CONSERVATION PLAN FOR THE

PACIFIC WALRUS

IN ALASKA

June 1994

U.S. Fish and Wildlife Service
Marine Mammals Management
1011 East Tudor Road
Anchorage, AK 99503

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This Conservation Plan for the Pacific Walrus is dedicated to the memory of Mr. Matthew Iya, who as a leader, teacher, and friend exemplified the cultural values of his people in his sincere care and compassion for others and by his untiring dedication to the issues he strongly believed in. One of those issues was the completion of this Plan.

PREFACE

This Conservation Plan for the Pacific Walrus in Alaska has been approved by the U.S. Fish and Wildlife Service. During the 1988 reauthorization of the Marine Mammal Protection Act, Congress suggested conservation plans: (1) be prepared where they could benefit the population, and (2) provide certain background material and develop a strategy for achieving the primary goal of the MMPA of maintaining population stocks with their optimum sustainable population level. This plan has been developed accordingly. The Conservation Plan does not necessarily represent official positions or approval by cooperating agencies or organizations. The Conservation Plan was prepared by the staff, Marine Mammals Management, U.S. Fish and Wildlife Service with the assistance of the Marine Mammal Commission, the Eskimo Walrus Commission, and the University of Alaska to delineate reasonable actions believed required to conserve the Pacific walrus population within the requirements of the Marine Mammal Protection Act of 1972, as amended. While many of the contributions and recommendations made by these organizations have been incorporated into this Plan, the Plan does not necessarily represent the views of these groups, nor does it always represent a consensus of these views.

This Conservation Plan will be reviewed on a periodic basis on an as needed basis. The time frame for the plan is viewed as 5 years. It is subject to modification as dictated by new findings, changes in species status, completion of tasks, ongoing legal interpretation, policy changes, or Congressional direction. Completion of most tasks is dependent on obtaining additional funds.

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LIST OF FIGURES

LIST OF ACRONYMS

Acronyms are defined in the text after the first use of the term. This list is provided as a reference to the reader.

ADFG	Alaska Department of Fish and Game
AFWRC	Alaska Fish and Wildlife Research Center
ALJ	Administrative Law Judge
BOG	Alaska Board of Game
CITES	Convention on International Trade in Endangered Species
EWC	Eskimo Walrus Commission
FWS	Fish and Wildlife Service
FY	Fiscal Year
GIS	Geographic Information System
HMP	Harvest Monitoring Program
I&E	Information and Education program
INS	Imigration and Naturalization, Customs Service
K	Carrying Capacity of the Environment
LOA	Letters Of Authorization
MMC	Marine Mammal Commission
MMPA	Marine Mammal Protection Act
MMM	Marine Mammals Management
MMS	Minerals Management Service
MNPL	Maximum Net Productivity Level
MTRP	Marking, Tagging, and Reporting Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic Atmospheric Administration
NPFMC	North Pacific Fisheries Management Council
NBS	National Biological Survey
NPS	National Park Service
OSP	Optimum Sustainable Population
PBR	Potential Biological Removal
RF	Russian Federation (various organizations)
RFLP	Restriction Fragment Length Polymorphism
TAR	Total Allowable Removal
TBD	To Be Determined
TINRO	Pacific Institute of Fisheries and Oceanography (Russia)
TNWR	Togiak National Wildlife Refuge
UAF	University of Alaska - Fairbanks
WISGS	Walrus Islands State Game Sanctuary
WITS	Walrus International Technical and Scientific Group

I. INTRODUCTION

The Pacific walrus (Odobenus rosmarus divergens) has been an important resource for human inhabitants of the Bering and Chukchi sea coasts for thousands of years (Collins 1937; Fay 1982; Krupnik 1984). These large pinnipeds have provided meat, oil for fuel, and raw materials for a variety of needs. The skins traditionally were used in the construction of houses in the Bering Strait region and still are employed in the construction of boats and rope. Ivory was used in making a great variety of tools such as harpoon tips and continues to be carved in an elaborate art form. Today the harvest of walruses adds significantly to the economy of coastal Natives as a source of meat and money from the sale of ivory carvings. The dollar value of the harvest to Alaskan Natives is estimated to be in the millions (J. J. Burns, Living Resources Inc., Fairbanks, AK, unpublished data); the value in terms of cultural well-being is immeasurable.

The walrus is important ecologically as a large marine predator and as prey of top-level predators. The structure of the benthic community of the Bering and Chukchi shelves may be influenced strongly by walrus foraging. While foraging, walruses disturb the sediments in ways that may influence the release of nutrients and the settling of benthic invertebrates (Ray 1973; Fay et al. 1977; Oliver et al. 1983). Their removal of large, mature bivalve mollusks may influence productivity of those prey species (Vibe 1950; Fay et al. 1977; Sease and Fay 1987).

Pacific walruses have been harvested on a sustained basis by subsistence hunters for thousands of years. Commercial exploitation severely reduced the population at least three times since the middle of the last century but each time it recovered when protected (Fay et al. 1989). Those authors expressed concern that the population may have exceeded the carrying capacity of its environment and may have begun to decline in the early 1980s. The sizable Russian and Alaskan harvests of the early 1980s could further compound such a possible decline. The population also faces threats from increasing human exploitation of biological, mineral, and petroleum resources in the Bering and Chukchi seas.

Active efforts to manage the exploitation of Pacific walruses did not begin until the current century (Fay 1982). The Soviet Ministry of Fisheries has regulated the take in Soviet waters since the 1950s. Commercial harvests were banned within Alaskan territorial waters by the USA government in 1909 but resumed on a small scale after World War I. U.S. Department of Commerce regulation (1937) and the "Walrus Act," passed by Congress in 1941, limited the killing of walruses to Native hunters. In 1960 the Alaska Department of Fish and Game (ADFG) began limiting the take of female walruses to 5 per hunter per year and provided protection for walruses on Round Island in Bristol Bay.

With passage of the Marine Mammal Protection Act (MMPA) in 1972, the Federal government assumed management authority for Pacific walruses in USA waters. The MMPA stated that the primary objective in managing marine mammals should be to maintain the health and stability of the marine ecosystem and, where consistent with that

objective, marine mammal stocks should not be permitted to diminish below their optimum sustainable population levels (by definition, becomes depleted). To achieve those objectives the MMPA established, with certain exceptions, a moratorium on the taking (defined as harassing, hunting, capturing, killing, or attempting any of those activities) of marine mammals. Among the exceptions were taking by Alaska Natives for traditional subsistence and handicraft purposes and limited taking incidental to commercial fishing, offshore petroleum exploration and development, and for scientific research and public display. The immediate effect of the MMPA on walrus management was to suspend regulation of the Native harvest. Over the next two decades, the harvest of Pacific walruses increased substantially, and the proportion of females in that harvest nearly doubled.

The MMPA also provided that states could re-assume management of marine mammals under guidelines developed by Federal agencies. In 1976 the State of Alaska (State) resumed management of Pacific walruses with a federally-imposed provision that the catch be limited to 3000 walruses per year. As the result of a lawsuit (People of Togiak vs United States, 77-0264), the State found the quota and other Federal requirements unworkable and, in 1979, relinquished management authority for walruses to the U.S. Fish and Wildlife Service (FWS). Amendments to the MMPA in 1981 resolved many of the issues previously identified by the State as unworkable. After the publication of the final rule implementing the amendments in 1983, the State considered reinitiating a return of marine mammal management. After a series of public meetings and debates, ADFG informed the FWS in 1988 (Pamplin et al. 1988) that it would not pursue this goal due to unresolved subsistence issues, uncertainty of funding, and conflicting priorities. The State recommended that walruses be managed cooperatively by the FWS, the State, and the Eskimo Walrus Commission. The FWS then expanded development of a long range Marine Mammals Management program for Alaska. Under Federal management, the harvest of walruses by Native subsistence hunters can not be regulated by the FWS unless the population is found to be depleted.

In 1978 the Eskimo Walrus Commission (EWC) was formed as a consortium of Native hunters concerned with the health of walrus and other marine mammal populations (Iya 1986). The EWC consists of representatives from the villages of Barrow, Brevig Mission, Diomede, Gambell, King Island, Kivalina, Kotzebue, Kwigillingok, Mekoryuk, Nome, Pt. Hope, Savoonga, Shishmaref, Stebbins, Togiak, Unalakleet, Wainwright, and Wales. The EWC's goals are to: (1) work with management agencies in developing a management plan for Pacific walrus; (2) encourage self-regulation by walrus hunters; (3) develop safety and technology involved in walrus hunting; (4) investigate ways of assuring full utilization of harvested walruses; (5) review activities and regulations affecting the walrus population; (6) involve hunters in walrus management; (7) involve hunters in walrus research; and (8) encourage international cooperation in research, enforcement, and management to ensure the health of marine mammal populations. The EWC has taken an active role in walrus management and research at the local, state, national, and international level. Since its inception, the EWC has advocated a cooperative

approach be taken for management and recommended that development of a Conservation Plan be a high priority.

International concern with the status and management of walrus populations increased notably in the last few years. Walrus populations were considered for inclusion on Appendix II at the 1987 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) but that action was withdrawn before being put to a vote. In late 1989 through 1992, several stories appeared in the national and international news media reporting on "headless" walruses washing up on northwest Alaskan shores and a "drugs for ivory" trade in remote villages. "Operation Whiteout," which was initiated cooperatively as the result of concern by the Native community, resulted in further publicity around the resulting "wasteful take" cases. As a result, a large number of individuals wrote to the USA government requesting stronger restrictions on international trade and increased protection of the Pacific walrus population.

In 1990 an international workshop convened in Seattle, Washington, to consider the ecology and management of walrus populations (Fay et al. 1990). That group initiated a Walrus International Technical and Scientific (WITS) group consisting of experts from Canada, Greenland, Norway, the Soviet Union (now the Russian Federation), and the United States "with the goal of encouraging and assisting in the achievement of mutual understanding and coordinated research and management of walruses throughout their range" (Burns 1990). The international walrus workshop also recommended the development of "long-range management plans that will restore and sustain all walrus populations at appropriately high, stable levels" (Fay et al. 1990).

By adding section 115(b) to the MMPA in the 1988 amendments, Congress directed the development of Conservation Plans for certain depleted species. They also noted that other non-depleted species might benefit from such plans. In House Report 100-975, the House stated the purpose of such conservation plans should be to identify the cooperative actions needed to restore and maintain marine mammal stocks within Optimum Sustainable Population (OSP) levels. Both the House and Senate (100-592) reports suggested that plans discuss current status, threats, habitat requirements, information gaps, and a clear strategy for accomplishing research and implementation of management strategies to achieve the goal.

The FWS has determined a Conservation Plan would benefit the Pacific walrus population by clearly identifying critical management and research needs, coordinating the tasks, and providing the justification for acquiring long-term support. The Plan incorporates the components of a Conservation Plan as outlined in the 1988 and 1994 amendments to the Marine Mammal Protection Act and also includes a detailed plan for implementation with estimated costs.

The FWS involved representatives from Federal, State, Alaskan Native, industry, and private sector groups interested in cooperative walrus research and management in the

development of this plan. A Draft Management Plan and an Executive Summary were completed and distributed for public comment from January 15, 1993, to February 28, 1993. Public meetings were held in Anchorage, Diomede, Gambell, Nome, Savoonga, Shishmaref, and Wales. Comments were received from a wide variety of government agencies, Native groups, conservation and protection organizations, and private individuals. A Draft Final Management Plan was published and distributed for comment in April, 1993. Comments received on that version were considered and incorporated into a Conservation Plan issued for limited review on December 8, 1993. Many of the comments received in that process have been incorporated into this document. Finally, the Conservation Plan was revised to incorporate new directions provided by the May 1, 1994, reauthorization of the Marine Mammal Protection Act.

This Walrus Conservation Plan is divided into three parts:

1) a background section summarizing knowledge of walrus biology and identifying conservation issues,

2) a Conservation Plan outlining research and management tasks, and

3) an Implementation Schedule.

Many organizations and individuals contributed to development of this Conservation Plan at several meetings and reviews of early drafts. The Conservation Plan is a framework of cooperative actions to be taken by FWS, National Biological Survey (NBS), EWC, ADFG, Minerals Management Service (MMS), National Marine Fisheries Service (NMFS), and other organizations to study and reduce or mitigate adverse effects on the walrus population from hunting practices, offshore oil and gas exploration and development, commercial fishing, tourism, research, and other human activities. In some cases alternative strategies are identified. The Implementation Schedule identifies a time table, lead and cooperating participants and, where possible, estimates costs for the tasks in the Conservation Plan. These sections identify research and management priorities over a 5 year period, but they should be updated as additional biological information becomes available and political conditions change. The ability to complete the proposed actions also will depend on fiscal conditions. These plans are working documents and are responsive to changing conditions; it is likely they will be updated frequently.

II. GOAL OF THE CONSERVATION PLAN

The goal of this Conservation Plan is to describe management and research actions that will maintain the Pacific walrus population within its Optimum Sustainable Population range, thus ensuring that walruses remain a sustained resource for coastal Native inhabitants of the Bering and Chukchi seas and a functioning component of the Bering-Chukchi shelf ecosystem. To be concise, this goal is paraphrased as "maintaining a healthy population" in some sections of the text.

III. BACKGROUND

A. Species Description

The walrus (Odobenus rosmarus) is the only living representative of the Odobenidae, a family of marine carnivores that was highly diversified in the late Miocene and early Pliocene (Repenning and Tedford 1977). Two subspecies of walrus are recognized today: O. r. rosmarus of the North Atlantic Ocean and O. r. divergens of the North Pacific Ocean. Walruses in the Laptev Sea may qualify as a third subspecies (Chapskii 1940; Fay 1982; Miller 1990; Vishnevskaia and Bychkov 1990). In Alaska, Yupik-speaking Natives refer to walruses as "asveq," "kaugpak," or "ayveq" (St. Lawrence Island). To Inupiaq speakers the walrus is "aivik" and, to Aleut speakers, "amak" or "amaghak." The Native languages include many additional terms for walruses of specific ages, sexes, and body conditions.

The Pacific walrus is one of the largest pinnipeds and is moderately sexually dimorphic. The average standard (nose-tail) adult length is 3.2 m for males and 2.7 m for females; average adult weights are 1210 kg for males and 830 kg for females (Fay 1982). The body is somewhat fusiform and the maximal girth is nearly equal to the nose-tail length.

The walrus head has a pair of enlarged upper canine teeth that project downward as tusks, small eyes, a lack of external ear pinnae, dorsally situated external nares, and a squarish snout bearing hundreds of stiff mystacial vibrissae. The head and body are sparsely covered with short, tawny hair but the flippers are bare. Walruses are dark colored when they are young and become progressively lighter with age; old males are the lightest. Immersion in cold water causes a restriction of blood flow to the skin and a consequent pale, almost white appearance. When the walrus hauls out of the water, the skin warms and again becomes perfused with blood; a pink to red color results.

In addition to sexual dimorphisms in body size and pigmentation, the head of the male is larger and more block-shaped; and the tusks are stouter, straighter, and more elliptical in cross section than those of females (Fay 1982). The tusks are used in intra-specific threat displays and fighting that are most severe for breeding males. Raised nodules on the skin of the neck and shoulders develop only in sexually mature males.

B. Distribution and Migration

Walruses are nearly circumpolar in distribution, generally occurring between the 10°C isotherm for average July air temperature and the edge of the permanent polar pack ice (Scheffer 1958; Fay and Ray 1968). They mostly are found in shallow shelf waters, usually of less than 100 m depth (Vibe 1950; Fay and Burns 1988). Pacific walruses mainly inhabit the shelf waters of the Bering and Chukchi seas, occasionally moving into the eastern East Siberian Sea and western Beaufort Sea in summer (Fay 1982). Small numbers of walruses once were found in the western North Pacific Ocean as far south as the Kuril Islands and the Okhotsk Sea (Borisiak 1930; Voronov and Voronov 1981; Fay and Fedoseev 1990). They were exterminated from the Okhotsk Sea in the early 18th century and have not returned. They occupy most of their historical range today (a few haulout sites remain unused) although they were absent from some regions for variable amounts of time after over-harvests in the 19th and 20th centuries (Fay et al. 1989).

The distribution of Pacific walruses varies markedly with the seasons (Figure 1). Virtually the entire population is found in the Bering Sea in winter, hauling out on pack ice. The following description of the seasonal distributions and movements is based mostly on Fay (1982).

During the breeding season in January, February, and March of years with average ice extent, Pacific walruses are seen mostly in two areas, one immediately southwest of St. Lawrence Island and the other in outer Bristol and Kuskokwim bays. Walruses in the two areas may represent two discreet breeding groups. However, mitochondrial and nuclear DNA analysis of tissue samples taken from the two general areas in April (shortly after the breeding season) showed that either they are not discreet breeding groups or that the separation took place so recently that it is not yet detectable genetically (Alaska Fish and Wildlife Research Center [AFWRC], unpublished data).

As the Bering Sea pack ice begins to loosen in April, walruses begin to move northward and their distribution becomes less clumped. By late April they are found from Bristol Bay northward to Bering Strait. The ice in the eastern Chukchi Sea opens widely in May and the first of two waves of migrants pass northward through Bering Strait. Walruses in the first group were believed to consist mainly of animals that wintered in the St. Lawrence Island area but recent satellite tracking data indicate both wintering groups are represented (S. Hills, unpublished data). By the end of May, walruses are widely distributed, from northern Kamchatka and the Alaska Peninsula through Bering Strait to the edge of the consolidated ice in the Chukchi Sea. The largest concentrations occur then between St. Lawrence Island and Bering Strait and between the Alaska Peninsula and Norton Sound.

