternative 4: Modify the management to allow for a regulated harvest of male northern fur seals to meet the subsistence needs described in the petition of the Traditional Council and implement new conservation controls.

Alternative 4 would modify the northern fur seal subsistence harvest to (1) create a second harvest season in the autumn for taking of up to 50 young of the year male northern fur seals (to be subtracted from the total allowable harvest of up to 500 fur seals, such that the total allowable harvest range does not increase), (2) add a new conservation control to prevent more than 20 female fur seals from being killed during harvest, (3) add a new conservation control allow harvests only at those breeding areas capable of sustaining any harvest, and (4) encourage the development of best harvest practices within the co-management structure to minimize sub-lethal effects to seals not harvested. NMFS would revise the regulations to better characterize the co-management relationship between NMFS and the Council to promote the conservation of fur seals as identified in the co-management agreement. If Alternative 4 is selected, NMFS would make specific necessary regulatory changes similar to those described above for the preferred Alternative 2, but consistent with the measures described in this paragraph.

2.5 Comparison of Alternatives

Table 1 Comparison of the primary features of Alternatives 1 through 4

	Alternative 1, Status quo	Alternative 2, Preferred	Alternative 3	Alternative 4
Harvest Range	300-500 male fur seals	300-500 male fur seals	300-500 male fur seals	300-500 male fur seals
Harvested Animals	Sub-adult males	Sub-adult and young of the year males	Young of the year males	Sub-adult and young of the year males
Harvest Area	Northeast and Zapadni hauling grounds	Any breeding or resting areas capable of sustaining a harvest	Any breeding or resting areas capable of sustaining a harvest	Any breeding or resting areas capable of sustaining a harvest
Harvest Season	June 23 to August 8	Sub-adults - June 23 to August 8 Young-of-year - September 16 to November 30	Young-of-year - September 16 to November 30	Sub-adults - June 23 to August 8 Young-of-year - September 16 to November 30
Harvest restrictions	Prohibit (1) harvest of males greater than 124.5 cm in length; (2) harvest of adult males; (3) harvest of pups; (4) harvest of adult females. No more than two harvests at each site per week.	Prohibit (1) harvest of females; (2) harvest of adult males; (3) harvest in breeding areas with low pup production. Distribute the harvest of pups equally across the three breeding regions.	Prohibit (1) harvest of females; (2) harvest of adult males; (3) harvest in breeding areas with low pup production. Distribute the harvest of pups equally across the three breeding regions.	Prohibit (1) harvest of females; (2) harvest of adult males; (3) harvest in breeding areas with low pup production. Distribute the harvest of pups equally across the three breeding regions.
Suspend Harvest When…	Harvest is being conducted in a wasteful manner, or when lower end of the range of subsistence need has been reached.	Harvest is being conducted in a wasteful manner, or when lower end of the harvest range of subsistence need has been reached, or when two female fur seals have been harvested.	Harvest is being conducted in a wasteful manner, or when lower end of the harvest range of subsistence need has been reached, or when nine female fur seals have been harvested.	Harvest is being conducted in a wasteful manner, or when lower end of the harvest range of subsistence need has been reached, or when 19 female fur seals have been harvested.

	Alternative 1, Status quo	Alternative 2, Preferred	Alternative 3	Alternative 4
Terminate Harvest When….	Subsistence need has been met.	Subsistence need has been met, or three female fur seals have been harvested.	Subsistence need has been met, or ten female fur seals have been harvested.	Subsistence need has been met, or 20 female fur seals have been harvested.
Harvest practices	Only experienced sealers using traditional methods of round-up, stunning, and immediate exsanguination.	Continue to use humane methods which minimize sub-lethal effects on unharvested seals. Develop best harvest practices based on experiences and methods developed by harvesters and NMFS through co-management.	Continue to use humane methods which minimize sub-lethal effects on unharvested seals. Develop best harvest practices based on experiences and methods developed by harvesters and NMFS through co-management.	Continue to use humane methods which minimize sub-lethal effects on unharvested seals. Develop best harvest practices based on experiences and methods developed by harvesters and NMFS through co-management.
Research and Scientific Cooperation	Required to cooperate with scientists engaged in fur seal research.	Evaluate research and data collected from the subsistence harvest through the co-management process.	Evaluate research and data collected from the subsistence harvest through the co-management process.	Evaluate research and data collected from the subsistence harvest through the co-management process.
Subsistence	Limit subsistence opportunities for fur seals to the 6-week summer season	Increase fur seal subsistence opportunities to include a 6-week summer and 10-week autumn harvest season	Change fur seal subsistence opportunities from a 6-week summer to a 10-week autumn harvest season	Increase fur seal subsistence opportunities to include a 6-week summer and 10-week autumn harvest season
Co-management	Continue co-management as-is	Strengthen co-management partnership with tribal government	Harm co-management partnership with tribal government	Harm co-management partnership with tribal government.
Data Collection	Collect samples from harvested sub-adult male seals.	Collect samples from harvested sub-adult and young of the year seals.	Collect samples from harvested young of the year seals.	Collect samples from harvested sub-adult and young of the year seals.

2.6 Alternatives Considered and eliminated from detailed study

NMFS considered two additional alternatives and eliminated then from detailed study because they do not meet the purpose and need for the proposed action.

NMFS considered an alternative to eliminate all harvest regulations governing subsistence harvest of northern fur seals. Under this alternative NMFS would remove all regulation of the subsistence harvest of northern fur seals on the Pribilof Islands. This would result in a significant change in the protections afforded northern fur seals using the Pribilof Islands for breeding, rearing young, molting, and resting. This alternative is legally possible, as the FSA and MMPA provide an exemption on taking to Alaska Natives who reside on the coast of the North Pacific Ocean or the Arctic Ocean, who may take any marine mammal under the authority of 50 CFR 216.23(a). If a marine mammal stock has been listed as depleted under the MMPA, the Secretary of Commerce may prescribe regulations pursuant to section 103. NMFS determined the eastern Pacific stock of northern fur seals as depleted on May 18, 1988 (53 FR 17888). NMFS promulgated the final subsistence harvest regulations on May 15, 1986 (51 FR 24840).

Pribilovians are in a unique position among Alaska Natives as they live within walking distance to the majority of the U.S. breeding population of a species they harvest for subsistence purposes. The ease of public access, site fidelity, and predictability of fur seal presence seasonally on the Pribilof Islands has resulted in the development of important conservation and protection measures over the past 100 years. These measures have included harvest and access restrictions intended to protect fur seals from the effects of human presence and harvest in the areas they use during the breeding and non-breeding season. The Council does not have the infrastructure or capacity to monitor and enforce any provisions that would be developed independent of NMFS and outside of the MMPA or FSA. It would be impractical to monitor or enforce informal restrictions in lieu of regulations. Given the depleted status of northern fur seals, NMFS cannot justify removing the regulatory restrictions to monitor and manage the subsistence harvest on St. George Island.

NMFS also considered an alternative that would modify the current regulations to allow for a regulated harvest of both male and female northern fur seals to meet the subsistence needs of the community of St. George Island. This alternative would include all of the changes to the harvest regulations requested by the Council, but allow harvests of female young of the year fur seals. The Council is not interested in this alternative as it includes the intentional taking of females or methods which increase the likelihood of taking females which is not consistent with the Council's request or their traditional ethic. Comments received from St. George residents during scoping further reinforced the Council's position that intentional taking of females or employing a harvest method which increased the likelihood of taking females was not part of their request. This alternative is not being considered further because the intentional taking of females or employing a harvest method which increases the likelihood of taking females is inconsistent with both the petition from the St. George Council and the need for sustainable management of the subsistence harvest consistent with the MMPA.

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3 Northern Fur Seals

NMFS has analyzed northern fur seals in previous environmental impact statements for the Pribilof Island subsistence harvest regulations (NMFS 2005) and Steller sea lion and northern fur seal research (NMFS 2007b), which are incorporated by reference. The most recent status information is in the Marine Mammal Stock Assessment Report (Allen and Angliss 2013). Relevant information from these documents is summarized in this chapter. This chapter also contains recent information on northern fur seals.

3.1 Biology of the northern fur seal

The northern fur seal ranges throughout the North Pacific Ocean from southern California north to the Bering Sea and west to the Okhotsk Sea and Honshu Island, Japan. Breeding is restricted to only a few sites: the Commander, Kuril, and Pribilof Islands, Bogoslof Island, and San Miguel Island (NMFS 2007a). They are seasonal migrants, spending the winter and spring entirely at sea and the summer and autumn alternating between marine foraging and their breeding and resting sites on islands.

Northern fur seals belong to the Order Carnivora, Suborder Pinnipedia, Family Otariidae, and Subfamily Otariinae. The genus Callorhinus contains one species, the northern fur seal, *C. ursinus* (Rice, 1998). Little evidence of genetic differentiation among breeding sites has been found (Dickerson et al., 2010; Ream, 2002; Rice, 1998), but for management purposes five stocks (populations) of northern fur seals are recognized that breed on at least six island groups in the North Pacific; the Eastern Pacific stock includes the Pribilof Islands and Bogoslof Island, San Miguel Island stock located off the coast of southern California, the Commander Islands stock (Russia), the Kuril Islands stock (Japan), and the Robben (Tuleniy) Island stock in the Okhotsk Sea (Russia). Stock designation is based principally on geographic separation during the breeding season (Dizon et al., 1992). Considerable interchange of individuals takes place between the breeding areas; however growing evidence of significant behavioral separation within islands exist suggesting smaller management units may be appropriate. Northern fur seals are considered one biological species.

The prevalence of disease and parasites has not been implicated as an important factor affecting the fur seals breeding on the Pribilof Islands (NMFS 2005; NMFS 2007a; NMFS 2007b). Necropsies of juvenile seals taken in the St. Paul subsistence harvest during the 1980s suggest that the population is relatively disease free compared to the period from the 1950s to early 1970s (NMML, unpublished data). Lyons et al. (2001) indicated a dramatic decline in the incidence of hookworm disease in fur seal pups on St. Paul Island in recent years. Infectious diseases were found in 4 percent of the pups on St. Paul. Spraker and Lander (2010) found no evidence over the past 27 years to implicate diseases or mortality of pups prior to weaning as an important factor in the current population decline on St. Paul. In 2003, hookworm mortality at San Miguel Island exceeded 50 percent and was a significant cause of mortality of pups in the first three months of life (Melin et al., 2005). Killer whales are seen around St. Paul in early and late summer, but fishermen see killer whales offshore from June-August. Springer et al. (2003) hypothesized that sequential declines in North Pacific populations of seals (including fur seals), Steller sea lions, and sea otters were due to increased predation by killer whales, following the removal by commercial whaling of baleen whales as the killer whales primary food source. Wade et al. (2003) disagreed with the hypothesis of Springer et al. (2003) and proposed that killer whales may have caused or contributed to the decline of species like sea otters, but suggested that little evidence of a lack of available cetacean prey resulted in elevated killer whale predation on pinnipeds. DeMaster et al. (2006) evaluated the Springer et al. (2004) hypothesis and reported both top-down and bottom-up factors provided a more consistent

explanation of the observed pinniped declines rather than top-down alone. Steller sea lions kill weaned fur seal pups close to shore on St. George Island (Gentry and Johnson, 1981), and were seen killing fur seal pups in 1992 (reported in NMFS 1993). Attacks on northern fur seals by Steller sea lions may be lower in recent years due to concurrent and sustained declines of both species, however, no recent data and investigations have been undertaken.

3.2 Status of northern fur seal

The Pribilof Islands northern fur seal population designated as depleted under the MMPA. The MMPA defines the term "depletion" or "depleted" (16 U.S.C.1362(1)) as meaning any case in which "(A) the Secretary of Commerce, after consultation with the Marine Mammal Commission (MMC) and the Committee of Scientific Advisors on Marine Mammals established under title II of this Act, determines that a species or population stock is below its optimum sustainable population; (B) a State, to which authority for the conservation and management of a species or population stock is transferred under U.S.C. 1379, determines that such species or stock is below its optimum sustainable population; or (C) a species or population stock is listed as an endangered species or a threatened species under the Endangered Species Act of 1973 (16 U.S.C. 1531, *et seq*.)."

The MMPA defines optimum sustainable population (OSP) as " . . . with respect to any population stock, the number of animals which will result in the maximum productivity of the population or the species, keeping in mind the optimum carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element (16 U.S.C.1362(9))."

NMFS designated the Pribilof Islands northern fur seal population depleted under the MMPA on June 17, 1988 (53 FR 17888) because it declined to less than 50 percent of levels observed in the late 1950s (about 2.1 million fur seals). At that time, the causes of the decline of fur seals were thought to be the harvest of adult females from 1956 to 1968, and the lower survival of juveniles and adult females at sea since 1975 which may have been caused by an unexpected increase in fur seal entanglement in marine debris, including fishing gear and plastic packing bands. However, recent estimates of the annual rates of entanglement in marine debris do not support that previous speculation. Emigration from the Pribilof Islands cannot account for the entire decline. The fur seal populations breeding on Russian islands, Japanese islands, and Bogoslof Island have all increased or been stable since the late 1990s. Another factor in the decline may have been the potential effects of regime shifts, or the Pacific Decadal Oscillation (PDO). However, York (1995) found no consistent relationship or any clear causative link between several environmental indices and northern fur seal survival.

The Pribilof Islands portion of the population has continued to decline since the depleted listing. There continues to be no compelling evidence suggesting that the northern fur seal carrying capacity of the Bering Sea had changed substantially since the late 1950s. The 2012 abundance of fur seals on the Pribilof Islands is about 38% lower (611,617) than the 1992 estimate.

3.3 Abundance and Trends

Loughlin et al. (1994) estimated approximately 1.3 million northern fur seals exist worldwide, and the Pribilof Islands represented about 982,000 (74 percent) in 1992. The Pribilof Islands provide terrestrial habitat for the majority of the population to reproduce and rest during the summer and autumn. Northern fur seals are pelagic, occupying the Bering Sea and North Pacific Ocean during the winter and spring. Northern fur seals use the marine environment for foraging and migrating, and rarely use terrestrial sites

during winter or spring. In 2005, the Eastern Pacific stock of fur seals was estimated at 888,120 had declined to an estimated 611,617 in 2012 (Allen and Angliss 2013) from a historical high of about 2.1 million during the late 1940s and early 1950s (Briggs and Fowler, 1984). From 1976 to 1981, small numbers of fur seals were observed on Bogoslof Island (Loughlin and Miller, 1989), and pup production has continued to grow rapidly (Ream et al., 1999). Annual pup production at Bogoslof Island is approximately 22,000 (Towell and Ream 2012).

Pup production, the most accurate indicator of population size, has been estimated since 1912 (Figure 2). NMFS currently estimates pup production for each island independently every two years and has established consistent methods to improve the precision of those estimates. After the depleted listing the best estimate for pup production on St. George was 25,160 in 1992 (Table 2). NMFS (2005) reported the 2004 pup production estimate for St. George as 16,876 and the 2012 estimate was 16,184 (Table 2). Pup production on St. George Island declined 1.95% per year (SE = 0.50, P < 0.01) between 1998 and 2012 (Towell et al., 2013). NMFS examined the period since the 2005 EIS and the trend between 2004 and 2012 was not significantly different from zero (SE = 0.79, P < 0.69).

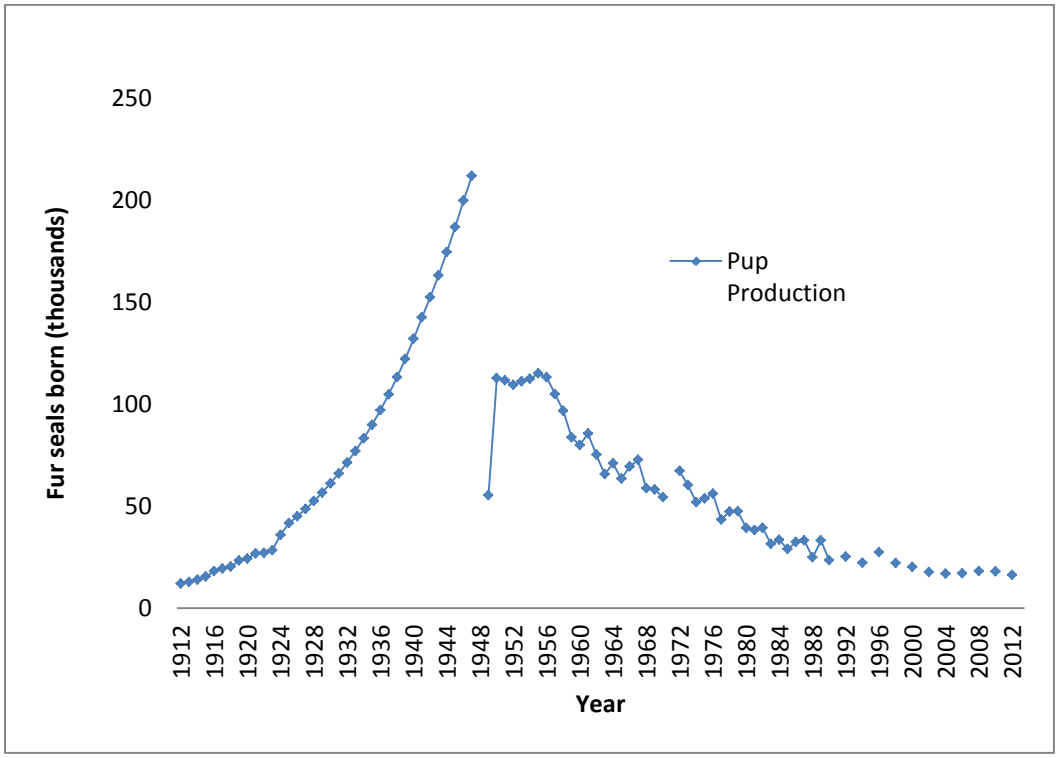

Figure 2 Estimated number of pups born* on St. George Island, Alaska 1912-2013.

* Most estimates of pups born from 1925-1965 for St. George Island are based on assumptions from data collected on St. Paul Island, and are not from data collected on St. George Island.

Adult male fur seals are counted every year since 1911 (Lander 1980), and this count serves as a rudimentary index of population size on St. Paul and St. George. Fowler and Robson (1994) reported an increase in the total number of adult males from 1985 through 1993. They speculated this was related to the cessation of the commercial harvest on St. Paul Island, although recent adult male counts on St. Paul

and St. George are as low as the early 1900s. Gentry (1998) reported an increase in adult males on St. George Island a few years after the cessation of the commercial harvest in 1972, followed by a reduction in both numbers of adult males and continued declines in pup production.

Table 2 Estimate of the number of pups born on St. George Island from 1992-2012, including the count standard error and the 95% confidence interval.

Year	Estimated number of pups born	Standard error	95% Confidence interval
1992	25,160	707	23,430-26,890
1994	22,244	410	21,241-23,247
1996	27,385	294	26,666-28,104
1998	22,090	222	21,547-22,633
2000	20,176	271	19,513-20,839
2002	17,593	527	15,890-18,238
2004	16,876	238	16,291-17,461
2006	17,070	144	16,742-17,404
2008	18,160	288	17,491-18,854
2010	17,973	323	17,201-18,780
2012	16,184	155	15,821-16,555

3.4 Migration Patterns

Northern fur seals begin to return to the breeding islands in the spring of each year from their pelagic winter foraging. On the Pribilof Islands they arrive in descending order by age, beginning in early May (Bigg 1990; Fiscus, 1978; Fowler, 1998). Adult males arrive first and establish territories on the breeding rookeries. The youngest males (i.e., 2-year olds) may not return to the breeding areas until mid-August (Bigg 1990). Some yearlings arrive as late as September or October; however, most remain at sea (NOAA's National Marine Mammal Laboratory (NMML) unpublished data). The older pregnant females arrive on island from the North Pacific about mid-June; the peak of pupping occurs in early July. Pups wean themselves and begin departing the islands in early November and nearly all pups have departed by early December (Ragen et al., 1995; Goebel 2002; Baker 2007, Lea et al., 2008). Pups generally migrate from the Pribilof Islands through the Aleutian Islands within 3 weeks (Ragen et al., 1995; Baker 2007; Lea et al., 2008). After pupping, mating, and weaning of pups, adult females from the Pribilof Islands migrate south through passes in the Aleutian Islands into the North Pacific Ocean (Ream et al., 2005).

Most females, pups, and juveniles leave the Bering Sea by late November and migrate during early winter through a few Aleutian Island passes into the North Pacific Ocean. They occupy coastal waters of British Columbia, Washington, Oregon, and California, and pelagic waters of the North Pacific transition zone. Older males appear to remain in the northern part of the range (Loughlin et al., 1999), while young males and females of all ages spend the winter feeding in the southern part (Ream et al, 2005). The northward migration begins in March. This migration brings the animals back to the breeding colonies where the cycle is repeated.

3.5 Reproductive Ecology

Northern fur seals occupy terrestrial habitat for about 6 months, exhibit natal site fidelity (Baker et al., 1995; Gentry 1998), and segregate into distinct central breeding and resting areas. Individual seals, however, may be found on land for only a fraction of the time during this entire period (mid-May through November). Pregnant females arrive on land beginning in mid-June and intermittently depart for multiple days to forage. Lactating females occupy terrestrial sites on the Pribilof Islands for on average 38 days per year, non-lactating females occupy terrestrial sites for fewer days per year (Gentry, 1998). Females tend to use a small (less than 20 m diameter) subarea of their central breeding area that minimizes interactions with males and maximizes proximity to other females (Gentry, 1998). Non-breeding males typically occupy inland resting areas that are significantly larger than nearby breeding areas (Gentry, 1981).

Male fur seals become sexually mature at 5-7 years of age and begin competing for a territory after about 7-9 years of age (Johnson, 1968). Adult males arrive on island in mid-May, begin to establish territories, and defend those territories until early August. Adult males defend small territories (averaging a maximum area of about 110 m^2), for an average of about 42 days while fasting (Gentry, 1998). NMFS categorizes adult males during these counts into three categories: territorial with females, territorial without females, and non-territorial (Antonelis, 1992). Territorial males spend about 1.5 seasons competing for breeding opportunity before they are deposed by new males. About 40-50% of adult males counted on land in early July account for the vast majority of breeding. Most adult males do not successfully defend territories or have breeding opportunities, but instead spend time on the periphery of the breeding areas (where they are counted) or at sea (where they are not counted) annually. Recent fur seal population modeling suggests many more (~85 – 95%) adult-aged males may exist in the population than are counted annually (Towell, 2007).

Northern fur seals are highly polygynous resulting in a few adult males dominating insemination of reproductively active females. One way to quantify the level of polygyny is by calculating the ratio of annual pup production to the number of harem males in the same year. This method is biased lower than actual polygyny, in that it does not account for the percentage of non-pregnant females in the population, but it is a reasonable index to show that excess males are in the population at all locations and levels of abundance. Smith and Polacheck (1984) reported average annual adult male harem size from about 20-260 pups/adult harem male, indicating very few adult males are required to maintain adequate pregnancy rates across the various breeding areas. Towell et al. (2012) estimate the ratio of pup production to harem males on the Pribilof Islands in 2010 ranged from about 20-25 pups per harem male, and that at least 700 additional non-territorial adult males were counted on St. George in 2010. These adult males would not have bred otherwise in 2010, but were available to breed with mature females. This shows that there are currently excess adult males in the population even though significantly lower than the ratios calculated by Smith and Polacheck (1984).

Most females become sexually mature between four and seven years of age (average about five) (York, 1983) and are known to give birth up to at least 23 years of age (Lander, 1981). Pregnant females begin to arrive in mid-June; non-pregnant adult females arrive later (Bartholomew and Hoel, 1953; Gentry and Holt, 1986; Gentry, 1998). Arrival of pregnant females peaks in early July, followed by a progressive decline in numbers of new arrivals through August (Gentry and Holt, 1986; Gentry, 1998). Females give birth to a single pup within two days of arriving on shore, and mate 3 to 8 days after parturition (Petersen, 1968; Gentry and Holt, 1986; Gentry, 1998). Female fur seals delay implantation of the blastocyst until at least mid-November (York and Scheffer, 1997). Lactating females make three to ten day foraging trips from the island, punctuated by one to two day visits to the rookery to suckle their pups. Upon the female's return from foraging, they recognize their pup initially by vocalizations (Insley, 2000).

The young rearing season extends from late June through early December (about 160 days) although mothers are on shore for about 38 days (Gentry, 1998). Offspring are weaned at about 125 ± 10 days old (Gentry and Holt, 1986; Goebel, 2002). Offspring begin swimming at about 26 days of age, spend a substantial amount of time in the water by 40 to 50 days of age, and by 100 days old are making shallow dives for short durations (Baker and Donohue, 2000). While still dependent on their mother's milk, young have molted into their adult fur at approximately 100 days old (Scheffer and Wilke, 1953). Young of the year show a crepuscular activity cycle while spending about one third of their activity budget in the water as they approach weaning (Baker and Donohue, 2000). Weaning is abrupt, and offspring begin leaving the Pribilof Islands in early November or late October, although average departure is mid-November and complete by early December (Ragen et al., 1995; Goebel, 2002; Baker, 2007; Lea et al., 2008). Migrating young of the year are widely dispersed by the time they reach the Aleutian Islands (Ragen et al., 1995; Baker, 2007; Lea et al., 2008). Weaned offspring from the Pribilof Islands travel through Aleutian Island passes after leaving their birth islands, and remain at sea in the North Pacific Ocean (Lea et al., 2008) for about 22 months before returning to their islands of birth as 2-year-olds. A small proportion of one-year-old fur seals may return to the Pribilof Islands each year from October to December (Bigg 1990). Baker et al. (1994) and Baker and Fowler (1992) showed that larger-than-average male young of the year were more likely to survive to at least two years of age.

3.6 Diet & Foraging Behavior

Walleye pollock, squid, and bathylagid fish (northern smoothtongue, *Leuroglossus schmidti*) were the predominant prey of fur seals in the Bering Sea during the first half of the 20th century (Scheffer, 1950) and continue to be important. Northern fur seals consume schooling fish and gonatid squid, although the species eaten vary with location and season (Kajimura, 1984; Sinclair et al., 1994; Ream et al., 2005). The Northern Fur Seal Conservation Plan (NMFS 2007a) includes additional details about the seasonal and geographic variation in fur seal diet and foraging. The stomach contents of female northern fur seals in the Eastern Bering Sea between 1958 and 1974 consisted of juvenile walleye pollock (35 percent), capelin (*Mallotus villosus*;16 percent), Pacific herring (11 percent), and squid (30 percent) (Perez and Bigg, 1986). Pollock was particularly important around the Pribilof Islands and other inshore areas from July to September. More recent diet information has been obtained from fecal analyses, stable isotope analysis, and fatty acid signature analysis (Antonelis et al., 1997; Sinclair et al., 1996; Kurle and Worthy, 2001; Goebel, 2002; Gudmundson et al., 2006; Zeppelin and Ream, 2006). All methods of analysis to estimate species and size composition of pinniped diets are limited by some form of bias (Pierce et al., 1993; Sinclair et al., 2000; Bowen et al., 2001; Tollit et al., 2004; Yonezaki et al., 2003; Yonezaki et al., 2005). Diet composition of lactating adult females breeding on the Pribilof Islands continues to be dominated by walleye pollock (Gudmundson et al., 2006; Call and Ream 2012).

Lactating females breeding on the Pribilof Islands usually forage within 187 km of the rookeries, but round-trip distances about 530 km have been recorded (Call et al., 2008). During the summer, adult female (Robson et al. 2004; Kuhn et al. 2010; Gentry 1998) and juvenile male fur seals (Sterling and Ream 2004) forage at sea, returning to St. Paul, St. George and Bogoslof Islands intermittently throughout the summer and autumn. Fur seal foraging locations at sea and durations during the summer and autumn vary significantly by both island and rookery (Robson, et al. 2004; Sterling and Ream 2004; Call et al., 2008). The variability in foraging locations result in significant differences in diet (Zeppelin and Ream, 2006; Zeppelin and Orr, 2010). For example, on St. George fur seals consume pollock, squids, salmon, and northern smoothtongue most frequently, while St. Paul fur seals consume more pollock and fewer salmon and off-shelf prey. The diet of adult females breeding on Bogoslof Island includes off-shelf prey such as Gonatid squid and northern smoothtongue, but also includes Atka mackerel, pollock, capelin, eulachon, and herring (Springer et al., 2010; Zeppelin and Orr, 2010). Call and Ream (2012) found that

significant dietary overlap exists between juvenile male and adult female northern fur seals. The degree of competition between these two portions of the northern fur seal population is not fully understood. The implications of intra-specific competition for food could be important as the juvenile male portion of the population may be significantly higher due to the termination of the commercial harvest than it has been at any point since human contact. It is unknown whether these differences in diet represent preferential selection or availability of different prey types in marine habitats closest to the breeding islands. Northern fur seals appear to segregate their at-sea foraging areas by breeding island, but also groups of breeding areas within islands appear to have limited overlap in their foraging areas that persists over many years (Robson, et al. 2004; Sterling and Ream 2004; Call et al., 2008).

3.7 Impacts on Northern Fur Seals

This section analyzes the effects of the St. George subsistence harvest alternatives on the Eastern Pacific stock of northern fur seals.

Northern fur seals exhibit philopatry on land (Gentry 1998) and segregate their marine foraging areas in the Bering Sea based on their natal sites (Robson et al 2004; Sterling and Ream 2004). The philopatry and other behavioral tendencies exhibited in northern fur seals indicates that subsistence harvest activities associated with northern fur seals on St. George Island will most likely only impact those fur seals breeding and resting on St. George Island. NMFS has not identified any evidence to indicate the subsistence harvest on the Pribilof Islands or other islands where there have been harvests has affected fur seal behavior in such a way that they no longer return to the site where they were born to breed or rest. As described previously in Section 1.2, fur seal behavioral tendencies include the preference to be near other fur seals, to return to their place of birth with increasing frequency and precision as they age, and for males to detect females on land easily and tenaciously defend space for breeding opportunities with females. Fur seal behavioral tendencies are those behaviors which they tend to exhibit, but represent generalities across a continuum of individual behaviors that are also referred to as “behavioral plasticity” in the scientific literature (Krommers 1997).

The range of alternatives incorporates measures designed such that proposed harvest would not significantly impact northern fur seals at the population level or result in localized reductions in productivity within individual rookery sites. Under Alternatives 2-4, this is accomplished by setting the harvest levels well below PBR, by limiting harvest to sub-adult males and/or male young of the year, and by establishing a means to halt harvests whenever the female mortality thresholds are reached, as described in Table 1 and section 3.7.4.1. Localized depletion will be addressed by prohibiting the harvests on any single rookery or breeding area when statistical evaluation of the pup production estimate and trend indicates the population may not be within viable levels. In addition NMFS will distribute harvests over a greater number of harvest sites than had previously been practiced on St. George. NMFS also monitors fur seals on the Pribilof Islands very closely, with pup production estimated bi-annually, setting the range of subsistence needs every 3 years, and continual coordination with our co-managers on the numbers, behavior, distribution, and impacts associated with the harvests of seals. NMFS and the Tribal Governments of St. George and St. Paul will continue to conserve the northern fur seal population by protecting female fur seals from harvest, minimizing their exposure to incidental sub-lethal effects from harvesting, and balancing the ability of the Alaska Native residents to meet their subsistence needs for northern fur seals. These conservation measures will ensure that the subsistence harvest does not undermine the ability for the northern fur seal population to recover from the unknown factors causing the population to decline on the Pribilof Islands and not at their other breeding locations.

The Pribilof Islands and the surrounding Bering Sea marine environment support high concentrations of marine mammals, seabirds, fish, and invertebrates. However, NMFS has not identified any other biological resources that would be potentially impacted by the alternatives due to (1) where subsistence harvest occurs and (2) the selective harvest methods used. Section 4 evaluates potential effects of the alternatives on the subsistence community of St. George. The subsistence harvest occurs on land using harvest methods developed during nearly 80 years of commercial harvesting managed by the government under the Fur Seal Treaty and subsequent international conventions.

To carry out the subsistence harvest, a crew of 3-5 people will typically walk or crawl from the end of the road system into fur seal resting areas to surround the seals and prevent their escape into the water. Once surrounded, the crew slowly herds the sub-adult seals inland to areas separate from those areas previously occupied and as close as practical to the end of the road system to minimize transport of the meat and other non-edible portions. The distances over which sub-adult seals are herded range from 100 to 500 m on St. Paul Island and those distances are very similar on St. George. No firearms are used during the fur seal subsistence harvest. Death during the subsistence harvest is accomplished in the same manner as the commercially established method of clubbing and severing the aorta to ensure humane death (Keyes 1977; Stoskopf 1984). No cases of a lethal strike where the seal is subsequently lost during the subsistence harvest have been reported or observed on St. George. The lack of struck and lost seals is a function of the controlled harvest process. The seals herded from the beach to the inland harvest area are subsequently separated into smaller groups of fewer than 20 and surrounded by the harvesters. Any seal chosen by the harvester is either missed and the seal moves immediately, or it is struck with the club in the head or neck and immediately collapses. When the chosen seals have been stunned, the remaining seals are allowed to escape at their own pace towards the water. At this point the seal may be struck again depending on involuntary muscle contraction to ensure harvester safety prior to handling to sever the aorta. Typically for each individual seal the interval between stunning and exsanguination by severing the aorta takes about 30 seconds to at most a few minutes, and once the seal stops bleeding it is skinned and butchered for consumption. This harvest process results in the fur seal subsistence harvest exclusively affecting fur seals. There is no potential for subsistence harvests to affect habitat, seabirds, or harass or accidentally capture other marine mammal species and no instances of such effects to other species or habitats have been observed on St. George during harvest monitoring by NMFS or NMFS representatives.

Mitigation of possible sub-lethal effects of the young of the year harvests under Alternatives 2-4 will be accomplished by the development, implementation, and adaptive refinement of best harvest practices with the harvesters. The specific measures to be included in the best harvest practices are uncertain because an autumn young of the year harvest has not occurred for over 120 years and the traditional methods were not documented. In addition, the habitat occupied by fur seals in the autumn is highly variable depending on the prevailing weather and other unknown factors. It is anticipated that young of the year harvest sites will include rookery sites where male and female young will be herded inland for harvest away from those areas used by adults to minimize incidental harassment and displacement during the harvest. The terrain or weather conditions at other sites might result in harvests occurring within those areas typically occupied by adult and sub-adult seals and they would be displaced and harassed as long as harvesters are present. Other young of the year harvest sites may include sites only occupied by young, and there would be no incidental harassment or displacement of adult or sub-adult seals if harvests are successful at these sites. As a result, NMFS expects that best harvest practices will be identified with harvest experience, as well as changes in the fur seal population, and community needs. NMFS and the Council intend to describe the best harvest practices in a living document, improved annually after review and consideration in accordance with the co-management agreement. The best harvest practices will be useful in setting and sharing the necessary cultural and conservation precepts to ensure the community's ability to meet their subsistence need during each season are balanced against practical measures for harvesting to minimize potential sub-lethal effects on seals not harvested.

NMFS and the Council agree that the best harvest practices would include a description of field measures intended to: 1) reduce impacts to lactating females, 2) ensure the detection of female young of the year, 3) distribute the harvest proportionally among all the breeding areas, 4) ensure full utilization of harvested young of the year, and 5) describe opportunities for coordination of sampling and measuring harvested young of the year during the harvest season. The best harvest practices also will consider communication methods to specify a harvest schedule which minimizes repetitive disturbances at breeding areas and allows for NMFS to schedule monitoring during and after the harvest. The best harvest practices will include a description of jointly agreed-upon measures to consider before each young of the year harvest. These measures would include criteria such as whether the harvest location includes adult females and if so how harvesters can reduce the duration of their presence, avoid harvest locations where downwind seals will be unintentionally harassed or displaced, or choose an un-harvested location where adult females are not present. To effectively address the detection of female young of the year, harvesters will consider a minimum number of independent handlers who would sex every young of the year seal prior to the harvest, or the number of times a young seal must be sexed as male before it can be harvested. Alternatively, a best harvest practice may be to release all young of the year not positively identified as male on their first handling. Harvesters will maintain as a best practice a record of previous harvest attempts to compare with future harvest locations where young have been observed to ensure the harvest is not concentrated at any location where sub-adult male and female or adult female fur seals are present. The community and harvesters will identify their individual needs for meat and handicraft materials and any cultural preference for various parts of the young seal to encourage full utilization of the edible and non-edible portions of each harvested seal. The harvest of young is foremost a food harvest, but in consideration of full utilization there has been a growing interest on St. George in the development of authentic native articles of handicraft and the economic opportunities they present for individuals and the community. The Council and NMFS representatives who will be present at each young of the year harvest will share in advance harvest plans and schedules, as best practices, to ensure opportunities to sample tissues and measure young during and after the harvest are available and do not impair the efforts to minimize effects or effectively harvest.

3.7.1 Context for Impact Analysis

Humans harvested northern fur seals commercially for their pelts for over 200 years. A general discussion of the commercial harvest can be found in Section 5.3. The United States managed the commercial harvest intensively and conducted concurrent scientific investigations of the effects of the harvest from 1876 through 1984 (Scheffer et al., 1984; Roppel 1984). NMFS's best estimate of the United States commercial harvest and associated killing for research over this extensive period is over 7 million seals killed, the vast majority on the Pribilof Islands. The U.S. commercial harvest and research provides significant context and understanding of the likelihood of lethal and sub-lethal effects which might be expected to result from the proposed subsistence harvest alternatives. Russian and Japanese breeding populations of fur seals are similar in size to those on St. George and have experienced both significant increases and decreases and variable harvest regimes, including harvests of primarily males, but also harvests which have included both male and female young of the year. NMFS has provided specific analysis and details of harvesting of males and females to inform the analysis of the alternatives.

The U.S. harvested 540,027 sub-adult male fur seals from St. George Island under the Treaty and subsequent Conventions. The average harvest on St. George Island during the commercial period from 1911-1972 was 8,710 sub-adult males killed each year. The commercial harvest season lasted 6 to 8 weeks and we estimate about 35 harvests occurred annually each season, resulting in about 248 seals killed per harvest per year. Analyzing the absolute number of seals killed shows that at least ten times the number of male seals were killed annually in the commercial harvest (1911-1984) compared to those

taken for subsistence between 1985 and 2013. It is also useful to compare the percentage of annual production for the early commercial period 1912-1921 to the most recent decade of subsistence harvesting because of the similarity in population size to the present.

The northern fur seal population in 1911 was thought to be at its lowest level in history, with pup production estimates ranging from about 11,000 to 26,000 from 1912-1921. Harvests during this decade killed about 14% of annual production, compared to up to 3% of pup production (500/16,184) that could be harvested in 2014. Based on the calculated PBR for St. George between 1912 and 1921, the harvest killed between 57% and 471% of PBR. Despite the number of harvested seals, the population increased at about 8% per year. The 2012 fur seal pup production on St. George was 16,184, a number that falls between the 1915 and 1916 estimates of 15,390 and 18,122 respectively. In 1915 and 1916, 994 (112% of PBR) and 2,479 (233% of PBR) sub-adult males were killed, yet the population continued to increase in following years thus indicating there were no long-term adverse consequences of these higher levels of harvest on the population.

Since 2008 the actual subsistence harvest of sub-adult males on St. George has been less than 11% of PBR (see Table 9, Figure 3). The most recent information regarding the actual subsistence harvest and pup production would suggest that since the subsistence harvest kills a smaller percentage of PBR (11 % of PBR in 2008 and less than 5% in 2012), pup production declines at a higher rate, suggesting that a higher harvest would increase pup production. Based on these historical analyses of pup production, it is not likely that the subsistence harvest of young male fur seals measurably affects annual pup production. There is no historical or current evidence that the proposed subsistence harvest of up to 500 sub-adult males would have negative consequences on the St. George fur seal population.

When compared to historic commercial harvests, all of the alternatives considered would remove a small percentage of annual pup production and an equally small percentage of PBR. If the commercial harvest of males affected the St. George population, we would have expected the population to respond positively by increasing pup production when commercial harvest was terminated after the 1972 season. NMFS detected an increase in number of adult males counted annually in the late 1970s until the early 1980s on St. George as a result of the cessation of the commercial harvest of thousands of sub-adult male fur seals annually (see Figure 3 and Figure 4; Fowler and Robson 1994, Gentry 1998). These results showed that more sub-adult males survived to adulthood when they were not harvested commercially. Despite this, pup production continued to decline again suggesting that harvest of males is not related to annual pup production. NMFS estimates of pup production have declined consistently from the early 1970s to 2004 (Towell et al., 2006). There was a short period of little or no change in pup production on St. George (see Figure 2, Figure 3, and Figure 4). The number of sub-adult males harvested for subsistence purposes on St. George has declined about 1% per year since 1976 and during this time, more males survived to adulthood. While pup production has declined over the past 40 years, there is no evidence that the harvest of males has contributed to this decline.

The Russians harvested from 34-93% of the estimated surviving sub-adult males on Tyuleniy Island from 1990-2003 (Kuzin 2010). Kuzin (2010) estimated during this same period the pup production on Tyuleniy Island increased from about 15,000 to 42,000. This provides further evidence of the sustainability of male harvests and all the associated sub-lethal effects can occur at much higher levels than that proposed under any of the alternatives considered.

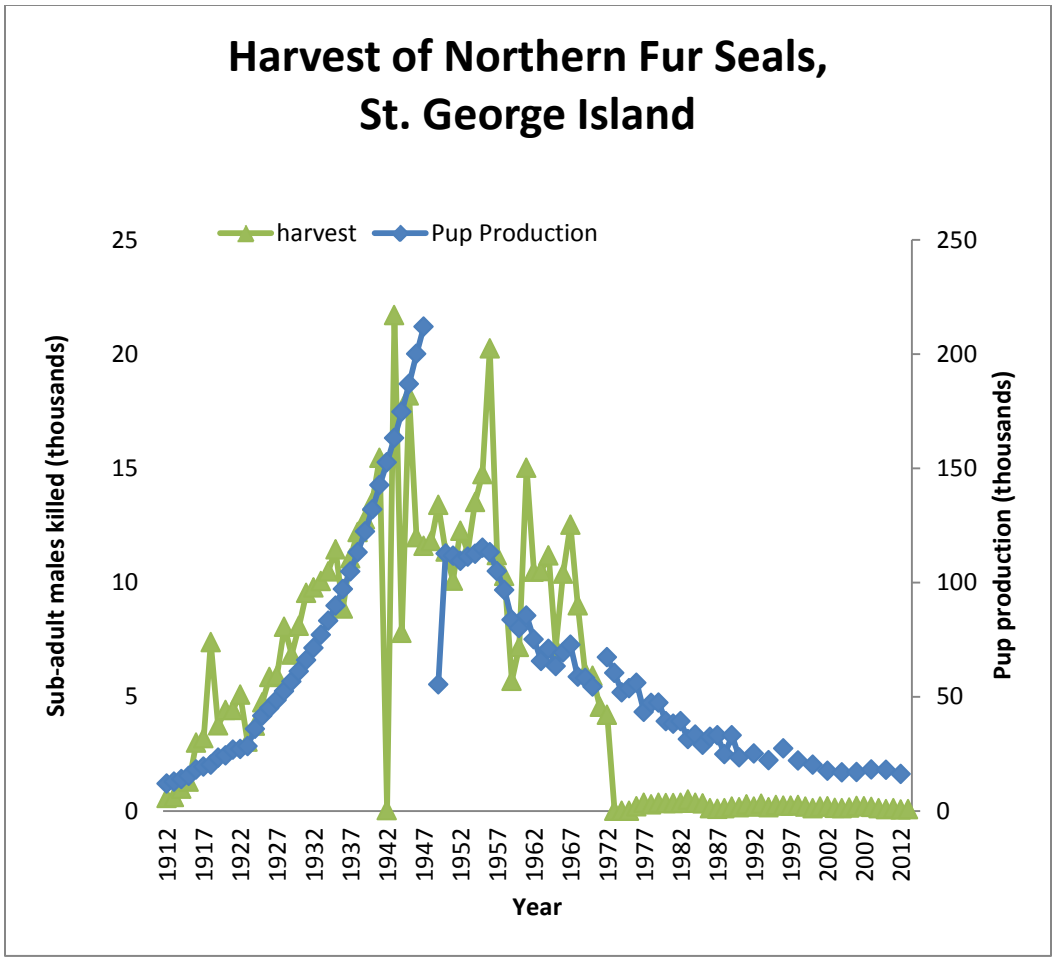

Figure 3 Land harvest of sub-adult male northern fur seals and pups born* on St. George Island, Alaska

*See note from Figure 2 regarding estimated pups born on St. George from 1925-1965.

3.7.1.1 Context of female mortality

The Russians instituted the first harvest restriction for the benefit of the Pribilof Island fur seal population by prohibiting the harvest of female seals. The Russians were able to maintain high harvests on the Pribilof Islands and the population was robust when the U.S. purchased Alaska. Roppel and Davey (1965) report the history of pelagic sealing from 1875 to 1909, the significant negative impact on the fur seal population due to the mortality of females. At the peak of pelagic sealing (1891-1900), more than 42,000 fur seals (mostly lactating females) were taken annually in the Bering Sea (Scheffer et al., 1984). The protection of female seals due to the prohibition of pelagic sealing resulted in the recovery of the Pribilof population. International negotiations during the 1950s to extend the Treaty resulted in a decision to reduce the population size to increase annual pup production. From 1956 to 1968, the U.S. killed a total of about 300,000 female fur seals on the Pribilof Islands as part of the herd reduction program (Figure 4). In addition, the United States and Canada collected about 16,000 females at sea for scientific investigations of distribution, reproduction, and diet from 1958 to 1974 (York and Hartley, 1981). Concurrently, 30,000 to 96,000 sub-adult males were harvested each year during that period (Lander and Kajimura, 1982).

The Pribilof Islands fur seal population did not react as expected to the herd reduction program initiated in the 1950s. Kajimura (1980) reported that neither a substantial decrease in age at first pregnancy nor an increase in pregnancy rates occurred as the pup production declined (Figure 4). Additionally, survival rate increases did not overcome population losses resulting from intentional female harvests to achieve herd reduction. The inability of the herd to recover generated speculation that some natural or anthropogenic factor, or combination of factors, may have adversely affected the recovery of the herd and caused extreme fluctuations in year class survival (Roppel, 1984). York and Hartley (1981) were able to attribute the majority of the fur seal population decline through the 1970s to the killing of female fur seals.

Harvests from the Russian Islands where fur seals breed provide additional context for the importance of protecting females and the ability of the fur seal population to sustain high levels of male harvests. The commercial harvest on Bering Island was not managed similarly across the time period and additional analysis lends insight into the possible population effects. The Bering Island commercial harvest included only male fur seal young of the year from 1987-1992 and averaged over 6,000 annually (14.6% of annual production) in addition to a harvest of 2-5 year old males (Ream and Burkanof pers. comm.). Ten years after the initiation of the male young of the year harvest, there were no observable effects on pup production at Bering Island; the trend in pup production during this time period was not statistically different from zero. These results indicate that a male young of the year harvest of about 14% of annual production does not have any detectable direct or indirect population level effects. From 1993-1998 Russians harvested approximately equal proportions of male and female young of the year at about 10% of annual pup production in addition to harvests of 2-5 year males. During 1993-98, beginning four years after females were first harvested until four years after the harvest of females stopped, the population trend was negative (~ −6% annual decline, Ream and Burkanov pers. comm.). NMFS analyzed the trend for females at four years after the harvest because that is the age at which female fur seals first reach sexual maturity and possible sub-lethal effects could occur. Kuzin (2010) reported that the harvest of 16,180 female young of the year from Bering Island directly affected the reproductive capacity of the population and ultimately the population trend.

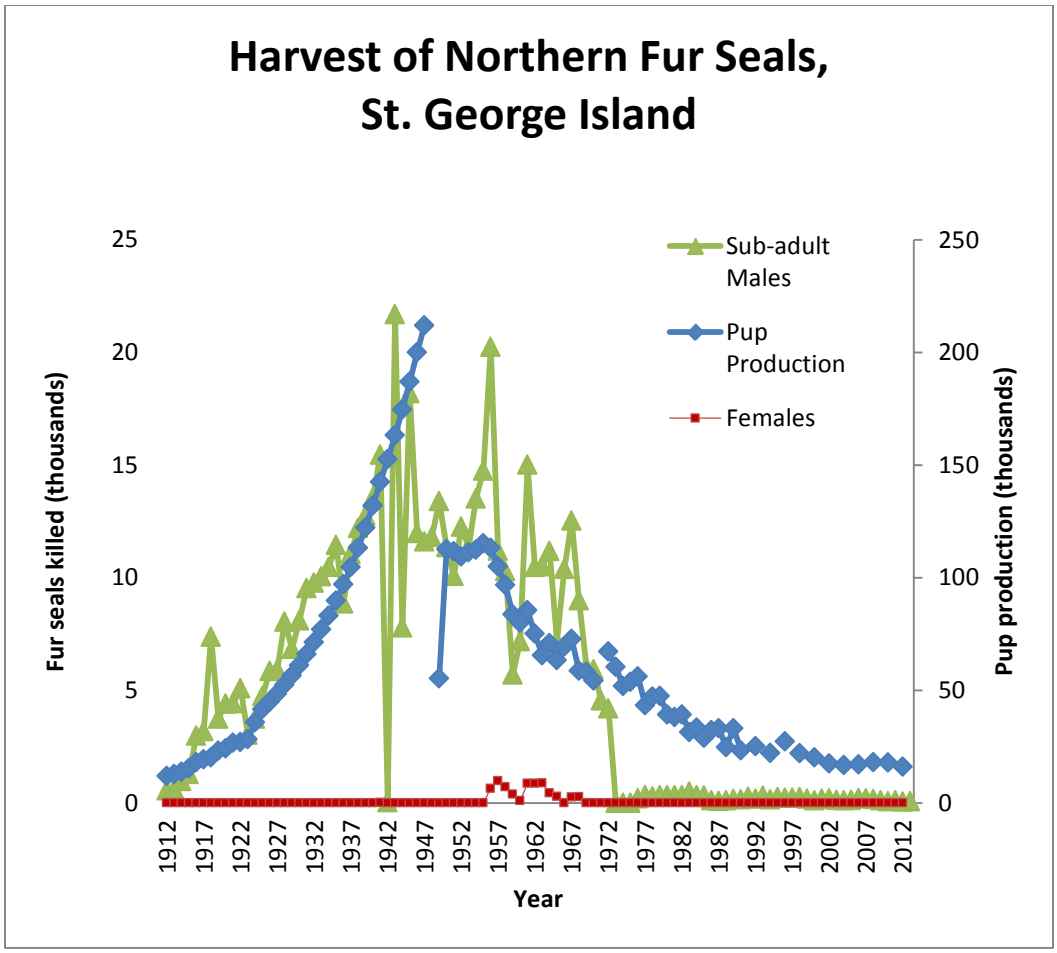

Figure 4 Land harvest of male and female northern fur seals and estimated pups born* on St. George Island, Alaska

*See note from Figure 2 regarding estimated pups born on St. George from 1925-1965.

3.7.1.2 Context of sub-lethal effects

Whether additional energy expenditures due to harvest would have consequences to the survival and reproduction of non-harvested individuals is unknown, but such effects are not anticipated because seals return within a few hours to the site from which they were disturbed. The few additional hours is a small fraction of the variation observed in duration of fur seal foraging trips away from the islands. Lactating females' foraging trips range from 4-13 days covering hundreds of kilometers per round-trip (Nordstrom 2012), and for St. George mean foraging trip duration is 6.5 days covering a mean round trip distance of 432 km (Call et al., 2008). Therefore, we anticipate a few hours additional waiting in the nearshore zone is not likely to impair the survival or reproduction of lactating females who spend on average 165 hours at sea during each of their 7-13 foraging trips (Gentry and Holt 1986). Pups regularly experience these long durations without their mothers (average 165 hrs). While the pup's response to harassment by harvesters is likely different than the normal pup response to the absence of their mothers it is probably not much different than pup's response to sub-adult and adult male aggression. Pups will immediately flee towards the water when they experience male aggression. If they are pursued by males they will ultimately attempt to flee to the water where they are less likely to be injured or killed by male aggression (Kiyota

and Okamura 2005). Kitoya and Okamura (2005) reported pups experienced 3.8 harassment encounters with aggressive males during a season, which could result in injury or death, so pups learn to respond quickly by fleeing. We would expect pups to exhibit a similar reaction to harassment by subsistence harvesters as is observed during research harassment.

Pups spend longer and longer durations swimming at sea in the absence of their mothers, and daily will swim long distances and wander inland to and from their place of birth (Baker and Donahue 2000), such that a few hours of harassment is not expected to result in any measureable sub-lethal effects (e.g., due to expending energy to avoid harassment).

NMFS considered that the sub-lethal effects of the young of the year harvest on female fur seals might cause detectable effects on the population. There have been no directed studies on the sub-lethal effects of harassment on female fur seals. NMFS considered that sub-lethal effects as described previously occurred during the female culling program from 1956-1968 (York and Hartley 1981) and concurrent pup tagging programs. Under the female culling program the U.S. Government rounded-up adult female fur seals from the breeding areas, moved them to upland harvest areas, and killed an average of 24,000 adult female seals per year, resulting in the deaths of their dependent offspring. In addition on average 36,996 pups were tagged each year by rounding them up, moving them inland, handling them for tag application, sex identification, and weighing before releasing them back to their suckling areas. NMFS considered the sub-lethal effects as a result of these two historic programs which occurred in the rookeries would have resulted in those seals which were not killed from 1956-1968 to have experienced sub-lethal effects similar to those which seals would experience during the proposed young of the year harvest, except that many fewer seals would be exposed.

For example, if one were to predict that sub-lethal effects might occur and be detected we might expect it would have occurred during this period on St. Paul for which there are available population data. There are limited population data from St. George during this period of time. Examining 1964, there were at least 12,034 adult females rounded up from the breeding grounds on St. Paul to allow them to be killed by the U.S. Government under the Convention (York and Hartley 1981, Roppel 1984, NMML unpublished data). In addition, all of their pups died. In 1964 the U.S. Government rounded up at least 19,998 pups on St. Paul Island, drove them to an area on the periphery of the rookery, tagged them with flipper tags, and released them to reunite with their mothers. Using the same rationale as we used in the quantitative analysis of the sub-lethal effects of the harvest of male pups (Section 3.7.2.2 and 3.7.2.3), we would use 1.15 non-pups exposed per seal killed and an additional 50 non-pups exposed per event. Thus, approximately 30,000 pups and 44,000 non-pups (mostly adult females since they were the object of the female culling program) would have been exposed to sub-lethal effects from the round-up, handling, and tagging in 1964. In 1965, the pup production was estimated as 253,768, whereas in 1963 the pup production was 262,498 (NMML unpublished data). In order to properly estimate the sub-lethal effect, we must first remove the direct effect of mortality in 1964 from the 1963 pup production estimate by subtracting 10,830 (pregnancy rate of about 90% for those 12,034 harvested females; Trites and York 1993). Therefore, we would have expected the 1965 pup production estimate to be 262,498-10,830=251,668, but it was higher: 253,768. If the seals had experienced sub-lethal effects due to round-up, driving, and pup tagging, we would have expected to detect a reduction in pup production the year after the 1964 tagging and culling programs-affected seals, but we did not.

NMFS considered that if sub-lethal effects on non-pups due to a harvest of 150 male pups (as in the preferred Alternative 2) were detectable, then this historic program would have exposed non-pup seals to similar sub-lethal effects. NMFS considered there would have been a detectable change in reproduction, because thousands of seals were exposed to sub-lethal effects, and while the population at the time was larger than today, it provides the best available evidence of how the current population may be affected by

the proposed harvest alternatives. Thus, we might expect that if sub-lethal effects were to occur, pup production from those 44,000 females left alive but exposed to harvesters entering the breeding areas to kill 12,304 females would have been reduced the year after the harvest (1965). Because the pup production estimate in 1965 after removing the direct effect of mortality was actually higher by about 2,000 pups rather than lower, we do not anticipate the sub-lethal effects on females to cause a detectable reduction in pup production as a result of the harvest of 150 male young of the year. In addition, researchers entered the breeding and suckling areas to round-up, drive inland, and tag 24,000 pups during about 15 to 20 different events in 1964. This aspect of the NMFS research program would have exposed adult females to additional sub-lethal effects, and also female pups to those same sub-lethal effects we are predicting to occur. Therefore, NMFS considered sub-lethal effects were not detectable under these circumstances where thousands of seals, including pups and non-pups of both sexes, were exposed to activities we consider very similar to the proposed harvest alternatives.