A second group of migrants passes through Bering Strait in June. The opening of ice in the western Chukchi Sea in June is reflected in the distribution of walruses, which extends along the northern shore of Chukotka. Major concentrations in June occur north of St. Lawrence Island and along the coasts of the Chukchi Peninsula and off northwest Alaska.

Although most of the population migrates into the Chukchi Sea, several thousand animals, mostly adult males, remain for the summer (June-September) in the western Bering Strait, the Gulf of Anadyr, Kamchatka, and in Bristol Bay. In the last 10 years many more females and young have remained in the Gulf of Anadyr during summer (Fedoseev 1990). Previously virtually all of the females and young migrated into the Chukchi Sea (Fay 1982; Fedoseev 1990). Fedoseev (1990) suggested that the shift in summering areas has been related to ice conditions.

In July the walruses north of Bering Strait continue their northward movement as the pack ice recedes. The largest concentrations are near the coasts, between Icy Cape and Pt. Barrow in the east and between Bering Strait and Wrangel Island in the west. Concentrations, mainly of males, are found on and near terrestrial haulouts in the Bering Sea in Bristol Bay and the northern Gulf of Anadyr.

The distribution in August and much of September is similar to that in July, but the northern limit is increased to approximately 76° N, just beyond the minimal extent of the pack ice. The greatest concentrations at that time are found in the vicinity of Wrangel Island and the northwestern coast of Alaska. Mitochondrial and nuclear DNA analysis indicates no significant genetic differentiation between the two areas (AFWRC, unpublished data). In late September walruses in the Chukchi Sea begin moving south. At the same time, some of those in the Bering Sea begin swimming northward and the groups meet south of the Bering Strait (Fay et al. 1984a; Taggart 1987).

In October the pack ice develops rapidly in the Chukchi Sea, and large herds begin to come ashore on Big Diomede, King, St. Lawrence, and the Punuk islands. A few are found as far south as Bristol Bay, Gulf of Anadyr and Northern Kamchatka. Depending on ice conditions, terrestrial haulouts are occupied through November and into December, but with the continuing development of ice, most walruses move to the wintering areas south of St. Lawrence Island by early to mid-December.

C. Habitat Requirements

Although capable of diving to deeper depths, Pacific walruses usually are found in waters of 100 m or less, possibly because of higher productivity of their benthic foods in the shallower waters (Fay and Burns 1988). They thus feed mostly in the waters over continental shelves. Feeding areas typically are composed of sediments of soft, fine sands; compacted sediments apparently inhibit their preferred prey (Richard 1990). In some instances walruses forage along rocky substrate. The range of feeding habitats probably fluctuates with the densities of walrus and prey populations. When bivalves are abundant, walruses feed almost exclusively on those, but their diet broadens when no one prey species is abundant.

Walruses rest and give birth on pack ice. They require pack ice that will support their weight and allow ready access to the water in which they forage. Although walruses can

break (with their heads) ice up to 20 cm thick, they require ice thicknesses of 60 cm or more to support their weight (Fay 1974; Richard 1990). Ice that rises too high out of the water, such as multi-year floes, is difficult for walruses to haulout on. Generally walruses occupy first-year ice with natural openings such as leads and polynyas and are not found in areas of extensive, unbroken ice (Fay 1982). Thus, in winter they concentrate in areas of divergent ice flow or along the margins of persistent polynyas (Fay 1974; Burns et al. 1981). In summer those associating with ice are found along the southern margin of the Chukchi pack ice; they may move farther into the pack during storms (Fay 1974; Richard 1990). Floe size and topography appear to be important in the selection of haulout sites (Wartzok and Ray 1980; Richard 1990).

Use of terrestrial haulouts seems to be influenced by natural or human disturbance; isolated sites such as islands, points, spits, and headlands are occupied most frequently (Richard 1990). A wide variety of substrate apparently are suitable, but protection from strong winds and surf seems to be important also. Social factors, learned behavior, and proximity to prey probably influence the choice of haulout sites but little is known about such factors. Major currently used terrestrial haulouts in Alaska are Cape Seniavin, Round Island, Cape Peirce, Cape Newenham, and the Punuk islands (Figure 2). Major sites used in Russia include: Meechken Spit, Rudder Spit, Arakamchechen Island, and Wrangel Island (Figure 3). Many terrestrial haulouts are used less consistently, such as Amak, Big Twin, Crooked, St. Matthew, Big Diomede, and King islands, and Cape Lisburne.

Consistent seasonal occupation of specific haulouts by some individual walruses suggests at least some site fidelity. Limited data from tagging and radio-tracking studies suggest that site fidelity may be interrupted at least temporarily by anthropogenic disturbances (S. J. Taggart, National Biological Survey, pers. comm.).

D. Population Size

The size of the Pacific walrus population has never been known with certainty and it is not likely to be known in the near future. Fay (1957) estimated that the population numbered more than 200,000 animals before large commercial harvests began in the second half of the 19th century. At least three episodes of heavy harvesting between about 1870 and 1960 seriously depleted the population (Fay et al. 1989). Protection of walruses in America began in the 1940s and in Russia in the 1950s, and was followed by an increase in population size. Sease and Chapman (1988) reviewed 15 aerial surveys conducted between 1958 and 1985 calculating estimates for the population, and suggested an increase from roughly 50-70,000 walruses in the mid-1950s to about 250,000 walruses in 1980.

Cooperative surveys of the Pacific walrus population have been conducted at 5 year intervals since 1975 under the 1972 "Agreement on Cooperation in the Field of Environmental Protection," between the USA and the USSR. However, results from aerial censuses have been inaccurate and imprecise due mainly to the clumped distribution of walruses, the difficulty of counting individuals in the largest groups, the unknown

proportion of the population under water and not visible during surveys, the great area over which the population is distributed, variable and unpredictable environmental conditions, and the degree of coordination and cooperation between nations (Estes and Gilbert 1978; Gilbert 1989). Because of such biases the 1975, 1980, and 1985 survey estimates of 221,360, 246,140, and 232,518 (respectively) are best estimates of minimum population size. Confidence intervals on the estimates can only be calculated for the portion of the population surveyed on ice or in the water (not for animals on land haulouts) and only for some survey years. Furthermore, because it is unknown if an equivalent proportion of the population was surveyed in each year, these estimates can not be used to detect trends.

Although the 1990 joint USA/USSR aerial survey was conducted with an unprecedented degree of cooperation, unusual ice conditions (minimal autumn ice formation in the Chukchi and East Siberian seas) influenced walrus distribution and probably accounted for the low numbers of walrus seen on the pack ice. As a result the estimate (201,039) produced by the joint survey is not comparable with those from prior surveys (Gilbert et al. 1992). The imprecision of current survey methods makes detection of any more than gross trends in the size of the population extremely difficult. However, recent changes in population parameters and in hunter success suggests a decrease in population size may have occurred in the early to mid-1980s (Fay et al. 1989; Fay et al. 1990).

One goal of the Marine Mammal Protection Act is to maintain populations at their Optimum Sustainable Population (OSP) level. The determination of population status relative to OSP is important because it provides the basis for implementing a wide range of cooperative, voluntary, and regulatory activities that can influence population size and composition. Differing management strategies might be appropriate for populations judged to be declining towards the lower bound of OSP range or one that is increasing towards the upper bound of its OSP range. The determination of the lower bound of OSP is especially important because, under current regulations, it is only when a population passes below this bound that the population is declared "depleted" and the FWS may take action through regulations to restore the population to its OSP range. A formal determination of the lower bound of OSP, the Maximum Net Productivity Level (MNPL), has not be made. However, in 1977 the status of the Pacific walrus population was reviewed by the State of Alaska, the FWS, and an Administrative Law Judge (ALJ). Based on a 1972 estimated population size of 170,000 walruses, the ALJ concluded that the population was above the MNPL. All population estimates since 1972 have been greater than 170,000, so the FWS continues to recognize the Pacific walrus population is likely above the lower bound of its OSP range.

E. Reproduction

Between 1950 and about 1975, female Pacific walruses ovulated for the first time at 4 to 8 years of age (Krylov 1966; Fay 1982). By the late 1980s the age of first ovulation increased by about 2 years, presumably due to changes in the food supply (Fay et al. 1989). Fecundity appears to be greatest in younger females. Fay (1982) and Fay and

Stoker (1982a) reported that fecundity peaked at 9 to 10 years of age and Fay (1990) noted a decline in productivity by 16 to 18 years of age. A single calf is born; twins are rare, having been observed at a frequency of 3/1000 pregnancies (Fay et al. 1991).

Male walruses are capable physiologically of breeding at 9 to 10 years of age but apparently are not able to compete successfully for access to females until they are about 15 years old (Krylov 1966; Fay 1982). Competition for mates occurs in the moving pack ice of the Bering Sea in January and February, hence it seldom has been observed. Competition for females includes male-male fighting, visual and acoustic displays performed aquatically by males, and defense of groups of females (Fay 1982; Fay et al. 1984b). Displaying males monopolize access to multiple females but the degree of polygyny is unknown. Copulation has not been observed in the wild but probably occurs in the water.

Mating takes place mainly in February when the population is concentrated southwest of St. Lawrence Island and in the Kuskokwim-Bristol Bay area (Fig. 1). The blastocyst does not implant in the uterus until 3 or 4 months after fertilization (May-June) and gestation lasts an additional 11 to 12 months before birth the following May (Fay 1982). Because the breeding season is annual and pregnancy lasts 15 to 16 months, females can produce calves no more frequently than once every 2 years. The most fecund females (9-10 years old) produce calves that frequently, but older females may breed at intervals of 3 to 4 years and less often in old age (Krylov 1962). As a consequence, the pregnancy rate in walruses is considerably lower than that observed in other pinnipeds. During the rapid growth in the Pacific walrus population from 1960 to 1980, about 40 percent of the adult females gave birth each year (Fay 1982), but the observed pregnancy rate varied from 20 to 60 percent per year between 1980-1985 (Fay et al. 1989). That variable rate appears to have resulted from decreased success in implantation and increased frequency of abortions and premature births (Fay and Stoker 1982a). Females who miscarry are available to breed the following winter. A large proportion of the pregnancies fail in some years (Fay et al. 1989) and the result is oscillations of rates higher and lower than were observed before.

Calves are born from late April to early June during the northward migration (Krylov 1969; Fay 1982). Extensive contact between cow and newborn appears to be essential for the maintenance of the latter's body temperature (Fay and Ray 1968). The calf is closely attended by the cow and typically nurses for 2 years. Weaning occurs gradually over the course of the 2-year period (Chapskii 1936; Brooks 1954; Mansfield 1958; Fay 1982). No paternal role is evident.

F. Growth and Development

Female Pacific walruses increase in length most rapidly during the first 4 to 5 years of their lives and reach their maximal length between 7 and 10 years of age (Fay 1982). Males show a similar growth pattern but with a second acceleration of growth between 9

and 13 years, finally achieving maximal length at about 15 years. Fully-grown males are, on average, 15 to 20 percent longer than females.

The weight at birth, 45 to 77 kg, almost doubles in the first 5 months and triples by 1 year of age. Thereafter, weight changes with age in a pattern similar to that of length. At maturity males are, on average, about 45 percent heavier than females (Fay 1982).

Blubber thickness varies with age, season, and reproductive condition in walruses and has been used as an indication of overall condition (Fay 1982; Fay et al. 1989). In adult male walruses the blubber is thickest in fall and early winter, when it may reach 15 cm (Fay 1982). In adult females it is thickest in spring, just before parturition. Controlling for age, season, and sex, Fay et al. (1989) found that walruses collected in 1980-1983 had significantly thinner blubber than those collected between 1958 and 1972. There is some evidence of a parallel decrease in body length at a given age but confirmation awaits standardization and comparison of data collected by a number of investigators (F. H. Fay and B. P. Kelly, University of Alaska Fairbanks, unpublished data). The increased average age at sexual maturity for females observed in the 1980s may be related to a reduced growth rate (Sease and Chapman 1988).

G. Molt

The first molt, in which the white lanugo is shed, occurs in utero 2 to 3 months before birth (Fay 1982). The coarse, dark, natal coat is shed in June and July, 1-2 months after birth (Nikulin 1941; Fay 1982). Thereafter, walruses molt annually during the summer. Those subsequent molts are more prolonged than the postnatal molt and molting individuals can be found from June to October (Fay 1982). Pacific walruses at the southern edge of their range complete the molt sooner than those in the north, perhaps related to the requirement that skin temperatures be elevated for epidermal regeneration (Feltz and Fay 1966; Fay 1982). Since walruses require elevated skin temperatures to complete their molt, frequent disturbance from haulout sites (e.g. retreating into cold water) may result in prolonging the molt period and increasing metabolic costs. The resting metabolic rate in phocid seals decreases almost 20 percent during the molt (Ashwell-Erickson et al. 1986) but whether a similar decrease occurs in molting walruses is not known.

H. Sensory Perception and Disturbance

The eyes are small and vision is not well developed in walruses. Tactile perception via the mystacial vibrissae is well developed and important in feeding and, perhaps, site recognition (Salter 1979; Fay 1982; Kastelein and Mosterd 1989). In air, walruses are especially responsive to odors (Salter 1979; Fay et al. 1984a).

Underwater hearing capability of walruses, as in other pinnipeds, is binaural with good directional ability (Møhl 1964; Moore 1975). Sensitivity to airborne sounds is lower than to underwater sounds, but the degree of sensitivity loss is not clear (Watkins and Wartzok

1985). No audiograms have been made for walruses, but Repenning (1972) concluded that their adaptations for hearing were most similar to the fur seals (Callorhinus ursinus). Northern fur seal hearing underwater is more sensitive than that of harbor seals (Phoca vitulina) below 16 kHz, essentially the same as the harbor seal's at 16-28 kHz, and drops off sharply above 28 kHz with an effective upper limit of 40 kHz (Moore and Schusterman 1987). In air the fur seal's hearing sensitivity is greatest at 16 kHz and is greater than the harbor seal's at all frequencies between 1 and 32 kHz (Møhl 1968; Moore and Schusterman 1987).

Although responses of walruses, as well as certain other pinnipeds, to humans are variable, they often flee haulouts en masse in response to the sight, sound, and especially odors from humans and machines (Loughrey 1959; Bel'kovich and Yablokov 1961; Tomilin and Kibal'chich 1975; Johnson 1976; Pitcher and Calkins 1979; Fay et al. 1984a; Kelly et al. 1986; Lewis 1987; Kelly et al. 1988). The significance of such disturbance to individuals and to the population is not known. Walruses haul out to complete their molt and grow new hair, to whelp, to nurse young, and probably to rest (Fay 1982). At those times even temporary displacement from haulout areas may be detrimental to individuals. There is some evidence of haulouts being abandoned as a result of prolonged disturbance, but those cases must be assessed carefully because evidence also exists for changes in walrus distribution for reasons not fully understood.

Proximal stimuli causing walruses to flee the ice during the mating season have been discussed by Fay et al. (1984) but the long-term significance of such disturbance is unknown. Walruses are highly vocal at that time (Ray and Watkins 1975) and loud noise might interfere with underwater communication, as described by Ronald and Dougan (1982) for harp seals (Phoca groenlandica). Walruses also may flee or avoid areas of intense industrial activity (Mansfield 1983; Brueggeman et al. 1990, 1992).

Females with young show the most negative response to noise disturbance (Popov 1960; Salter 1979; Miller 1982; Fay et al. 1984a) and the potential for harm from disturbance probably is greatest when it causes separation of females from their dependent young. Early abandonment, especially in the first year of nursing, probably results in starvation of the calf. In the first few days of the calf's life, the mother and calf maintain close contact. As the calf grows older the primary responsibility for maintaining the close association shifts to the calf (Gehnrich 1984), increasing the potential for separation during disturbance (Fay et al. 1984b). Polar bears prey upon calves and take advantage of even brief separations from the normally attentive cow (Fay et al. 1984a; B. P. Kelly unpublished data). Calves especially are vulnerable to disturbance on terrestrial haulouts (Loughrey 1959). Calves have been trampled to death during stampedes caused by human and natural disturbances of terrestrial haulouts (Tomilin and Kibal'chich 1975; Fay and Kelly 1980). The potential for mortalities during stampedes is less for herds on ice which generally are smaller than herds on land.

At-sea movements and important feeding areas of walruses are not well known, nor are the effects of noise on walruses at sea well understood. Noise from human activities could cause walruses to avoid preferred feeding areas and travel corridors, as well as haulouts (see Habitat Protection, below). More information is needed on walrus activity at sea and their responses to noise in that environment.