The Russians harvested from 34-93% of the estimated surviving sub-adult males on Tyuleniy Island from 1990-2003 (Kuzin 2010). Kuzin (2010) estimated during this same period the pup production on Tyuleniy Island increased from about 15,000 to 42,000. This provides further evidence of the sustainability of male harvests and evidence that the associated sub-lethal effects can occur at much higher levels than that proposed under any of the alternatives considered, without adverse effects to the population. We can presume the fur seal population on Bering Island would have experienced sub-lethal effects by Russian harvesters rounding up and moving young of the year seals some similar distance (Burkanof pers. comm.), disturbing seals such that they move into the water, and handling male and female pups in a similar fashion to that proposed in Alternatives 2-4. Russian harvesters killed thousands of pups during their harvests on Bering Island and those harvests would have resulted in significantly greater exposure to sub-lethal effects due to longer duration harvests and more repeated events than the proposed harvest alternatives analyzed.

3.7.2 Methods for Impact Analysis

This section describes the methods used to assess the impacts of the alternatives on direct and indirect fur seal mortality, direct and indirect sub-lethal effects on fur seals, and achieving established conservation objectives.

The terms “effects” and “impacts” are used interchangeably in preparing these analyses. The CEQ regulations for implementing the procedural provisions of NEPA, also state “Effects and impacts as used in these regulations are synonymous” (40 CFR §1508.8). The terms “positive” and “beneficial,” or “negative” and “adverse” are likewise used interchangeably in this analysis to indicate direction of intensity. The significance of an impact is determined by considering both the context in which the action will occur and the intensity of the action (40 CFR 1508.27). The context is comprised of the extent of the effect (geographic extent or extent within a species, ecosystem, or region) and any special conditions, such as endangered species status or other legal status. The intensity of an impact is the result of its magnitude and duration or frequency. These terms are used in this assessment to describe the criteria against which potential effects of the alternatives are compared and are presented in Table 3.

3.7.2.1 Direct and Indirect Mortality

The magnitude or intensity of effects on biological resources is generally assessed in terms relative to the population rather than the individual. To measure the direct and indirect effects of the harvest alternatives, analysts compared the total number of harvested seals to the Potential Biological Removal (PBR) of the

northern fur seal population breeding on St. George Island. The calculation relative to PBR considers direct and indirect effects of the proposed action on the northern fur seal population, and allows the scaling of the effect to the estimated population size under consideration (in this case the estimate of pup production for St. George Island). The rationale for using PBR as a metric for mortality effects on northern fur seals is based on the 1994 amendments to the MMPA, which defined PBR as "...the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population." PBR was intended to serve as an upper limit guideline for fishery-related mortality for each stock rather than population unit and is annually reported in the stock assessment report (Allen and Angliss 2013) and it is appropriate to use for other human-caused sources of mortality. NMFS used PBR as the threshold for evaluating the effects of Steller sea lion and northern fur seal research (NMFS 2007). PBR is a precautionary or conservative measure of human-caused mortality that could be expected to affect a population's ability to recover from a depleted state or to remain at a sustainable level. The PBR calculation accounts for uncertainty in population estimates and protects half of annual productivity for the depleted Eastern Pacific stock of fur seals through the use of a recovery factor set at 0.5 rather than 1 (Wade 1998). Because the calculation of PBR contains a recovery factor for these stocks, mortality levels that exceeded PBR would not necessarily cause a population to decline.

Direct and indirect mortality is analyzed as a proportion of the most recent PBR estimate from the Alaska Marine Mammal Stock Assessment report adjusted for just the St. George portion of the stock. Thus, for the entire Eastern Pacific stock of northern fur seals, PBR = 11,130 animals (517,679 × 0.043 × 0.5) (Allen and Angliss 2013). The estimate of PBR for the analysis of direct harvest mortality effects when scaled to St. George Island population size (61,628 x 0.043 x 0.5) is 1,325 animals.

To implement the MMPA, NMFS defined the insignificance threshold for fisheries related mortality as being 10 percent of PBR for the stock of marine mammals (69 FR 43338). To be consistent with this threshold, this analysis considers harvest-related mortality less than or equal to 10 percent of PBR "negligible". Following the logic of this threshold for fishery related regulations, this analysis considers harvest-related mortality more than or equal to 50 percent of PBR "major". There are no comparable thresholds used in the fishery regulations to distinguish between "minor" and "moderate" levels of mortality. For the purposes of this analysis, these thresholds are evenly divided between the 10 percent (negligible) and 50 percent (major) thresholds. Thus, this analysis considers harvest-related mortality between 10 percent and 30 percent of PBR to be "minor" and mortality equal to or more than 30 percent and less than 50 percent of PBR to be "moderate" (Table 3).

PBR assumes random mortality across all age classes and both sexes in the population (Wade and Angliss 1997). However, the subsistence harvest is selective for males 4 years old and younger. This male-only harvest protects the female portion of the population and provides an additional protection factor because male harvests will not negatively affect pup production. NMFS has sub-adult male survival estimates from the 1970s (Lander 1981), but estimates of sub-adult female survival from the same period are more uncertain. Therefore, applying estimates using sub-adult female survival to the current population is highly variable and uncertain. For this reason, NMFS does not know the actual level of female harvests which may affect the fur seal population, but evidence from studies of Russian fur seal harvests (from 1990-2007 on Tyuleniy Island and 1996-2006 on Bering Island) suggests that any additional female mortality has a high probability of negatively affecting the population. In addition to the selective harvest of males, the harvest is limited to the younger age classes in the population. The sub-adult age classes have lower survival than adults. In other words, a proportion of the population of young males that can be harvested would die naturally whether they are harvested or not.

Human-caused mortality on younger age-classes will have less effect on the population than the same mortality of older age-classes. Lander (1981) estimated 1-3% of male pups born survive to adulthood (≥9 years old). Supporting this concept, DeMaster (1981) modeled the "maximum yields" for Weddell seals and found that approximately twice as many pups could be harvested annually versus non-pups. While a comparable analysis of the maximum yield for northern fur seals has not been completed due to a lack of current age-specific survival data, the similarities in life history suggest the harvest of young during their first year of life minimizes potential reproductive losses for the population compared to harvesting animals that survive into adulthood. Eberhardt (1990; 2002) describes the importance of high adult survival for long-lived species' ability to maintain or recover to an equilibrium population. Thus, any increase in human-caused mortality for age classes approaching sexual maturity is more likely to cause a detectable reduction in population abundance versus human-caused mortality during the first year of life. The harvest of young of the year rather than 2 to 4 year old seals reduces the likelihood of any population levels effects.

Table 3 Criteria for Determining Impact Level for the St. George Subsistence Harvest on Northern Fur Seals

Effect	Component of Effect	Major	Moderate	Minor	Negligible
Direct and indirect mortality on the St. George fur seal population	Magnitude or Intensity	Total mortality equal to or more than 50% of PBR	Total mortality equal to or more than 30% and less than 50% of PBR	Total mortality assessment between 30%-10% of PBR	Total mortality assessment less than or equal to 10%of PBR
	Geographic Extent	Effects concentrated at one subregion or rookery	Effects distributed among a few subregions or rookeries	Effects distributed across range of population	No measurable Effects across a rookery
Direct and indirect sub-lethal effect on the St. George fur seal population	Magnitude or Intensity	Enough to cause a measurable change in reproductive success	Equivocal change in reproductive success	Mechanisms for effects, but productivity similar	No mechanisms for reproductive effects
	Geographic Extent	Effects concentrated at one subregion or rookery	Effects distributed among a few subregions or rookeries	Effects distributed across range of population	No measurable effects
Beneficial contribution toward Conservation Objectives	Magnitude or Intensity	Achieves all conservation objectives in Conservation Plan	Achieves most conservation objectives in Conservation Plan	Achieves a few conservation objectives in Conservation Plan	Achieves no conservation objectives in Conservation Plan
	Geographic Extent	Research pertinent for local and population-wide management needs	Research pertinent for local and subregion management needs	Research pertinent for local management needs only	Provides no information for management

3.7.2.2 Direct and Indirect Sub-lethal Effects

Direct and indirect sub-lethal effects are potential effects to animals incidental to human presence on or near the breeding area, the herding of animals into groups, maintaining the groups, and the subsequent release of individuals from the groups. This analysis estimates the mortality associated with exposure to these direct and indirect sub-lethal effects.

This analysis followed the methods described in the Steller Seal Lion and Northern Fur Seal Research PEIS (Research PEIS) (NMFS 2007b) and subsequently used in 2009 to estimate effects of research activities requested in permit applications submitted for northern fur seals. The Research PEIS evaluated possible incidental effects of "Activities involving pup round-ups" as one of the categories used to estimate northern fur seal mortality due to researcher presence among animals (which includes incidental disturbance during animal captures). Potential effects that the Research PEIS analysis evaluated included known lethal consequences (the observed mortality rate) and unknown lethal effects (estimated mortality resulting from animals being alerted, entering the water, and/or being injured during the disturbance). Animals potentially exposed to the round-up activities included pups and non-pups that are disturbed but not rounded-up, as well as pups that are rounded-up and subsequently released.

The research category "pup round-ups" is the closest proxy for evaluating potential effects of the young of the year harvest round-up. The principal difference between the activities analyzed for the Research PEIS and the harvest activities analyzed here is that fewer animals are rounded up for harvest than those typically herded for research (3,000).

NMFS has not detected a reduction in reproductive rates due to sub-lethal effects. However, as a precautionary measure, the observed rate of mortality has been used as an upper limit to evaluate such effects. Known (observed) mortalities incidental to pup round-ups have all corresponded to dense aggregations of young of the year involved in research, so it is likely that the observed mortality rate per affected animal (0.00001 for pups (young of the year) and 0.0 for non-pups) applied in the analyses of sub-lethal effects would be lower during the proposed harvest due to the lower number of young of the year in each harvest round-up. In other words, mortality expected from incidental disturbance (potential sub-lethal effects) from young of the year round-ups during harvest would be less than that estimated for scientific research, which was also quite low (0.4 total seals) (NMFS 2007b).

Given this background, the type of effects, estimated proportions of animals affected, and estimated mortality rates per animal affected were applied to the harvest analysis using the same methods used in the Research PEIS (NMFS 2007b) for activities involving pup (young of the year) round-ups. Two scenarios were used to evaluate the range of possible disturbance levels under each of the four proposed alternatives:

(1) 150 animals are harvested during 3 harvests. Under this scenario, 50 animals would be harvested at each of three harvests; 50 is the maximum number that can be harvested from any of the three regions per Alternative 2.
(2) 150 animals are harvested during 150 harvests. Under this scenario, only one animal is taken per harvest, resulting in more harvest days and locations, as well as more incidental disturbance.

The analysis of these two scenarios allows NMFS to estimate the range between the minimum and maximum level of disturbance that could result in sub-lethal effects under the proposed alternatives. The actual level of sub-lethal effects due to the proposed harvest of young of the year would likely fall in between these two levels.
The numbers of animals potentially exposed to the disturbance for either the male sub-adult or male young of the year harvests were estimated as follows:

(1) Young of the year: 2 young of the year are disturbed for each young of the year harvested, 60 additional young of the year are disturbed for each harvest event. No young of the year are disturbed during the harvest of non-pups.
(2) Non-pups: 1.15 non-pups are disturbed for each animal (either young of the year or older) harvested, 50 additional older animals (i.e., non-pups) are disturbed for each harvest event.

3.7.2.3 Process Used to Assess Probability of Mortality Due to Sub-Lethal Effects

As indicated previously, NMFS has not detected a reduction in reproduction as a sub-lethal effect in fur seals exposed to research activities, harvest activities, and repeated human presence. In the absence of such evidence, NMFS has based the assessment of potential sub-lethal effects by using direct mortality observed during research as the maximum level of sub-lethal effects. This allows NMFS to estimate the number of animals exposed to sub-lethal effects and convert that exposure into the probability of mortality due to the proposed harvest alternatives. Estimating the probability of mortality due to sub-lethal effects involves a multi-stage process shown in Table 4 and described by the following steps:

- **Step 1**. Categorize the potential responses to different types of harvest activities according to the intensity of an animal's response. Different responses can lead to mortality through a variety of known or suspected mechanisms for potential injury.
- **Step 2**. Estimate the proportion of animals that typically respond with a certain behavior based on observed responses in various locations and under different environmental conditions. This estimate represents a "typical" response and considers the range of responses observed at different rookeries/haulouts over the years.
- **Step 3**. Estimate the percentage of animals that would be injured and die as a result of various harvest activities, either while harvesters are present or sometime in the future after they have left. These estimates include sub-lethal injuries that require some time to heal, may involve some pain or discomfort, and may affect the ability of animals to move or behave normally for a period of time. It also includes estimates of individuals that may die as a result of infections, tissue damage, or impaired ability to forage successfully because of their injuries. These estimates do not include animals that would be injured and die due to natural causes.
- **Step 4**. Calculate potential mortality for each activity in the pup harvest process (round-up and capture and handling to identify sex), as a function of the mortality risk associated with an individual animal's response. This risk factor is then multiplied by the number of animals exposed during harvest activities under the range of harvest scenarios (ranging from the highest number of seals exposed to harvest round-ups [150 harvests of one pup each] to the lowest number of seals exposed [3 harvests of 50 pups each]).

As described in the beginning of Section 3.7.2, the duration or frequency of the activity provides the context of time of the effect. In this assessment, the intensity or magnitude of the effect is evaluated on the basis of the northern fur seal population rather than individual animals. There are about 100,000 fur seals using habitat on St. George during the seven-month terrestrial portion of their annual cycle. "Short-term" effect is something that is temporary and lasts anywhere from a few minutes to a few days, then the affected animals revert back to a "normal" condition. A "long-term" effect refers to something that would last more than a few days or result in a permanent change to an animal's behavior or state. Long-term effects include serious injury or death and may include other effects as described in Sections 3.7.4.3 and 3.7.4.4. Moderate duration is somewhere in between and may integrate intermittent or infrequent effects occurring a few times a year or less. Frequency refers to regularly or repeatedly occurring effects each year. Other elements of the temporal context of effects, such as whether the effects occur primarily during a sensitive or critical part of the year, are described in the analyses. For some aspects of this assessment, analysts will conduct a qualitative analysis of potential effects based on professional judgment and experience. In such cases, while a formal probability calculation will not be undertaken potential effects will be described using the impact criteria defined in Table 2.

3.7.3 Impacts of Alternative 1: No Action

Alternative 1 would continue the current harvest take levels along with age and location restrictions. NMFS's current regulations governing the subsistence harvest of northern fur seals on the Pribilof Islands are more restrictive regarding sex, size, and age of harvested seals than those in effect during the ~80 years of the commercial harvest on the Pribilof Islands. St. George has a long history of harvesting of male fur seals and the population implications are well understood. Only subadult males (less than 124 centimeters in length) are allowed to be taken in the subsistence harvest. This size range corresponds to the size of male fur seals aged less than 4 years old. The actual number of seals taken for subsistence each year since 1986 has been less than the upper limit of the allowable range (see Table 7). In addition the subsistence harvesters (from 1985 to present) tend to select predominantly 2 year old males on St. George (Figure 5).

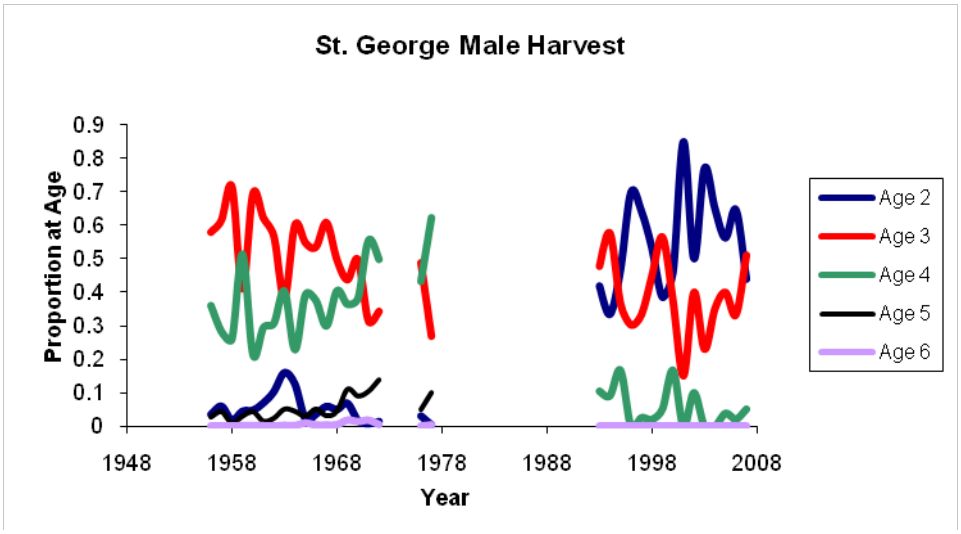

Figure 5 Age composition of the commercial (pre-1972) and subsistence (post-1972) male northern fur seal harvest on St. George Island

3.7.3.1 Direct and Indirect Mortality

NMFS has analyzed the biological implications of the subsistence harvest up to the upper end of the harvest range and found those effects to be insignificant (NMFS 2005). No young of the year (pup) mortality occurs as part of the status quo.

Sub-Adult Male Mortality: The magnitude of direct and indirect mortality effects of the status quo are considered minor to moderate since the lower limit of 300 two to four year-old male seals (23% of PBR) can be harvested prior to any controls being initiated by NMFS under 50 CFR 216.72 (e)(1)(iii). When the lower limit has been reached the harvest is suspended pending a written request from the community identifying their subsistence need has not yet been met and asking that they be allowed to continue to harvest. If the community submits such a request NMFS can decide to allow the harvest to continue to the upper limit of the harvest range (500 seals, 38% of PBR) at which point the harvest would be permanently suspended for the year. St. George has requested to exceed their lower limit on two occasions (1991 & 1993) by submitting a written request to continue to harvest. In both cases the harvest extension was granted by NMFS. In 1993 St. George harvested more than 300 seals (Table 8). This was the first time this had occurred since 1984 (NMFS unpublished data). No seals have died during the subsistence harvest due to hyperthermia (i.e., overheating) on St. George Island. The lack of hyperthermia mortality on St. George appears to be a direct function of the small number of seals involved in each round-up.

There are no other known causes of sub-adult male mortality which would occur during the subsistence harvest on St. George.

As described in Section 3.7.2, NMFS is using PBR as a quantitative measure to analyze the effects of mortality of the subsistence harvest alternatives. PBR considers how random mortality might affect marine mammal populations and includes a "recovery factor" as a precautionary buffer to protect populations that are declining or listed under the ESA. In the case of fur seals, the recovery factor is 0.5. NMFS is protecting 50% of the PBR, creating a buffer of over 1,000 seals for St. George by using a recover factor of 0.5. In addition to the use of the recovery factor, subsistence harvesters select sub-adult males and therefore reduce the impact to the population because this age class is less valuable in terms of reproduction (as compared to females of any age) (Section 3.7.2; NMFS 2005c; Wade and Angliss 1998). Based on the impact criteria in Table 2 the potential effect of harvest proposed under Alternative 1 (no action) is considered minor to moderate because mortality would be between 23 and 38% of PBR.

Another more rigorous method for evaluating potential reproductive effects is to estimate the loss of seals through mathematical models of survival and reproduction to understand the effects on the population composition over time (e.g., Lander 1981, Towell 2007). NMFS modeled the direct effect of the mortality of 500 sub-adult males. NMFS estimated a cumulative loss of between 6.61 and 9.06% more males from the population after 25 years of harvesting when compared to no harvest at all, which is greater than any of the other alternatives considered. Considering the excess of males in the population and replacement of those males through annual production, the long-term effect of the harvest is considered negligible because of harvest measures to specifically target only males. Overall, mortality effects on sub-adult males are likely to be minor under the no action Alternative.

Female mortality: Since 1985, there have been five reported sub-adult females accidentally harvested on St. George Island out of a total harvest of 4,994 seals (0.1% accidental female harvest rate). This small rate of accidental female harvests is a result of several factors including: the prohibition on harvests after August 8 each year; efforts by harvesters to identify young females during the round-up; and restricting harvests to the hauling grounds at this time of the year. NMFS and the Council anticipate low female mortality to continue based on this history. If the accidental mortality of sub-adult females were to increase, there are no regulatory mechanisms in place under the status quo to reduce or prevent additional accidental female mortalities. In order to better understand which driving factors could contribute to accidental female mortality, NMFS attempted to analyze the St. George harvest data assess whether the timing of harvest or specific harvest locations are good indicators of when accidental female mortalities occurred. However, given there are only four instances of female harvests on St. George, extrapolating from those data was not useful for examining details of accidental female mortality. Thus, the very low rate of accidental female mortality on St. George under the status quo is currently the best indicator that measures to reduce female mortality are effective. If we evaluate the accidental harvest of five sub-adult females on St. George over a period of more than 30 years (since 1985), results indicate a negligible effect on the population because less than one female per year represents less than 0.1% of PBR.

From 1985 through 2011, St. Paul subsistence harvesters have accidentally killed 35 sub-adult females during the harvest of sub-adult males. Harvesters killed 51% (18/35) of those sub-adult females on the last four days of the harvest, and the remaining accidental female harvests occurred over the last 16 days of the harvest. The analysis suggests the majority of females are killed late in the harvest period when sub-adult females more commonly come ashore, such that prohibiting the extension of the 2-4 year old male harvest season past August 8 is the most effective means of keeping accidental female mortality low.

Geographic extent of mortality effects: The geographic extent of the direct and indirect mortality effects of the status quo is moderate as the status quo harvest occurs only at Northeast and Zapadni hauling grounds. The harvest mortality is concentrated at two of the nine harvestable hauling grounds, and not at any rookeries. Subsistence harvesters have historically taken an equal number of seals from each of the two hauling grounds (about 14 seals per harvest during nine harvests each year). Thus, the harvest rate per hauling ground is about 50%. The strong site fidelity exhibited by northern fur seals makes them susceptible to the effects of over-harvesting by humans (Gentry 1998). Northern fur seals' behavioral preference for a particular site, adult females' preference to be near other adult females, excess of males in the population for reproductive purposes, and the fact that no extinct sites have ever been recolonized (Gentry 1998) suggests that any concentration of female mortality may disproportionately affect those sites. There is no evidence to suggest the geographic extent of mortality (see previous section on female mortality) resulting from the status quo has caused any rookeries to become extinct, but concentrating the harvest in two locations increases the intensity of effects at those sites as compared to a more evenly distributed harvest under Alternatives 2-4.

Female fur seals exhibit stronger site fidelity than males (Baker et al., 1995), and may be the main cause for a lack of recolonization of those sites which have historically become extinct. Little Eastern Rookery on St. George went extinct in 1915, and there are no records to indicate that any commercial or subsistence harvests occurred at Little Eastern Rookery. The historic concentration of female culling for the commercial harvest (not the accidental killing during the sub-adult male harvest) caused population declines and excessive pelagic harvests of adult females as described previously caused extinctions (York and Hartley 1981). Restricting the harvest to a period ending on August 8 and limiting it to the hauling grounds prevents most young females from being rounded up, but not all of them. Baker et al., (1995) also found that the tendency to return to the natal site increased as fur seals approached adulthood. Adult females captured by researchers repeatedly return, and are recaptured within 30-50 m of their original capture location (NMFS unpublished data). Given the current low rate of accidental female mortality during the sub-adult male harvest, it is highly unlikely any direct effects of mortality or the geographic extent of effects are detectable on the population level. An analysis of the commercial harvest of sub-adult males (Gentry 1998; Gentry 1981) was unable to detect any measureable population change in harvested versus un-harvested hauling grounds, or the movement of sub-adult male seals from harvested locations to un-harvested locations. Based on this evidence, the subsistence harvest would have a lesser effect than the commercial on the St. George population.

3.7.3.2 Sub-lethal effects of the status quo

The number of sub-adult male fur seals exposed to sub-lethal effects such as harassment or displacement is about 1,025 sub-adult males under the status quo (no action) alternative (Table 3). Neither pups nor females would experience sublethal effects under the status quo because they are not typically found in the hauling grounds at the time of year when the sub-adult male harvest occurs. The duration of sub-lethal effects is short-term because each harvest will last less than two hours and would be relatively infrequent (on average 9 harvests per year over the last decade). The magnitude and intensity of direct and indirect sub-lethal effects of the status quo are also minor. During any particular harvest approximately 25 to 30% of the sub-adult male fur seal population is onshore at any one time during the breeding season (Gentry 1981), but only one hauling ground of the nine where seals are present is harvested on any particular day. Thus, under the status quo only a few hundred seals would be exposed to disturbance due to the harvest, and only 10 to 20 (average harvest is 14) male seals are harvested on any particular day. Sub-adult males do not participate in reproduction until age 6-8 years. Assuming they may have been harassed for a very short period (less than two hours) at some point between ages 2 and 5, it is not likely they would experience some reduction in reproduction after being exposed to a few round-ups. Gentry (1998; 1981) was not able to detect any changes in the population after the cessation of the commercial harvest on St.

George Island, when on average there were 10 times as many round-ups each year and 10 times as many fur seals rounded-up during each harvest when compared to the subsistence harvests.

We have direct evidence of short-term changes in behavior of sub-adult male fur seals as a result of the subsistence harvest. Other potential sub-lethal effects may occur, but NMFS has no evidence to describe the extent of such effects. Therefore some assumptions must be made based on professional judgment and experience regarding the magnitude, extent, and likelihood of other possible sub-lethal effects. Sub-adult male fur seals are disturbed from their resting place and subsequently enter the water for a few hours while there are harvesters present nearby. Once the harvest is complete (average duration about one hour) or harvesters are no longer present on the hauling ground (average duration about 15 minutes), seals will begin to reoccupy their habitat. This type of response by fur seals occurs commonly (Gentry 1998; 1981), and within a few minutes to hours the fur seals return to their previously occupied sites and resume their normal behaviors. NMFS used the method described in sections 3.7.2.2 and 3.7.2.3 to analyze the sub-lethal effects of the status quo and estimated the probability of mortality due to sub-lethal effects was about 0.17 as shown in Table 3. Considering the maximum mortality estimate of 0.17 due to sub-lethal effects, the lack of historical evidence of sub-lethal effects from the commercial harvest, and low numbers of sub-adult males exposed to disturbance from the subsistence harvest, NMFS determined that the magnitude of sub-lethal effects is minor according to the criteria in Table 2.

Table 4 Estimated mortality occurring incidental to the harvest of sub-adult males under Alternatives 1, 2, and 4 due to sub-lethal effects.