I. Foods and Feeding

Walruses are benthic feeders, eating mostly invertebrates that live on or in bottom sediments. Pacific walrus in the Bering Strait region eat mostly bivalve mollusks, especially Mya truncata, Serripes groenlandicus, Hiatella arctica, and Tellinid clams (Macoma spp. and Tellina spp.) (Fay et al. 1977; Fay and Stoker 1982b; Fay et al. 1989). Invertebrate foods of secondary importance there (in terms of volume) include Nephthys spp. (Annelida), Echiurus echiurus (Echiurida), several species of gastropod mollusks, some crustaceans, holothurian echinoderms, and Pelonaia corrugata (Urochordata). Over 65 species of prey have been identified from walrus stomachs but it is difficult to assess the importance of each in the diet. Some may be ingested adventitiously, while others may be sought selectively. Little is known about the nutritional importance of the food items. Food taken only in small quantities may be of great importance in providing essential nutrients.

Pacific walruses rarely consume fishes (Delyamure 1955; Krylov 1971; Delyamure and Popov 1975). They more frequently eat phocid seals than fishes and the incidence may vary with the status of the walrus population. The frequency of walrus stomachs containing seals generally is less than 10 percent but has increased in recent decades (Fay 1960; Krylov 1971; Lowry and Fay 1984).

Evidence from research collections and reports from Native hunters suggest regional and seasonal variations in the walrus' diet but the data are insufficient for definite conclusions. There is some evidence that amphipods, polychaetes, gastropods, and seals may be more important prey than bivalve mollusks for walruses summering in the Chukchi Sea (Lowry 1990). Fay et al. (1977) showed that the species composition of food items in stomachs of males and females from the Bering Strait region in spring were similar but that males consumed larger prey than did females. Stomach samples collected there in the early 1980s indicated a convergence by males and females on small sized prey, suggesting fewer large bivalves and increasing intra-specific competition (Fay and Stoker 1982a; Fay and Stoker 1982b; Fay et al. 1984a). Greater quantities of gravel and sediment in the stomachs suggested that the walruses were searching harder for food. Studies have been initiated recently to assess the biases in food habit studies due to state of digestion of stomach contents (Fay and Sheffield, pers. comm.).

Data from captive and wild walruses indicate that rates of feeding vary seasonally and by age and sex. Growing young and lactating females consume large amounts of food throughout the year but adult males and non-lactating adult females reduce their intake

seasonally. The males eat most in November and December, immediately prior to the breeding season; they consume little or no food during the breeding season for 2-3 months thereafter. Consumption decreased during the breeding season for non-lactating adult females as well. Adult females also fast briefly at estrus and for a longer period at parturition.

Food is located tactually by the highly sensitive and mobile mystacial vibrissae (Fay 1982). With head down and vibrissae in contact with the bottom, the walrus proceeds forward, propelling itself by sculling with the hind flippers. Most food is encountered at the surface of the sediments but some must be dug out. Such digging probably is accomplished by "rooting" with the snout, pig-fashion, rather than with the tusks (Fay 1982) or by jetting water from the mouth (Oliver et al. 1983). Prey are manipulated by the lips and grasped with the aid of roughly textured gums, rather than by the teeth. The soft parts of mollusks are removed from the shells by suction and the shells are then ejected. Occasionally, small mollusks less than 30 mm in diameter are swallowed whole, shell and all (Vibe 1950; Fay 1982); larger clams may be sucked whole from the shell and swallowed. Invertebrates without shells may be swallowed whole without mastication.

J. Morbidity and Mortality

Pathologies described for Pacific walruses include umbilical hernia, acute pneumonitis, cystic ovaries, uterine tumors, kidney stones, pleural fibropapilloma, biliary fibrosis, renal calculi, frostbite, and a congenital limb deformity (Fay et al. 1979; Fay 1982). Only the first two and possibly the last of those conditions are known to have resulted in mortality.

Two ectoparasites and fourteen endoparasites are known to infect Pacific walruses. None are believed to have significant adverse effects at the individual or population level (Brooks 1954; Loughrey 1959; Fay 1982). Less than 2 percent of the Pacific walrus population is infected with Trichinella spiralis; its impact on walruses is unknown (Rausch et al. 1956; Fay 1960; Yurakhno and Treschev 1972). Occasionally, people contract trichinosis as a result of eating raw or under-cooked walrus meat (Fay 1960).

A calicivirus similar to San Miguel Sea Lion Virus has been found in walruses and may be a proximal cause of reproductive failure (Fay et al. 1983; Smith et al. 1983; Barlough et al. 1986).

Native hunters from St. Lawrence Island have described walruses becoming emaciated after becoming entrapped in heavy ice (Fay 1982). It is probable that in some instances those walruses starve to death but no documentation of such events exists. Rock slides are a hazard to walruses on terrestrial haulouts and occasionally result in mortality (Kelly and O'Connor 1979).

Serious injury and death can result from intra-specific interactions, mainly involving strikes with tusks and trampling. Skin lacerations and subcutaneous hemorrhages resulting from

tusk strikes are common in both sexes and all age-classes. The most serious wounds are observed on males during the breeding season when they wound each other during vigorous fights in the water (Fay 1982). Trampling can result in abortion, injury, and death during stampedes at crowded haulouts and has been observed at Wrangel Island in the Chukchi Sea (Tomilin and Kibal'chich 1975) and the Punuk Islands in the Bering Sea (Fay and Kelly 1980).

Walruses are preyed upon by polar bears (Ursus maritimus), killer whales (Orcinus orca), and humans (Scammon 1874; Zenkovich 1938; Fay and Kelly 1980; Fay 1982; Kochnev 1991).

The magnitude of natural mortality is unknown but is assumed to be low, given the population's low productivity. Estimating mortality rates from life history data collected from harvested animals is not possible due to biases in those samples (Kelly 1990). Juvenile mortality rates have been estimated from age and sex composition data collected visually from aboard ships (Fay and Kelly 1989).

Mortality caused by humans includes actual harvests and may involve indirect effects. Indirect effects include disturbances causing stampedes or abandonment of important habitat, alteration of habitat, contamination with oil or other pollutants, competition for food with fisheries, and incidental take by fisheries (Sease and Chapman 1988). There is no evidence that any of those are significantly affecting the population at present. The human activity with the greatest impact is hunting (Fay 1982; Fay et al. 1989).

Natives on both sides of the Bering Strait hunted walruses from the Bering and Chukchi seas for thousands of years before the 19th century and probably had little effect on the population (Fay 1982). Thereafter the take by non-Natives was comparatively large. In the past 150 years the population size has fluctuated markedly under the influence of alternating periods of high harvest levels and near total protection (Fay et al. 1989). In two different periods, 10,000 or more animals per year were removed from the population. This resulted in major declines of the population (Fay et al. 1989). The first of those declines contributed to famine among Natives of the Bering Strait region (Nelson and True 1887; Allen 1895; Muir 1917; Fay et al. 1989).

Commercial harvest of walruses was banned in the United States in 1941 (Brooks 1953; Fay 1957) and in the Soviet Union in 1957 (Krylov 1968). The average total harvest in the 1960s and 1970s (Fig. 4) was just over 3000 walruses per year; in the 1980s the rate averaged more than twice that (6700) (Fay et al. 1989; FWS, unpublished data).

The number killed but not retrieved is unknown. Fay (1958), Kenyon (1958), and Harbo (1961) independently derived similar estimates that put the retrieval rate in Alaska at about 49 percent of the walruses shot. Surveys of beach-cast carcasses of walruses along the coast of western Alaska indicated that most of the wounded animals died soon after they were struck (Fay and Burns in litt.). Recent retrieval rates are estimated to be much higher

(M. Iya of the Eskimo Walrus Commission [in Kelly 1990]) but it is unclear whether the suggested rate was based on retrieval of walruses known to have been killed or known to have been shot. Retrieval rates probably vary regionally and may have changed since the estimates were made in the late 1950s and early 1960s.

Estimates of the total annual kill (including those struck and lost) in the mid-1980s were 10,000 to 15,000 animals or 4 to 6 percent of the estimated minimum population size (Sease and Chapman 1988; Fay et al. 1989). Coupled with an estimated natural mortality rate of 3 percent (DeMaster 1984), that removal rate probably greatly exceeded the recruitment rate which could have been as low as 1 percent (Fay et al. 1989). The low recruitment rate could have resulted from reduced productivity and juvenile survival, possible density-dependent responses to the large population size in the early 1980s. The combination of a sustained high removal rate, low recruitment rate, and an increased proportion of adult females in the harvest (nearly doubled between 1970 and 1985) may cause a decline in population size (Fay et al. 1989). Additional supporting evidence for a decline may be inferred from harvest statistics (Fay and Bowlby in prep.). In 1988 and 1989 the Alaskan harvest declined almost to half that observed in 1985 (Seagars et al. 1989). During this period the overall Soviet harvest remained high because they compensated for low shore-based catches by increasing their ship-based harvest. The retrieved harvest declined slightly during the early 1990s in both Russia (1990 - 2,435, 1991 - 1,860, and 1992 - 1,750; Bukhtiiarov, pers. comm.) and Alaska (1990 -1,461, 1991 - 2,154, 1992 - 1,485, FWS unpubl. data). The estimated lower total annual kill (6,717, 6,921, and 5,578 for 1990-1992 respectively) was in part due to a cessation of ship based harvesting on the Russian side and a reduction in take by Alaskan Native hunters.

IV. CONSERVATION ISSUES

The Pacific walrus population has been made to fluctuate greatly over the past 150 years with severe consequences for both walruses and humans. The following have been identified as the principal threats, conflicts, and conservation issues needing resolution to ensure that the population remains healthy (e.g. within the OSP range) over the long term and remains a functional part of the Bering-Chukchi ecosystem.

A. Assessing and Monitoring Population Status and Trends

Determining the current status of the population and predicting future trends is difficult, imprecise, and expensive. However it is essential to any conservation effort. Current methods used to monitor the size and vital parameters of the walrus population are extremely imprecise. The MMPA requires that the population be managed so that its size is maintained within the OSP level. OSP is:

> "… a population size which falls within a range from the population level of a given species or stock which is the largest supportable within the ecosystem to the population level that results in maximum net productivity. Maximum productivity is the greatest net annual increment in population numbers or biomass resulting from additions to the population due to reproduction and/or growth less losses due to natural mortality." (50 CFR 216.3)

The OSP for walruses cannot be defined in a statistically rigorous manner since carrying capacity (K) is not known and MNPL can not be calculated with precision. Estimates of four critical values - current population size, annual female harvest rates over the last 150 years, K, and where MNPL occurs relative to K currently are insufficient for precise calculation of OSP range. Additional resources might slightly improve the estimate of the first and could measurably improve current estimates of the second of those values. However, an accurate estimate of historic K (e.g. using back-calculation) is not possible without reliable information about the total number of walruses (by sex and age classes) removed by hunting in the past (DeMaster, in litt.). Regardless of funding levels, precise determination of MNPL relative to K is very unlikely in the foreseeable future (DeMaster, in litt.).

Aerial surveys have produced estimates of population size with confidence limits so large that it is virtually impossible to reliably detect, much less quantify, changes. The 1975-1985 cooperative USA-USSR surveys for walruses along the ice-edge often were not well coordinated to provide total coverage of the area and sometimes the surveys were not concurrent. As a result, both double counting and under counting have been identified as possible errors associated with past estimates. Other basic issues identified with obtaining reliable estimates include: 1) difficulty in sampling the large area potentially occupied by walruses; 2) the extreme variability caused by aggregation of walruses into large groups and the concentration of these groups in certain areas of the pack ice; 3) the bias in the survey because an unknown portion of the walruses are in the water and cannot be observed on either ice or beaches; and 4) bias because the number of walruses in the large groups often have been estimated and not counted (Gilbert et al. 1990). Estes and Gilbert (1978) review these and other sources of imprecision and bias in population surveys for walrus. Because of the biases, results from the cooperative surveys are most accurately recognized as best estimates of the lower limit of population size. Furthermore, these estimates should not be compared or used to determine trends in population size because the relationship between the proportion counted and not counted between surveys is not known. At this point survey data are useful only to determine the population status relative to the lower bound of OSP, as determined by the ALJ hearing.

Soviet participants in the joint USA-USSR walrus surveys have requested that the USA consider surveying in the spring rather than in the fall because of their economic constraints and their misconception that Pacific walruses inhabit a smaller area in spring than fall. Recent communication from biologists of the former Soviet Union indicates they anticipate lack of funds to cover the expense of future fall walrus surveys

and they foresee a need to combine their walrus surveys with surveys of ice-inhabiting seals. The alternative may be a delay in the next survey or the need for the USA to pay all costs. Spring surveys would not be comparable. Contrary to the assertion of Fedoseev (p.57 in Testa 1990), the population is spread over a much greater area in spring than in the fall and surveying in spring might entail greater expense and less precision than in the fall.

A recent analysis of walrus survey design and results (Hills 1992) concluded that aerial survey data can not produce estimates of total population size that are useful for detecting trends within acceptable confidence limits even with vast (> 100%) increases in survey effort. The costs of increasing survey effort to bring results within acceptable limits would be exceptionally high. Thus, the cost-effectiveness of continuing aerial surveys employing current technology needs to be evaluated. The cost of conducting surveys (and at what intensity and intervals) to obtain minimum population size estimates needs to be compared to the costs of conducting other monitoring and research programs. There is a critical need to investigate and develop alternative methods of determining population size and monitoring trends in a timely manner.

B. Monitoring and Cooperatively Managing Harvest

The number of Pacific walruses harvested in Soviet waters was unregulated until population depletion was perceived in the late 1950s. The Soviet Union then implemented a quota and limited the harvest almost entirely to males and, through 1989, imposed a quota (varying from 1000 to 4000 walruses per year) on their hunters; 66 percent was allocated to shore-based hunters and the rest to ship-based hunting (Sease and Chapman 1988; DeMaster 1990). Ship based harvesting was discontinued in 1989 and coastal harvesting by different Native groups living on the eastern coast from Chukotka to Kamchatka is an evolving situation at this time.

Harvesting of walrus in Alaska, except by Native Alaskans, was prohibited in 1937 by regulation and by the Walrus Act of 1941 (Fay 1982). Between 1960 and 1972 the State of Alaska limited the take of walruses to five females and an unlimited number of males per subsistence hunter per year. Less than 50 walruses per year were allotted to sport hunting. After passage of the MMPA, the FWS had management authority for three years; no numerical limit on the Native subsistence take was, or could have been, imposed and sport hunting was discontinued. The State urged Native hunters to voluntarily follow the previous limits. From 1976 through 1979, the State again managed the harvest with a quota of 3,000 walruses per year. Since July 1979 the FWS has had management authority and, under terms of the MMPA, can not regulate the subsistence harvest. It is likely that the combined USA-USSR harvest exceeded the replacement rate in several years under both State and Federal management. For example, the estimated retrieved walrus catch (does not include animals struck and lost) exceeded 7,090 walrus/year between 1984-1987 (Fay and Bowlby in prep.) as compared to a previously estimated allowable Potential

Biological Removal (PBR) of 7,021 walrus/year (NMFS 1992). (Note: subsequent calculations of PBR as prescribed by language in the 1994 MMPA amendments may result in a different PBR figure.) The estimated number of walruses retrieved in the Alaskan harvest levels of the past 5 years (1989-1993) has been more restrained; probably averaging about 1,500 walrus/year (Seagars et al. 1989; FWS, unpublished data).

Estimation of the total kill is inaccurate and imprecise because not all seasons and villages have been monitored, harvest varies greatly among villages and years, and the retrieval rate (struck and lost proportion) is not known with certainty. Estimates of the number of walruses struck and lost range from 20 to 80 percent; most recently Fay and Burns (in litt.) estimate overall Alaskan struck and loss rates of recent (post 1950s) years to about 50 percent. Additional study and monitoring is needed to more thoroughly address these information needs.

Monitoring the harvest of walruses in both Alaska and Russia is necessary to determine the size and composition of the kill and to compare with the estimated total population. Harvest monitoring also provides data on reproductive performance, feeding habits, and contaminants that are useful for assessing the health of the population. Until 1989 the Soviet Ministry of Fisheries monitored the Soviet harvest, and data on numbers of walruses taken were shared through the USA-USSR Environmental Protection Agreement. From 1980 through 1989 the FWS monitored the Alaska harvest at 5 villages where an estimated 80 percent of the walruses were harvested. No villages were monitored in Alaska in 1990 or 1991 due to funding constraints, but a Harvest Monitoring Program (HMP) resumed in 4 villages in 1992 and continued in the 1993 and 1994 seasons. The HMP was restructured to make sampling more scientifically accurate and to increase the opportunity for participation by villagers. The FWS is pursuing long term funding for this program.

Final rules establishing the FWS's Marking, Tagging and Reporting Program (MTRP) requiring the skulls and pelts of sea otters and polar bears and the tusks of walruses be tagged became effective on October 26, 1988. The program is now fully implemented throughout Alaska with more than 100 individuals designated as taggers. While the MTRP does not obtain the biological samples collected through the HMP, it does collect harvest data from across the State throughout the year.

The number and composition of walruses harvested in both Alaska and Russia should be kept, by mutual agreement, within limits that will ensure a healthy population and continuing supply of walruses to subsistence hunters. The questions of what are acceptable limits and how to ensure the harvest remains within them have been a problem and source of conflict for managing agencies, walrus hunters, and conservation groups for over 20 years. There is a critical need to determine cooperatively acceptable harvest levels, provide that information to hunters in both countries, and to monitor the harvest to ensure those levels are not unacceptably exceeded.