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal	Predicted mortalities (number of animals)	Mortality subtotal for activity by age class
Activities involved in the conduct of Alt 1 harvest	pups	0	Observed mortality during activity			0.00001	0.000	
500 Sub-adult males			Alert response	1	0	0	0.000	
harvested during 9 harvests			Enter water	0.01	0	0.001	0.000	
			Injured during disturbance	0.001	0	0.05	0.000	0.00
	non-pups	1025	Observed mortality during activity	n/a	n/a	0.00008	0.082	
			Alert response	1	1025	0	0.000	
			Enter water	0.8	820	0.0001	0.082	
			Injured during disturbance	0.0005	0.51	0.02	0.010	0.17

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal	Predicted mortalities (number of animals)	Mortality subtotal for activity by age class
Activities involved in the conduct of Alt. 2 harvest	pups	0	Observed mortality during activity			0.00001	0.000	
350 Sub-adult males			Alert response	1	0	0	0.000	
harvested during 9 harvests			Enter water	0.01	0	0.001	0.000	
			Injured during disturbance	0.001	0.00	0.05	0.000	0.00
	non-pups	853	Observed mortality during activity	n/a	n/a	0.00008	0.068	
			Alert response	1	0	0	0.000	
			Enter water	0.8	682.4	0.0001	0.068	
			Injured during disturbance	0.0005	0.43	0.02	0.009	0.15

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal	Predicted mortalities (number of animals)	Mortality subtotal for activity by age class
Activities involved in the conduct of Alt. 4 harvest	pups	0	Observed mortality during activity			0.00001	0.000	
450 Sub-adult males			Alert response	1	0	0	0.000	
harvested during 9 harvests			Enter water	0.01	0	0.001	0.000	
			Injured during disturbance	0.001	0	0.05	0.000	0.00
	non-pups	968	Observed mortality during activity	n/a	n/a	0.00008	0.077	
			Alert response	1	968	0	0.000	
			Enter water	0.8	774.4	0.0001	0.077	
			Injured during disturbance	0.0005	0.48	0.02	0.010	0.16

Geographic extent of the sub-lethal effects of the status quo: The geographic extent of the direct and indirect sub-lethal effects of the status quo is moderate as the status quo harvest would continue to occur at Northeast and Zapadni hauling grounds. Alternative 1 would continue to concentrate the sub-adult male harvest at two of the nine harvestable hauling grounds on St. George Island resulting in approximately 1,025 sub-adult seals exposed to sub-lethal effects at Northeast and Zapadni hauling grounds. The duration of potential sub-lethal effects would include short-term and temporary changes in behavior for those sub-adult males not harvested and as such are considered minor. Under the status quo (no action) alternative the frequency at which the subsistence harvests are to occur is annually and not more than twice per week per location during the season from June 24 until August 8. At this frequency over this timeframe, the effects would be considered negligible across the population. The potential that sub-lethal effects, as part of the status quo subsistence harvest, would result in a detectable change in reproduction is highly unlikely. No changes in reproduction were detected as a result of the commercial harvest which was conducted with higher frequency and higher magnitude than under the status quo. Gentry (1995) described various aspects of male behavior studied

during the commercial harvest which provide the biological basis to consider the likelihood of sub-lethal effects of the subsistence harvest to be highly unlikely and therefore negligible. First, at least 80% of adult males never have contact with adult females in estrus at both high and low harvest rates and population sizes. Second, the male social system is marked by a high turnover rate. Gentry (1995) reported 65% of all adult males on the breeding grounds fail to return to a breeding site the next year, but adult females are seldom observed untended by adult males during the breeding season for long. Third, Gentry (1995) describes the male territorial and reproductive system as, "…neither fragile nor susceptible to human disturbance, as once believed." Fourth, adult male fur seals show great fidelity to their territorial sites over years, irrespective of the availability of females at those sites.

3.7.3.3 Conservation objectives

NMFS conservation objectives for northern fur seals include monitoring and managing the subsistence harvest on the Pribilof Islands. This would continue under the status quo alternative. NMFS would continue to collect teeth and tissues to understand the age composition of the harvest and other indices of population health as funding allows.

Research directly related to the local and sub-regional management fills long-term information needs for the northern fur seal population and harvest on St. George. Assuming this level of monitoring continues under the status quo, conservation objectives including assessments on population, health, human-related mortality and serious injury would contribute to conservation objectives. Status quo harvest regulations do not have a measure for preventing accidental harvest of females and while the rate of accidental harvest is extremely low, this could be considered a negative contribution to overall conservation. For this reason, the potential beneficial effects of Alternative 1 (status quo) on conservation objectives are considered minor.

3.7.4 Impacts of Alternative 2: Preferred Alternative

The preferred alternative would create a new subsistence harvest regulation based on the petition from the Council and would retain the range of allowable subsistence harvest set for the 2011 to 2013 period at 300-500 animals. The preferred alternative creates greater flexibility for the community to meet their subsistence needs by authorizing harvests:

1. of up to 150 male young of the year at all breeding and non-breeding areas from September 16 through November 30 each year,
2. at all hauling grounds on St. George for sub-adult males from June 24 through August 8, and

The preferred alternative creates effective conservation controls for the implementation of the subsistence harvest by:

1. prohibiting the taking from any breeding areas where annual pup production estimates reach levels determined to be unable to sustain a harvest,
2. suspending the harvest when two females have been killed, and describing the means to resume the harvest only after an assessment of the circumstances of the deaths and measures implemented to detect and avoid accidental taking of females are agreed upon, and
3. terminating the harvest for the year when three females have been killed on St. George.

The preferred alternative clarifies and acknowledges the roles and responsibilities of NMFS and the Council by:

1. developing best harvest practices guidelines which will describe measures intended to reduce direct and indirect sub-lethal effects,
2. describing the co-management relationship between NMFS and the tribal government and the partnership to cooperatively manage the subsistence harvest of northern fur seals and associated scientific research, and
3. clarifying that only authorized harvesters are allowed access within the posted northern fur seal breeding areas from September 16 through November 30 each year.

3.7.4.1 Direct and Indirect Mortality

Sub-adult Male Mortality; The direct and indirect mortality effects of the preferred alternative are considered minor to moderate since the lower limit of 300 seals (23% of PBR) can be harvested, similar to the status quo. When the lower limit has been reached, the St. George Council will notify NMFS in writing in the event their subsistence need has not yet been met and that they wish to continue to harvest to the upper limit of the harvest range (500 seals, 38% of PBR). The average annual harvest on St. George Island is 218 sub-adult males killed during an average of 9 harvests per year, resulting in about 24 seals killed per harvest per year.

The Council's request effectively limits the number of 2-4 year-old males to be annually harvested to 350 to ensure they will have 150 male young of the year available within their harvest range of 500. Therefore, the sub-adult male mortality effects of the preferred alternative (up to 350 killed) are reduced when compared to the status quo (up to 500 killed).

Female Mortality: The preferred alternative suspends harvests if two female fur seals are accidentally killed during the subsistence harvest. No such threshold exists for accidental mortality of sub-adult females under Alternative 1 status quo. Under the preferred alternative the circumstances surrounding the two female mortalities will be examined by NMFS and the Council. If it is determined the Council can implement measures to improve the detection and avoidance of females during the harvest, then NMFS can authorize the harvest to resume under conditions described by NMFS and agreed to by the Council in writing. If the harvest resumes and a third female is accidentally taken, then the harvest is permanently terminated for the year. Therefore, the preferred alternative has reduced effects on the population when compared to the status quo, which has no limit on accidental sub-adult female mortality.

Young of the Year Mortality: Under the preferred alternative up to 150 male young of the year can be harvested each year from September 15 through November 30. The status quo prohibits the harvest of young of the year. Despite this, the preferred alternative has a lesser effect on the population than the status quo because of the high natural mortality of young of the year. Specifically, Lander (1981) estimated 70% of weaned male young departing from St. George would die before returning to the island as a two year-old that could be harvested, and 20-25% of two and three year-old male fur seals who survive would die before returning the next year as three or four year-olds that could be harvested. There is no evidence that harvesters or scientists are able to identify and capture only those young of the year most likely to survive until adulthood (e.g., those that would contribute to the reproduction of the population). Therefore, we assume that of those 150 male pups randomly selected for harvest, 105 would have died from natural causes prior to returning to the island as a 2 year old seal. For comparative purposes, out of 150 two and three year old males, 30-38 would die naturally before returning the following year. So overall, when considering the effects of removing seals that otherwise may someday

contribute to the breeding population, the preferred alternative would result in less adverse effects than the status quo because of the high level of natural mortality for young of the year fur seals.

Another way of evaluating potential effects of this alternative is to consider annual pup production. NMFS estimated that in 2012 a total of 16,184 pups were born on St. George. If 150 of those 16,184 pups were harvested, it would represent less than 1% of annual production. The Russians experimented with a young of the year fur seal harvest during October from 1973-1976 under the North Pacific Fur Seal Commission (1980). The Russians harvested 2,419 young of the year fur seals (89% were males) from Northwestern rookery on Medney Island in 1973. The percentage of young of the year harvested on Medney Island was about 4.5% of the annual number of pups born there. The Russians harvested 200 young of the year on Robben Island in 1975 and 1976, 69% and 79% of which were males respectively. The young of the year harvest rate on Robben Island was less than 1% of annual production, but it included as much as 31% females. Russians continued the harvest of sub-adult males during this period as well, and the fur seal populations on both Robben and Medney either were stable or decreasing through the remainder of the 1970s and the 1980s (NMML unpublished data).

Direct evidence of the potential population effects of a young of the year harvest are available from the Russian islands where fur seals breed and have been harvested for commercial and subsistence purposes since the cessation of the Convention in 1985. Northern fur seal young of the year were harvested from Bering Island from 1987-2006 (Ream and Burkanov pers. comm.). The Russians commercially harvested about 4,300 young of the year each year on average, representing about 11% of annual pup production on Bering Island during this 20-year period. This rate is a much higher percentage of pup production than the experiments in the 1970s described above.

It is worth noting that the commercial harvest on Bering Island was not managed similarly across the time period (i.e., different proportions of male and female young of the year were harvested). NMFS analyzed these differences in sex composition of the Bering Island young of the year harvest to inform the most effective measures to protect the population from negative effects. The Bering Island commercial harvest included only male fur seal young of the year from 1987-1992 and averaged over 6,000 annually (14.6% of annual production) in addition to a harvest of 2-5 year old males (Kuzin 2010). Ten years after the initiation of the male young of the year harvest, there were no observable effects on pup production at Bering Island; the trend in pup production during this time period was also not considered measureable (less than zero). These results indicate that even a male young of the year harvest of at least 14% of annual production does not have any detectable direct or indirect population level effects.

From 1993-1998 Russians harvested approximately equal proportions of male and female young of the year at about 10% of annual production, in addition to smaller harvest of 2-5 year old males than during the 1987-92 period. During the 1993-98 period, beginning four years after females were first harvested until 4 years after the harvest of females stopped, the population trend was negative (~ −6% annual decline, Ream and Burkanov pers. comm.). NMFS analyzed the trend for females at four years after the harvest because that is the age at which female fur seals first reach sexual maturity and possible sub-lethal effects could be observed. Kuzin (2010) reported that the harvest of 16,180 female young of the year from Bering Island substantially affected the reproductive core of the population and ultimately the population trend (as found by NMFS quantitative analysis of the available pup harvest and population data).

A simple way to analyze potential population level effects of pup harvest mortality is to consider the percentage of the St. George Island fur seal population killed for subsistence. This analysis considers an additive loss of seals over time adequate for all age classes to be affected. In the case of male northern fur seals, NMFS estimates that 25 years covers at least one and more likely two generations of males through their average reproductive lives, and represents a practical modelling duration. The proposed regulations

would result in the annual loss of up to 150 male young of the year; this represents less than 1% of current annual production and, if multiplied over 25 years it totals 3,750 males removed from the population. This is the highest possible calculated reduction to the population over a predicted 25-year subsistence harvest and it does not account for natural mortality from birth to adulthood. We then compare the maximum subsistence harvest mortality with natural mortality estimates from birth to two years old. The range of natural mortality estimates is 60-67% (Lander 1981; Trites and Larkin 1989), and indicates that 2,250-2,513 of the 3,750 harvested pups over 25 years would have died of natural causes by the age of two.

Another more rigorous method for evaluating potential reproductive effects is to estimate and predict the loss of seals through mathematical models of survival and reproduction to understand the effects on the population composition over time (e.g., Lander 1981, Towell 2007). Fowler et al. (2009) compared mammalian population models of mortality and reported that a harvest of 150 male young of the year fur seals from St. George Island would be sustainable and not have detectable population level effects. NMFS modeled the direct effect of the mortality of 150 male young of the year and 350 sub-adult males. NMFS estimated a cumulative loss of between 0.14 and 0.87% more males from the population after 25 years of harvesting when comparing the status quo (Alternative 1) to the preferred alternative (Alternative 2). While more males are lost under the status quo alternative than the preferred alternative, the difference is small. These estimates do not account for the possible excess of adult males in the population that are not counted annually on land (Towell 2007), or whether the modeled "loss" of adult males due to the harvest would simply be replaced by peripheral adult males (see Gentry 1998) who would not otherwise have bred. As described in section 3.5, less than half of adult males counted on land account for all breeding each year, and about 20% of those adult males counted on land are territorial, but do not have females in their territories. The combination of non-territorial adult males and territorial males without females represents the excess of males at adulthood that are available for reproductive purposes.

Geographic extent of effects: The geographic extent of the direct and indirect mortality effects of the preferred alternative on the fur seal population is moderate to minor as sub-adult male harvests would be distributed among all the accessible hauling grounds and male young of the year harvests would be distributed among all locations within and outside the rookeries as practical. NMFS expects the extent of effects on the population to be distributed more broadly across the population than under the status quo. Thus sites not recently exposed to harvest will experience harvest effects. By distributing the same harvest mortality as the status quo (maximum of 500) among many sites would reduce localized effects. By localized effects we mean those effects that occur disproportionately relative to the population size. For example, the status quo restricts all seals harvested to Northeast and Zapadni resulting in 100% of the harvest occurring over 35-40% of the available population. The preferred alternative would allow harvest at all sites, but does not increase the overall number of seals to be harvested such that each site may only be harvested once or twice in a season among 6 or more sites, with fewer seals harvested from each site than has historically been harvested from Northeast or Zapadni. Northern fur seals' behavioral preference for a particular site and that no extinct sites have ever been recolonized on the Pribilof Islands (Gentry 1998) indicates that a concentration of female mortality has the potential to disproportionately affect the seals which occupy those harvested sites.

The duration of the direct and indirect mortality is long-term and permanent for the small number of seals harvested spread across the entire population of fur seals on St. George. The preferred alternative includes a second harvest season during the autumn, such that harvests will occur at more times than under the status quo. The preferred alternative proposes to spread the harvest across all available harvestable locations, rather than concentrating the harvest at rookeries and hauling grounds that comprise about 30-35% of the entire population. The harvest location restrictions in the status quo were instituted to protect the research program initiated in 1973, which ended in the mid-1980s. The research program created closures to study

effects on some seals over others, and ultimately did not detect any differences between harvested and u-harvested sites (Gentry 1998). The preferred alternative also includes an additional restriction where harvests are prohibited at any breeding ground where the annual estimate of pup production is deemed to be at a level unable to sustain a harvest. The minimum number of seals required for them to maintain the social structure and reproductive ecology of a breeding area is not known. The status quo does not include any such restriction such that the preferred alternative protects relatively smaller breeding areas from harvest and is an improvement towards conserving the population. Pups also exhibit the behavioral tendency to return to a site within a few hours (i.e., do not show long-term displacement as a result of harassment) as exhibited by the ability of researchers to capture hundreds of fur seal pups from the same location by waiting unobtrusively after the initial captures. Researchers regularly re-capture pups that escaped to the water after tagging or marking and return to land within a few minutes to an hour (NMFS unpublished data). While the geographic extent of effects would be broader than Alternative 1, the effects of harvest would be distributed across more locations and a longer period of time meaning that fewer seals would be harvested at each location and longer intervals before a subsequent harvest would occur at a site previously harvested. The preferred alternative does not restrict the number of harvests per location per week and could have adverse effects in comparison to the status quo limitation of two harvests per site per week. Therefore, under the preferred alternative the selective harvest mortality would not be concentrated at harvest sites as under the status quo alternative.

3.7.4.2 Summary of the Direct and Indirect Effects of Mortality Under the Preferred Alternative

The preferred alternative would result in the mortality of up to 500 male fur seals under four years old. The magnitude of effects from this harvest is considered minor to moderate in light of the level of potential biological removal calculated for the St. George fur seal population (1,325 seals). NMFS considers the overall mortality effects of Alternative 2 to be minor because of the lower survival of young of the year and minimal reproductive contribution of males when compared to the assumed random mortality (across ages and sexes) of PBR.

The harvest would be suspended if two females are accidentally taken during the annual harvest. NMFS would review the circumstances of the female deaths and could reinstate the harvest if, in consultation with the St. George Council, NMFS can determine measures to be implemented to improve detection and avoidance of females. If a third female is killed NMFS would terminate the harvest for the remainder of the year. These thresholds for suspension and termination of the subsistence harvest due to accidental female harvests provide maximum protection of the population while allowing the harvest under the anticipated methods. Subsistence harvesters have not accidentally harvested sub-adult females at the beginning of the harvest; in part because they are not present on the hauling grounds to be rounded up for the harvest (see analysis of sub-adult female mortality under the status quo). Subsistence harvesters can and will handle and sex young of the year fur seals prior to the harvest, identify males to be harvested, and release all identified females and those pups where there is uncertainty about the sex. The Council and NMFS would coordinate through the MMPA co-management process to identify best harvest practices based on experience of the subsistence harvesters.

In summary, the proposed harvest of up to 500 males which would include up to 150 young of the year may affect less than 1% of the St. George Island fur seal population. Whether using direct evidence of the harvest of northern fur seal pups from their Russian breeding islands (Kuzin 2010, Ream and Burkanov pers. comm.), survival models (Towell 2007, Fowler et al., 2009), or simplified direct additive losses (which assume all harvested males 4 years and younger would have survived to become reproductively active harem males), no population level effects are anticipated. In addition, the direct evidence of a significantly larger (about 14% versus 1% of annual pup production) harvest of male young of the year on Bering Island did not result in detectable effects on the population. The harvest of female

fur seals, whether or not they are sexually mature, has been repeatedly shown to have direct adverse effects on fur seal populations and confirms that the measures in the proposed rule (keeping the accidental mortality of females as close to zero as practical) are the best measures to minimize effects on the population.

3.7.4.3 Sub-lethal Effects of the Preferred Alternative

Fur seals incidentally harassed during the harvest are most likely to experience a small change in their annual energy budget, which we categorize as a sub-lethal effect. As described previously, northern fur seals displaced from their preferred habitats by humans return to those habitats after the humans have departed or are no longer detected. The sub-lethal effects of the sub-adult male harvest are well understood because of the long history of commercial harvests. The magnitude of the sub-lethal effects on sub-adult males not harvested during the harvest round-ups under the preferred alternative are estimated in Table 3. The sub-lethal effects of the sub-adult male harvest of the preferred alternative (i.e., 0.16 probable mortalities) would be less than those of the status quo (i.e., 0.17 probable mortalities), and higher than that estimated for Alternative 4 (i.e., 0.15 probable mortalities). There is no sub-adult male harvest under Alternative 3, and therefore no sub-lethal effects from this part of the action of Alternative 3.

Gentry (1998) summarized the results of the short and long-term disturbance investigations: “Brief, infrequent human disturbances are not likely to affect fur seals through breakage of the maternal bond within a season.” He continues, “The activity pattern on shore was also little affected by these occasional disturbances” (Gentry 1998). The reported examples suggest that harassments during the non-breeding season under the preferred alternative would not result in the permanent abandonment of habitat, but would cause additional energy expenditures by the fur seals temporarily disturbed during the harvest.

Under Alternative 2, NMFS and the Council would work together to identify, describe, and implement best harvest practices which would minimize repeated harassment of previously harvested sites by scheduling repeated harvests at the same site only after consideration of non-harvested sites. This approach would allow those females displaced from their young by the harvest to reunite and suckle their young without being disturbed before they depart on their subsequent foraging trip.

Following the approach used to evaluate potential sub-lethal effects of fur seal research (NMFS 2007), NMFS has quantified the likelihood of sub-lethal effects of the subsistence harvest by estimating the probability of mortality due to harassment, as shown in Table 4.The analysis considered possible sub-lethal effects that could occur incidental to human presence on or near the breeding area, the herding of animals into groups, maintaining the groups, and the subsequent release of individuals from the groups. Table 4 presents the result of each calculation for a particular activity and age class of animal as a fraction of one mortality (i.e., an estimated average mortality rate that could occur over time as a result of many different animals being exposed to a type of activity or disturbance).

To calculate these numbers, NMFS estimates a proportion of animals that might exhibit a response to harassment (i.e., alert response, enter water, etc.) during the harvest. This number is multiplied by the number of animals exposed to come up with how many animals could be affected. The number of animals that might exhibit a certain response is then multiplied by the estimated mortality rate to predict the number of mortalities that could occur from that sub-lethal effect. The estimated number of mortalities for each age class and type of effect are totaled to get an overall estimate of the lethal risks to seals that could result from the range of young of the year harvest scenarios that could occur if there were only three harvest events of 50 animals each (least amount of disturbance) up to the highest number of harvest

events that could occur (150 harvest events of one seal each) which would represent the greatest amount of disturbance. Please also see Table 4.

It is not always possible to detect animal responses to disturbance. Some responses go unnoticed for various reasons including animal behaviors that may be hidden or limitations in methods used to observe or measure responses. For those species or circumstances where responses may be detected, the type and intensity of response can vary greatly. For example, researchers have observed a variety of behaviors and measured various physiological indicators of stress in response to certain research activities as described in detail in the Research PEIS (NMFS 2007b).

In response to harvest activities, some animals exhibit no obvious behavioral response although they may have physiological responses associated with stress. Other animals are alerted and show a noticeable increase in awareness of the presence of harvesters (e.g., head up, vocalization, etc.). Others may move away from the harvester or toward the water without actually entering the water. Others may enter the water without trampling seals around them or they may cause a stampede. Some mechanisms for sub-lethal effects, including injury and mortality, during a stampede or flight into the water include:

- Increased corticosteroid levels or other physiological stress responses, especially from prolonged or repeated exposure to disturbance.
- Increased energy expenditure with the potential for hyperthermia (excessively high body temperature which could lead to muscle rigidity, brain damage, or death) for those animals involved in strenuous or prolonged activity.
- Hypothermia (characterized by abnormally low body temperature and associated with rapid, progressive mental and physical collapse which could be life-threatening) for those animals forced into the water, particularly animals undernourished or in poor health.
- Injury to pups from being trampled by adults or other pups.
- Injury to adults and pups from landing on sharp rocks when jumping or falling off cliffs or rocks.
- Injury to pups from aspirating water.
- Death of pups by drowning.
- Increased risk of predation for those animals forced into water, especially pups and sub-adults with limited mobility.
- Increased conspecific aggression (e.g., biting and pushing) among adults and from adults toward pups as animals try to reestablish or access territories on the rookery or reunite with their pups.
- Delay in return of nursing females to the rookery/haulout, leading to a malnourished or weakened pup, or slower pup growth.
- Failure of pups and mothers to reunite after separation resulting in pup death by starvation or exposure.
- Stress reactions that produce psychological and physiological responses, especially if disturbance is chronic or frequent.

3.7.4.4 Mechanisms of Injury from Capture and Restraint

Since pup harvests require capture and restraint of pups to identify their sex prior to harvest, there are risks of injury in addition to those listed above. Mechanisms by which northern fur seals can be injured during capture or incidental to capture include:

- Efforts to avoid or escape capture can lead to contusions, lacerations, hematomas, nerve injuries, concussions, and fractures, as well as hyperthermia and myopathy from increased muscle activity.
- Pups herded into large groups for processing or that pile up in response to disturbance on rookeries may be injured or suffocated under the weight of other pups.
- Pups attempting to reunite with their mothers after harvesters leave may encounter lactating females who may aggressively displace and injure them.

As shown in Table 4, Scenario 2, the estimated maximum mortality due to sub-lethal effects of pup round-ups and handling, assuming one male pup is harvested for every attempt until 150 are harvested, is about 1.2 additional fur seal mortalities (0.6 pups and 0.6 non-pups). The lowest estimate of sub-lethal effects from harvesting 50 pups during one event at each of the three locations is less than 0.1 mortalities due to sub-lethal effects (Table 4, Scenario 1). The anticipated harvest would be somewhere between these two extreme scenarios and therefore the sub-lethal effects of the young of the year harvest would range between 0.1 and 1.2 mortalities per year. Considering the impact of direct harvest mortality is minor (percentage of subsistence mortality equivalent to 30% or less of PBR), the overall sub-lethal effects of one or fewer mortalities per year would be negligible to the population.

Table 5 Estimated mortality occurring incidental to two pup harvest scenarios (3 harvests of 50 males and 150 harvests of 1 male) of the preferred alternative on St. George Island

Incidental effects due to harvest activity - two scenarios

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal	Predicted mortalities (number of animals)	Mortality subtotal for activity by age class
Activities involved in the conduct of proposed harvest	pups	480	Observed mortality during activity			0.00001	0.005	
			Alert response	1	480	0	0.000	
Scenario 1: 150 animals			Enter water	0.01	4.8	0.001	0.005	
harvested during 3 harvests			Injured during disturbance	0.001	0.48	0.05	0.024	0.03
	non-pups	323	Alert response	1	323	0	0.000	
			Enter water	0.8	258.4	0.0001	0.026	
			Injured during disturbance	0.0005	0.16	0.02	0.003	0.03

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal	Predicted mortalities (number of animals)	Mortality subtotal for activity by age class
Activities involved in the conduct of proposed harvest	pups	9300	Observed mortality during activity			0.00001	0.093	
			Alert response	1	9300	0	0.000	
Scenario 2: 150 animals			Enter water	0.01	93	0.001	0.093	
harvest during 150 harvests			Injured during disturbance	0.001	9.30	0.05	0.465	0.65
	non-pups	7673	Alert response	1	7673	0	0.000	
			Enter water	0.8	6138.4	0.0001	0.614	
			Injured during disturbance	0.0005	3.84	0.02	0.077	0.69

A change in reproduction due to sub-lethal effects as a result of the preferred alternative is unlikely to be detected. Adult females and males are not breeding during the young of the year harvest season, so sub-lethal effects on their reproduction would not be likely to occur until the following year. The sub-adult male harvest occurs on non-breeding habitat where no breeding seals are present, therefore sub-lethal effects on their reproduction also would be not likely to occur.

Geographic extent of sub-lethal effects: The geographic extent of the direct and indirect sub-lethal effects of the preferred alternative is considered moderate because the harvest extends over all the accessible locations where fur seals are found on St. George. Alternative 2 would not concentrate the harvest at any particular sites on St. George Island as under the no-action alternative, and would reduce repeated harassment at any particular site (and therefore reduce the probability that any individual fur seal would experience sub-lethal effects). The preferred alternative would likely cause short-term harassment of adult females and some sub-adult males in addition to young of the year targeted for harvest. The male young of the year harvest would also not concentrate harvest harassment at any one location because young of the year are available for harvest within the hauling grounds, the breeding grounds, and at nearshore locations away from the breeding areas. It is anticipated that each site within the breeding areas during the non-breeding season would experience a harvest event no more than twice per season such that any individual adult females at harvest areas would be harassed only once. Young of the year harvest areas used only by young of the year would be considered first priority to harvest as part of the process to identify best harvest practices.

Under the preferred alternative the duration of the direct and indirect sub-lethal effects would include short-term harassment and displacement for those sub-adult males not harvested during the summer harvest season and as such would be minor. To estimate the duration of the harvests and the short-term harassment one must consider three aspects of the process: the round-up, the drive, and the stunning and exsanguination.

Data on the duration of the sub-adult male harvest has been collected since 1987 on St. Paul Island. The round-up includes sending the crew discreetly towards the beach to prevent the hauled out seals from escaping to the water. The round-up takes only a few minutes and largely depends on the terrain and wind direction relative to the water and seals. Once the crew prevents the seals from escaping they are slowly moved inland at a pace to minimize potential overheating. Harvest drives range from 2-75 minutes, but average about 12 minutes, followed by an average of 11 minutes of resting prior to the actual harvest. The average stunning and exsanguination (i.e., harvest) lasts about 72 minutes but can range from 7 to 200 minutes depending on the number of sub-adult males harvested in any particular harvest.

Since 1987 the average rate of stunning seals is about one seal per minute. Although timing data for this aspect of the harvest are not collected during the St. George Island harvests, the harvest process on both islands is similar. St. George harvests fewer seals than St. Paul during most harvests, so we anticipate the St. Paul harvest data are an accurate representation when harvests of similar sizes are compared. Based on data from St. Paul, the longest duration of a harvest would occur when over 100 seals are harvested on a single day. St. George has never harvested over 100 seals on a single day during the subsistence period. On average there have been nine and seven sub-adult male harvests per year on St. George and St. Paul, respectively during the last decade. St. George harvests on average 15 seals per harvest, whereas St. Paul harvests 53 seals per harvest during the last decade. Thus St. George harvests estimated by the rate of seals killed per hour would indicate the stunning component of the harvests would last about 15 minutes.