Several alternatives exist for improving walrus conservation. A cooperative management agreement should be established between Russia and the United States that includes Native organizations from both nations. The 1994 amendments to the MMPA provided new direction to the Secretary of Interior to develop cooperative agreements with Alaska Native organizations to conserve marine mammals and provide co-management of subsistence use. It is imperative that a partnership be established to address the harvest issue so that the common goal of maintaining a healthy walrus population is achieved and maintained for generations to come.

C. Fishery Conflicts and Incidental Take

Fishery conflicts and incidental take may adversely affect walruses. Conflicts between commercial fisheries and marine mammals typically consist of competition for resources, or incidental catch. Although impact to feeding habitat and prey resources has not been an issue with respect to walruses, it could become one if commercial harvesting of clams is done on a large scale (Fay and Lowry 1981). One company has approached the State in recent years to examine the clam fishery potential of eastern Bristol Bay. To assess the effect of such an activity it will be necessary to determine and monitor distribution, abundance and composition of prey resources, and distribution of feeding walruses, before and after the fishery commences. Available data on benthic resources are not sufficiently detailed to assess adequately the impacts of a clam fishery on walruses. The potential also exists for adverse impact to feeding habitat due to sea floor destruction from bottom trawls for fish.

Incidental catch of walruses has been reported infrequently in the groundfish trawl fishery in the USA zone of the eastern Bering Sea. NMFS observer data (Braham and Perez, in litt.) collected from 1977 through 1993 found an average of 12.8 walrus were taken per year (range 1-40), more than half of these were identified as "decomposed" at the time of catch indicating they had died of unknown causes long before being caught; only 3 live takes (released) were reported during this period. In the cases where sex was identified, almost all were adult males. Most were reported within 37 km (20 nm) of Round Island in northern Bristol Bay. Between one-half to one-third of the animals observed in the nets were decomposed, indicating that at least a portion of the catch was of individuals whose mortality may have been due to a source other than a fisheries related one. No data are available concerning current levels of incidental take in in Russian waters.

The 1994 amendments to the MMPA require the FWS cooperate with the Secretary of Commerce in a series of tasks related to monitoring and regulating incidental catch in commercial fisheries. These include working with regional scientific review groups appointed by the Secretary of the Interior to prepare stock assessments, to calculate "Potential Biological Removal" (PBR) levels, to carry out monitoring programs for certain fisheries, and to incorporate actions recommended by "take reduction teams" into Conservation Plans. The FWS will work in cooperation with the NMFS to carry out these tasks. For example, the "Proposed Regime to Govern Interactions between Marine

Mammals and Commercial Fishing Operations" (NMFS 1992) set levels of allowable incidental catch based on calculations of a species' PBR level. In the case of walruses the total PBR could be consumed by the combined USA and Russian harvest. As the new regime prescribed by the 1994 MMPA reauthorization is implemented, it will need to establish a mechanism to address the issue of continued incidental take of walrus by commercial fisheries in cases where the subsistence harvest exceeds the PBR.

D. Protecting Habitat

Walrus habitat needs to be protected in a consistent manner. A major threat to walrus habitat is disturbance by human activities, especially on terrestrial haulouts. Encounters with people are increasing both at sea and onshore; the extent of disturbance at sea is more difficult to assess. On land, both natural and human related disturbances have caused stampedes and mother-calf separation resulting in mortalities, especially of young walruses (Tomilin and Kibal'chich 1975). At sea, walruses may respond by moving away from important feeding or haulout regions.

The 1994 reauthorization of the MMPA more explicitly provides for protection to essential marine mammal habitat. Congress stated its intent that, the Secretary has the authority to develop and implement conservation measures to protect areas of special ecological significance to marine mammals such as mating grounds, feeding grounds, and migration paths.

1. Walruses on Terrestrial Haulouts

Land based disturbance: Walruses on terrestrial haulout sites are subject to human disturbance from a variety of sources. In Russia, hunting has been prohibited at haulout sites on land, although application and enforcement of these regulations has been inconsistent over the years. In the USA, access to coastal haulouts by Native Alaskans for hunting has been unlimited except for Round Island. In 1960, Round Island, in the Walrus Islands State Game Sanctuary (WISGS), was closed to entry for hunting. In November, 1992, the Alaska Board of Game (BOG) directed the ADFG to appoint a Task Force to examine a proposal from the Togiak Traditional Council (TTC) to eliminate the restriction on access for Native hunting at Round Island. The Task Force met several times in 1992 and prepared a final report (ADFG 1993) concluding that a carefully controlled harvest of up to 10 male walruses from Round Island in October would not have a serious impact on the walrus population or the continued use of the Island as a haulout. The BOG reconsidered this proposal at the Spring 1993 meeting, voted to deny the proposal, but passed a resolution directing the ADFG to determine if the request could be accommodated through a cooperative agreement between the State, the EWC, the TTC, and the FWS. Additional discussion was scheduled for the November, 1993, BOG meeting. However, in September the State wrote to the Bristol Bay Native Association to notify them the issue would not be on the agenda because it had been determined that neither the State or the Federal government could regulate the harvest once access had been granted. In the event

the request is reconsidered and approved, it will be necessary to conduct a study to determine if there are effects on walrus as a result of permitting access to Round Island for hunting.

In the late 1980s public visits to both Round Island (WISGR) and Cape Peirce (TNWR) increased, primarily to observe and photograph walruses. Regulation of visits needs to be continued to ensure that regular patterns of use by walruses are not disrupted.

Disturbance from aircraft: Flights over most walrus haulouts in Russia are prohibited within 22 km except by special permit. Several areas in Alaska, Round Island and Cape Peirce, have guidelines on aeronautical charts setting overflight altitudes. The MMPA prohibits harassment, for example from overflights, but enforcement is difficult and disturbance of walruses on both land and ice has been reported. There is a need to review the FWS regulations in this area and to issue and publicize clear and consistent regulations or guidelines to protect walruses from disturbance from aircraft.

Disturbance due to offshore activities: Access within 22 km is limited at haulout sites in Russia. In Bristol Bay, the NMFS issued regulations in 1989 and 1992 prohibiting fishing for yellowfin sole closer than 22 km (12 nm) to Round Island, the Twins (both WISGS) and Cape Peirce (TNWR). These regulations were implemented because circumstantial evidence indicated that yellowfin sole fishery operations were causing airborne and waterborne acoustic disturbance responsible for a significant decline (up to 60%) in the number of walruses reported hauling out at Round Island. Many of the walruses from Round Island may have moved to Cape Peirce or Cape Seniavin (Mazzone 1986; Hills 1987; O'Neil and Haggblom 1987; Sherburne and Lipchak 1987; Hessing and Brandt 1988; Hills 1990; Sheffield 1988; Hessing and Sheffield 1990; Jemison 1991). Census data have been collected showing the number of walrus utilizing Round Island initially increased following implementation of these closures. The number of walruses at Round Island has since declined. At this time it is difficult to determine how effective these regulations may be for reducing disturbance to resting male walruses at Round Island. The closure has been vigorously enforced; 10 cases were prosecuted through the end of 1992 and penalties in excess of $800,000 and loss of fishing privileges have been levied. Additional cases are expected to be heard in 1993. Additional monitoring studies are needed to follow up on the effectiveness of these regulations.

The NMFS groundfish regulations can not regulate transit of vessels within State waters. Thus there is a 5.5 km (3 nm) travel corridor in the northeastern section of the Round Island closure zone. The sounds generated from transiting vessels often are louder than vessels fishing. The transit zone compromises the closure zone and makes an evaluation of the effectiveness of the closure zone difficult. The FWS has discussed this issue with State managers on several occasions. Resolution of the issue will be up to the State Board of Fisheries (BOF). The BOF meetings address regional issues on an area specific rotating basis; this issue should be raised at the first appropriate opportunity.

Near shore, within 5.5 km, fisheries (such as for herring) and tourist vessels may also disturb walruses. The need for measures designed to reduce disturbance from such fisheries and tourism should be examined for Bristol Bay haulout sites such as Cape Peirce and Cape Seniavin.

As the walrus population grew rapidly in the 1970s, many terrestrial haulouts that had been unused for decades were recolonized (Fedoseev 1981; Frost et al. 1982; Fay et al. 1984a). The historical and current significance of all haulout sites needs to be determined. A consistent national and international approach for management and protection of terrestrial walrus haulouts is needed.

2. Walruses at Sea and in Pack Ice

Walruses at sea and in the pack ice are subject to disturbance. Walruses and other pinnipeds take advantage of the acoustic properties of sea water to aid in navigation (Schusterman et al. 1975; James and Dykes 1978; Wartzok et al. 1987), social communication (Ray et al. 1969; Stirling 1973; Watkins and Ray 1977; Stirling et al. 1983; Calvert and Stirling 1985), and probably avoidance of predators (Mate 1975). Increasing aircraft and boat traffic in the Bering and Chukchi seas, largely associated with fisheries and petroleum exploration and development, may disturb walruses in important breeding, nursing, and feeding areas in both open water and pack ice. In recent years, hunters from several villages along the northwest coast of Alaska have commented that the abundance of walruses in retreating spring pack ice declined coincidental with the appearance of large tugs pulling supply barges. If these activities are responsible for reduced availability of walruses to hunters, action will need to be taken to protect Native people's ability to secure an important food and handicraft resource, especially if shipping expands on the proposed northern sea route through Russian waters in the Chukchi Sea and Arctic Ocean. The need for guidelines, regulations, and educational materials to reduce disturbance to walruses at sea and in the pack ice should be examined.

3. Contaminants Found in Walrus Tissues

Contaminants are found in walrus tissues. Long-lived carnivores, such as walruses, can concentrate environmental toxins. The health of the walruses and their predators, including human, could be at risk from those toxins. Taylor et al. (1989) and Warburton and Seagars (1993) examined levels of heavy metals, organochlorines, and aliphatic hydrocarbons in Pacific walruses harvested from 1981 through 1989. They reported high levels of cadmium and mercury that merit further investigation. More tissues are being analyzed.

E. Petroleum Exploration and Development

Petroleum exploration and development can adversely affect walruses via oil spills from well blow-outs, pipeline ruptures, or shipping accidents, as well as through acoustic disturbance. Recent offshore exploratory activities in Alaska have occurred in the Beaufort

and the Chukchi seas in areas important to walruses for summer feeding, especially by females and calves. The relatively high mobility of walruses could allow them to avoid oil spills except if spilled oil concentrated in leads and other openings in the ice where walruses may be confined. It is unknown, however, whether they would move out of and/or avoid oiled areas. The direct effects of oil on walruses is unknown, but are probably similar to those of other pinnipeds, such as irritation of eyes, mouth, lungs, and anal and urogenital surfaces (St. Aubin 1990). Inhalation of aromatic fractions may cause neural damage and death, as occurred in harbor seals following the Exxon Valdez oil spill (ADFG, unpublished data). Ingestion of petroleum products through feeding would probably cause short and long term kidney and liver damage (Cornelius and Kaneko 1963; Geraci and Smith 1977; Holden 1978).

An oil spill's greatest impact on walruses might be damage to benthic food resources. Mortality of several species of benthic invertebrates including bivalve mollusks has been observed as a direct effect of petroleum oil spills (North 1967; Percy and Mullin 1975). Sublethal effects might have an even greater impact; the behavior, physiology, and productivity of benthic mollusks are affected by exposure to petroleum products. Once in the sediments, oil may have long-term effects. In the arctic and subarctic marine environment, the problem is compounded by the relatively slow degradation of oil in the cold sediments (Clark and Finley 1977). Productivity of the benthic foods of the walrus, therefore, could be impaired for long periods of time and over greater areas than affected by the initial spill.

Under the MMPA, certain industrial activities (other than commercial fisheries) may be authorized to incidentally, but unintentionally "take" (e.g. harass, injure, or kill) small numbers of walruses. Several oil and gas companies requested that the FWS issue regulations for certain offshore oil and gas exploratory activities (including ship and aircraft traffic, seismic testing and other petroleum exploration activities, and drilling) in the Chukchi Sea. Such taking can be authorized only if the FWS determines that it would include small numbers of animals and that it would have a "negligible" impact. In 1991, the FWS issued regulations (56 Fed. Reg. 27443-27465) covering exploratory activities in the Chukchi Sea. To date, the FWS has issued Letters of Authorization (LOA) to two companies for exploratory activities; these require seasonal closures on operations, reporting, and monitoring programs. Data on walrus distribution and acoustics around industrial activities have been collected as a result of these programs. Similar regulations were issued for the Beaufort Sea (58 Fed. Reg. 60402-60412) and became effective December 16, 1993.

F. International Cooperation

International cooperation in research and conservation needs to be increased and formalized. A lack of international cooperation was a major factor in past declines of the Pacific walrus population (Fay et al. 1989). The situation was improved greatly in 1972 when Soviet and American walrus biologists began working together under the USA-USSR

Environmental Protection Agreement. Cooperation in walrus research and management increased in the last four years as the political situation changed in the former Soviet Union. Recent exchanges have included the 1990 range wide population survey, studies of walrus movements and distribution on the Chukchi coast, and a two month research/harvesting cruise throughout the Bering Sea to collect life history and distribution information.

There has been a recent increased interest in Russia for the commercial and sport use of all natural resources, including marine mammals (Volokhov, pers. comm.). These rapidly changing political and economic conditions in Russia make international conservation of walruses a critical need. Achievement of this long term goal of the marine mammal working group of the USA-USSR Environmental Protection Agreement may be possible in the near future.

An International Workshop on the Ecology and Management of Walrus Populations was held in 1990 and led to the formation of the Walrus International Technical and Scientific (WITS) group composed of representatives from Canada, Greenland, Norway, the former Soviet Union, and the United States (Burns 1990). A second meeting was held in Winnipeg, Canada, in January 1993. The WITS group will continue to be important for exchange of information relevant to conservation, management, and research of walrus populations.

In 1987 a proposal was put forth at the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to list all walrus populations on Appendix II. Species listed on Appendix II are not presently threatened with extinction but may become so unless their trade is regulated. Walruses are currently listed on Appendix III at the request of Canada; trade is monitored but not restricted provided the origin of the product is documented. The 1987 proposal was eventually withdrawn. It was subsequently reconsidered for reintroduction prior to the 1992 CITES meeting, but the proposal was not introduced. However, in response to worldwide media attention to an intensive law enforcement program called "Operation Whiteout," the FWS received numerous letters in 1992 advocating a change in the CITES status and increased restriction on the Alaska Native harvest of walruses. At this time, the FWS believes it inappropriate to list the Pacific walrus on Appendix II because the population is not depleted and the MMPA provides adequate protection through its restrictions on international trade and for potential regulation of the Alaskan harvest. It will be important to have up-to-date information on the status of the Pacific walrus population whenever the matter is next considered by the parties to the CITES.

V. CONSERVATION PLAN

This Conservation Plan identifies objectives that will contribute toward achieving the overall goal (page 5) of the Conservation Plan. Tasks are identified for each objective to resolve conservation issues. This outline provides a framework for cooperative actions that need to be taken by agencies, organizations, and individuals to achieve the long range goal of maintaining the Pacific walrus population within its OSP range.

A. Objectives

(1) determine and monitor the status and trends of the Pacific walrus population;

(2) define the Optimum Sustainable Population range of the Pacific walrus;

(3) identify, protect, and monitor essential habitat of the Pacific walrus;

(4) identify, monitor, and manage human activities (other than subsistence hunting) that may be detrimental to the walrus population;

(5) ensure the subsistence/handicraft harvest is consistent with the provisions of the MMPA and will allow the population to remain within a healthy range;

(6) establish information and education programs promoting conservation of the Pacific walrus through increased understanding; and

(7) coordinate Federal, State, Native, international, and other cooperative conservation efforts.

B. Step Down Outline and Narrative

Objective 1: Determine and monitor the status and trends of the Pacific walrus population

To determine if the goal and objectives of the plan are being met, if conservation actions are effective, and if additional actions are needed, it is essential to have a reliable measure of population trends. The only way to gather data necessary for such analyses is through close cooperation between Federal, State, Native, and Russian groups. In the past, there has been a lack of timely information on the size, demography, and productivity of the Pacific walrus population. In recent years, aerial surveys, supplemented by ground counts at terrestrial haulouts, have been used to assess the size and trends in the Pacific walrus population. Survey methods for estimating population size need to be more reliable if they are to be the basis of meaningful conservation decisions. The reliance on aerial surveys needs to be replaced or augmented by other more cost-effective, precise and accurate

methods of monitoring population status and trends. These have yet to be identified and considerable research and development will be required. Biological samples and data from animals killed by subsistence hunters offer important opportunities for monitoring trends in some population parameters, although the biases of hunter selection require careful interpretation. Harvest monitoring should be continued and designed to provide information on trends in vital population parameters, body condition, and contaminant loads. Analyses of those data should be up-dated and reported annually to facilitate rapid detection and response to population-level changes.

11. Hold a workshop to assess and develop new methods for monitoring population status and trends

Over the past 15 years estimates of walrus population size and trends have been based largely on results of joint USA-USSR aerial surveys conducted in the fall every 5 years. While the surveys were intended to provide a basis for assessing population size, they have been expensive, required extensive effort to plan and carry out, and produced imprecise results. Due to funding constraints, Russia may not be able to participate in future fall surveys. Therefore, new approaches for estimating population size and monitoring trends must be developed.