The portion of young of the year harvest occurring in the suckling areas and would result in short-term harassment of adult females, pups, and any non-breeding males resting onshore. There are no data to evaluate the duration of young of the year round-ups, drives, and harvests and the possible sub-lethal direct and indirect effects. Boltnev et al., (1997) describes the perinatal period (birth to 10 days old) as the most sensitive based on survival and growth, followed by the molting period from 40-80 days of age based on growth. Most pups die prior to 40 days of age, and their survival from 40 days to weaning is quite high (Boltnev et al., 1997). NMFS and Council timed the young of the year season to start at the end of the molt period and to occur during the period of high pup growth and survival as described by Boltnev et al., (1997). The young of the year harvests are not anticipated to last longer than the average sub-adult

male harvest on St. George, but may be more frequent as there may be unsuccessful attempts to harvest. If we assume the number of young of the year harvested during each event is similar to the number of sub-adults harvested then we can estimate the duration of the young of the year harvest to range from at least one hour to probably not more than 3 hours depending on the terrain and weather which determine the number of young that can be collected during any one event. Whether an unsuccessful young of the year harvest attempt will be followed by another attempt is unknown.

NMFS considered whether the sub-lethal effects of the young of the year harvest on female fur seals might cause detectable effects on the population. There have been no directed studies on the sub-lethal effects on female fur seals, but the female culling program from 1956-1968 (York and Hartley 1981) and pup tagging programs during this period can be considered proxies for the possible sub-lethal effects of the young of the year harvest. Under the female culling program the U.S. Government rounded-up adult female fur seals from the breeding areas, moved them to upland harvest areas and killed an average of 24,000 adult female seals per year, resulting in the deaths of their dependent offspring. In addition, on average 36,996 pups were tagged each year by rounding them up, moving them inland, and handling them for tag application, sex identification, and weighing before releasing them back to their suckling areas.

If one were to predict that sub-lethal effects might occur and be detected we might expect it would have occurred during this period on St. Paul. In 1964, there were at least 12,034 adult females rounded up and killed from the breeding grounds on St. Paul (resulting in the subsequent deaths of their dependent pups on land) by the U.S. Government under the Convention (York and Hartley 1981, Roppel 1984, NMML unpublished data). In 1964, the U.S. Government rounded up at least 24,000 pups on St. Paul Island and tagged them for research. Using the same rationale to evaluate sub-lethal effects as presented in Table 4, approximately 1.15 non-pups could be exposed to sub-lethal effects for every 150 male pups killed and an additional 50 non-pups exposed per event. Therefore, in 1964 approximately 30,000 pups and 44,000 non-pups (mostly adult females since they were the object of the female culling program) would have been exposed to sub-lethal effects from the round-up, handling and tagging. In 1965, the pup production was estimated to be 253,768, whereas in 1963 the pup production was 262,498 (NMML unpublished data). In order to properly estimate the sub-lethal effect, we must first remove the direct effect of mortality in 1964 from the 1963 pup production estimate by subtracting 10,830 (pregnancy rate of about 90% for those 12,034 harvested females; Trites and York 1993). Using these assumptions, we would have expected the 1965 pup production estimate to be 262,498-10,830=251,668, but the actual production was higher at 253,768.

Thus we might expect that if sub-lethal effects were to occur because of the 1964 female culling, among those 44,000 females left alive but exposed to disturbance from harvesters entering the breeding areas to kill 12,304 females, pup production would have been reduced the year after the harvest (1965). But the pup production estimate in 1965 (after removing the direct effect of mortality) was actually higher by about 2,000 pups, rather than lower. Sub-lethal effects on females as a result of harvesting male young of the year are not anticipated. In addition researchers entered the breeding and suckling areas to tag 24,000 pups during probably 15 to 20 different tagging events in 1964, exposing those females to additional sub-lethal effects. If sub-lethal effects were not detectable under these circumstances (about 20-30% of pup production exposed to sub-lethal effects), the harvest of 150 male young of the year would likely result in negligible (no detectable change in reproduction) sub-lethal effects based on the exposure of less than 10% of pup production to disturbance related to harvest.

The risk of seals overheating (i.e., hyperthermia) during the subsistence harvest of sub-adult male harvest has also been evaluated. NMFS does not anticipate death of pups during round-ups or handling due to hyperthermia for two reasons. First, average ambient temperature in July when the sub-adult male harvest occurs on St. George Island is about 48ºF and the average ambient temperature in October, when the

majority of the pup harvest will occur, is about 39ºF. The nine degree difference in temperature substantially reduces the risk of young of the year seals overheating during the round-up. Second, the small number of young of the year to be rounded up reduces the risk of hyperthermia. The large number of sub-adult seals rounded-up during the commercial harvest was the predominant factor behind the concerns for overheating seals when the subsistence harvest regulations were first developed (May 15, 1986; 51 FR 24840). With a proposed subsistence harvest that is one-tenth the number of seals harvested commercially in the past, sub-lethal effects from hyperthermia would be negligible. Likewise, sub-lethal effects related to hyperthermia observed and described in the Research PEIS (NMFS 2007b) are related to hundreds or thousands of young of the year between 30 and 40 days old being rounded-up and held for marking. Young of the year to be harvested under Alternatives 2-4 are at least twice as old as those considered in the Research PEIS, and also will be in rounded-up in groups of tens unlikely to cause hyperthermia rather than hundreds (as considered in the Research PEIS).

NMFS also considered the possibility that young of the year rounded-up but not harvested could become cold and not be able to return to their resting grounds from the harvest areas. NMFS estimated this effect was highly unlikely due to young of the year daily activity cycle and behavior. Baker and Donahue (2000) reported that young of the year during the autumn spend an increasing amount of time in the water (up to 35% of their time). Mean sea surface temperature in the Bering Sea in October is about 44ºF and heat loss is 20 times faster in water than in air. Upon weaning, young of the year spend 100% of their time in the water for the next 10-24 months. In addition, Gentry (1998) reported that experimentally transported young of the year walked overland a few kilometers to return to their preferred location of suckling on numerous occasions. The animals from these experiments were all less than 40 days old, the age described by Boltnev et al., (1998) where the highest on land mortality occurs. The combination of these two studies suggests the energy expenditures associated with natural movement of distances far greater than that anticipated for the young of the year harvest are well within the normal tolerance of northern fur seals and would not cause stress due to cold. In addition, there are no records or evidence from the Russian young of the year harvests indicating some percentage of those pups not harvested have been unable or delayed in their natural return to their suckling areas. Therefore it is highly unlikely that harvestable-aged pups would become cold or not have the energy after a harvest round-up and drive to return a few hundred meters or even further to their resting habitat, and if sub-lethal effects were to occur at most they would be negligible.

3.7.4.5 Mitigating sub-lethal effects

While we have concluded sub-lethal effects are negligible, both NMFS and the Council are committed to reduce any effects to the lowest level practical. The co-management process will serve as the most appropriate venue to consider mitigation measures intended to reduce possible effects. The risk of mortality due to sub-lethal effects during the preferred alternative is estimated conservatively to be one seal. Despite this low number, the Council in consultation with NMFS is committed to determining the best harvest locations, handling criteria for determining sex, and other methods and practices to reduce potential sub-lethal effects. These methods and practices include direct assessments of the wind direction, given a seal's ability to detect human presence on scent or sound alone. Young of the year harvest locations on any particular day would be determined to avoid locations where nearby seals could be harassed by scent or sound propagated by wind. These measures cannot be defined in advance as they are based on the prevailing weather conditions.

The sex of young of the year cannot be reliably determined based on physical characteristics without handling them individually. The sex ratio at birth is one to one, thus in order to harvest 150 male young of the year approximately 300 young will be rounded-up, handled, and sexed and approximately 150 female

young would be released. Young of the year are sexed by handling them by the rear flippers and identifying either the penile opening or vagina and then separating the males prior to harvest and releasing the females to escape back to their suckling and resting areas.

Harvesters will determine in the field how to minimize time spent directly on the hauling grounds or areas important for suckling while balancing the safety of moving, handling, and harvesting young in addition to separating non-harvestable seals from those to be harvested. In some harvest locations this will allow those non-target seals that may be displaced by harvester presence to return as soon as practical and resume their normal patterns on land, whereas other locations may not allow the harvest to occur in a separate area. Harvesters will attempt to round-up and separate young from the rest of the population and move them to inland locations for handling and harvesting, but this will be determined on a case by case basis by the harvesters.

The subsistence harvests will occur from September 16 until November 30, depending on community needs and weather. Since the autumn harvest season is approximately 10 weeks long under the preferred alternative, NMFS anticipates 10 to 15 harvests taking approximately 60-90 minutes. Therefore seals may be displaced for 90 minutes and begin to return to land within a few hours. Any one adult female at a harvest location is unlikely to be disturbed more than once per season because over 60% of their time is spent foraging at sea.

Alternative 2 would minimize incidental harassment by harvesting across all breeding and non-breeding areas rather than concentrating on harvesting at only two areas under the status quo. Adult seals are aggressive and more difficult to work around safely. Because harvesters want to minimize their time harvesting they inevitably will harvest preferentially at locations primarily occupied by the target age classes and avoid adult seals thereby minimizing potential sub-lethal effects due to disturbance. In addition harvesters must consider prevailing weather, wind direction, and terrain to ensure harvestable seals are approachable at close distances and do not escape to the water prior to being herded inland. Authorizing harvests at all breeding and non-breeding sites would allow harvesters to choose from multiple sites based on the prevailing conditions. Harvesters would be able to move harvestable seals efficiently to locations away from the breeding, resting and suckling areas where they regularly occur to allow non-harvested seals to return to their normal attendance cycle and previous location as soon as practical.

In addition, the amount of time harvesters spend in the presence of seals would be minimized for the same reasons it would be during the sub-adult male harvest. The sub-adult male subsistence harvest typically lasts approximately two to three hours depending on the number of seals to be harvested and occurs at locations a few hundred meters distant from the hauling grounds. The Council would consider and identify harvest areas for young of the year and schedule harvests consistent with the regulations. It is uncertain how long it will take for harvesters to access the areas safely and harvest young of the year at any particular site as the weather conditions, terrain, and animal behavior have the most influence on the duration of the harvest. We anticipate the duration of the young of the year harvests will not be any longer than the duration of the sub-adult harvests during the summer. The herding of young of the year is expected to cover less distance than the sub-adult male harvest and therefore could be shorter in duration but this would depend on how many young of the year need to be handled in order to determine their sex. Since the number of animals that would likely be harvested (up to the allowable limit) at any one time cannot be predicted, the exact duration of the harvest event cannot be determined. The effective hours to harvest would be 8am to 3pm though at this time of year the hours of daylight decline from 10 to 5 hours by the end of the season. Duration of the young of the year harvest would be monitored and reported to consider the development of best practices to minimize the occurrence of sub-lethal effects.

Fur seal young of the year whose mothers are at sea feeding spend an increasing portion of their time at sea swimming nearshore around the island of their birth (Baker and Donahue 2000). Approximately 60% of all young of the year on any given day during the autumn are waiting for their mothers to return from feeding trips. Young of the year from a given breeding area typically aggregate in large groups and occupy nearshore habitat both within and outside habitat used by adult and sub-adult fur seals during the breeding and non-breeding season. They may occupy a nearshore area a few kilometers or more from their natal site (i.e., birth area) for a few hours during the day and then return to their natal site. The exclusive young of the year habitats are not used predictably, are often very near the water, and it is not known whether young of the year can be safely harvested from these sites until it is attempted. These sites represent the only habitat used nearly exclusively by young of the year during the autumn. If harvestable, these sites would be first priority to harvest from and would significantly reduce exposure of non-harvestable seals to sub-lethal effects.

Second priority young of the year harvest sites would include resting/hauling grounds occupied by non-adult seals and small numbers of adult seals. It is not known how frequently young of the year are found in high numbers in the resting/hauling grounds during the autumn. If young are observed to be consistently present in these areas, harvests would be considered and attempted, because this would minimize displacement and harassment of lactating females.

Most young of the year, about one-third of the adult females, and non-breeding age males occupy the breeding areas during the non-breeding season on any particular day. The remaining adult females are foraging at sea. These suckling areas are the most frequently and predictably occupied by young of the year and adult female fur seals and represent the third priority young of the year harvest sites. Territorial males occupy these areas during breeding and they exclude all non-breeding seals. Territorial males depart by late August and these sites become suckling and resting areas during the non-breeding season. Therefore, the most predictably used areas in the autumn by young of the year are also occupied by adult females and any other remaining fur seals occupying the island. Given this, the easiest place (suckling areas) for harvesters to find young of the year would result in incidental harassment of adult female and other male fur seals. Therefore NMFS anticipates that young of the year harvests will be attempted at all the three sites described, and as experience is gained will develop best harvest locations which balance the interest to safely and efficiently harvest seals with minimizing effects on non-harvested seals.

3.7.4.6 Conservation Objectives

The preferred alternative includes several key elements that contribute positively to conservation objectives including: 1) limiting accidental harvest of female seals to three before stopping the harvest; 2) not concentrating the harvest regionally and protecting small breeding areas; 3) evaluation of harvest locations, handling criteria for determining sex, and other methods and practices to reduce potential sub-lethal effects; and 4) research on the fur seal population by collecting data from the harvest and harvest activities.

NMFS conservation objectives for northern fur seals include monitoring and managing the subsistence harvest on the Pribilof Islands. Under the preferred alternative this would be expanded to include sampling and measuring of harvested male young as they approach weaning. NMFS would continue to collect teeth and tissues to understand the age composition of the sub-adult male harvest and other indices of population health of young males as funding allows. Meeting the conservation objectives under the preferred alternative would provide research directly related to the local and sub-regional management and annual and long-term information needs for the northern fur seal population and harvest on St. George. It is likely that a few additional conservation objectives may be accomplished under the preferred

alternative as the monitoring, management, and sampling of the subsistence harvest would provide indices of population health that are unavailable through non-lethal research methods. The combination of these specific elements under the preferred alternative are considered moderate beneficial impacts towards meeting conservation objectives.

3.7.5 Impacts of Alternative 3: Harvest 500 male young of the year and no sub-adult male fur seals

Alternative 3 would retain the range of allowable subsistence harvest set for the 2011 to 2013 period at 300-500 animals, but would increase the allowable harvest of male young of the year to 500 and decrease the sub-adult male harvest to zero. Alternative 3 creates opportunity for the community to meet their subsistence needs in the autumn by authorizing harvests:

- of up to 500 male young of the year from September 16 through November 30 each year;
- distributed equally by the three breeding regions to minimize effects across all breeding and non-breeding areas.

Alternative 3 would create the same conservation controls as Alternative 2 (preferred alternative) including minimizing potential sub-lethal effects through evaluation and implementation of best harvest practices. Harvest would be stopped if 10 females are accidentally harvested. Alternative 3 would clarify and acknowledge the roles and responsibilities of NMFS and the Council as under the preferred alternative.

3.7.5.1 Direct and Indirect Mortality

Sub-adult Male Mortality: No sub-adult males would be harvested under Alternative 3.

Young of the Year Mortality: The direct and indirect mortality effects of Alternative 3 are considered minor to moderate since the lower limit of 300 seals (23% of PBR) can be harvested, similar to the status quo. When the lower limit has been reached, the St. George Council will notify NMFS in writing in the event their subsistence need has not yet been met and that they wish to continue to harvest to the upper limit of the harvest range (500 seals, 38% of PBR). When compared to the status quo, Alternative 3 could have a reduced effect on the population due to the low natural survival rate of young of the year (70% die naturally). Harvest of 500 male young of the year from an age class of animals that has a 70% mortality rate would be less of an impact as compared to harvest of 500 sub-adult males that have a greater chance of reaching reproductive age.

It is also important to consider harvest of 500 male young of the year as a percentage of the annual production. Direct evidence of the potential population effects of a young of the year harvest is available from the Russian islands where fur seals breed and have been harvested for commercial and subsistence purposes since the cessation of the Convention in 1985. The Russians harvested northern fur seal young of the year from Bering Island from 1987-2006 (Ream and Burkanov pers. comm.). During this 20-year period, the Russians commercially harvested about 4,300 young of the year fur seals on average, representing about 11% of annual production, from Bering Island each year, a much higher percentage of production than the experiments in the 1970s (see description for Alternative 2 in Section 3.7.4.4). The proposed male young of the year harvest on St. George under Alternative 3 is 3% of the 2012 pup production estimate (500 seals out of 16,184). This small proportion of annual pup production is less than the commercial harvest from Russian islands.

To evaluate the population level effects of young of the year harvest mortality, the percentage of the St. George Island fur seal population killed due to the proposed subsistence harvest must be considered. By considering a span of 25 years of potential harvest under this alternative, NMFS is able to assess at least one and more likely two generations of males through their average reproductive lives. Alternative 3 would result in the annual loss of up to 500 male young of the year, less than 3% of current annual production. Similar to the analysis described for the preferred alternative, if multiplied over 25 years, this would equate to 12,500 males removed from the population. This is the highest possible calculated reduction to the population over a predicted 25-year subsistence harvest and does not account for natural mortality from birth to adulthood. The range of natural mortality is 62-70% (Lander 1981; Trites and Larkin 1989), and indicates that over 25 years most (i.e., 7,500-8,375) of the 12,500 harvested pups would have died of natural causes by the age of 2 years. Lander (1981) reported the cumulative survival of males from age 0 to 7 was 0.06, such that of those 12,500 males removed from the population only 750 would have survived to adulthood over the 25 year period, and about half or fewer of those adult males may contribute to reproduction in any year.

In addition to the simple harvest mortality assessment presented above, the loss of seals can be estimated through a more rigorous approach using mathematical models to understand the effects on the population composition over time (e.g., Lander 1981, Towell 2007). NMFS modeled the direct effect of the mortality of 500 male pups. NMFS estimated a cumulative loss of between 6.17 and 6.19% of males from the population after 25 years of harvesting. When compared to the range of males removed from the population due to Alternative 1 (6.61-9.06 %) and Alternative 2 (6.47-8.19%) this loss is the lowest of all alternatives. As described previously for Alternative 1 and 2 these estimates do not account for the possible excess of adult males in the population that are not counted annually on land (Towell 2007), or whether the modeled loss of adult males due to the harvest would simply be replaced by peripheral adult males (see Gentry 1998) who would not otherwise have bred.

Female Mortality: Alternative 3 suspends harvests if nine female fur seals are accidentally killed during the subsistence harvest. No such threshold exists for accidental mortality of sub-adult females under the status quo and that threshold is 2 under the preferred alternative. Under Alternative 3 the circumstances surrounding the nine female mortalities will be examined by NMFS and the Council. If it is determined the Council can implement measures to improve the detection and avoidance of females during the harvest, then NMFS can authorize the harvest to resume under conditions as described by NMFS and agreed to by the Council in writing. If the harvest resumes under Alternative 3 and a tenth female is accidentally killed then the harvest is permanently terminated for the year. Therefore, the Alternative 3 has reduced effects on the population when compared to the status quo and greater effects than Alternative 2 in terms of female mortality.

Geographic extent of effects: Young of the year harvests would be distributed equally among regions (identical to Alternative 2) and within and outside the rookeries as practical, thereby minimizing potential concentration of potential impacts, however minor, on specific locations. For this reason, the geographic extent of the direct and indirect mortality effects of the Alternative 3 is considered minor to moderate based on the impact criteria provided in Table 2. This distribution of harvest mortality across all sites would be very similar to that described for Alternative 2.

3.7.5.2 Summary of the Direct and Indirect Effects of Mortality under Alternative 3

Alternative 3 would result in the mortality of up to 500 male young of the year. The magnitude of effects from this harvest is considered minor in light of the level of PBR calculated for the St. George fur seal

population (1,325 seals) and that pups have the lowest natural survival of the age class considered in all of the other alternatives.

The harvest would be suspended if nine females are accidentally killed and terminated if ten females are killed during the annual harvest. Alternative 3 would use identical measures as described under Alternative 2 to reinstate the harvest after suspension. The Council and NMFS would coordinate through the MMPA co-management process to identify best harvest practices based on experience of the subsistence harvesters under Alternative 3 similar to the process for Alternative 2.

In summary, the proposed harvest of up to 500 male young of the year would affect the population less than Alternatives 1, 2, or 4. Because Alternative 3 includes the mortality of up to 10 females this is greater than the female mortality in Alternative 2, but less than Alternative 4. Since young of the year have notably lower survival than 2-4 year old seals harvested under the status quo or preferred alternative, Alternative 3 would affect even fewer surviving seals each year. For these reasons, total mortality under Alternative 3 is considered a minor effect.

3.7.5.3 Sub-lethal Effects of the Alternative 3

Sub-lethal effects under Alternative 3 are identical to those described for Alternative 2. Under Alternative 3, NMFS and the Council will work together to identify, describe, and implement best harvest practices which would minimize repeated harassment of previously harvested sites by scheduling repeated harvests at the same site only after consideration of non-harvested sites. This approach would allow those females displaced from their young by the harvest to reunite and suckle their young without being disturbed before they depart on their subsequent foraging trip.

To evaluate Alternative 3, NMFS has used the methods applied in the 2007 Research PEIS for estimating potential mortality associated with sub-lethal effects (NMFS 2007b). NMFS shows that for Alternative 2 harassment associated with harvesting 150 male pups (may be one additional mortality) is not different than the effect of actual harvest mortality of 150 pups. The estimated average mortality rate that could occur over time and as a result of animals being disturbed is calculated based on the probability that a proportion of animals could die. The estimated number of mortalities for each activity and age class (Table 5) are totaled to get an overall estimate of the lethal risks to animals for the scope and type of sub-lethal effect as a result of the harvest of 500 male pups. Under Alternative 3 a total number of mortalities that could occur during harvests ranges from 0.7 to 4.5 animals based on whether there are three harvest events or 500 separate harvest events respectively.

The mechanisms for sub-lethal effects under Alternative 3 are identical to those described for Alternative 2 including injury from round-up, capture and restraint associated with identifying the sex of pups prior to the harvest of males.

The estimated maximum mortality due to sub-lethal effects during pup round-ups and handling (assuming 1 male pup is harvested for every attempt) until 500 are harvested is about 4.5 seals (2.1 pups and 2.3 non-pups) (Table 5, Scenario 2). The lowest estimate of mortality due to sub-lethal effects if 1,180 pups and 725 non-pups are exposed to harvest is less than 0.2 seals (Table 5, Scenario 1). This assumes 166 pups would be harvested during a single event from each of the three regions. We anticipate the actual harvest will range between these two scenarios. In other words, the sub-lethal effects of the harvest of 500 male young of the year harvest could result in 1-4 mortalities under Alternative 3. This means that if a maximum of 3 mortalities were to occur due to sub-lethal effects, the total number of mortalities under this alternative would be 503 (3 more than the allowable harvest of 500).

Table 6 Estimated mortality occurring incidental to two pup harvest scenarios (3 harvests of 166 males and 500 harvests of 1 male) of Alternative 3 on St. George Island

Incidental effects due to harvest activity - two scenarios

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal	Predicted mortalities (number of animals)	Mortality subtotal for activity by age class
Activities involved in the conduct of proposed harvest	pups	1180	Observed mortality during activity			0.00001	0.012	
			Alert response	1	1180	0	0.000	
Scenario 1: 500 animals			Enter water	0.01	11.8	0.001	0.012	
harvested during 3 harvests			Injured during disturbance	0.001	1.18	0.05	0.059	0.08
	non-pups	725	Alert response	1	7825	0	0.000	
			Enter water	0.8	580	0.0001	0.058	
			Injured during disturbance	0.0005	0.36	0.02	0.007	0.07

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal	Predicted mortalities (number of animals)	Mortality subtotal for activity by age class
Activities involved in the conduct of proposed harvest	pups	31,000	Observed mortality during activity			0.00001	0.310	
			Alert response	1	31,000	0	0.000	
Scenario 2: 500 animals			Enter water	0.01	310	0.001	0.310	
harvested during 500 harvests			Injured during disturbance	0.001	31.0	0.05	1.550	2.17
	non-pups	25,575	Alert response	1	25575	0	0.000	
			Enter water	0.8	20460	0.0001	2.046	
			Injured during disturbance	0.0005	12.79	0.02	0.256	2.30

The sub-lethal effects on adult females and males of the preferred alternative are highly unlikely to be detected as a change in reproduction as was the case for Alternative 2.

Geographic extent of sub-lethal effects: The geographic extent component is for Alternative 3 is not different from that estimated for Alternative 2.

3.7.5.4 Mitigating sub-lethal effects

While we have concluded sub-lethal effects are insignificant, both NMFS and the Council are committed to reduce any effects to the lowest level practical as under Alternative 2. The co-management process will serve as the most appropriate venue to consider mitigation measures intended to reduce possible unknown effects under Alternative 3 similar to the process described for Alternative 2.

The subsistence harvests under Alternative 3 will occur from September 16 until November 30, depending on community needs and weather. Since the autumn harvest season is approximately 10 weeks long under the Alternative 3 NMFS anticipates 15 to 20 harvests taking approximately 60-90 minutes. Therefore seals may be displaced for 90 minutes and begin to return to land within a few hours, and any one female at a harvest location is unlikely to be disturbed more than once because over 60% of their time is spent foraging at sea. It is uncertain how long it will take for harvesters to access the areas safely and harvest young of the year at any particular site as the weather conditions, terrain, and animal behavior have the most influence on the duration of the harvest under Alternative 3. We anticipate the duration of the young of the year harvests will not be any longer than the duration of young of the year harvests under Alternative 2. NMFS anticipates harvests later in the season will be of shorter duration as harvesters learn how to efficiently move young of the year with experience gained. As more young of the year are handled

in order to determine sex the overall duration of harvests per animal handled will be shorter. As with Alternative 2 we do not know how harvesters will determine the number to be harvested during each event, but we can expect efficiencies to develop as experience is gained.

3.7.5.5 Conservation Objectives

The Alternative 3 includes several key elements similar to those described for Alternative 2 that contribute positively to conservation objectives including: 1) limiting accidental harvest of female seals to 10 before stopping the harvest; 2) not concentrating the harvest regionally and protecting small breeding areas; 3) evaluation of harvest locations, handling criteria for determining sex, and other methods and practices to reduce potential sub-lethal effects; and 4) research on the fur seal population by collecting data from the harvest and harvest activities.

NMFS conservation objectives for northern fur seals include monitoring and managing the subsistence harvest on the Pribilof Islands. Under the alternative 3 this would be include sampling and measuring of harvested male young as they approach weaning. Because there is no sub-adult male harvest NMFS would not collect teeth and tissues from this age class any longer. NMFS would be able to collect other indices of population health from young of the year as funding allows. Meeting the conservation objectives under the Alternative 3 would provide research directly related to the local and sub-regional management and annual and long-term information needs for the northern fur seal population and harvest on St. George. It is likely that a few additional conservation objectives may be accomplished under the preferred alternative as the monitoring, management, and sampling of the subsistence harvest would provide indices of population health that are unavailable through non-lethal research methods. The combination of these specific elements under Alternative 3 are considered moderate beneficial impacts towards meeting conservation objectives, though less than Alternatives 2 and 4 since information about both sub-adult and young of the year could be collected.

3.7.6 Impacts of Alternative 4: Harvest 50 male pups and 450 sub-adult male fur seals

Alternative 4 would create a new subsistence harvest regulation marginally based on the petition from the Council. It would retain the range of allowable subsistence harvest set for the 2011 to 2013 period at 300-500 animals, but would allow the harvest of 50 male young of the year and 450 sub-adult males. Alternative 4 creates flexibility for the community to meet their subsistence needs in the autumn by authorizing harvests:

1. of up to 50 male young of the year from September 16 through November 30 each year,
2. distributed equally by the three breeding regions to minimize effects across all breeding and non-breeding areas.

Alternative 4 creates the same conservation controls as Alternative 2, the preferred alternative. Alternative 4 clarifies and acknowledges the roles and responsibilities of NMFS and the Council identical to be implemented under the preferred alternative.