Experts in population biology, sampling theory and design, and walrus ecology should conduct a thorough review of past aerial survey data and make recommendations for the continuance or discontinuance of that effort. In considering the value of continuing the surveys, the review should address the potential for: (a) improving the method sufficiently to produce more acceptable confidence limits; (b) keeping the surveys more consistent with previous efforts for the sake of comparability; (c) incorporating methods to determine age/sex composition; or (d) continuing surveys only as an interim approach while developing and testing alternative methods of population assessment. Alternative methods of monitoring population status, such as indices of condition (e.g. based on fat, cementum deposition, or other such physical factors), composition counts on land and ice haulouts (Fay and Kelly 1989) should receive a thorough review. If alternative methods are identified, more than one method may need to be used for some specified amount of time. To be effective, adequate time to allow a thorough review of the data will be needed; a discussion of general principles and problems will not suffice. Specific and detailed recommendations for a long-term population monitoring program should be made. The FWS, Alaska Fish and Wildlife Research Center conducted a review of the Walrus Research Program in the summer, 1993. Discussion of this topic was a part of the review. It is desirable to conduct further review through a specific workshop of experts from both within and outside of the FWS.

12. Monitor the size and trends of the walrus population

To determine if the population is healthy (OSP) and if conservation practices are effective, it is imperative that long-term reliable methods of monitoring the population be put in

place. Such monitoring may be based in population estimates from surveys or condition indices based on life history parameters (see 15). The following three alternatives are being considered.

121. Consider conducting a range wide USA-Russia aerial survey

At present the best, albeit imperfect, method for estimating the size of the walrus population is an aerial survey augmented with a substantial concurrent satellite tagging effort. The most recent aerial survey of the Pacific walrus population in 1990 was not conducted in conditions comparable with previous surveys (Gilbert et al. 1992). Because alternative monitoring measures are not yet available, it will be a number of years before a check on the population status will be made unless a new survey is conducted soon. However, due to the vast area covered and current economic conditions in Russia, it is likely that most, if not all costs, will have to be borne by the USA. To date base funds to conduct routine population monitoring surveys have not been provided to the FWS. Furthermore, it will be necessary to augment base funds with additional funds to conduct periodic and expensive range-wide walrus surveys, especially in light of current economic conditions in Russia. Several alternatives are being considered:

121a. No immediate survey

Do not conduct an aerial survey within the immediate future (e.g. until after the year 2000) or until new survey methods become available. Acquire new resources and direct all effort into research and development of new technology and methods for assessing population status. No population estimate would be available for at least a 10 year period.

121b. Conduct a joint aerial survey in 1997

Because of evidence of a possibly declining population, high harvests in the mid-1980s, and the time lag associated with developing alternative monitoring approaches, an updated estimate of minimum population size is desirable. The survey should use the same methods and level of effort as previous surveys. Budgeting and planning should allow postponing the survey should ice, weather, or other unforeseeable conditions make the survey not feasible. Additional budgetary flexibility will be required to conduct operations through the end (September 30) of one Fiscal Year (FY) and the beginning of a new FY (October 1). Harvest monitoring (task 52) and development of new assessment methods should be implemented concurrent with this approach of population assessment. Limited survey resources, other priorities (e.g. the need for a more immediate polar bear survey in the Chukchi Sea) and the need to carefully plan and train personnel dictate the earliest a survey could be expected is FY 1997, if funds are available. Estimated costs for both 121b and 121c are based on most, but not all, flight costs occurring in FY 1997.

121c. Conduct an expanded joint aerial survey in 1997

Increased survey effort may provide a more precise estimate and clearer understanding of the proportion of the population available to be counted. Doubling the effort could be achieved with a 30 percent increase in cost. However, the precision of the estimate will still be at least twice as imprecise as commonly considered acceptable for marine mammal surveys. Monitoring the harvest and development of alternative assessment methods also should be concurrent but funds for these studies might be more difficult to obtain due to high cost of conducting the survey.

122. Develop and test alternative methods for monitoring and assessing population status and trends

Based on the results of task 11 begin researching and testing alternative methods for population assessment and monitoring (see 151-155, 16). Evaluate alternatives and recommend a long-term monitoring program by spring 1996. Costs to conduct this research are uncertain and no base funds are currently available to conduct this work.

123. Implement a long-term walrus population monitoring program by 1997

Based on the outcome of task 11 and research conducted under 122, implement a comprehensive long-term population monitoring program by FY 1997. The FWS should take the lead in ensuring monitoring will be conducted on a regular, on-going and cost effective basis with results being reported promptly and used to assess the population status with respect to requirements of the MMPA. The funds required to implement this task will be identified through the recommendations of task 12. No funds to conduct long-term monitoring are now part of the base budget; these monies will need to be in place by FY 1997 if this task is to be implemented.

13. Convene an interagency working group to assess the need for, and if appropriate prepare, a comprehensive and coordinated monitoring regime for terrestrial haulouts in Bristol Bay and other USA locations; factor into Ecosystem Initiative

The total number of walruses using haulouts in Bristol Bay during the summer and the relative use of these sites has varied dramatically in the last decade. Counts of walruses on shore in that region are needed for several reasons. Approximately 7 percent of the entire population uses this area (Gilbert 1989); because those animals are almost exclusively males, they represent an even larger fraction of the male population. Furthermore, frequent land-based counts provide a more reliable estimate of the local population size than do instantaneous aerial survey counts. These data played an important, but controversial, role in establishing regulations intended to reduce disturbance to walruses from the yellowfin sole fishery. Continuation of those counts may be important for monitoring effectiveness of these regulations, assessing trends in the local population size and, potentially, as an index of trends in the overall population, provided they are collected

in a systematic manner that is part of a well thought out research plan. However, costs associated with obtaining these data are not insignificant.

The ADFG, in cooperation with the FWS, has conducted ground counts at Round Island, in the WISGS, most years since 1977, but the effort has been variable depending on other duties assigned to the monitors. Visits by tourists more than doubled on Round Island between 1985 and 1987; through a permit system, visitation has been held relatively constant since then. However, the ADFG staff spends an increasing proportion of their time managing tourists and performing routine maintenance, leaving less time for counting walruses or conducting related studies. In addition to overall budget reductions, funding of the Sanctuary in recent years has not kept pace with increases in operating expenses, thus available funds are insufficient to maintain the existing program. Additional expenses, associated with increased monitoring duties or the proposed change to permit access for hunting, will require additional funds.

In summer 1981 walruses hauled out at Cape Peirce in the Togiak National Wildlife Refuge (TNWR) for the first time since the turn of the century. Systematic monitoring began in 1985. In the last few years, FWS and ADFG personnel have standardized data collection at Cape Peirce and Round Island (Jemison 1991). Reduced TNWR budgets and a termination of support from the Minerals Management Service (MMS) for sea bird projects has forced the TNWR to increasingly depend on obtaining funds for walrus monitoring from other FWS sources. Other higher priority tasks (e.g. 121) makes continuation of this support unlikely.

Walruses also haul out on Cape Seniavin, a site on State of Alaska land. There are no regulations specifically protecting walruses at this site (e.g. hunting or visitation may occur without restriction other than as prohibited by the MMPA). Walruses have been counted there sporadically by FWS personnel.

An interagency meeting should be held to address the value of monitoring walrus numbers in Bristol Bay. Until the late 1980s, counts of walruses in Bristol Bay had been sporadic, inconsistently conducted, and not well coordinated. In some cases, the questions to be addressed and the kind of data required still need to be clearly identified through the preparation of detailed study plans. Justification for specific projects should be consistent with tasks identified and prioritized in this Plan (e.g. 412, 44, and 55). Once a sampling strategy has been developed, personnel and support needs can be identified for each haulout site. Study plans will assist in the acquisition of long-term support from agencies or alternative funding sources. These studies will contribute to, benefit from, and should be integrated with other work conducted under the broad category defined as the "Bering Sea Ecosystem Initiative" (task 39).

14. Cooperate with Russian biologists monitoring status and trends of walrus on coastal haulout sites in Russia and work toward standardizing methods to be used by both nations.

Opportunities to work on Russian haulout sites are likely to occur in the process of completing tasks identified elsewhere (e.g. 122, 32). Invitations to visit USA haulout sites should be extended to Russian biologists conducting haulout studies in the process of carrying out tasks such as 412, 44, and 54. These exchanges will provide opportunities to compare and standardize methods so results may be easily compared.

15. Monitor the health, condition, and vital parameters of the walrus population

Samples of teeth, reproductive organs, and other walrus tissues collected in the subsistence harvest or from cooperative research cruises have provided ancillary information for hypotheses about walrus population status and trends (Fay et al. 1989). Such data may become critical components of a population monitoring program. A sampling design needs to be developed that focuses on collection of data directly pertinent to monitoring the health, condition, and vital parameters of Pacific walruses. Study design should include review of previous data and evaluation of the frequency and size of samples available from the subsistence harvest and their utility in the following studies. It may be necessary to obtain an unbiased sample outside of the harvested portion of the population; mechanisms for obtaining such a sample would need to be evaluated.

151. Analyze reproductive tracts and teeth to determine the age and reproductive status of harvested walruses

Teeth (for age determination) and female reproductive tracts should be collected from the subsistence harvest and analyzed. Reproductive tracts should be analyzed to determine age of first ovulations and pregnancy rates. Those data should be analyzed to look for changes in age at first reproduction and overall reproductive performance. The age distribution of harvested animals should be compiled by location and compared with previous information. A review of previously collected data should be undertaken to determine the frequency of sampling. The relationship between samples collected from the harvest and the general population needs to be established.

152. Review and analyze walrus stomach contents data

Stomach contents from walruses collected in the spring harvests and cooperative cruises have been useful in describing their diet and may be useful for identifying changes in prey composition. A study is in process to review previously collected data and to determine the utility of further sampling (Fay and Sheffield, pers. comm.). Additional sampling and analysis should be conducted as appropriate.

153. Develop a body condition assessment

Data assessing blubber thickness of harvested walruses has been collected from spring harvests and research cruises. These data should be reviewed to determine the utility of such measurements. If found to be a useful indicator of animal health or fitness, appropriate additional sampling should be conducted and recorded in a standardized manner by experienced personnel. The usefulness of portable ultra-sound devices should be examined on both live and dead walruses. The utility of other measurements, such as blood chemistry, internal body fat, or width of dentine or cementum layers for assessing condition should be evaluated and condition monitoring protocols should be recommended for routine use as part of task 123. The data should be compiled, analyzed, and made available on a regular basis to determine trends in body condition.

154. Monitor contaminant levels in harvested walruses

Standardized protocols for collecting, analyzing, and reporting data from samples have been developed and should be followed. Review and publish results obtained through 1993 and provide analyses to public health agencies. Initiate a study to determine if there is a relationship between levels of key contaminants and walrus health. Collect and analyze benthic invertebrates for contaminants from major feeding and migratory regions. Identify sources of key contaminants. Funding identified in the Implementation Schedule is for a study to determine if a relationship exists between high levels of key contaminants and pathologies in internal organs. "Acceptable levels" of metals and other contaminants within walrus tissues need to be determined. Monitoring should be continued on a routine 5 year cycle. Results of contaminant monitoring studies should be made available to Native hunters, the scientific community, and public health agencies in a routine and timely manner.

155. Archive tissue samples in the National Marine Mammal Tissue Bank and other similar collections

Section 307 of the Marine Mammal Stranding Response Act (P.L. 102-587) directed the establishment of a National Marine Mammal Tissue Bank (NMMTB). The purpose of the Bank is to provide for standardized archival and analysis of tissues over a long term period. A related project is the NMFS, Alaska Marine Mammal Tissue Archival Project (NBS sponsored) whose purpose is to examine the transport of contaminants and other compounds through the polar ecosystem (Becker et al. 1988). The University of Alaska Fairbanks (UAF) Museum also maintains a regional collection of marine mammal tissue samples. Sampling conducted under task 154 should include samples for the NMMTB and other related programs.

156. Investigate walrus health using observations of Native hunters

Cooperate with the Eskimo Walrus Commission and others to develop and use traditional knowledge questionnaires regarding walrus health, distribution, and abundance. Native people spend more time than biologists looking into the insides of walruses. Traditional knowledge has been passed between generations of Native people for thousands of years. Monitors in villages need to systematically collect and incorporate these traditional observations about walrus health into quantifiable records as an additional means of detecting changes in animal health and population fitness.

16. Assess age/sex composition

Periodic assessments of the age/sex composition of the population may become a critical component of a population monitoring program (Tenner 1965; Kelsall 1968; Carrick et al. 1962; Caughley 1977), in part because the method can be used to estimate recruitment as well as productivity and juvenile survival. Walruses can be sampled visually for sex and age class because they are sexually dimorphic and their relative tusk size corresponds to age class (Chapskii 1936; Brooks 1954; Fay 1955; Mansfield 1958). Juvenile mortality rates have been estimated from such data collected aboard ships (Fay and Kelly 1989). Cow:calf ratios of Pacific walruses can be estimated to within 3 percent from a sample of 2,500 animals (Czaplewski et al. 1983; Fay and Kelly 1989). Such data also may help to interpret results from other studies such as aerial survey data and the evaluation of reproductive success from female reproductive tracts. For example, these data will help to describe the biases associated with assessments of reproductive status of harvested animals relative to that of the population as a whole. This approach should be evaluated and, if appropriate, tested in a cooperative USA-Russia research cruise in the pack ice, perhaps as soon as FY 1995.

Objective 2: Define the Optimum Sustainable Population range for the Pacific walrus

For operational purposes, the FWS has defined the OSP for Pacific walruses as a range of population levels whose upper limit equals the maximal number of animals the environment will support (K) and whose lower limit equals the population level at which the greatest net population growth occurs, the Maximum Net Productivity Level (MNPL). Those limits have not been determined for the Pacific walrus population. Therefore, to ensure that the goals of the MMPA and this plan are met and that Pacific walruses are maintained at OSP levels, working estimates of the OSP range must be developed for comparison with current estimates of population size. In addition to selecting an approach to define these levels, studies may be needed to develop or improve estimates of parameters essential for making OSP calculations. Through the tasks described below and new direction provided by the 1994 amendments to the MMPA (e.g. conduct population

status reviews), the FWS will devise and, as appropriate, revise a working definition of OSP.

21. Estimate the number of walruses the habitat can support (K)

One way of estimating the K for walruses is by assuming the present K level is the same as the pre-exploitation population level. The pre-exploitation population level could be back-calculated from information on historic population levels and models of population growth. Other methods are the dynamic response analysis (Gerrodette and DeMaster 1990) or judging the population at a particular time to be at or near K, based on indirect measures, but those methods have been considered inappropriate in the case of the Pacific walrus population (Testa 1990).

For present planning purposes, the approach described by DeMaster (in Testa 1990) is suggested for estimating K. That approach requires estimates of current numbers, annual removals by hunting, maximal rates of population growth, and the population growth rate relative to population size. Limited knowledge concerning the age and sex composition of the walrus harvest over the last 120 years will limit the precision with which K can be estimated, and the range of estimates of historic abundance provided by that approach no doubt will be large. Efforts should be made to incorporate likelihood methods to determine historic abundance (McDonald, pers. comm.). A qualified biometrician should develop and assess estimates of K. In the future new tasks might be developed to modify those estimates based on new information or, alternatively, to develop new estimates based on entirely new approaches. Increased knowledge of the benthic ecology of the Bering and Chukchi seas may alter predictions about the carrying capacity for walruses.

22. Estimate the population size where the maximum number of calves are born each year (MNPL)

Determining MNPL is part of determining OSP. Knowing the OSP range is critical for selection of conservation strategies appropriate to current population status. Knowledge of the MNPL is especially important for Native hunters as well as the FWS because different harvest management measures (e.g. increased self-regulation) might be employed should a population approach this bound due to harvest pressure. Furthermore, under the MMPA, regulations directing activities to restore the population can not be promulgated until the population passes below this bound and becomes (by definition) "depleted." The MNPL could be estimated as a percentage of the estimated pre-exploitation population level by analogy to other, better understood species. For example, the MNPL of North Pacific fur seals (Callorhinus ursinus) has been estimated to be 60 percent of the historic K. Data are not available, however, for an appropriate analogue of a K selected benthic feeder such as the walrus. Another approach for calculating MNPL would be to examine results of a model that describes the pattern of walrus population trends over several decades of decline and recovery. Either independently or in conjunction with the study conducted under 21, a study should be undertaken to develop and assess estimates of MNPL for Pacific walruses.

Should the population be thought to be below MNPL, new language of the 1994 amendments to the MMPA (Section 101(b)) requires opportunity for public hearing prior to making a depletion determination. Congress specifically called attention to a need for the Secretary to identify and make available to Alaskan Natives the reasons for making such a determination.

23. Improve estimates of parameters needed to calculate upper and lower limits of the healthy population (OSP) range for walruses

Some parameters needed for calculating estimates of the current K and MNPL under tasks 21 and 22, respectively, will be developed or improved during the course of population monitoring studies conducted under other parts of this plan. For example, population size estimates will be developed under tasks 121 and 123, and harvest estimates will be developed under tasks 521 and 522. Other studies, however, may be needed to develop estimates of other key parameters. For example, estimates of pre-exploitation population size need to be reviewed and improved as part of task 21. If other parameters needed to calculate OSP are identified that have not been defined under tasks elsewhere in this plan, tasks should be developed and undertaken to review relevant data sets and theory and develop numerical values.

24. Determine the number and age/sex composition of walruses that can be taken each year while keeping the population within the limits required by the MMPA

Using information obtained in the above tasks and through conservative population models, develop an agreed methodology for calculating the total number of walruses that can be taken from all sources (harvest, loss, incidental catch, "small" takes, research, public display, etc.) per year. Following direction in the 1994 reauthorization of the MMPA, current information from a variety of sources (e.g. ice conditions, indices of health, traditional knowledge, data obtained in tasks 21, 22, 23, 424, and 43) will need to be incorporated into an estimate of Total Annual Removal and the prescribed calculation of Potential Biological Removal (PBR) to maintain the population within OSP range. These determinations will need to be provided to cooperative management organizations, hunters, industry, NMFS, and managers in a timely manner. So long as the population is not depleted, the level of subsistence taking will have to be considered first when making any other allocations for "small takes" (424), incidental take (43), and any other taking (e.g. research and public display). These allocations should be determined in a cooperative manner, involving a variety of agencies and organizations both from the USA and Russia. Various approaches to these tasks may be taken (e.g. through cooperative management agreements).

25. Identify actions to be taken if the population approaches or exceeds bounds of OSP

Plans need to be in place and agreed to by Russian managers, FWS, EWC, ADFG, and other interested parties in the event that the population is below or above the bounds of

OSP, or approaching those bounds. Population monitoring and modeling should be used to assess regularly the population status relative to OSP. Harvests of various sizes and age/sex compositions should be modeled to predict their impacts on population size and trends. Mechanisms for altering the size and composition of harvests throughout the range should be developed to ensure the population is maintained within the OSP range (see task 51).

26. Cooperate with the Secretary of Commerce to prepare a comprehensive stock assessment for the Pacific walrus

The 1994 amendments to the MMPA direct the Secretary of Commerce, in consultation with the appropriate regional scientific review group, to prepare stock assessments for each marine mammal stock which occurs in waters under the jurisdiction of the United States by August, 1994. (See also 43.)

Objective 3: Identify, protect, and monitor essential habitat of the Pacific walrus

The distribution of Pacific walruses changes seasonally and inter-annually. The significance of walrus concentration areas is not well known and it is difficult to predict the consequences of human disturbance or pollution of those habitats. Known regions of concentration include winter mating areas southwest of St. Lawrence Island and in the southeastern Bering Sea and, during summer, terrestrial haulouts of the Bering and Chukchi seas and the ice-edge in the Chukchi Sea. The locations of those concentrations varies between years depending on ice conditions. Certain traditional locations are used as terrestrial haulout sites (see Background, Habitat Requirements). A cooperative multi-organizational effort to describe important walrus habitat needs to be undertaken so essential habitat can be adequately monitored and protected.

The 1994 reauthorization of the MMPA and associated reports more explicitly provides for protection to essential marine mammal habitat. Congress emphasized its concern by including new language specifically protecting essential marine mammal habitat and by calling for immediate new research to monitor the health and stability of two key marine regions important as habitat for many marine mammal species.

31. Use remote sensing imagery and walrus distribution data to expand knowledge of relationships between walrus distribution and pack ice and oceanographic variables

Understanding distribution patterns and the variables that affect distribution is essential for designing and interpreting surveys. Assessment of habitat use during much of the year is made difficult by inter-annual variations in ice conditions. As remote sensing imagery becomes more sophisticated and offers higher resolution (e.g. Synthetic Aperture Radar Imagery), it should be employed to examine relationships between walrus distribution, ice conditions, and other oceanographic variables. Because of the high degree of inter-annual variation in those environmental parameters, this investigation should be over a time scale

of decades. Using data from previous surveys, the distribution of walruses on ice should be examined as a function of extent and location of the ice edge, water depth, and benthic productivity. Considerable ice data may be available through cooperative studies with Russian biologists.

32. Assess habitat use patterns and diving behavior

The importance of at-sea habitat for walrus feeding and social behavior is largely unknown. Food may limit population size (Fay et al. 1989), and feeding behavior may be important in determining social organization (Taggart 1987). To protect at-sea habitats, the location and temporal use of feeding areas must be identified.

321. Continue development of reliable satellite-linked instrumentation and procedures for deployment

The FWS has been developing methods for tracking walruses at sea since the 1970s (Taggart and Zabel 1980; DeMaster et al. 1981; Taggart 1987). Satellite-linked radio transmitters first were applied to walruses by the FWS in 1987 (Hills 1992). Since then, close to 30 walruses have been tagged with these devices. Most transmitters provided data for periods of a few days up to several months. The performance of satellite tags on walruses is still at a point where considerable improvements need to be made prior to initiating large scale range-wide deployments. There is considerable variation in the accuracy of location data obtained from such tags. There will be a need to keep abreast of changing regulations and technology of agents used to immobilize walruses for instrument attachment.

322. Investigate at-sea movements and habitat use

Once reliable, cost effective capture techniques and instrumentation are available and the difficulties in obtaining accurate location data have been worked out, at-sea habitat use, particularly use of feeding and breeding areas, should be investigated further via satellite-linked tags that give diving information (dive depth, surface intervals, dive duration, diurnal and seasonal patterns, etc.). Data on the frequency and duration of feeding excursions and dives also may help to correct biases in aerial survey population estimates. Other geo-location devices and time-depth recorders should be evaluated and used as appropriate. Location, water depth, time-of-year, time-of-day, and frequency and duration of foraging dives should be determined for juveniles and adults of both sexes. Adequate sample size for each sex and age-class should be determined and provided for in fiscal planning. The results of previous satellite tracking should be evaluated to determine where and on what sex and age classes additional tags should be deployed. Results from aerial surveys and monitoring of coastal haulout sites needs to be incorporated into an overall assessment of habitat.

33. Assess the distribution and status of prey species in primary walrus feeding areas

Changes in diet, productivity and survival, blubber thickness, and age composition suggest that the Pacific walrus population may have declined during the past decade (Fay et al. 1989). Changes in diet and decreased blubber thickness, first noticed by Native hunters in the late 1970s, suggested a reduced food supply may be involved in the proposed decline. A better understanding of prey availability is needed to determine the carrying capacity of the Pacific walrus' environment. Primary walrus feeding areas should be identified from historical information, data collected in task 322, and other potential sources. Benthic sampling should be conducted to identify the distribution and densities of prey species in those areas and other regions likely to be subjected to potentially adverse impacts of bottom trawling or proposed commercial clam fishing (see task 44). Little is known about the life history and ecological relationships of many principal walrus prey species; available information should be reviewed and used to assess the ability of prey stocks to sustain predation by walruses.

34. Periodically check previously occupied, but infrequently monitored terrestrial haulout sites, to check for reoccupation or changes in abundance

Periodic surveys of previously occupied haulout sites should be conducted to determine if such sites are being used and to assess potential for reoccupation. Some sites are remote (e.g. St. Matthew Island, Amak Island) and are not visited frequently by biologists. These sites should be surveyed during population surveys, but more frequent visits might prove enlightening. Some of these sites may be subject to disturbance from a variety of human activities which may be precluding walruses from returning to the site.

35. Assess potential for competition for food between walruses, other marine mammals, and commercial fisheries

Walruses may compete with other marine mammals (eg. bearded seals) for some prey. The intensity of competition may be influenced by environmental conditions (eg. ice, sea temperature, etc.) and by the abundance of the competing species. Complex relationships are likely to exist which may be influenced significantly by human activities such as harvest and incidental catch of competitors and both direct and indirect affects of commercial fisheries in the Bering Sea. These relationships need to be examined as part of a comprehensive assessment of benthic ecology in the Bering and Chukchi Seas. Specific cruises to address specific questions may be desirable in some cases. However, these may be prohibitively expensive; approaches such as closely integrating this task with related tasks (33 or 44) or use of "platforms of opportunity" may be more cost effective. There may be opportunities to conduct these studies cooperatively as the NMFS has indicated they have a strong interest in seeing that these studies are conducted (NMFS, Resource Ecology and Fisheries Management Division, in litt.).

36. Assess acoustic habitat requirements

Understanding of the acoustic sensitivity of walruses is poor. Some workers have hypothesized that walrus behavior in the breeding season is similar to a "mobile lek" where large groups of females aggregating in suitable breeding season habitat are joined by groups of males who compete for access to breed (Fay et al. 1984b). Similarly, large socially connected groups of walrus may persist throughout the non-breeding season as walruses travel, feed, and rest (Taggart 1987). Walruses travel as widely distributed groups. They may remain in contact through complex underwater vocalizations, much in the same manner as some large cetaceans. This communication may explain why walruses are capable of traveling great distances to reappear almost simultaneously in large numbers in newly-opened leads, in breeding or feeding habitat in the pack ice, or on terrestrial haulouts to rest. Such behavior suggests they may rely on underwater communication and be sensitive to or even depend upon an underwater acoustic habitat free from human generated noise. The concept of acoustic habitat needs to be examined by conducting audiograms and behavioral studies using captive walruses, comparing these values to potential sound sources (fishing vessels, tugs, drill ships, etc.), and by conducting controlled behavioral studies in the wild to test walrus responses to a variety of stimuli. The potential for habituation needs to be examined. If possible, critical sound frequencies and levels should be identified and an attempt made to describe buffer zones or "important acoustic habitat" for walruses in specific regions and seasons.

37. Identify important habitat by seasons and sensitivity (e.g. breeding, resting, feeding, acoustic, etc.)

Review, compile, and digitize sources of historical and modern data on benthic resources, bathymetry, substrate composition, currents, ice, and walrus biology, behavior, and ecology for use in characterizing habitat importance. Incorporate data from habitat tasks described above. Establish criteria for assessing a hierarchy of relative importance of habitat for habitat protection.

38. Establish a Geographic Information System (GIS) database as a tool for habitat protection and for identification and resolution of conflicts

A GIS capable of recording, displaying, analyzing, and retrieving data on walruses and their habitat should be developed by the FWS in consultation with the EWC, the ADFG, other potential users, and experts in walrus ecology as well as people experienced in developing and employing GIS systems. Data compiled in task 37 and related tasks should be incorporated into the GIS. Such a tool could prove useful to identify potential resource conflicts and for reducing or mitigating adverse impacts of activities proposed within the range of the Pacific walrus.

39. Work with the Secretary of Commerce to undertake a scientific research program to monitor the health and stability of the Bering Sea marine ecosystem

In late 1993 the FWS began to implement a new "ecosystem approach" to fish and wildlife conservation for the regions and species under its jurisdiction. Ecosystem regions have been identified for the nation. Teams have been established to identify the critical research and management needs for each "ecosystem" and priorities established for budgetary purposes. The Bering Sea ecosystem has been identified as a high priority task within the FWS. The primary focus of walrus work within this task is to describe walrus habitat (e.g. feeding, resting, and traveling regions), prey distribution and abundance, the level and structure of removals due to incidental catch and harvest, and to identify human activities which might compromise walruses or their habitat.

Similarly the 1994 amendments to the MMPA direct the Secretary of Commerce, in consultation with the Secretary of the Interior, the Marine Mammal Commission, the State of Alaska, and Alaska Native organizations, to undertake a scientific research program to monitor the health and stability of the Bering Sea marine ecosystem and to resolve uncertainties concerning the causes of population declines of marine mammals, sea birds, and other living resources of that marine ecosystem. The program shall address the research recommendations developed by previous workshops on Bering Sea living marine resources, and shall include research on subsistence uses of such resources and ways to provide for the continued opportunity for such uses. To the maximum extent practicable, the research program undertaken shall be conducted in Alaska. The Secretary of Commerce shall utilize, where appropriate, traditional local knowledge and may contract with a qualified Alaska Native organization to conduct such research.

The FWS will work with the Commerce Department to integrate fully its Bering Sea Ecosystem Initiative into this work. For walruses, the initial focus of this work should be on the eastern Bering Sea (Amak Island to Cape Newenham and the region east) with subsequent work moving northeasterly through a wintering/pupping region south of Nunivak Island, on toward St. Matthew Island and north into the Bering Straits region). Such a project will most likely incorporate or contribute to some or all of the tasks identified in Objective 3 as well as others (e.g. 13, 152, 153, 154, 156, 41 et seq., 43, 44, 522, 55, and 65).

Objective 4: Identify, monitor, and manage other human activities (other than Native subsistence hunting) that may be detrimental to the walrus population

Disturbance, pollution, or other forms of habitat alteration in essential habitat could adversely affect the population. To prevent a reduction in the capacity of habitat to support walruses, it is necessary to determine how important different areas are to walruses

and how human activities affect walrus use of their habitat. Habitat that proves important should be protected from disruptive human activities. Assessing the effects of human disturbance in areas of walrus concentrations requires knowledge of (1) the animals' seasonal use of major haulout areas; (2) short-term and long-term behavioral responses to natural and anthropogenic disturbances; (3) the variety, frequency, and intensity of disturbances; and (4) the sensory sensitivity of the animals to those disturbances. Disturbance should be limited to those instances specifically authorized by the MMPA. Consider issuing guidelines or informational materials about the adverse affects of approaching walruses on haulouts and the open water - sea ice interface.

41. Improve understanding of the effect of human activities on walruses on terrestrial haulouts and protect against those effects

Use of some terrestrial haulouts appears to be changing. The number and age-sex composition of walruses on haulouts should be monitored in a systematic and rigorous manner (see also task 13). Some haulouts, such as Cape Peirce and Round Island in Bristol Bay, are protected through specific regulations (e.g. NMFS fishing closures) more restrictive than the broad prohibition on harassment provided in the MMPA; others are not. Protection of the haulouts at Round Island and Cape Peirce, and the Russian haulouts should continue. The adequacy of protection of those sites should be reviewed periodically, in view of tasks 13 and 411. The need for protection at other haulouts should be investigated and implemented as found necessary to meet the overall goal of this plan.

411. Monitor the effects of commercial fishing activities on terrestrial haulout patterns in Bristol Bay and assess the effectiveness of closures

Large declines in the peak numbers of walruses on Round Island were observed in 1987 and 1988. Circumstantial evidence suggested that the decline was caused by noise from yellowfin sole trawling vessels. No yellowfin sole fishing occurred in the area in 1989. Since late in 1989, the NMFS has restricted fishing within about 22 km (12 nautical miles) of Round Island and Cape Peirce. In 1989, the FWS conducted preliminary acoustic studies to test equipment and methods that might be used to characterize noise levels from fishing vessels around the island and to assess the need for, and effectiveness of, the 22 km fishing restrictions. The study report has not been completed due to limited staff resources and other priorities. This work should be completed and distributed. Based on the results, further studies should be planned and conducted to achieve the initial objectives. Such monitoring work should address a wide range of potentially disruptive human activities through a scientifically rigorous approach including not only counts but behavioral and acoustic studies (incorporate data or integrate project with tasks 36 and 413).

412. Establish consistent Federal and State regulations for vessel closures to protect walrus haulouts

The ADFG restricts all access (e.g. vessel and air traffic) within 5.5 km (3 nautical miles) of Round Island in the WISGS from May 1 through September 1; access is by permit only. Additional protection is provided through the NMFS Bering Sea groundfish regulations prohibiting fishing (broadly defined to include transit) for groundfish fishing around some walrus haulouts within 22 km (12 nm). To improve consistency in the closure at Round Island, the State should consider closure of the unregulated 5.5 km "transit zone" around Right Hand Point.

Regulation of fishing and other vessel activities in State waters (mean high tide to 5.5 km offshore) around other walrus haulouts in Bristol Bay is inconsistent. For example, access for commercial fishing in waters within 5.5 km of Round Island is denied by the State Sanctuary managers. Cape Seniavin, Cape Peirce and other haulouts are unprotected sites having no specific restrictions on near-shore activities. A consistent approach to protecting walruses at important haulout sites needs to be developed through consultation with appropriate Federal, State, Native, fishing industry, and conservation organizations.

413. Monitor and minimize disturbance to walruses on haulouts due to tourism, research, illegal hunting, and other human activities not addressed above

Tourism increased in the late 1980s at Round Island and recently there has been increased interest for visits to Cape Peirce. Non-Native poaching may occur at Cape Seniavin, and hunting may occur (in violation of State access regulations) in the future at Round Island. Comprehensive studies will need to be conducted not only to determine their impact, but also to separate their relative importance to walrus haulout patterns from other potentially disruptive activities. These studies will need to be coordinated with other tasks. Results will need to be made available to managers in a timely manner so they may propose changes in policy and regulations guiding human use of haulout habitat.

414. USA and Russian managers should coordinate research and management activities to ensure consistent regulations pertaining to vessel closures and other protective measures in the vicinity of walrus haulouts

Haulouts in Russian waters receive protection from hunting and harassment and are surrounded by a 22 km (12 nm) zone closed to commercial fishing; whether such protection will continue and be enforced under the new Russian government is unknown. Regulations restricting human activities at or near haulout sites should be based on the best estimates of tolerable limits and, as warranted, should be updated as more data becomes available.

42. Monitor and minimize disturbance of walruses by industrial activities other than commercial fisheries (oil and gas exploration, development and production, mining, transportation, etc.)