3.7.6.1 Direct and Indirect Mortality

Sub-adult Male Mortality: St. George harvesters could harvest up to 450 sub-adult males under Alternative 4. The direct and indirect mortality effects of the Alternative 4 are considered minor to moderate since the lower

limit of 300 seals (23% of PBR) can be harvested as sub-adult males, similar to the status quo. When the lower limit has been reached the St. George Council will notify NMFS in writing identifying their subsistence need has not yet been met and that they will continue to harvest to 450 sub-adult males in order to allow for the harvest of 50 male young of the year seals, after which the harvest would be permanently suspended for the year.

Young of the Year Mortality: Under the Alternative 4 up to 50 male young of the year can be harvested each year from September 16 through November 30. The status quo prohibits the harvest of young of the year. When compared to the status quo the Alternative 4 has a lower effect on the population due to the high level of natural mortality in young of the year (which cannot be harvested under the status quo). For the same reason, Alternative 4 would have a marginally greater effect on the population than either Alternatives 2 or 3 because fewer young of the year would be harvested. The proposed male young of the year harvest on St. George under Alternative 4 is 0.003% of the 2012 pup production estimate (50/16,184).

Female Mortality: The Alternative 4 suspends harvests if 19 female fur seals are accidentally killed during the subsistence harvest. No such threshold exists for accidental mortality of sub-adult females under the status quo. Under Alternative 3 the circumstances surrounding the 19 female mortalities will be examined by NMFS and the Council. If it is determined the Council can implement measures to improve the detection and avoidance of females during the harvest, then NMFS can authorize the harvest to resume under conditions as described by NMFS and agreed to by the Council in writing. If the harvest resumes under Alternative 4 and a twentieth female is accidentally killed then the harvest is permanently terminated for the year. Therefore, the Alternative 4 has greater effects on the population when compared to Alternatives 2 and 3 in terms of female mortality, but less than Alternative 1 which has no limit on accidental sub-adult female mortality.

Geographic extent of effects: The geographic extent of the direct and indirect mortality effects of Alternative 4 is moderate to minor as pup harvests would be distributed among all locations within and outside the rookeries as practical. This distribution of harvest mortality in time and space would be very similar to that for Alternative 2 and 3.

3.7.6.2 Summary of the Direct and Indirect Effects of Mortality under Alternative 4

Alternative 4 would result in the mortality of up to 50 male pups and 450 sub-adult males. The magnitude of effects from this harvest is considered a minor to moderate in comparison to the level of potential biological removal calculated for the St. George fur seal population. Similar to Alternatives 2 and 3, we can estimate and predict the loss of seals through mathematical models of survival and reproduction as a more rigorous approach to understand the effects on the population composition over time (e.g., Lander 1981, Towell 2007). NMFS modeled the proposed harvest of 50 male young of the year and 450 sub-adult males and estimated a cumulative loss of 6.57-8.77% fewer males in the population after 25 years of harvesting.

In summary, the proposed harvest of up to 50 male young of the year would affect less than 0.003% of the annual St. George Island fur seal pup production. The modeled cumulative loss is between that estimated for Alternative 1 and Alternative 2, but Alternative 4 allows a higher number of females (20) to be accidentally killed such that it also has greater effects on the population than Alternatives 2 and 3 in terms of female mortality, but less than Alternative 1. These estimates do not account for the possible excess of adult males in the population as described for the previous alternatives and the mortality effects are still considered minor.

3.7.6.3 Sub-lethal Effects of the Alternative 4

Sub-lethal effects under Alternative 4 are identical to those described for Alternatives 2 and 3. Under Alternative 4, NMFS and the Council will work together to identify, describe, and implement best harvest practices which would minimize repeated harassment of previously harvested sites by scheduling repeated harvests at the same site only after consideration of non-harvested sites. This approach would allow those females displaced from their young by the harvest to reunite and suckle their young without being disturbed before they depart on their subsequent foraging trip.

NMFS has used the identical approach for evaluating the sub-lethal effects of Alternative 4 as that used for Alternatives 2 and 3. The approach is probabilistic and should be considered in terms of an estimated average mortality rate that could occur over time and as a result of many different animals being exposed to the same type of activity or disturbance. The estimated number of mortalities for each activity and age class (Table 6) are totaled to get an overall estimate of the lethal risks to animals for the scope and type of sub-lethal effect as a result of the harvest of 50 male pups.

The mechanisms for sub-lethal effects under Alternative 4 are identical to those analyzed and described for Alternatives 2 and 3 including the identical mechanisms of injury from capture and restraint to identify the sex of pups prior to the harvest of males.

The estimated maximum additional mortality for quantifying the sub-lethal effects of pup round-ups and handling assuming 1 male pup is harvested every attempt until 50 are harvested (Table 6, Scenario 2) is about 0.45 additional fur seal mortalities (0.22 pups and 0.23 non-pups). The lowest estimate of sub-lethal effects using the same methodology (Table 6, Scenario 1) is that 280 pups and 208 non-pups would be exposed to harvest resulting in less than 0.04 additional mortalities if 16 pups were harvested during a single event from each of the three regions. We anticipate the actual harvest will be somewhere between these two extreme harvest scenarios and therefore the sub-lethal effects of the harvest of 50 male young of the year harvest to be less 1 additional mortality. Given the very small impact of the direct mortality from the harvest of 50 male young of the year, we cannot distinguish the difference to the population between the mortality of 50 and 51 male young of the year.

Table 7 Estimated mortality occurring incidental to two pup harvest scenarios (3 harvests of ~16 males and 50 harvests of 1 male) of Alternative 4 on St. George Island

Incidental effects due to harvest activity - two scenarios

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal	Predicted mortalities (number of animals)	Mortality subtotal for activity by age class
Activities involved in the conduct of proposed harvest	pups	280	Observed mortality during activity			0.00001	0.003	
			Alert response	1	280	0	0.000	
Scenario 1: 50 animals			Enter water	0.01	2.8	0.001	0.003	
harvested during 3 harvests			Injured during disturbance	0.001	0.28	0.05	0.014	0.02
	non-pups	208	Alert response	1	208	0	0.000	
			Enter water	0.8	166.4	0.0001	0.017	
			Injured during disturbance	0.0005	0.10	0.02	0.002	0.02

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal	Predicted mortalities (number of animals)	Mortality subtotal for activity by age class
Activities involved in the conduct of proposed harvest	pups	3100	Observed mortality during activity			0.00001	0.031	
			Alert response	1	3100	0	0.000	
Scenario 2: 50 animals			Enter water	0.01	31	0.001	0.031	
harvested during 50 harvests			Injured during disturbance	0.001	3.1	0.05	0.155	0.22
	non-pups	2558	Alert response	1	2558	0	0.000	
			Enter water	0.8	2046	0.0001	0.205	
			Injured during disturbance	0.0005	1.28	0.02	0.026	0.23

The sub-lethal effects on adult females and males of the Alternative 4 are highly unlikely to be detected as a change in reproduction.

Geographic extent of sub-lethal effects: The geographic extent component is for Alternative 4 is not different from that estimated for Alternatives 2 and 3.

3.7.6.4 Mitigating sub-lethal effects

While we have concluded sub-lethal effects are insignificant, both NMFS and the Council are committed to reduce any effects to the lowest level practical as under Alternative 4. The co-management process will serve as the most appropriate venue to consider mitigation measures intended to reduce possible unknown effects under Alternative 4 similar to the process described for Alternatives 2 and 3.

3.7.6.5 Conservation Objectives

NMFS conservation objectives for northern fur seals include monitoring and managing the subsistence harvest on the Pribilof Islands. Under Alternative 4 there would be moderate beneficial effects similar to that for Alternative 2.

Table 8 **Comparison of the effects of Alternatives 1 through 4**

	Alternative 1, Status quo	Alternative 2, Preferred	Alternative 3	Alternative 4
Direct / Indirect Effects				
Mortality *Sub-adult males*	Mortality of up to 500 sub-adult male fur seals	Mortality of up to 350 sub-adult male fur seals	No sub-adult males will be harvested.	Mortality of up to 450 sub-adult male fur seals
Young of the year males	Prohibited young of the year harvest	Mortality of up to 150 young of the year male fur seals	Mortality of up to 500 young of the year male fur seals	Mortality of up to 50 young of the year male fur seals
Females	Adult female mortality prohibited, sub-adult female mortality no regulatory limit	Mortality of up to 3 female fur seals	Mortality of up to 10 female fur seals	Mortality of up to 20 female fur seals
Effect on population relative to other Alternatives	Minor to moderate effect relative to PBR and greater than other alternatives	Minor to moderate effect relative to PBR, greater effects than Alt. 3, less than Alts. 1 and 4	Minor to moderate effect relative to PBR, least environmental effect of all alternatives	Minor to moderate effect relative to PBR, less effect than Alt. 1, greater than Alts. 2 and 3
Geographic Extent	Moderate, concentrated at Northeast and Zapadni hauling grounds	Minor, harvest is distributed equally among all breeding grounds	Minor, harvest is distributed equally among all breeding grounds	Minor, harvest is distributed equally among all breeding grounds
Sub-Lethal Effects	~1,025 sub-adult males exposed to effects	2,000 to 17,000 fur seals exposed to effects	2,000 to 55,000 fur seals exposed to effects	1,500 to 6,000 fur seals exposed to effects
Conservation Objectives	Continued contribution towards conservation objectives, less than Alts. 2, 3, and 4	Continued contribution towards conservation objectives	Continued contribution towards conservation objectives, less than Alts. 2 and 4	Continued contribution towards conservation objectives
Subsistence	Adverse effects, reduced flexibility and opportunity	Beneficial effects relative all other alternatives	Beneficial effects, less than Alts. 2 and 4	Beneficial effects, less than Alt. 2 greater than 3
Co-Management	Adverse effects on co-management	Beneficial effects on co-management partnership	Beneficial effects on co-management partnership, less than Alts. 2 and 4	Beneficial effects on co-management partnership but less than Alt. 2

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4 Subsistence Harvests and Co-Management

This chapter analyzes the impacts of the alternatives on subsistence harvests and co-management of northern fur seals on St. George. The economic effects of the alternatives are evaluated in the RIR prepared for this action and incorporated by reference (NMFS 2013b). The proposed action affects the Alaska Native community of the Pribilof Islands on St. George. This section describes the population size and ethnic composition, along with a key indicator of economic status.

St. George is a small Alaska Native village of fewer than 100 people. On St. George 88% of the population is Alaska Native which has declined in size since the 2000 census (U.S. Census Bureau, 2013). At least 6% of the population on St. George lives below the poverty level. The Alaska Native portions of both communities rely to varying degrees on a traditional subsistence lifestyle, consuming fur seals, sea lions, sea birds, fish and berries, and utilizing the non-edible portions to create handi-crafts (Veltre and Veltre 1981). The per capita income is about $22,000 and $25,000 on St. Paul and St. George, respectively. A gallon of gasoline costs between $6 and $7 on the Pribilof Islands. Residential electricity costs increased from 25 cents per KW/h on St. George in 2012 to $1.00 per KW/h in 2013 even after the State of Alaska subsidy, energy cost-equalization, for rural Alaska (St. George Public Work Director pers. comm., August 1, 2013). The average electricity cost for Alaska is 14.7 cents per KW/h and the national average is 9.8 cents per Kw/h (U.S. Energy Information Administration[5]). Detailed information about St. George is in *Community Profiles for North Pacific Fisheries – Alaska*, produced by the NOAA Alaska Fisheries Science Center, and this information is incorporated by reference.[6]

4.1 Historic Subsistence Fur Seal Harvest & Management

Northern fur seals have been hunted across their range by indigenous peoples and represent an important cultural icon for Pribilovians. NMFS distinguishes “hunting” as an individual killing specific fur seal(s) from some distance while the seal rests on land or at sea. The “harvest” of fur seals is defined as organized herding and driving groups of fur seals from their breeding or resting grounds to inland locations, where they are stunned by harvesters with clubs who come in close proximity with the seals before striking them. The Aleut people and other coastal indigenous peoples hunted fur seals for food, clothing, and raw materials prior to contact with Russian fur traders. The Aleut word used as reference to autumn is “Kimadgim tugida” which translates to “time of fur seal hunting.” Northern fur seals were likely available during much of the year to some Aleutian Island communities.

Early archeological excavations in the Aleutians show a high proportion of young animal remains suggesting a preference for younger seals or a higher availability of these age classes (Lippold, 1966). Yesner (1977) reported 70% of the northern fur seal bones at Aleutian Island archeological sites were from young of the year northern fur seals. Newsome et al., (2007) describes the array of bones found in Aleut middens to contain pre-weaned northern fur seals indicating breeding northern fur seals occupied the Aleutian Islands historically. Jochelson (1966) reported Aleut hunters mostly killed migrating northern fur seal young of the year passing through the islands. Pribilovians testifying during the Fur Seal Arbitration (Paris Tribunal, Vol. 3, 1893 pp. 731-732) indicated the most highly prized food was pups (~5 months old).

[5] Available at: http://www.eia.gov/electricity/state/, accessed Aug 1, 2013
[6] Available at: http://www.afsc.noaa.gov/REFM/Socioeconomics/Projects/CPU.php.

The desire to harvest young of the year was noted by a treasury agent on St. George in which he wrote, “Today is for pup driving, the greatest day in the life of the Aleuts” (St. George Log Book 1887). The Russian and American island agents maintained this subsistence use of young of the year until 1890. Pribilovians would gather, sex, and harvest male young of the year primarily in October and November, prior to weaning (Jordan 1898). St. George, with an approximate population of 89 residents, harvested an average of 1,477 (range 978 - 2,446) northern fur seal young of the year from 1870 to 1890. The termination of the young of the year harvest in 1891 was implemented as a conservation measure to help the recovery of the northern fur seal herd from pelagic sealing. That year, a village meeting about the termination of the young of the year harvest was held on St. Paul, with the natives agreeing to forego the young of the year harvest “if by so doing they would aid the government to protect seal life on the islands” (St. Paul Log book 1891). Although they agreed to the government’s conservation proposition, the Pribilovians still considered the termination of the pup harvest to be a harsh and extreme measure. In his deposition during the Fur Seal Arbitration (Volume 3 1893 p. 101) Chief Kerrick Artomanof of St. Paul said, “The pup seals are our chicken meat, and we used to be allowed to kill 3,000-4,000 male pups every year in November, but the Government agent forbade us to kill any more, and he gave us other meat in place of pup meat; but we do not like any other meat as well as pup-seal meat”. This local sentiment is continued to this day, and there is no alternative fresh meat available on the Pribilof Islands at this time of year due to current harvest restrictions.

On the Pribilof Islands young of the year fur seals were available in high concentrations and within a few minute walk from the communities. This resulted in a subsistence harvest situation on the Pribilof Islands which did not exist in the Aleutian Islands, where at best some young fur seals migrated in coastal areas where Aleuts hunted offshore. The easy access to this subsistence resource motivated the government to regulate the number harvested to meet the subsistence needs of the Pribilovians. Government records indicate the Pribilovians were allowed to retain the pelts from the subsistence pups harvest to barter and trade (St. George Agent Log Book 1887), unlike all other pelts. Numbers of seals reported as killed for food are significantly lower after 1895 than in earlier years, possibly reflecting seals used for food during the harvest season that are not recorded as in other years.

Although the population recovered after the cessation of pelagic sealing under the Fur Seal Treaty, the young of the year harvest was never reinstated. Many of the records for food harvests are incomplete or inconsistently reported after the fur seal population recovered. The records clearly show Pribilovians’ continued use of fur seals, and preferentially young of the year, for food during their existence on the Pribilof Islands; however a quantitative comparison is not possible due to inconsistent reporting of the food harvests independent of and during commercial harvests before and after the Fur Seal Treaty and subsequent management measures under the convention.

From the 1950s through 1984, harvests for food became less the duty of the lessee or the government and more a responsibility of local residents. Seal carcasses were available on the killing ground following the commercial harvest for anyone who needed food (Veltre and Veltre, 1981). Carcasses from the commercial harvest far exceeded the community’s need for fresh meat. Residents took meat for immediate needs and preserved it for the winter season. Commercial sealing, and the meat it provided, was banned in 1972 on St. George Island to allow for the St. George Island Research Program (Gentry 1998). In 1973 there was no harvest on St. George Island and accommodations were made to obtain and ship excess seal meat collected from the St. Paul commercial harvest. St. Paul residents collected the meat from the commercial harvest, but inter-island transportation and cold storage were limited and much of the meat spoiled prior to arrival on St. George. NMFS did not allow a harvest in 1974 on St. George, and again limited transportation and preservation resulted in failure of adequate seal meat for St. George residents. After the 1975 commercial harvest season failed again to provide seal meat for St. George, they were allowed a small subsistence harvest at Staraya Artil and Northwest hauling grounds starting in 1976

(NMFS internal memos between Dr. Harry and Mr. Kirkness 1976-1980). Mr. Walt Kirkness in a memo to Dr. George Harry indicated a lack of small seals from 1976 through 1979 required changes to the St. George subsistence harvest, they did not define small seals in their memoranda, but we might assume they were referencing a local preference for younger (smaller) seals in the two to four year old age group that were harvested previously for commercial purposes (Figure 5). NMFS changed the St. George subsistence harvest location to Northeast hauling ground in 1980 and mandated a subsistence harvest plan on Tuesdays and Fridays beginning July 8 to continue until 350 seals had been harvested (NMFS internal memos between Dr. Harry and Mr. Kirkness 1976-1980). Based on the harvest data it appears these harvest requirements on St. George were generally implemented through 1984, when the emergency subsistence harvest rule was implemented. The government attempted to keep the harvest on St. George Island at the lowest level practical from 1976 through 1985 and continued to provide supplemental meat from St. Paul (Zimmerman and Letcher 1986) to maintain the experimental design between the harvested and un-harvested islands (Gentry 1998). Zimmerman and Letcher (1986) and Zimmerman and Melovidov (1987) reported the subsistence harvests of 3,384 and 1,299 on St. Paul Island in 1985 and 1986, respectively. The higher harvest in 1985 is a result of the distribution of about 10,000 lb of seal meat to St. George and other Aleut communities (Zimmerman and Letcher, 1986).

4.2 Current Subsistence Fur Seal Harvest & Co-Management

Current northern fur seal subsistence harvests on the Pribilof Islands are managed under 50 CFR 216 subpart F. The regulations describe the harvest period (24 June – 8 August), allowable harvest locations, and prohibitions on harvesting adults, pups, or females.

On July 8, 1985, NMFS issued an emergency interim rule to govern the subsistence harvest of fur seals for the 1985 season under the authority of the Fur Seal Act due to the expiration of the Convention in 1984 and termination of the commercial harvest (50 FR 27914, July 8, 1985). A final rule was published the following year on July 9, 1986 (51 FR 24828) providing the authority for the subsistence taking of fur seals on the Pribilof Islands and retaining many provisions from the emergency interim rule.

The 1985 emergency rule implemented all aspects of the commercial harvest process to continue to promote humane killing (Roppel 1984). The main differences between the implementation of the commercial and subsistence harvests were the scale of killing and the regulatory restrictions on the subsistence harvest. About 20 to 30 commercial harvests occurred each year on each island, killing on average about 40,000 seals per year resulting in approximately 40,000 skins produced during the last few decades of the commercial harvest. Those skins were processed and sold by the government each year. There are no data to indicate the percentage of the meat of those 40,000 seals available for subsistence purposes as carcasses where considered excess to the commercial harvest. Any portion of the carcass not obtained for subsistence purposes was either disposed on island or processed into meal at the by-products plant also operated by the government. The 1985 emergency regulations were revised in 1986 to authorize continued subsistence harvests on the Pribilof Islands under regulations setting an annual upper and lower harvest range based on the legitimate subsistence need of the communities. No such restrictions were set during the commercial harvest as they were for the subsistence harvest. For example in 1974 the harvest forecast (not to be confused with a quota) for St. Paul was for 2,000 males aged 2 and 5 years old, the actual harvest was 2,656 (NPFSC 1975). The forecasted harvest of 3 year old males was 13,000 seals, and the actual harvest was 14,652. The forecasted 4 year old harvest was 9,600 and 15,533 were actually harvested on St. Paul. On St. George, NMFS did not allow Pribilovians to harvest any seals for subsistence purposes in that same year due to the fur seal research being conducted (Roppel 1984).

In 1986, NMFS revised the regulations to include the following new restrictions for St. George (51 FR 24828, July 9, 1986): (1) increase the subsistence harvest level from 329 in 1985 to a range of 800 - 1,800 in 1986; (2) added the need to publish by April 1 a summary of the preceding year's harvest in the Federal Register and a discussion of the number of seals needed in the current year for a 30 day public comment period; (3) added Zapadni rookery hauling ground as available for harvest twice per week; (4) added a clause for the Assistant Administrator to terminate the harvest when the number of female seals taken in the harvest since June 30 exceeds one half of one percent of the total harvest; (5) added a clause for the Assistant Administrator to terminate the harvest if 5 females are harvested during any 7-day period after August 8; (6) added the clause requiring "Pribilovians who engage in the harvest of seals are required to cooperate with scientists engaged in fur seal research on the Pribilof Islands who may need assistance in recording tag or other data and collecting tissue or other fur seal samples for research purposes."; (7) removed the responsibility of NMFS representatives to weigh meat taken for subsistence use on a daily basis; and (8) removed the option for Pribilovians to transfers skins taken for subsistence purposes to the United States Government.

On May 18, 1988, NMFS designated the Pribilof Islands northern fur seal population as depleted under the MMPA (53 FR 17888). On May 18, 1988, NMFS also announced the proposed subsistence need for the Pribilof Island (53 FR 17733) and subsequently finalized the harvest need (53 FR 28886, August 1, 1988). On June 3, 1991 NMFS announced a proposed rule to open the harvest season one week earlier (June 23 vs. June 30) to allow residents to obtain fresh meat earlier due to the termination of the harvest on August 8 to prevent the killing of young female fur seals (56 FR 25066).

NMFS revised the northern fur seal subsistence regulations in 1992 (57 FR 33900, July 31, 1992) to remove the option to extend the harvest of 2 to 4 year old male seals after August 8, and opened the season one week earlier on June 23 rather than June 30. In July 1992 (57 FR 33900) NMFS removed sections (f)(2) and F(2)(i-iii) as described in the proposed rule (56 FR 25066, June 3, 1991) which were the determination criteria issued in 1986, which prevented the accidental killing of sub-adult females during the harvest. NMFS revised the 1992 northern fur seal subsistence regulations in 1994 supported by a categorical exclusion under NEPA to make the subsistence harvest take levels applicable for 3 years rather than 1 year (59 FR 16849, July 12, 1994). In 1994 NMFS amended the harvest regulations to set three-year harvest ranges for both St. George and St. Paul (59 FR 35471).

In April 1994, the MMPA was amended to include Section 119 "Marine Mammal Cooperative Agreements in Alaska." Section 119 formalizes the rights of Alaska Native Organizations to participate in co-management of marine mammals used for subsistence resources. NMFS and the Pribilof Island Aleut Community of St. George Island, Traditional Council (Council), entered into a cooperative agreement in 2001 to work in partnership to achieve the following: Promote the conservation and preservation of fur seals and sea lions; to use traditional knowledge, wisdom and values, and conventional science to establish management actions for the protection and conservation of fur seals and sea lions on the Pribilof Islands; to establish a process of shared local responsibilities regarding the management and research of fur seals and sea lions on behalf of the citizens of the United States; to identify and resolve through a consultative process any management conflicts that may arise in association with fur seals and sea lions on the Pribilof Islands; and to provide information to hunters and the affected community, as a means of increasing the understanding of the sustainable use, management, and conservation of fur seals and sea lions. A most significant tenet in this agreement is the concept of shared management between members of the Council and NMFS in the conservation and management of fur seals and sea lions for the year 2001 and thereafter. As the primary customary/traditional users of the fur seals and sea lions in the Bering Sea Region, the Aleut Communities of St. Paul and St. George are committed to the long term sustainable use of these animals for cultural continuity, food, clothing, arts, and crafts. A key to the success of this

partnership is to incorporate the spirit and intent of co-management by building trust and by establishing close cooperation and communication between the Parties in the agreements.

The co-management agreement specifies NMFS and the St. George Traditional Council will review applicable laws and regulations governing subsistence take and use of fur seals and sea lions for the purpose of making recommendations for appropriate change. Therefore the regulatory suspension process under 50 CFR 216(e)(1)(iii) has come to be viewed as an impediment to allowing the Pribilovians to harvest to upper end of the range of their established subsistence need, reducing conservation value for fur seals, and developing cooperative responsibility under the co-management agreement. The co-management agreement has thresholds of five female mortalities to institute a temporary cessation of harvest and eight female mortalities for termination of the harvest in any particular year. Neither NMFS nor the Council has had to consider implementation or enforcement of these provisions of the co-management agreement due to the low rate of accidental female mortality during the subsistence period. Experienced and vigilant harvesters are able to detect subtle differences in the size, shape, and behavior of sub-adult female fur seals, and they are able to make an effort to avoid them during the established sub-adult male harvest process.

Beginning in 2000, the upper and lower fur seal harvest take ranges have been discussed with each tribal government as part of building co-management relationship, developing local capacity for co-management of fur seal harvests, and understanding the cultural significance of fur seals. The co-management relationship has also facilitated tribal consultations between NMFS and the tribal government on federal actions that may affect the subsistence harvest of northern fur seals. As the history of estimating the subsistence needs of the Pribilof communities has been one of practical and social difficulties, the process to comply with the harvest take range regulation has resulted in the reluctant acceptance of harvest ranges established in 1997. The process to set the subsistence harvest range began in 1976 at a level identified as unlikely to meet the subsistence needs of St. George (50 FR 27914, July 8, 1985; 51 FR 17896, May 15, 1986), in order to maintain the NMML research program.

In 1992 St. George began harvesting sub-adult male fur seals at both Northeast and Zapadni hauling grounds as allowed by the regulations. St. George residents' average harvest during the entire subsistence period is 215 seals per year. St. George has exceeded the lower harvest range twice since 1986, requiring explicit authorization from NMFS to continue to harvest fur seals for the remainder of the season to meet their subsistence need. On St. George subsistence harvests have likely declined during the subsistence harvest period under the regulations (Table 8, range 329-63; Figure 6). Subsistence harvests on St. George are lower during the most recent decade (2004-2013: mean harvest = 130) than the first decade under the subsistence regulations (1985-1994: mean harvest = 196). The human and fur seal populations have both declined, and subsistence harvests are lower than previously. Whether the subsistence harvest would be higher if the estimated harvest range were higher is unknown. The Council and St. George residents coordinate, implement, monitor, and report the subsistence harvest based on the regulatory restrictions.

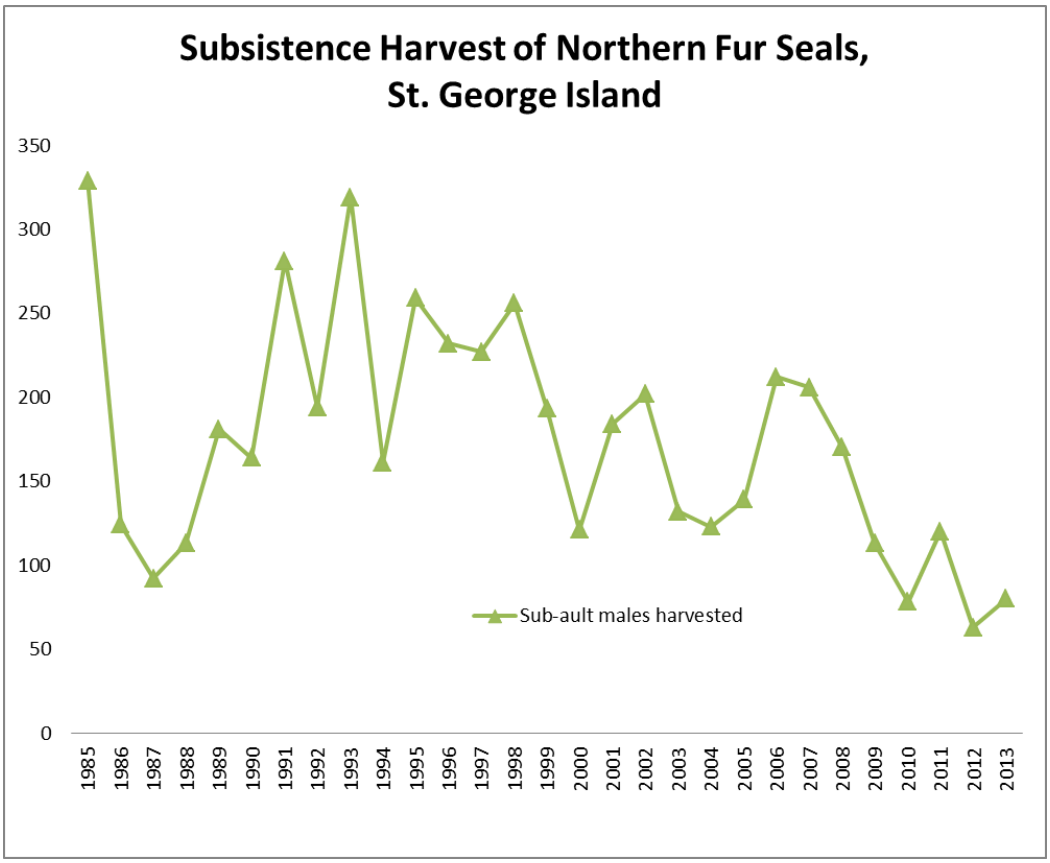

Figure 6 Number of sub-adult male northern fur seals harvested on St. George Island under the subsistence regulations

Table 9 Subsistence harvest range and actual annual harvest on St. George Island, Alaska 1986-2013

Year	Estimated Harvest Range	Actual Harvest	Difference between lower end and actual
Island	**St. George**	**St. George**	**St. George**
1986	800-1,800	124	676
1987	533-1,800	92	441
1988	600-725	113	487
1989	533-600	181	352
1990	181-500	164	17
1991	181-500	281	-100
1992	281-500	194	87
1993	281-500	319	-38
1994	281-500	161	120
1995	281-500	259	22
1996	281-500	232	49
1997	300-500	227	73
1998	300-500	256	44
1999	300-500	193	107
2000	300-500	121	179
2001	300-500	184	116
2002	300-500	202	98
2003	300-500	132	168
2004	300-500	123	177
2005	300-500	139	161
2006	300-500	212	88
2007	300-500	206	94
2008	300-500	170	130
2009	300-500	113	187
2010	300-500	78	222
2011	300-500	120	180
2012	300-500	63	237
2013	300-500	80	220

4.3 Impacts on Subsistence and Co-management

It is difficult to quantify the importance of the subsistence way of life and the value of co-management for purposes of a NEPA analysis. The subsistence way of life in these communities has remained an important, consistent, and supporting factor in the personal, economic, and traditional character of the Pribilof Islands. Subsistence is not simply the collection of food that can be replaced by a visit to a grocery store or the replacement of a pound of fresh fur seal meat for a pound of beef or pork or fish, or even other subsistence food. Subsistence connects community members and relatives through food sharing and cooperative hunting and harvesting efforts. Subsistence provides raw materials for the creation of crafts and other saleable items under federal law. Subsistence connects community members to their environment as an integral part of the system. A continued subsistence harvest preserves the traditional skills, cultural values and knowledge, and enables the passing of cultural values on to younger hunters. For this analysis, increasing the opportunities for subsistence harvests of fur seals is a beneficial effect, and changing the opportunities for subsistence harvests could results in beneficial or adverse effects, and retaining the same (limited) opportunities for subsistence harvests would have adverse effects.

The co-management agreements provide the framework for full partnership and full participation in decisions affecting the management of marine mammals used for subsistence purposes on the Pribilof Islands. Participation and partnership between the St. George Council and NMFS in decision-making regarding subsistence is built on trust and communication. For this analysis, beneficial effects on co-management build trust and a relationship that promotes open and regular communication and responsiveness. For this analysis, adverse effects to co-management are those which reduce communication, erode trust, and do not support partnership between the tribal government and NMFS.

4.3.1 Alternative 1: No Action

Adverse effects on subsistence are likely to occur under the status quo/no action Alternative. Alternative 1 would maintain the same harvest opportunities that have limited the community of St. George over the past 30 years and does not address the interest of the tribal government to reinitiate the young of the year harvest after a 100-year cessation of an important cultural need and tradition to obtain fresh meat and resources for handicrafts in autumn. The harvest ranges provide a degree of flexibility the St. George community supports regarding population changes and unanticipated needs within the community during the season when fur seals are easily available on the Pribilof Islands. However, the harvest restrictions under the no action Alternative do not allow the opportunity to obtain fresh fur seal meat and handicraft resources in the autumn, non-breeding season. Alternative 1 will have an adverse effect on the subsistence needs of the community of St. George Island as they will continue to not be allowed the opportunity to harvest male young of the year as they requested in 2006 and as they had historically been allowed. The status quo continues to restrict the flexibility of the community to meet their subsistence need due to the limited availability of preferred sub-adult male fur seals at the two authorized hauling grounds out of the nine sites available. Alternative 1 does not limit subsistence due to the accidental mortality of sub-adult females, but the prohibitions on harvesting young of the year and terminating the harvest for the year on August 8 would limit the harvest more dramatically than under Alternatives 2, 3, or 4.

The status quo has an adverse effect on co-management as it is not responsive to the petition received in 2006 from the Traditional Council of St. George Island to change the regulations governing the subsistence harvest of northern fur seals on St. George Island. While a few objectives of the co-management agreement will be met, the key action of the agreement to co-manage the harvest and review

applicable regulations for making recommendations for appropriate changes to NMFS will not be met. The effects extend across the entire Alaska Native community of St. George Island.

4.3.2 Alternative 2: Preferred Alternative

Alternative 2 would increase opportunities to harvest northern fur seals during the summer and autumn and is therefore considered a beneficial effect on subsistence. The geographic extent of subsistence opportunities is also major as they would allow these subsistence opportunities to range across the population of fur seals on St. George. The preferred alternative would allow the community greater resilience in meeting the demands of changing future environmental conditions to meet their subsistence need. The economic opportunities will also be gained by St. George residents having more flexible access to subsistence resources which are primarily limited by the regulations for harvesting northern fur seals and their seasonal availability. The preferred alternative would include a conservation control to suspend the subsistence harvest when two females of any age are killed and terminate the harvest for the season if a third female is killed. This conservation control within the preferred alternative could have dramatic adverse effects on subsistence opportunities if the measures identified to remove the suspension after two females are killed are not effective or implemented properly by harvesters. This potential outcome is highly unlikely to occur because three females have never been killed during the summer harvest and in 27 of those 30 years no females were killed on St. George. Subsistence harvesters would sex young of the year prior to harvest under the preferred alternative and therefore the likelihood that three female young of the year would be accidentally killed before harvesters and monitors would identify the mistakes is very small.

The strengthening of the co-management relationship prompted the St. George Traditional Council to petition NMFS in 2006 to change the harvest regulations to allow them to exercise their traditional and customary subsistence practices, but maintain the same harvest ranges already evaluated in NMFS (2005). The preferred alternative would institute conservation controls, which were developed in partnership under co-management with the Council and harvesters. The conservation control which would prohibit harvests at small breeding areas when they have been modeled to fall below the threshold level of pup production described in Johnson (2014) would not result in adverse effects on subsistence when compared to the status quo. The status quo prohibits harvest at all other fur seal locations except two, irrespective of the stability or size of the breeding site. Therefore the conservation control which prohibits harvests at small breeding areas will not have adverse effects on subsistence, until the number of harvestable locations falls below two sites (i.e., the number considered in the status quo). The preferred alternative has beneficial effects on co-management because it supports trust in the partnership intended under co-management to balance the ability of the community to meet their subsistence needs with conserving the fur seal population based on the best available science. The preferred alternative does not increase the number of fur seals that can be harvested for subsistence purposes on St. George, but adds flexibility by adding a new season and locations to improve the opportunities for successful harvests.

Beneficial effects on subsistence and co-management are likely to occur under the preferred alternative. The preferred alternative provides greater flexibility than the status quo and provides greater resiliency for the community to withstand dramatically changing environmental, social, and economic conditions. The preferred alternative addresses the interest of the tribal government to reinitiate the young of the year harvest after a 100-year cessation as an important cultural need and tradition, and institutes practical conservation controls to reduce accidental mortality of females and prohibit harvests at rookeries where the annual pup production cannot sustain a harvest. The Council's petition requests, and the preferred alternative would authorize, greater flexibility for the community to obtain fresh fur seal meat and raw materials for the creation of handicrafts during two harvest seasons. The second season would be 10 weeks long and would include

the harvesting of up to 150 male young of the year. NMFS assumes the desire for young of the year seals during the second harvest season will be important enough to not harvest over 350 sub-adult seals during the first season on St. George. The upper level of the harvest range (500 seals) provides a degree of flexibility that is supported by the community regarding population changes and unanticipated needs within the community during the fur seal breeding and non-breeding seasons. In addition to fresh meat, the longer harvest period will allow for new resources to be obtained for creation of handicrafts, thus strengthening the cultural relationship between St. George residents and the fur seals.

We have not quantified the increase in the duration of the harvest for scientists' sampling because there has always been the requirement to cooperate, and scientists are interested in collecting tissues from marine mammals because lethal research is not typical authorized. Tissues such as whiskers are valued by handicraft artisans and are also used for studies of the diet of fur seals. Because of the requirement to "cooperate with scientists" subsistence users have forgone opportunities to collect handicraft materials for scientific investigations. In addition, scientists sampling of organs or meats create the perception among some subsistence users that the organs or meat sampled may not be safe for consumption. The proposed action would revise the requirement to cooperate and instead provide for the Council and NMFS to work together through co-management to consider whether intrusive sampling methods or frequency of sampling can be altered to minimize the effects on the subsistence user's collection of food or resources for the creation of handicrafts. The Council and harvesters have expressed a perception among some community members that the harvest under the current regulations is prioritized for scientific sampling rather than subsistence as described in 50 CFR section 216.71 (a). The revised regulations would provide for monitoring, managing, sampling, and reporting in the two harvest seasons. The preferred alternative is responsive the petition submitted in 2006 from the Traditional Council of St. George Island to change the regulations governing the subsistence harvest of northern fur seals. The geographic scope, duration and frequency of the effects on subsistence and co-management are moderate and positive as it relates specifically to St. George Island.

4.3.3 Alternative 3: Harvest of 500 male pups and no sub-adult males

Alternative 3 would change the opportunities to harvest from a summer to autumn season. Because the autumn season is 10 weeks long versus the 6-week summer harvest season there would be an increase in subsistence harvest opportunities over the status quo. Alternative 3 would extend the harvest opportunities geographically to all locations on St. George creating beneficial effects on subsistence similar to those for Alternatives 2 and 4. Because Alternative 3 removes opportunities to harvest sub-adult male fur seals during the summer season, it has a negative effect on subsistence compared to Alternatives 2 and 4 which have two harvest seasons.

Alternative 3 would institute the same process under all alternatives for harvesting more than 300 seals. The need to harvest over 300 seals may occur with more frequency than under the other alternatives because a young of the year would likely yield less meat per seal than sub-adult males. So under alternative 3 the council may need to request to exceed the lower end of the harvest range with more frequency, but it would still only need to occur once per year under all of the alternatives. It is also possible that 500 young of the year would not meet their subsistence need due to the smaller size of young of the year compared to sub-adults – more of the smaller animals may need to be taken to yield the same amount of meat, such that Alternative 3 would have adverse effects on the ability of the community to meet their subsistence need. We do not have estimates of the edible portions of young of the year to compare with sub-adults to evaluate this possible outcome. Average mass of young of the year during the harvest season is about 12 kg, and average mass of 2 year-olds is about 22 kg (NMFS unpublished data).

By examining the current level of sub-adult male harvests it is likely that up to 500 young of the year would yield the meat equivalent of 215 sub-adult males.

Alternative 3 would institute a conservation control which is different from those developed in partnership under co-management with the Council. Alternative 3 would include a conservation control to suspend the subsistence harvest when nine females of any age are killed and terminate the harvest for the season if a tenth female is killed. This conservation control within the Alternative could have adverse effects on subsistence opportunities if the measures identified to remove the suspension after nine females are killed are not effective or implemented properly by harvesters. NMFS considered that this potential outcome is highly unlikely to occur because subsistence harvesters would sex young of the year prior to harvest under the preferred alternative and therefore the likelihood that 10 female young of the year would be accidentally killed before harvesters and monitors would identify the mistakes is very small. When compared to Alternative 2, Alternative 3 would allow more harvest opportunities for subsistence if harvesters cannot distinguish males from females as they have for the past 30 years of subsistence harvesting on St. George. Alternative 3 does not continue the subsistence harvest of sub-adult males during the summer as the community has practiced for about 200 years. Alternative 3 would cause adverse impacts on subsistence and co-management because it removes the ability for St. George residents to obtain fur seal meat during the summer. The conservation control which would prohibit harvests at small breeding areas that reach unstable levels under Alternative 3 would have beneficial effects on subsistence relative to the status quo, and similar to Alternative 2. Alternative 3 increases the ability for St. George residents to obtain fur seal meat during the autumn. Alternative 3 would likely result in net adverse effects on subsistence and co-management due to the loss of fresh fur seal meat during the summer and undermining the communities continued interest in retaining and increasing opportunities to build trust and improve availability of subsistence resources.

4.3.4 Alternative 4: Harvest of 50 male pups and 450 sub-adult males

Alternative 4 would have beneficial effects on subsistence and co-management when compared to the status quo but less than the preferred alternative. Alternative 4 provides greater flexibility than the status quo and provides marginally greater resiliency for the community to withstand dramatically changing environmental, social, and economic conditions. Alternative 4 would institute one conservation control which is different from that developed in partnership under co-management with the Council. Alternative 3 would include a conservation control to suspend the subsistence harvest when 19 females of any age are killed and terminate the harvest for the season if a twentieth female is killed. The conservation control within Alternative 4 could have dramatic effects on subsistence opportunities if the measures identified to remove the suspension after 19 females are killed are not effective or implemented properly by harvesters. NMFS and the council believe that this potential outcome is highly unlikely to occur because only two females have been killed during the summer harvest in one year and in 27 of those 30 years no females were killed on St. George. Alternative 4 would allow more subsistence harvest opportunities if harvesters cannot distinguish males from females as they have for the past 30 years of subsistence harvesting on St. George when compared to Alternative 2 and Alternative 3. The conservation control which would prohibit harvests at small breeding areas that reach unstable levels under Alternative 4 would have beneficial effects on subsistence relative to the status quo, and similar to Alternatives 2 and 3. Alternative 4 addresses the interest of the tribal government to reinitiate the young of the year harvest but does not meet the Council's requested need for fur seal meat in the autumn of 150 male pups. Alternative 4 increases the ability for St. George residents to obtain fur seal meat during the autumn over the status quo, but less than Alternatives 2 and 3.

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5 Cumulative Effects

Several past, present and reasonably foreseeable future actions were identified as cumulative effects for fur seals—

- disease, parasites, and predation
- commercial fisheries,
- entanglement in marine debris,
- historic commercial harvest of fur seals,
- illegal killing,
- disturbance and harassment due to human presence or activities,
- private actions, and
- climate and environmental change.

A discussion of the cumulative effects of the ecosystem management, marine mammal research, subsistence harvests, fisheries rationalization, and state and international fisheries management is in the Alaska Groundfish Harvest Specifications EIS (NMFS 2007b), Bering Sea Chinook Salmon Bycatch EIS (NMFS 2009), Steller sea lion and northern fur seal research EIS (NMFS 2007), the Setting of the annual subsistence harvest of northern fur seals on the Pribilof Islands EIS (NMFS 2005), and the Steller sea lion Protection Measures Draft EIS (NMFS 2013). These discussions are incorporated by reference. Relevant information from these documents is summarized or updated in this chapter. This chapter also contains recent information on the cumulative effects on northern fur seals and subsistence harvests.

Olesiuk (2012) completed a population viability analysis for the northern fur seal population and determined that fur seals in the North Pacific are not at risk of extinction. Though the Pribilof sub-population continues to decline the remaining sub-populations are increasing or stable and represent at least half of the world's population of northern fur seals. Olesiuk (2012) determined that sufficient inter-mixing during their annual winter migration and behavioral plasticity to colonize new sites such as Bogoslof Island will maintain population viability for the next 100 years.

5.1 Disease, parasites, and predation

The prevalence of disease and parasites has not been implicated as an important factor affecting the fur seals breeding on the Pribilof Islands (NMFS 2005; NMFS 2007a; NMFS 2007b). Spraker and Lander (2010) found no evidence over the past 27 years to implicate diseases or mortality of pups prior to weaning as an important factor in the current population decline on St. Paul. Lyons et al., (2011) described the decline in occurrence of hookworms in northern fur seals on St. Paul Island. Springer et al. (2003) hypothesized that sequential declines in North Pacific populations of seals (including fur seals), Steller sea lions, and sea otters were due to increased predation by killer whales, following the removal by commercial whaling of baleen whales as the killer whales primary food source. DeMaster et al. (2006) evaluated the Springer et al. (2004) hypothesis and reported both top-down and bottom-up factors provided a more consistent explanation of the observed pinniped declines rather than top-down alone. Steller sea lions kill weaned fur seal pups close to shore on St. George Island (Gentry and Johnson, 1981), and were seen killing fur seal pups in 1992 (reported in NMFS 1993). No recent investigations have been undertaken on the incidence of predation on northern fur seals.

5.2 Commercial Fisheries

The spatial or temporal concentration of commercial fisheries in the BSAI region during the summer breeding season (May through August) and autumn non-breeding season (September through November) may potentially influence foraging activity of fur seals. The extent of these impacts depends on the size of the fisheries, targeted species, the protection measures in place, and the level of interactions between the fisheries and fur seals. However, a number of factors have the potential to reduce the impacts of fishing activity on marine mammals in the future. These include the trend towards ecosystem management. Ecosystem management and institutionalization of ecosystem considerations into fisheries governance are likely to increase our understanding of the interactions between fur seal populations and domestic fisheries.

Due to northern fur seal migration and presence for 30 to 50% of their annual cycle in international waters, foreign fisheries also have the potential to impact their survival and reproduction. International scientific collaborations and sharing fisheries catch data can improve ecosystem management that may lead to mitigation of potential foreign fisheries impacts on marine mammals including northern fur seals. Whether international or domestic fisheries removals cause a change in prey availability, foraging behavior, reproduction, or survival of northern fur seals is unknown. We conclude that there is not sufficient information on the relative contributions of international and domestic commercial fishery harvests from the Bering Sea, Aleutian Islands, and North Pacific Ocean to determine whether population level effects on northern fur seals have occurred.

Currently, all marine areas used by fur seals are commercially fished by domestic or international fleets. Fur seal presence in the Bering Sea coincides with numerous commercial fisheries on species also found in the fur seal diet from May through November (see discussion previously and that found in Gudmundson et al., 2006, Zeppelin and Ream 2006, Call et al., 2007). Sablefish, rockfish, and lingcod are not considered important prey species of northern fur seals (NMFS 2009). No specific measures to protect northern fur seals are included in the State management plans for these species as there do not appear to be any practical regulatory linkages to fur seal marine foraging areas.

Groundfish fisheries that target potential prey for fur seals may have an effect on prey availability. These fisheries include a variety of gear types directed at pollock, Pacific cod, Pacific herring, Atka mackerel, squid, and salmon. In addition there are Bering Sea commercial fisheries directed at species (yellowfin sole, flathead sole, rock sole, Alaska plaice, Greenland turbot, halibut, and pollock) considered competitors with fur seals. In the Pacific Ocean there are also international commercial fisheries directed at fur seal prey (e.g., squid) and fish that compete with fur seals (i.e., yellowfin sole, flathead sole, rock sole, Alaska plaice, Greenland turbot, halibut, and pollock). Therefore international commercial fisheries in the Pacific Ocean could reduce, alter, or redistribute the prey field of northern fur seals similarly to that postulated in the Bering Sea. Fur seals are not central place foragers during the winter, and fur seals may respond differently to the effects of fisheries during the winter than the summer. Alternatively, removal of competitor species due to fishing may increase the availability of fur seal prey; however, the relationship between fur seals, fisheries, and fur seal prey likely varies by region and the extent to which one species is able to out-compete another for common prey is unknown.

Commercial fisheries have the potential to affect northern fur seals in several ways: (1) from incidental take during fishing operations, (2) from entanglement in marine debris lost or discarded from fishing activities, (3) from disturbance related to boat traffic, fishing activities, and the presence of fishing gear, (4) from changes in prey availability (abundance, density and distribution). The policies and management strategies that govern the Alaska groundfish fisheries are regularly reviewed by the North Pacific Fishery Management Council and NMFS, and changes to the policies could affect influence the northern fur seals

population (NMFS 2001, NMFS 2013). Pollock and flatfish fisheries management measures have been implemented that may reduce the potential effect of these fisheries on fur seals. The Pribilof Islands Habitat Conservation Zone is closed to trawling year round, which may protect foraging locations for fur seals near St. George and St. Paul Islands (50 CFR 679.22(a)(6)). The amount of salmon bycatch in the pollock fishery is also restricted under Amendment 91 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (75 FR 53026, August 30, 2010). Amendment 91 provides incentives for the pollock fishery to avoid Chinook salmon bycatch which may reduce the potential effects on fur seal salmon prey. Few data exist to indicate the level or probability of commercial fishery impacts through the proposed mechanisms described above.

The descriptions of historic levels of northern fur seal take in past fisheries can be found in NMFS (2007), but most likely does not reflect current conditions due to the significant changes and termination of many international gill and driftnet fisheries. Northern fur seals are not typically observed as take in any commercial fisheries (see Table 9; Allen and Angliss 2013) and the few takes that occur are well below the PBR for this stock. Therefore, the direct effects of fisheries mortality through incidental takes are presumed to be negligible.

The pollock and flatfish trawl fisheries in the Bering Sea and Aleutian Islands incidentally take other marine mammals and are categorized as Category II fisheries under the MMPA because they have annual mortality and serious injury of a other marine mammal stocks greater than 1 percent and less than 50 percent of the PBR level (78 FR 53336, August 29, 2013). The Pacific cod longline fishery is a Category III fishery with a remote likelihood of taking marine mammals. Older driftnet commercial fisheries incidentally caught and caused the mortality of northern fur seals. Since fur seals annually migrate into international waters, the actual numbers of northern fur seals killed by all fisheries operations is not known. NMFS monitors those U.S. commercial fisheries by placing observers on fishing vessels or from self-reporting by fishermen.

Table 10 Estimated mean annual mortality of northern fur seals from observed BSAI flatfish, Pacific cod fisheries, and pollock fisheries from 2007-2010 compared to the total mean annual human-caused mortality and potential biological removal for the entire Eastern Pacific stock.

Marine mammal species and stock	Years	Mean annual mortality from BSAI flatfish trawl fisheries*	Mean annual mortality from BSAI Pacific cod longline fisheries*	Mean annual mortality from BSAI pollock trawl fisheries*	Mean Annual Mortality from Alaska Groundfish Fisheries	Total mean annual human-caused mortality**	Potential biological removal
Northern fur seal, Eastern Pacific	2007-2010	1.01	0.31	1.89	3.21	500	11,130

* Mean annual fisheries mortality is expressed in number of animals from an extrapolation of the observed vs. unobserved portions of the fisheries and includes both incidental takes and entanglements. The averages are from the most recent 4 years of data. For more information see Allen and Angliss 2013.

** Other human-caused mortality is predominantly subsistence harvests for fur seals (496), with three accidental mortalities due to research for the 4-year period (Ream pers. comm. 2013).

Indirect commercial fishing effects could include a reduction, redistribution, alteration, or increase in the availability of prey. Fisheries could affect fur seal prey on either local (e.g. "localized depletion") or ecosystem-wide scales (NMFS, 2000; 2001) by removing fish biomass. Fisheries may reduce the density of individual patches of fish (through dispersion) or change the distribution, size, or number of patches in space. In addition, fisheries may affect fur seals through interactive competition (Baraff and Loughlin, 2000). Interactive competition may include disruption of normal fur seal foraging patterns by the presence and movements of vessels and gear in the water; abandonment of prime foraging areas by fur seals because of fishing activities; and disruption of prey schools in a manner that reduces the effectiveness of fur seal foraging behavior. Fishery removals may influence fur seals in numerous ways as do the effects of other predators in ecosystems, but effects of fisheries are orders of magnitude larger than the consumption by other predatory species (Fowler and Hobbs, 2002; Fowler, 2003). Ecosystem complexity, data and model limitations, and indirect linkages confound the quantification of most interactions between northern fur seal seals, their prey, and commercial fisheries. The most likely manifestation of indirect fishing effects would be the increasing energetic demand for fur seals to obtain necessary prey for growth, survival, or reproduction. In the absence of direct experimental manipulation of commercial fishing effort and measuring fur seal growth, survival, or reproduction we are unable to quantify and predict the extent of the indirect effects of commercial fisheries on northern fur seals.

The Northern Fur Seal Conservation Plan (NMFS 2007a) recommends gathering information on the effects of the fisheries on fur seal prey, including measuring and modeling effects of fishing on prey (both commercial and noncommercial) composition, distribution, abundance, and schooling behavior, and evaluate existing fisheries closures and protected areas. The Bering Sea and Aleutian Islands groundfish fisheries overlap in time and space with lactating adult female and sub-adult male northern fur seal foraging areas (NMFS 2007b). The EIS for the annual subsistence harvest of fur seals determined that the groundfish fisheries in combination with the subsistence harvest may have a conditional cumulative effect on prey availability if the fisheries were to become further concentrated spatially or temporally in fur seal habitat, especially during June through August (NMFS 2005). Changes in the commercial fisheries' spatial and temporal allocation and our knowledge of fur seal foraging, diet, and migration have altered our understanding of the potential fisheries effects.

Fur seals from the eastern Pacific stock forage across much of the southeast and central Bering Sea during the summer and autumn (Robson et al., 2004, Zeppelin and Ream 2006, Sterling and Ream 2005, Call et al., 2007). While in the Bering Sea fur seals from both islands consume from about 40-80% of their diet as pollock (Zeppelin and Ream 2006). Fur seals breeding on St. George Island forage primarily in the southeast Bering Sea and their diet includes more salmon and squid than fur seals breeding on St. Paul (Zeppelin and Ream 2006). Fur seal diet estimates are biased when only looking at scats, and when considering spew (i.e., regurgitations) the diet overlaps to a greater degree with size of fishes caught in the commercial fisheries (Gundmundson et al. 2006). Female fur seals segregate their at-sea foraging locations by St. George and St. Paul Island rookeries (Robson et al., 2004, Zeppelin and Ream 2006). Fur seal scat samples from St. George contain 10 to 19% salmon, while salmon occurs in 3% to 12% of the samples from St. Paul, with only 2 of the 11 rookeries sampled having more than 10% frequency of occurrence (Zeppelin and Ream 2006). Fur seal foraging on salmon represent the complexity of interpreting the indirect effects of commercial fisheries on fur seals. Whether fur seal foraging behavior is a preference for those fur seals on St. George or simply represents their availability in different foraging habitat (e.g., shelf or non-shelf) confounds any interpretation of commercial harvests of salmon in the Bering Sea that may compete with female fur seals. Competition with the pollock fishery is less likely for females using the Bogoslof Island rookery as these animals eat primarily squid and northern smooth tongue and are less likely to take foraging trips outside of the Bogoslof Foraging Area closure for the pollock fishery (Rolf Ream, NMML, pers. comm., September 26, 2008).

Adult pollock were most frequently found in the stomachs of fur seals collected over the outer domain of the continental shelf, while juvenile pollock were found in seals collected both over the midshelf and outer domain (NMFS 2006). Based on female fur seal scat samples from St. George and St. Paul Islands, fur seals prey on pollock from July through September most likely come from the hydrographic domains of the middle and outer shelf regions (Zeppelin and Ream 2006). Pollock occurred in 64% to 84% of the fur seal scat samples from St. Paul Island, and in 43% to 70% of the samples from St. George Island (Zeppelin and Ream 2006). In the summer of 1999 and 2000, spew samples from St. George had a 36.8% frequency of occurrence for pollock compared to 60% occurrence in the scat samples (Gudmundson et al. 2006). No difference was seen for the frequencies of occurrence for pollock in scat and spew samples from St. Paul Island which were both around 70%.