The potential for disturbance of walruses by activities associated with offshore oil, gas, and mineral exploration and development has increased significantly with the advent of exploratory drilling in the northern Chukchi Sea (Brueggeman et al. 1990, 1992). Section 101(a)(5)(A) of the MMPA allows the incidental take of "small numbers" of walruses by industry providing that such take has a "negligible impact" on the population. For example, the FWS developed regulations authorizing incidental take of walruses in the Chukchi Sea from 1991-1996 by individuals engaged in pre-lease and post-lease oil and gas exploratory activities. Incidental take regulations are in effect during the open water season, defined as that period from June 15 to November 30. Incidental taking is not allowed when walruses are concentrated in the spring lead system (56 Fed. Reg. 27443-27465, 1991). The 1994 amendments to the MMPA added a new section, 101(a)(5)(D) allowing the "… incidental, but not intentional, taking by harassment of small numbers of marine mammals" for 1 year periods ("small take harassment authority"). A shortened review and comment period (120 days) was specified to expedite the issuance of such non-regulatory authorization for taking.

421. Develop regulations for the authorization of incidental take of small numbers of walruses under section 101(a)(5)(A) of the MMPA

Regulations, which are based on the best currently available data, have already been promulgated for the exploration in the Chukchi Sea area. Analysis of data collected under task 424 should be used to develop any further requests for incidental take of walruses due to new activities. Similar regulations may be needed for other areas and times of year as industry expands its efforts. Regulations need to clearly specify limits and levels of take as discussed in 422.

422. Review and respond to requests for Letters of Authorization to take small numbers of walruses incidental to industrial activities under 101(a)(5)(A) and (D)

In the event that regulations developed under task 421 are issued or requests for "small take harassment authority" are received, requests for permits or LOAs will need to be reviewed and responded to in a timely and consistent manner. Both the potential effects of an individual activity and the cumulative effects of all authorized taking should be considered when any incidental take permits are issued. Permits or regulations will require annual reviews of industry monitoring plans required by permit or regulations. Those reviews should: assess the adequacy of industry's proposed monitoring plan and how it should be improved, assess changes in projections of cumulative effects, and indicate whether a permit or LOA is to be extended. Comments will be solicited from the ADFG and EWC as part of the public review process.

423. Determine definitions for thresholds identified in section 101(a)(5) of the MMPA ("small" takes, insignificant vs significant effects)

Regulations implementing section 101(a)(5) should define "negligible levels" of take in population terms and identify how industrial activities will be kept from exceeding that level. Clear legislative or judicial guidance is needed concerning the terms "small" and "insignificant effects" so applicants will know in advance what levels of take will be considered appropriate and likely to be authorized by the agency for exemption.

424. Monitor the effects of specific industrial activities on walruses. Ensure removals are considered within the framework of item 24

One of the conditions for allowing the incidental take of walruses under section 101(a)(5) of the MMPA is required monitoring and reporting of the take. Consistent with regulations authorizing exploratory work in the Chukchi Sea, industry was required to conduct site-specific monitoring studies in 1991 to document interactions with walruses. The FWS will provide guidance to industry in developing monitoring plans and will review the results of monitoring annually to determine its adequacy and whether authorization should be continued or modified. As projects continue, collection of additional data will be required to further understand the effects of such disturbance on walruses and, as necessary, to revise current regulations (or permits) and develop regulations for other areas.

Monitoring should be designed in such a way as to allow detection and documentation of the effects of authorized activities on walruses in the immediate vicinity of those activities. The FWS will seek scientific peer review of proposed monitoring plans and subsequent reports from a variety of sources. Reviews should include "… the appropriateness of methods proposed to be used to determine when, where, what, how and how many marine mammals are taken incidental to authorized exploration and development activities; the adequacy of planned survey effort; the reliability of survey and behavioral observation data; the appropriateness of statistical and other procedures used to analyze and compare data sets; and the validity of the program results and conclusions drawn therefrom" (Swartz and Hofman 1991).

High priority should be given to documenting the reactions of walruses to drill ships and icebreakers. Observations of the walruses' responses to industrial activity should include: (1) size of the group, (2) general age/sex composition of the group, (3) location of the group (on-ice or in-water), (4) closest point of approach to industrial activity, (5) distance at which walruses startled and lifted their heads, (6) distance at which walruses left floes (if originally on-ice) or dove and/or changed swimming direction (if in-water originally), (7) proportion of cow-calf pairs separated during flight response, (8) bearing from walruses to industrial equipment, (9) wind speed and direction at time of response, and (10) industrial activity occurring at time of response.

425. Monitor the walrus population for changes in status or health that might be related to oil and gas activities and review monitoring data to determine if modifications to previously issued regulations and LOAs (or permits) are appropriate

In addition to documenting and assessing site specific effects on walruses, understanding effects of human activities requires information on overall population trends. The FWS should incorporate monitoring studies and ongoing assessments of population status (tasks 123 and 15).

426. Identify other activities with the potential for adverse impact to walruses; reduce this potential through contact and distribution of educational materials

Appropriate agencies will need to take actions as activities are proposed or discovered that pose the potential for taking or otherwise affecting walruses and their habitat. In general the FWS should serve as the lead for notification of potential issues and for taking appropriate action. Such action may include notification that a "small take" regulation is needed, a research permit is needed, or suggesting ways to reduce the potential for disturbance to walruses. Examples include issuing a Notice to Mariners providing information to vessel operators about the need to proceed cautiously in the spring lead system to avoid disturbing migrating female and calf walruses, or contacting commercial air services with information about how flying over walrus in the pack ice can result in disturbance to walruses or walrus hunters.

43. Monitor and minimize taking of walruses incidental to commercial fishing activities and ensure removals are considered within framework of item 24

The FWS will continue to cooperate with the NMFS as they move toward developing a new process governing the incidental catch of marine mammals in commercial fisheries as prescribed by the 1994 amendments to the MMPA. Several activities will be required as part of this new process: (1) stock assessments (task 24), (2) participation in "take reduction teams," and (3) implementation and monitoring of incidental catch data. The FWS will work in cooperation with NMFS to implement a process to gather and assess information (both statistical data and biological sample material) on incidental catch of walrus and to recommend actions to be followed by regional take reduction teams if and when incidental take plans are prepared for walrus. It will be important for "take reduction teams" to: (1) specify steps for approaching the zero mortality goal of the MMPA, and (2) clearly outline a process that after considering Native subsistence taking and Russian harvests, will determine how to factor incidental taking and other takes into maintenance of the PBR level. Especially important are those cases where the combined USA-Russia harvest could approach or exceed the PBR, leaving little or nothing remaining to be allocated to incidental or other takes. The FWS has proposed previously that incidental catch of walrus be permitted beyond the PBR level so long as the total incidental catch remains at levels insignificant (e.g. $< 1\%$) relative to the PBR. Without such a mechanism, the potential exists for certain fisheries to be closed down or vessels prohibited

from fishing because the additional taking could be illegal. Monitoring of incidental take of walruses should be required as part of any such proposed regulations and Fishery Conservation Plans. The FWS will request these data from NMFS regularly and should incorporate them into estimates of Total Annual Removal (task 24, etc.). The additional issue of allocating takes when the fisheries takes are greater than 1 percent of the PBR will need to be addressed further as the process moves toward developing regulations. The FWS will work with the NMFS, industry, and Native interests where ever appropriate to ensure recommendations of the "Take Reduction Plans" take Native subsistence hunting into consideration and are incorporated into the Conservation Plan by reference.

44. Assess, monitor, and mitigate disruption of benthic food resources due to commercial fishing activities

Conduct a review of the effects of bottom trawling and clam dredging on benthic habitats and organisms important to walruses. Determine short and long term impact of bottom trawling on habitat and prey and subsequent impact to walruses. Results should lead to recommendations to reduce any adverse impact found through changes in Fishery Management Plans and appropriate regulations. Review MMPA habitat protection language to explore the FWS's ability to limit or mitigate resource exploitation that adversely affects marine mammals or their habitat; consider amending the MMPA to strengthen habitat protection language. Coordination with other agencies (e.g. NMFS, the State) and related tasks (e.g. 33 and 35) will provide a cost effective approach.

45. Cooperate with Russian biologists and managers to encourage implementation and enforcement of measures to protect walruses from adverse impact of commercial activities in Russia

Concern for the welfare of marine mammals and their habitats has been expressed by Russian biologists with the opening of resource development in Russia to outside commercial interests. In many cases, laws protecting marine mammals and their habitats from the adverse impacts of commercial development are reported to be non-existent or poorly enforced. Particular concern has been expressed for impact on walruses from offshore oil and gas development in the Arctic. The budgets of Russian resource monitoring agencies are inadequate. USA agencies will need to maintain close contact and be prepared to assist and cooperate to protect walruses and their habitat throughout their range.

46. Identify and prosecute walrus "poachers"

Harvest of walruses by persons other than Native Alaskans, generally termed "poaching," is illegal. Reports of such taking are infrequent, but not unusual and usually are of hunting from small planes or from fishing and recreational vessels. FWS Law Enforcement officers will expand cooperative work with the Coast Guard, the ADFG, and other organizations to investigate and prosecute such taking to the full extent of the law.

47. Assess cumulative impacts to walrus; implement measures to reduce adverse effects

Special attention should be paid to the cumulative effect of human activities and their impact on the population. This is an ongoing task touching on virtually all actions addressed in this Plan. Staff will consider the cumulative effects of human activities on walrus at appropriate opportunities.

Objective 5: Ensure that the subsistence/handicraft harvest is consistent with the provisions of the MMPA and will allow the population to remain within a healthy range

The harvest of Pacific walruses supplies an important source of food and cash income to Native inhabitants of the Bering and Chukchi sea regions. Walruses are harvested regularly in Alaska from Bristol Bay to Pt. Barrow. In the Bering Strait region especially, they historically provided meat for people and their dog teams; oil for fuel; stomach membranes for making drums; skins for boats, houses, and ropes; and ivory for harpoon tips, boat keels, tools, and art work. In recent decades, with a decreased need for dog food and an increased need for cash income, the relative importance of the meat has decreased, while the importance of ivory for carving has increased.

The MMPA provides that coastal dwelling Alaskan Natives may harvest marine mammals for subsistence or handicraft purposes if they are taken in a "non-wasteful manner." Currently the size and structure of the Native harvest is not subject to Federal regulation unless the walrus population size falls below its OSP range. The Conservation Issues section (IV) of this Plan summarizes the widely varying approaches taken over time to walrus harvest management and the inconsistencies between State and Federal management. The FWS believes the changes made in the 1994 amendments will work to the benefit of both hunters and the walrus population because the previous approach did not provide direction to either hunters or managers, and allowed for short term virtually limitless taking that may have resulted in long term population instability. Under the newly amended MMPA, various approaches to co-management may be implemented. However this new approach is ultimately worked out, the harvest of walruses should be monitored to ensure that it is consistent with the requirements of the MMPA and to provide data necessary for assessing its effect on the population. In addition, the number of walruses killed but not retrieved should be minimized and illegal trade in walrus ivory and other products should be prevented.

51. Initiate a program to manage the harvest of walruses through cooperative agreements with Alaska Native organizations to conserve marine mammals and provide for co-management of subsistence use by Alaska Natives

Pacific walruses are harvested by both Russia and the United States; the topic of international harvest management is addressed in 722. Domestically, the FWS believes the best approach to walrus harvest management is to implement the 1994 amendments to the MMPA authorizing the Secretary of the Interior to develop cooperative agreements with Alaska Native organizations to conserve marine mammals and provide co-management of subsistence use. Meetings should be held as soon as possible to open discussion on the development of such agreements.

Currently Alaskan Natives harvest walruses without knowing with reasonable certainty how many walruses can be taken without causing the population to decline. The Eskimo Walrus Commission (EWC) and the FWS issue notices to hunters requesting them to take only what they need, not to waste walruses, to reduce the number of females and calves taken, to reduce the number shot and lost, and reminding them of FWS Law Enforcement guidance on what is required to be taken. These notices have been based on general biological concepts; their effect on the size and structure of the harvest is unclear. Preliminary calculations indicate it is likely that the kill has exceeded the replacement rate in some years. Village walrus boat captain organizations have not been provided with specific information about safe harvest levels and there is no coordinated, formalized, and self-enforced international to national, national to local, step down approach to ensure the level of the harvest will keep the population within its OSP range. Since the harvest is clearly the single activity with the most immediate impact to population size and trend, it is imperative that the cooperative agreements called for in the 1994 amendments be implemented. Native Alaska walrus hunting organizations, scientists, and conservation organizations will need to work cooperatively to develop this new approach to harvest management.

The MMPA specifically noted that such cooperative agreements may include grants to Alaska Native organizations for, among other purposes--

> "(1) collecting and analyzing data on marine mammal populations;
> (2) monitoring the harvest of marine mammals for subsistence use;
> (3) participating in marine mammal research conducted by the Federal Government, States, academic institutions, and private organizations; and
> (4) developing marine mammal co-management structures with Federal and State agencies."

When using the term "co-management" the House noted it did not intend to grant any new political or governmental jurisdiction or judicial authority to Alaska Native organizations. The stated intent of this new language was that the Secretary of the Interior extend full cooperation as partners to Alaska Native organizations in the development and

implementation of marine mammal management plans. The House Committee noted the best way to conserve marine mammal populations in Alaska is to allow full and equal participation by Alaska Natives in decisions affecting the management of marine mammals taken for subsistence. Finally, in authorizing grants under this section, the Committee intended that such grants be made to Alaska Native organizations that directly represent subsistence users of marine mammals. The Committee expected that the Secretary, in administering grants, should provide an oversight role to ensure compliance with the law.

52. Monitor the Native Alaskan walrus harvest

Harvest monitoring is essential for collecting accurate data on the size and demography of the harvest. These data are needed to assess the impact of the harvest on the population and contribute to an assessment of population status relative to its OSP range (see task 21). The ADFG and the FWS, with the assistance of the EWC, monitored the Alaskan harvest from 1960 through 1989. A revised, but limited, monitoring program was reinitiated in 1991 by the FWS with input from and the cooperation of the EWC and hunters. A carefully designed harvest monitoring program remains to be fully implemented due to the lack of adequate resources and other FWS priorities.

Determining the total kill will require accurate estimates of (1) the total number retrieved, and (2) the number killed but not retrieved (struck and lost). Samples should be collected for monitoring productivity, sex/age composition, and other biological parameters.

521. Develop a long range Harvest Monitoring Program

In 1990, previous monitoring efforts were reviewed by the FWS to determine what changes were necessary to obtain accurate estimates of the total Alaskan harvest and what samples were needed. The review considered the frequency and locations of sampling, the measurements and tissues to be sampled, methods of sampling, costs of alternative methods, and the relationship between the Harvest Monitoring Program and the MTRP. Based on this review a limited HMP was proposed in cooperation with the EWC and hunters. The plan should be expanded and reviewed by EWC, ADFG, UAF, and the MMC, among others to reflect the newly mandated cooperative approach to management.

522. Expand the cooperative harvest monitoring program to sample the harvest

The FWS has planned a harvest monitoring program to be implemented in three phases as resources and staff become available. Current (FY 1994) funding levels allow for implementation of only the first of the 3 phases. In the current program monitors work each year in Diomede, Gambell, Savoonga, and Wales during the spring harvest. Phase 2 establishes spring monitors for Nome, King Island, Shishmaref, Point Hope, Point Lay and

Barrow and expands phase 1 work to a year round basis using local hires. In phase 3, tooth samples and other data will be collected in the remaining villages through the MTRP. A cooperative long range effort by the FWS and the EWC needs to be fully implemented. The selection of local Native people as Village Monitors should be done cooperatively; joint training efforts should be initiated. Eventually, as the program is developed, Village Monitors also could be responsible for environmental education promoting the subsistance lifestyle with a strong participatory conservation ethic. It is the goal of the FWS to see the creation of permanant part-time year around positions with liaison-type responsibilities similar to Refuge Information Technicians (see 613). Hunters voluntarily provide teeth for age determination and reproductive tracts for assessment of reproductive condition. Participation in the first season (1992) was good with teeth provided from about 50 percent of the harvest and reproductive tracts from about 20 percent of the females taken in the villages monitored. Participation in 1993 was similar except a smaller proportion of female reproductive tracts was obtained. Additional funding will be required to fully implement all phases of the Monitoring Program.

523. Compare information obtained through the Harvest Monitoring Program with that acquired through the Marking, Tagging, and Reporting Program

Integration of these data is incorporated into the revised HMP. A report reviewing the effectiveness of the MTRP will consider these data. The report is expected to be available in early 1994.

524. Cooperate with Russian biologists to work toward a standard method for assessing the effect of harvests on the population

Exchanges to discuss and review harvest monitoring programs of each nation should be carried out. A mechanism, perhaps formalized through international agreement (task 722), should be developed for timely exchange of harvest information and discussion of management actions.

53. Minimize the number of walruses struck and lost

A substantial proportion of the walruses struck by hunters is not retrieved. This contributes to the overall mortality rate. A harvest monitoring program should include an attempt to improve estimates of the number of walruses struck and lost by hunters to determine overall mortality from hunting. Management agencies and walrus hunters need to cooperate in estimating and minimizing the loss rate.

531. Determine the number of walruses struck and lost, factors contributing to losses, and find ways to reduce losses

The number of walruses shot but not retrieved should be determined as part of estimating total kill. Prior estimates of struck and lost may not reflect current hunting practices.