Since pollock is the dominant fish in the summer and autumn diet of fur seals in the Bering Sea, commercial fishing for pollock is the most likely fishery to affect fur seals. However, competition between the fishery and fur seals is complicated by numerous aspects of fur seal and pollock biology. Pollock cannibalism of year-0 and year-1 pollock are significant sources of natural mortality affecting recruitment (Dwyer et al., 1987; Mueter et al., 2006, 2011; Boldt et al., 2012), and northern fur seals consume both adult and juvenile pollock (Gudmundson et al., 2006). Thus northern fur seals compete with adult pollock for juvenile pollock and with the fishery for adult pollock. Since the fur seal diet is not comprised of primarily juvenile pollock as previously thought based on the analysis of scat (Gudmundson et al., 2006), the extent to which competition between the fishery and fur seals occurs is highly uncertain. Thus whether the pollock fishery removing adult pollock or removing a predator of juvenile pollock has a greater effect on fur seal survival or reproduction is unknown. Fur seal use of pelagic habitat across years or seasons is not clearly understood, but is beginning to be more fully investigated and understood. The sub-polar continental shelf and shelf break from the Bering Sea to California are known feeding grounds for fur seals while at sea. It has been suggested that the highest fur seal densities in the open ocean occur in association with major oceanographic frontal features such as sea mounts, valleys, canyons, and along the continental shelf break (Lander and Kajimura 1982; Kajimura 1984; Loughlin et al. 1999). Due to fur seals' long-distance winter migration into the North Pacific Ocean their interactions with domestic and foreign commercial fisheries are more likely to be different from those of Steller sea lions. Results of future fur seal and fisheries research will inform future management actions and may provide a more definitive understanding of the complexity of the interactions between commercial fisheries and fur seals.

5.3 Entanglement in Marine Debris

Fur seals become entangled at sea in debris from the commercial fishing industry and other sources. Fur seals were first seen entangled in marine debris just after World War II (Fowler et al., 1990), and records of entanglement of northern fur seals in marine debris have been kept since the late 1960s. Most data come from studies of sub-adult males collected during the commercial harvest between 1967 and 1985 (e.g., Scordino and Fisher, 1983), and scientific roundups conducted after the cessation of the commercial harvest (e. g., Fowler, 1987; Fowler et al., 1992). The most common types of debris include trawl net webbing, plastic strapping bands, and line.

The commercial harvest of fur seals sampled the sub-adult male portion of the population. Sub-adult male fur seals were the first portion of the population observed to become entangled in discarded fishing gear and marine debris in the 1940s and 1950s (Fowler 1987). Scientists realized that sub-adult males were the most reliably observed during the commercial harvest round-ups from the hauling grounds, although other portions of the fur seal population were entangled, sub-adult males provided a reliable index of entanglement. The sub-adult male fur seal entanglement rate has fluctuated over time but was generally lower in the 1990s (about 0.2 percent) than in the 1970s and 1980s (~0.4 percent). Robson et al. (1999)

reported no difference between entanglement rates on St. Paul and St. George Islands from 1995-1997. Williams et al. (2004) reported that entanglement rates remained generally consistent from 1995 to 2003, and determined that approximately 20,000 sub-adult male seals would need to be sampled to detect a 50 percent change in the proportion of sub-adult males entangled. Sub-adult male entanglement rates do not account for seals that become entangled at sea and are unable to return to the Pribilof breeding grounds.

The rates of entanglement for adult females may be higher than that of adult males because of their smaller size and slower rate of growth. In 1985, DeLong et al. (1988) estimated between 0.06 and 0.23 percent of adult females on select St. Paul rookeries were observed entangled in marine debris. Mass and survival of pups with entangled mothers were significantly lower than other pups. Entangled lactating females spent more time at sea feeding than non-entangled females or did not return to the rookeries at all (DeLong et al., 1988). A sample of adult females was counted from 1991 to 1996 during the counting of adult males on St. Paul to determine the percentage of adult females entangled. The percentage of adult females entangled at this time was lower than for sub-adult males, suggesting that either adult female fur seals are less likely to become entangled or their survival once entangled is lower than sub-adult males.

Observations of fur seal entanglement at sea are limited, and the actual extent and significance of entanglement at sea are unknown (Fowler, 2002). Captive studies on three sub-adult male fur seals showed that a free-swimming animal entangled in a net fragment of 200 g or larger will experience considerable difficulty swimming (Feldcamp et al., 1988). The relative size of females and sub-adult males (i.e., 2 to 4 year old) correlates well with the common mesh sizes of trawl net material. Females, due to their smaller size at age, may have a longer opportunity to become entangled in the prevalent net material than older males. Younger age classes of both sexes may be more likely to become entangled than adults.

State-managed fisheries represent an additional source of entanglements due to lost or discarded fishing gear in fur seal foraging or migratory areas. The amount of state-managed fishing resulting in entangling debris in the Aleutian Islands relative to amount of debris related to other past and present fisheries are not likely to result in detectable changes in entanglement of northern fur seals. The current levels of observed fur seal entanglement on land are small as to be considered unlikely to effect the population. Attempts by local and federal staff to disentangle seals and remove accumulated marine debris from the shore further reduces the effects of entanglement on the survival and reproduction of fur seals.

Laist (1997) suggested that while the entanglement rates seen on land are too low to account for the fur seal population decline, the unrecorded number of animals entangled and killed at sea may be a potentially significant factor. Trites and Larkin (1989) modeled fur seal population trends and speculated that entanglement related mortality was likely contributing significantly to the decline observed through 1987. Trites and Larkin (1989) indicated a 2-5% reduction in adult female survival provided the best fit of model choices to the available trend data and that entanglement might be a plausible contributor to reduced adult female survival. Pup entanglement prior to weaning is highly variable, though significantly lower than other portions of the fur seal population (Gearin et al., 1989; Kingsbery 2012). Entanglement in marine debris is a plausible mechanism for the reduction in adult female survival in the late 1980s. Fowler (1985; 1997; 2002) estimated that entanglement mortality could be as high as 15% for seals from birth to age three.

5.4 Commercial Fur Seal Harvest

Russian explorers first visited the Pribilof Islands in June 1786, and the exploitation of fur seals began almost immediately thereafter. From 1786 to 1828, the Russians, with enslaved Aleut labor, harvested an

average of 100,000 fur seals annually, primarily males and pups (Roppel, 1984). It was not until 1822 that bulls were protected by the Russians and restrictions were placed on the number of pups killed (Scheffer et al., 1984). From 1835 to 1839 an average of 70,000 seals were harvested annually. Beginning in 1847, the Russians regulated the harvest of males and the harvest of females was stopped. About 30,000 to 35,000 fur seals were killed annually during the last 10 years of Russian occupation. The population was reportedly thriving and was sustaining an annual harvest of several thousand males when the United States purchased Alaska in 1867 (York and Hartley, 1981). During the first 2 years following the purchase of Alaska by the United States, the fur seal harvest ensued without management actions implemented by the Russians. Approximately 240,000 fur seals were taken on land in 1868. Meanwhile, pelagic sealing resulted in numerous seals killed and lost at sea.

Roppel and Davey (1965) report the history of pelagic sealing from 1875 to 1909, its impact on the fur seal population, and a discussion of a treaty banning pelagic sealing. At the peak of pelagic sealing (1891-1900), more than 42,000 fur seals (mostly lactating females) were taken annually in the Bering Sea (Scheffer et al., 1984). In addition, pelagic sealing removed a large but unknown number of fur seals from waters off British Columbia (Scheffer et al., 1984). Because the takes greatly reduced the fur seal stock, Great Britain (for Canada), Japan, Russia, and the United States ratified the Fur Seal Treaty of 1911, which was the first international wildlife management agreement of its type in modern history. The Fur Seal Treaty prohibited pelagic sealing and required a reduction in the harvest of seals on land. There was no commercial harvest from 1912 to 1917 due to the severe population reduction, though a subsistence harvest did occur.

The United States government continued the commercial harvest of fur seals after the population began to recover. From 1918 to about 1941, the Pribilof Island fur seal stock grew at 8 percent per year under a harvest that ranged from 15,862 in 1923 to 95,016 in 1941 (NMML, unpublished data). In 1941, Japan abrogated the Convention to the Treaty on the grounds that fur seals were too numerous and were damaging their fisheries; after World War II, a similar concern on the part of Japan was important in negotiating the 1957 version of the Convention (Scheffer et al., 1984). The take from 1943 to 1955 averaged about 70,000 per year. The U.S. commercial harvest was primarily focused on sub-adult males due to their high quality fur and because dense aggregations on land facilitated harvesting and processing. Harvests also occurred intermittently at sea and, relative to harvests on land, often resulted in high numbers of animals killed but not retrieved, including a high mortality of females. From 40,000 to 126,000 fur seals were harvested annually on land during the peak harvest from about 1943 to 1968. Adult females comprised from 50 to less than 1 percent of the on-land harvest during this same period.

In 1957, the signatories of the Treaty ratified a new agreement, the Interim Convention on the Conservation of North Pacific Fur Seals, for the conservation, research, and harvesting of fur seals. During those negotiations, calculations presented by the United States suggested that maximum sustained productivity would occur at lower female population levels than those of the early 1950s. These projections postulated higher pregnancy and survival rates from a smaller herd (Anonymous, 1955). From 1956 to 1968, a total of about 300,000 female fur seals were killed on the Pribilof Islands to reduce the herd and increase production. In addition, a United States and Canada collected about 16,000 females at sea to for scientific investigations of distribution, reproduction, and diet from 1958 to 1974 (York and Hartley, 1981). Concurrently, 30,000 to 96,000 sub-adult males were harvested each year (Lander and Kajimura, 1982).

The Pribilof Islands fur seal population did not react as expected to the female herd reduction program initiated in the 1950s. Kajimura (1980) reported that neither a substantial decrease in age at first pregnancy nor an increase in pregnancy rates occurred as the population was reduced. Additionally, survival rate increases did not overcome population losses resulting from intentional female harvests to

achieve herd reduction. The inability of the herd to recover generated speculation that some natural or anthropogenic factor, or combination of factors, may have adversely affected the recovery of the herd and caused extreme fluctuations in year class survival and ultimately reduced the numbers of harvestable males (Roppel, 1984). The United States established a research sanctuary and commercial harvest moratorium on St. George in 1972 while continuing the commercial harvest on St. Paul to study the effects of commercial harvesting on fur seal population dynamics (Roppel, 1984; Gentry, 1998). St. Paul Island harvest management regulations changed very little from 1973 to 1979, and harvests ranged from 24,000 to 27,000 animals per year (Harry and Hartley, 1981).

The level of commercial sub-adult male harvests on the Pribilof Islands from the 1950s through 1984 was not believed to have deleteriously affected the population (Gentry 1998). The U.S. commercially harvested 5,764,318 male fur seals on land on the Pribilof Islands until 1984 (average annual harvest of 49,267). From 1985 through 2012, the Pribilovians have harvested 33,362 male fur seals on land (average annual harvest of 1,191) for subsistence purposes. In addition to the male kill an additional 330,988 females were killed during the commercial period through 1984. The Pribilovians have killed 57 female fur seals during the subsistence harvest period from 1985 through 2012 and five of the 57 were accidentally killed on St. George. Whether the fur seal population is now influenced by any residual effects from the past commercial male harvest is unknown though not suspected. NMFS (1993) describes the suspected effects of commercial harvesting on the fur seal population and numerous publications describe the results of commercial harvest studies (e.g., Roppel, 1984, Roppel and Davey, 1965; York and Hartley, 1981; Gentry, 1998). The killing of over 300,000 female fur seals from 1956 through 1978 changed the age at first reproduction, and reduced pup production substantially (York and Hartley 1981). The female killing at this level changed the age and sex composition of the fur seal population at that time. Since NMFS does not have estimates of the age and sex composition of the current population we have no way to estimate whether the population composition is still altered from what we would expect based on the theoretical population response to the small-scale subsistence killing of fur seals for the past 28 years. The population composition of fur seals breeding on the Pribilof Islands is very likely significantly different than any time since pre-contact of the Russians. The proportion of males alive in the current population is likely higher than it has been in over 100 years. We have no recent data on age and sex specific survival therefore we cannot estimate whether changes in the age and sex structure of the population due to the commercial harvest or lack of a commercial harvest may be affecting the estimates of abundance of the population.

5.5 Illegal Killing

In some areas northern fur seals were deliberately shot by fishermen (and perhaps other people), but it is unclear how such mortality may affect the population because the overall magnitude of the take is unknown. Illegal harvests are known to occur in the Aleutian Islands and Pribilof Islands. Due to the rare occurrence of fur seals nearshore in the Aleutians this source of mortality is anticipated to be insignificant. Fur seal young of the year and sub-adult males are harvested from the breeding islands in Russia and Japan as described previously. Estimates of emigration from the Pribilof Islands to the other breeding colonies indicate a small percentage of fur seals born on the Pribilof Islands would be susceptible to harvest outside the United States. Illegal killing may occur on the Pribilof Islands in the spring and autumn, but actual rates are unknown. Any fur seals killed in the spring on the Pribilof Islands would be exclusively males prior to the breeding season and have negligible impacts on the population. Similar killing during autumn on the Pribilof Islands could include both young females and males. As described previously mortality of the younger aged seals would impact the population less than equal harvests of older seals. The killing of any female seals, however, can have population implications and could contribute to localized declines over time. There are few data to explore the magnitude of effects of

other killing of fur seals may have on the population and as such the effects of illegal killing of fur seals is unknown.

5.6 Disturbance and Harassment due to Human Presence or Activities

Disturbance of fur seals on land can be caused by human presence, from vessel and aircraft traffic, and vehicle traffic. As described in NMFS (2005) the most likely response of fur seals to these types of disturbances ranges from no reaction at all, to temporary changes in behavior or alertness, or temporary departure from hauling grounds and rookeries. Such short-term reactions and return to the previously occupied site within hours suggest that disturbance at levels observed in the past would not be predicted to have detectable effects on the survival or reproduction of the population. Whether increasing levels of disturbance beyond that previously documented would cause more long-term displacement or changes in survival or reproduction is unknown. During the commercial harvest period it is known that on average there was 10 times the level of harassment of non-breeding males, 10 times as many seal pups handled and tagged or permanently-marked, and over 320,000 females harassed as part of the herd reduction program alone. NMFS does not believe that current levels of human-caused harassment (whether subsistence harvest or research) as absolute numbers or percentages of the population are going to increase above those historic levels.

The Pribilof Islands are primary breeding and resting habitat for northern fur seals in the United States and are also inhabited by Alaska Native and non-native peoples. No other marine mammal population is so concentrated in time and space with the public and such there is the possibility that a substantial number of fur seals could be harassed. In light of this co-occurrence of the public and fur seals, NMFS regulations at 50 CFR 216, subpart G prohibit trespass by any unauthorized member of the public on Federal lands posted as northern fur seal habitat. The Federal land administered by NMFS on the Pribilof Islands includes habitat used by northern fur seals for breeding, resting and social interactions, in addition to a buffer intended to prevent accidental or unintentional disturbance of fur seals. NMFS does not post guards or enforcement agents on federal lands designated as fur seal habitat while fur seals are present from May through December at the 22 different breeding and resting areas on St. George Island from May through December to prohibit trespass and potential disturbance or harassment of fur seals. NMFS has not built walls or installed fencing around the inland portions of all Federal lands designated as fur seal habitat on the Pribilof Islands to prevent trespass and the potential for harassment or disturbance of fur seals. There is no evidence that human activities or presence on the Pribilof Islands outside of the Federal lands designated as fur seal habitat are affecting fur seals present on island.

If unauthorized humans trespass on to Federal lands designated as fur seal habitat their presence can disturb or harass fur seals present. The most likely source of disturbance of fur seals is due to trespass by the public on Federal fur seal habitat. As a result, regulatory closures (50 CFR 216, subpart G) preclude unauthorized human access to posted fur seal breeding and resting areas from 1 June until 15 October. The dates for closing and opening the breeding and resting areas to human presence are not based on the absolute absence of fur seals but represent a compromise between access and the suspected biological consequences of human-related harassment. NMFS has defined this unauthorized disturbance and harassment as sub-lethal direct effects in the previous analysis of the alternatives. NMFS has not installed fences, walls, or have patrols guarding the border between Federal and local lands on the Pribilof Islands, and therefore non-marine mammal wildlife researchers, tourists, and local residents all have the potential to trespass on to Federal lands designated as fur seal habitat. In practice, less than 10 times per year human activities occur near posted Federal fur seal habitat and cause major disturbance (greater than 100 seals involved) and are most likely associated with federal or private aircraft overflights. Fur seals occupy a progressively smaller area and at lower densities in October and November than in July and August.

NMFS must receive and review an application for northern fur seal research or incidental harassment prior to issuance of a permit authorizing any associated incidental and intentional fur seal harassment. NMFS (2007) described their analysis and consideration of the sub-lethal effects of research-related disturbance of up to 483,280 individual fur seals. Research on northern fur seal pups includes the rounding up and handling of an estimated 25,535 individuals out of 276,630 total pups exposed to harassment due to researcher presence among or in view of seals each year. NMFS (2007) concluded the population level effects of disturbance and handling of up to 276,630 northern fur seal pups was unknown. The sub-lethal effects analysis including disturbance and harassment in NMFS (2007) is included by reference.

The short-term biological effects of disturbance of northern fur seals are related to the age and sex of the seal, season, type of disturbance, and frequency. NMFS has not detected a reduction in survival or reproduction as a result of harassment or disturbance by humans of adult or sub-adult fur seals present on the Pribilof Islands (NMFS 2007). Some additional description is useful to understand the rationale for the subsequent impact analysis and conclusions. During the peak of the summer breeding season, adult fur seals are reluctant to leave the breeding areas (Gentry 1995). Adult female fur seal's tolerance is likely due to the territorial nature of adult males during the breeding season. Fur seals often detect human scent and become vigilant prior to detecting a visual stimulus, like the silhouette of a person. Outside of the breeding season, mothers will separate from their young once human presence is detected in the breeding area, but often return within a few hours. Displacement of females and pups from breeding areas during the later portions of the lactation period (e.g., October and November) might result in longer periods of separation between mothers and pups, but there are no direct data from this time period to evaluate this. Repeated displacement of adult females might result in permanent abandonment of suckling sites; however, there are no data to confirm this speculation. Anecdotal observations of lactating females disturbed in October during researcher presence in the breeding and suckling areas indicates females will wait offshore and return to land as soon as human presence is not detected (Ream and Towell pers. obs., 2009-2011).

5.7 Private Actions

Private actions that may have an effect on northern fur seals on and around St. George Island include oil and gas development, harbor development, and shipping/transportation activities. Oil and gas leasing on state lands or the outer continental shelf near St. George is unlikely to occur in the future. Such leasing and exploration has occurred for a long period of time in other areas. However, given changes in energy prices and increasing demand, it is also likely that more interest may result in future lease sales or exploratory plans to occur.

Shipping routes from Pacific Northwest ports to Asia run through the Bering Sea and Aleutian Islands, and pass near or through important migratory areas used by fur seals. The key transportation route from west coast ports to East Asia occurs at Unimak Pass. An estimate is that 3,100 large vessels used this route in the year ending September 30, 2006. An estimated 853 of these were bulk carriers, and an estimated 916 were container ships. (Nuka Research & Planning Group & Cape International 2006: 12). Recent shipping accidents of the M/V Selendang Ayu and the M/V Cougar Ace indicate the risk of oil spills in this important fur seal migratory corridor exists. Fur seals are especially sensitive to oil spills in the marine environment. Shipping activities can result in incidental takes of marine mammals through vessel strikes and disturbance of fur seals by vessel activities and pollution discharges. It is not likely that these types of adverse effects occur at a level that may affect the fur seal stock, though a large oil spill within Unimak Pass during the spring or winter fur seal migration has the potential to affect a large portion of the St. George population if response capabilities are not able to contain the spill. St. George

Island has a small boat harbor capable of supporting the local small boat halibut fishery. The harbor also provides services to fishing vessels less than 100ft. Local efforts to develop crab and other commercial fish processing capacity has been proposed, but none of the funding, permitting, or engineering have been explicitly proposed and are not anticipated in the near future.

5.8 Climate and Environmental Change

There is now widespread consensus within the scientific community that atmospheric temperatures on earth are increasing (warming) and that this will continue for at least the next several decades (IPCC 2001, Oreskes 2004). There is also consensus within the scientific community that this warming trend will alter current weather patterns and patterns associated with climatic phenomena, including the timing and intensity of extreme events such as heat waves, floods, storms, and wet-dry cycles. Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average seal level (IPCC 2007).

The Intergovernmental Panel on Climate Change (IPCC) estimated that average global land and sea surface temperature has increased by 0.6°C (±0.2) since the mid-1800s, with most of the change occurring since 1976. This temperature increase is greater than what would be expected given the range of natural climatic variability recorded over the past 1,000 years (Crowley 2000). The IPCC reviewed computer simulations of the effect of greenhouse gas emissions on observed climate variations that have been recorded in the past and evaluated the influence of natural phenomena such as solar and volcanic activity.

The effects of climate change to the marine ecosystems of the Bering Sea, Aleutian Islands, and the Gulf of Alaska, and how they may specifically affect northern fur seals are uncertain. Warmer waters could favor productivity of certain species of forage fish, but the impact on recruitment dynamics of fish important to fur seals is unpredictable. Recruitment of large year-classes of gadids (e.g., pollock) and herring has occurred more often in warm than cool years, while the distribution and recruitment of other important fur seal prey (e.g., osmerids) could be negatively affected. Whether these patterns will continue as overall temperatures increase is uncertain, as are the effects on the duration and strength of atmospheric and oceanographic regimes (Trenberth and Hurrell 1994; Hare and Mantua 2000). Climate-driven changes in productivity and community structure due to warming oceans may already be underway in the northern portion of the Bering Sea and Bering Strait, where sea ice plays a major role in structuring the food web and the ecosystem is particularly vulnerable to rapid system reorganization under global warming. Reduced seasonal sea ice cover, changing hydrographic conditions, and reduced primary production in the northern Bering Sea may be associated with apparent declines in ice-associated benthic species of mollusks and amphipods since the 1990s (Grebmeier et al. 2006). Changes in sea level, snow cover, ice extent, and precipitation are consistent with a warming climate near the Earth's surface. The IPCC (2001) noted "Examples include…increases in sea level and ocean-heat content, and decreases in snow cover and sea-ice extent and thickness" and consider their statement that "rise in sea level during the 21st century that will continue for further centuries" to also be a "robust finding."

However, they highlight the uncertainty of understanding the probability distribution associated with both temperature and sea-level projections. Fluctuations or cycles in physical and biological characteristics of marine ecosystems may not necessarily affect higher trophic levels because of strategies for survival they have evolved to buffer them against environmental uncertainty. Trites and Antonelis (1994) modeled pup survival and Pribilof weather indices and predicted that pups born earlier in the year (June) would succumb to hypothermia during periods of generally colder, wetter, and windier weather than conditions

in July. Such investigations highlight the need to consider both the marine and terrestrial aspect of fur seal life history and adaptation when analyzing their relative contribution to adult and sub-adult survival. In 1950, severe storms and low temperatures during the winter may have contributed to the deaths of 700 fur seals found on the Oregon and Washington coasts (Scheffer, 1950). From 1977 to 1986, there was a very large North Pacific basin temperature anomaly, with temperatures in Alaska warming more than 1.5°C (Trenberth 1990), that might have resulted in a regime shift or a community level reorganization of the marine biota (Anderson and Piatt 1999). Pribilof female feeding trip duration during 1979-1985 decreased relative to the period from 1974-1978 suggesting that prey may have been more abundant or located closer to the colony during the post-1977 regime (Gentry, 1998).

Fauquier et al. (1998) report that the peak years of fur seal strandings off the central California coast from 1975 to 1997 were during the El Niño events of 1992 and 1997. El Niño events of 1972, 1983, 1992, and 1997 had dramatic impacts on birth rates, and pup growth and survival for fur seals on San Miguel Island (NMML, unpublished data). Fur seal pup survival on San Miguel is lower during El Niño events, but survival of Pribilof sub-adult males over longer time periods is positively correlated with El Niño (York, 1991) and higher air and sea surface temperature trends (York, 1995). Kuzin and Shatilina (1990) reported a significant correlation between the survival of fur seals less than two years of age and the temperature of the sea water near Hokkaido where fur seals winter. It was suspected that fur seal food sources may have decreased near Hokkaido during warmer years.

Major shifts have occurred in the abundance of fish and shellfish in the Bering Sea over the past several decades (Anderson and Piatt 1999). The possibility that these shifts in prey may be related to climatic regime shifts is well documented (e.g., Beamish and Bouillon 1993; Benson and Trites 2002). The fish community in the Bering Sea appears to have shifted from one dominated by pelagic and semi-demersal species to one with fewer pelagic species and a larger biomass of semi-demersal (walleye pollock and Atka mackerel) and demersal (all flatfishes) species (Conners et al., 2002). Important fur seal prey species continue to include pollock (Gudmundson et al., 2006; Zeppelin and Ream, 2006) and the number of pollock consumed by fur seals in the Bering Sea is directly related to pollock year-class strength (Sinclair et al. 1994; 1996).

Since environmental conditions strongly influence pollock and other important fur seal prey year-class success, fur seals could be directly impacted. Naumenko (1996) identified four periods with differing ichthyofaunal community structures from 1958 to 1993 in the western Bering Sea. The causes of this structuring were apparently related to commercial fishing pressure and to environmental conditions. The first period (1958-1964) was dominated by herring, the second was a transitional period (1965-1974), the third period (1975-1987) was dominated by pollock, and the fourth period (1988-1993) was dominated by groundfish (pollock and large flatfish) or may have been another transitional period.

Merrick (1997) suggested that the adult groundfish biomass has been at high levels since the decline of the whale and fur seal populations, and that adult groundfish may be out-competing other predators, such as seals and seabirds. As the numbers of marine mammals declined more prey became available for groundfish, thereby increasing groundfish abundance. High populations of adult walleye pollock might have resulted in a reduction in the availability of fur seal prey such as juvenile pollock. Fritz and Hinckley (2005) indicate limited, if any, evidence supporting the nutritional stress hypothesis and the variation in fur seal prey consumption is more consistent with seasonal and regional variation in prey abundance from fur seals sampled at different locations, rather than an indication of nutritional stress.

As temperatures warm and global ice coverage decreases, sea levels will rise. This will directly affect terrestrial rookery and haulout sites currently used by northern fur seals. Presumably, fur seals using terrestrial sites will simply move upslope as sea levels rise, assuming that the terrain at the site is suitable.

However, sites on some islands with low relief or bounded by high cliffs may be submerged. The net effect of a rise in sea level on overall terrestrial fur seal habitat amount or availability is uncertain, but at the projected rate it is unlikely to have a significant effect for many years.

More research is necessary to describe linkages between changes in the environment and the dynamics of apex predators such as northern fur seals. Distinguishing between anthropogenic and environmentally-driven changes in the abundance and distribution of prey resources has eluded scientists and managers, but is necessary in order to understand the forces underlying change in population size and demographics. Furthermore, the direct effects of temperature increases on fur seal metabolic rates, foraging efficiencies, and disease transmission are unknown.

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8 Distribution

NMFS sent the Draft SEIS to the following organizations. NMFS also posted the Draft SEIS for download on the NMFS Alaska Region web page at: http://alaskafisheries.noaa.gov/protectedresources/seals/fur.htm, under NEPA Analyses.

- Pribilof Island Aleut Community of St. George Island, Traditional Council
- City of St. George
- Tanaq Corporation
- Aleut Community of St. Paul Island, Tribal Government
- Tanadgusix Corporation
- Aleutian Pribilof Island Association, Inc
- Indigenous People's Council for Marine Mammals
- Marine Mammal Commission
- Seven Generations Consulting
- US Environmental Protection Agency, Region 10
- Humane Society
- Greenpeace
- Nature Conservancy
- World Wildlife Fund

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