Biologists and hunters (through the EWC) should cooperate in designing and conducting a study to obtain a current description of hunting practices and estimates of the number struck and lost. A meeting should be convened at the conclusion of the study for hunters and biologists to evaluate the major causes of loss and propose means to minimize it.

532. Incorporate struck and lost rates into the calculation of total annual removal

Revised estimates need to be factored into harvest management regimes (task 51) and total allowable take (task 24).

533. Implement recommendations to reduce loss

Mechanisms proposed in 531 should be implemented through the HMP information and education element (tasks 62-64).

54. Hold a meeting to address harvest issues

The MMPA requires that harvest of walruses be conducted in a "non-wasteful manner." The situation is complicated because the economic life of Native hunters has changed substantially in recent decades. In addition, while guidance is provided through regulations and policy statements issued by the FWS, the definition of what constitutes "waste" for walrus needs to be more thoroughly addressed and clarified. The EWC should hold an interdisciplinary meeting of Native elders, hunters, economists, wildlife managers, social anthropologists, and others to evaluate the causes of "head-hunting" and other wasteful taking. The consequences of wasteful taking should be examined in terms of modern Native culture, compliance with the MMPA, and the perceptions of the public at large. Specific recommendations to minimize wasteful taking should be formulated.

541. Implement actions to encourage non-wasteful take

Native elders traditionally set standards and guidelines for hunters in their communities. Based on the discussions in tasks 531 and 54, the EWC should encourage village elders to influence hunters to minimize wasteful taking of walruses. The EWC and the FWS should emphasize the importance of minimizing wasteful take under tasks 63 and 64. FWS Law Enforcement should be expanded in the Bering Straits region. Estimated costs in the Implementation Schedule reflect both personnel and aircraft acquisition; these programs include activities for polar bears, and to a lesser extent, sea otters.

55. Determine the impact of a limited walrus harvest from Round Island as part of a comprehensive assessment of walrus management

Residents of Togiak have requested the Alaska Board of Game (BOG) to permit access to Round Island in the Walrus Islands State Game Sanctuary for purposes of an annual,

limited, walrus harvest. The BOG has requested the FWS to assess walrus management concerns in Bristol Bay (see task 13). The recommendations of the Task Force, the ADFG, and the BOG should be considered in task 13. As of September, 1993, the State has indicated they will not consider further this request "because no government agency had authority to regulate a harvest" once access is permitted (Rosier in litt.). Should the request be reconsidered and approved at a later date, hunting activities will need to be monitored and the take considered in any harvest management regime.

56. Regulate trade in walrus ivory

With decreased availability of elephant ivory, demand for walrus ivory may increase. Illegal trade in raw walrus ivory encourages excessive harvest and takes money away from legitimate ivory carvers. The health of walrus populations, the economic well-being of Native carvers, and the MMPA require prevention of illegal trade in walrus ivory.

561. Expand law enforcement efforts to closely regulate trade in walrus ivory

The FWS Law Enforcement Division has been increasingly active in pursuing prosecution of illegal trade in walrus ivory. These activities have proceeded with the cooperation and assistance of the EWC and the Native hunting community. The FWS must continue and expand education and enforcement activities both within and outside of Alaska to reduce illegal trade in walrus ivory.

562. Continue and improve marking and tagging program for harvested walruses

In October 1988, the FWS implemented requirements of an amendment to Section 109(i) of the MMPA (50 CFR Part 18), requiring the marking, tagging, and reporting of sea otters, polar bears, and walruses taken by Alaskan Natives. In 1991 monitoring of "beach-found" ivory (a legal take by non-Natives) was included in the program. The program helps prevent illegal trade and provides data on harvest levels. Within 30 days of the kill of a walrus or acquisition of raw ivory, the ivory must be presented to a local FWS tagging representative. That representative tags each tusk with a lead-headed wire tag attached through a hole drilled in the root end of the tusk and then marked with a liquid containing identifying micro-particles. An attempt is made to count calves in the harvest, but they are not tagged. When possible, tagging representatives record the date and place of kill, sex, age, tag numbers, date of tagging, tagging location, and length and circumference of the tusks. As of December 1992, 104 tagging representatives were in 80 villages and towns. The EWC and the North Slope Borough Department of Wildlife Management cooperate in arranging for local tagging representatives, most (80%) of whom are Natives.

After the second year of the tagging program, the FWS identified several problems with the program, including under-counting of calves in the harvest and a lack of specific data on the levels of compliance (FWS, unpublished data). The marking and tagging program should be continued and improved as a means of combating illegal ivory trading. Funding

for the extensive travel required by this program has been inadequate and has limited the ability of the FWS to follow up on tagging records, a key element to the success of the program.

563. Maintain an on-going review of walrus-related proposals and actions relative to the CITES

CITES is an international convention for regulating international trade in endangered and threatened species or parts. In recent years interest has continued in listing walruses on Appendix II (see "Conservation Issues," item F.). The FWS anticipates international interest in further restricting trade in walrus parts, and will promptly review any proposals to change the listing status of walruses in cooperation with the ADFG, the EWC, the MMC, and other interested parties.

57. Work cooperatively to ensure the annual removal due to all components of the harvest (USA and Russia combined harvest including retrieved, lost, waste, and illegal taking) does not exceed levels of total annual removal determined in 24

The FWS also should continue its participation on the newly formed Walrus International Technical and Scientific group as a mechanism to further international communication and cooperation. See also tasks 721 and 722.

58. Develop and implement regulations easing import restrictions on personal marine mammal items for cultural exchange

The 1994 amendments to the MMPA added a new section, 101(a)(6), allowing the importation of marine mammal products into the United States (USA) when such products were exported by a citizen in conjunction with travel outside of the USA; such products are imported by Native Alaskans through cultural exchange; are imported by Native inhabitants of Russia, Canada, or Greenland visiting the USA as part of a cultural exchange. A process for documentation of items crossing the border will have to be developed or appended to existing procedures.

Objective 6: Establish information and education programs promoting the conservation of the species through increased understanding.

61. Develop information and education materials to further public knowledge and understanding of marine mammals and their habitat

Such programs are not in place for marine mammals; current funding is inadequate to develop these materials. Public interest in marine mammals is high and there is a need to provide biological information to many segments of the public. There is a specific need to develop conservation education materials outlining FWS management and research programs for, and with Alaskan Natives, with every age level being targeted. Such

programs will not only benefit the species, but also result in increased public support for sound management and research programs.

62. Determine ways to increase the flow of information between managers, scientists, conservation groups, and Native users

The FWS, in cooperation with other organizations, should convene a workshop of specialists in environmental education, Native culture, rural villages, and conservation biology to create a medium range (5-10 yr) action plan for an interdisciplinary, multicultural information and education program.

63. Develop a Village Information Technician program in rural Alaskan villages to increase communication between resource management agencies and Native users

There are a number of Refuge Information Technician positions within national wildlife refuges in Alaska. These are cultural specialists and interpreters who work to benefit both Native and FWS interests. Working through the EWC, the FWS is training Native Alaskans as Village Monitors in the walrus Harvest Monitoring Program. The current positions are seasonal, but additional training and materials should be provided in environmental education for use in village primary and secondary schools. The goal is to formalize these into long term Village Information Technician positions and to provide greater opportunities for these individuals by expanding their work to include other FWS programs. Through these positions, the FWS hopes to understand the needs of Native Alaskans and to incorporate these needs into management and research activities.

64. Develop and implement two-way educational programs for primary and secondary schools

Based on the recommendations of task 62, Native liaisons (task 63), and through other means (e.g. Information and Education professionals at the National Training Center), materials should be developed on the conservation and use of Alaskan marine mammals. Programs should be developed for both rural and urban communities. Emphasis on Native values and use of marine mammals should assist those outside of those communities to understand better the needs of a subsistence lifestyle. Clear explanation of the methods employed in biology and management should assist hunters to understand clearly scientific methods and how science can help them to keep populations within a healthy range (OSP). Scientists and managers should also learn ways to incorporate Native knowledge into their programs.

65. Make educational materials available to Refuges, conservation groups, and other organizations for their use and dissemination to the general public

School materials should be modified for the general public. The National Wildlife Refuge System has excellent educational programs. Materials should be provided to the many conservation and scientific groups with active education programs (e.g. the Society for Marine Mammalogy, the National Wildlife Federation).

66. Incorporate ideas generated by education programs into management and research programs

These outreach programs are likely to generate questions and suggestions about FWS or cooperative management programs. A mechanism needs to be established to get this feedback to hunters, biologists and managers.

Objective 7: Coordinate Federal, State, Native, international, and other cooperative conservation efforts

The FWS must provide staff to administer and coordinate the walrus management program described in this Plan. It also must provide funding and support for program coordination and planning, including periodically reviewing and updating this plan.

71. Conduct short and long range planning

711. Designate and support a walrus management/conservation coordinator

A member of the Marine Mammals Management staff of the FWS, knowledgeable about walrus ecology and management issues, should continue to serve as a walrus conservation coordinator and be provided support for overseeing the provisions of this Plan.

712. Conduct periodic review, revise and update this plan as necessary to reflect new activities, biological findings, and conservation agreements

The Walrus Conservation Plan should be reviewed, revised, and updated on a continuing basis; general meeting(s) of interested publics will be scheduled as determined to be necessary by the FWS. A 5-year evaluation of the Plan should be conducted to determine the future plan needs relative to accomplishments.

713. Identify and obtain the resources required for the implementation of a long-range, scientific and comprehensive walrus conservation program

Disseminate this Conservation Plan as one mechanism for showing the need for, and required levels of, adequate long-range funding. Develop detailed budgets for specific

tasks; seek funding for these tasks in a prioritized manner. Develop a cooperative approach with other agencies and organizations (e.g. NMFS, MMS, NPFMC, and appropriate Russian organizations) whenever possible to maximize funds acquired.

72. Cooperate with Russian managers and scientists to:

721. Carry out provisions of the Walrus Conservation Plan (i.e. see items 11, 12, 14, 24 45, 515 and others)

722. Develop an agreement with Russia on the conservation of the Pacific walrus

Close cooperation with Russian managers, researchers and users is vital to the conservation of shared resources such as Pacific walruses. Since 1974, bilateral research and management activities have been coordinated through the Marine Mammal Project of the USA-USSR Environmental Protection Agreement. The FWS, in close coordination with the EWC, should seek to formalize continued cooperation with Russian officials to carry out provisions of this Conservation Plan, particularly those related to range-wide census efforts, allocation of harvest, and the collection and analysis of samples from harvested walruses. Procedures for standardizing data collection and their prompt exchange should be agreed to by both nations.

73. Increase the level of participation of Native users in the development and implementation of walrus management and research programs

Assisting Alaskan Native organizations to obtain financial resources could facilitate participation in cooperative management. These resources could be used by Alaskan Native organizations to hire professional biologists and subsistence use specialists. Such personnel could facilitate interaction with Federal and State managers and biologists. This could assist in development and implementation of cooperative management, research, and education programs.

74. Develop and implement cooperative agreements to carry out specific management and research activities

A three-way agreement exists between the EWC, the State of Alaska and the FWS. Expansion of that agreement or the development of additional agreements should considered to implement more fully the goals, objectives, and tasks identified by this Plan. This approach also has been advocated in the past by the EWC, the State, and others.

VI. IMPLEMENTATION SCHEDULE

The approach advocated by this Conservation Plan is cooperation between management agencies, Native users, and the institutions, organizations, and individuals interested in the

Pacific walrus. Sharing the responsibilities for management, research, and conservation of Pacific walruses will result in increased benefit to the species and the parties concerned. Cooperative management recognizes the value of active participation by those closest to the resource as well as those trained in resource management or working within the authorized agencies. In Alaska, cooperative management of marine mammal resources has been exemplified by the Alaska Eskimo Whaling Commission, the Eskimo Walrus Commission, the Alaska Inuvialuit Belukha Whale Committee, and the Alaska Sea Otter Commission. Those groups provide an organized structure for the participation of indigenous people in the management of their traditional resources.

The Conservation Plan for the Pacific walrus was developed with input from the EWC, the MMC, and other members of the Walrus Management Planning Team. It is recognized that cooperative efforts will be necessary to manage harvest and carry out numerous conservation measures necessary to maintain the population within healthy (OSP) levels. The Implementation Schedule is intended to specify and prioritize research and management actions to be undertaken as well as the estimated costs and time required for completion. Background information for each task is provided in the Conservation Plan. Task numbers in the Implementation Schedule refer to those in the Conservation Plan.

The recent formation of the National Biological Survey (NBS) in October 1993 should be noted when reviewing implementation tasks. Certain research programs previously associated with the following agencies were combined to form the NBS: FWS, National Park Service, Bureau of Land Management, and MMS. The roles and responsibilities of this organization are evolving, although it is expected the NBS will continue many of the research functions for walruses. Because of this recent change and the uncertainty of roles and responsibilities for the newly emerging NBS, research functions previously identified as a FWS responsibility have accordingly been assigned to NBS. Future clarification or revision of these roles may be necessary.

Dollar values are estimated in 1994 dollars. These values are estimates (e.g. +/- 25%) only and are certainly subject to change as more information becomes available and detailed budgets are prepared. They do not reflect a commitment on the part of any agency or organization to fund these tasks. FWS support for the plan is subject to future appropriations. Estimated costs are presented to show what resources are needed to carry out the actions determined to be important to sound management of the Pacific walrus.

Priorities have been set according to the following criteria:

> Priority 1: These tasks are essential for sound management or they provide data or are actions required by law. These tasks are essential to determine if the population is crossing a critical breakpoint (i.e., K or MNPL) and, if so, what the essential action should be. For example, not having this information could lead to over harvesting or unchecked population growth because agencies, hunters, conservation organizations, or others, would be uncertain where the population is relative to the

MNPL or K; Native organizations would not know how to advise hunters of appropriate harvest levels.

Priority 2: These tasks provide information critical to management actions required or suggested by law, provide information essential for monitoring impact of regulations or other legislation, or provide information essential to sound long-term management actions.

Priority 3: These tasks provide information contributing to sound long-term management of the species through collection of new data (i.e., discovery of new threats, or voids in species biology) or otherwise support completion of higher level tasks.

Organizations represented in the following tables are shown in the List of Acronyms. "TBD" means to be determined, "y" stands for years, and "m" stands for months.

WALRUS PLAN IMPLEMENTATION SCHEDULE						Est. Fiscal Year Costs					
	Task			Agency		(thousands of $)					
Brief Description of Plan Task	#	Priority	Duration	Lead	Coop	Year 1 (FY94)	Year 2	Year 3	Year 4	Year 5	Comments
Population monitoring workshop	11	1	1 m	FWS NBS	EWC MMC UAF NMFS		50				
Conduct range wide aerial survey (Alternatives)	121 b	1	1.5 y	FWS RF	EWC ADFG				550	250	121a: all funds into 122, 153, 16, 21, 22. Selection of alternative TBD from outcome of task 11
	121 c	1	1.5 y	"	"			250	850	150	
Develop alternative population monitoring & assessment methods	122	1	5 y	NBS FWS	ADFG EWC RF		TBD	TBD	TBD	TBD	
Implement a long-term comprehensive population monitoring program	123	1	ongoing	FWS RF	EWC UAF				TBD	TBD	cost depends on 11 and recs from 123
Hold interagency meeting to assess value & procedures for a monitoring regime for haulouts in Bristol Bay; implement regime as appropriate.	13	1	1 m ongoing	FWS ADFG	EWC NPFMC NMFS	30 /yr FWS (MMM/AFWRC) 50 /yr ADFG (WISGS) 30 /yr FWS (TNWR) 20 /yr NPFMC/NMFS					meeting in 1994; some long term projects to be done under 412, 44, 55.

WALRUS PLAN IMPLEMENTATION SCHEDULE						Est. Fiscal Year Costs					
	Task			Agency		(thousands of $)					
Brief Description of Plan Task	#	Priority	Duration	Lead	Coop	Year 1 (FY94)	Year 2	Year 3	Year 4	Year 5	Comments
Exchanges w/ Russian biologists to cooperate in haulout work	14	2	ongoing	FWS RF	NBS ADFG			25	25		included w/ 122, 32, 412, 44
Determine reproductive status & age from Alaska harvest	151	1	ongoing	FWS	EWC UAF	20	50	100	100	100	funding tied to expansion of 522
Analyze stomach contents procedures	152	2	2 y	UAF	NBS FWS	20	20				data to 123, 522
Develop body condition indices	153	2	5 y	NBS FWS	EWC UAF		25	15	15	15	if useful, process used in 123, 522
Assess levels & effects of contaminants	154	2	ongoing	FWS	EWC	20	50	30			move to 5 yr cycle
Archive tissue samples	155	3	ongoing	EWC FWS	NMFS UAF						included w/ 522
Investigate walrus health using observations of Native hunters.	156	2	ongoing	EWC	FWS						included w/ 522

WALRUS PLAN IMPLEMENTATION SCHEDULE						Est. Fiscal Year Costs					
	Task			Agency		(thousands of $)					
Brief Description of Plan Task	#	Priority	Duration	Lead	Coop	Year 1 (FY94)	Year 2	Year 3	Year 4	Year 5	Comments
Age/sex composition: methods test & (possible) periodic monitoring	16	1	1 y or more	NBS FWS	RF UAF		100	20	TBD	TBD	If useful (TBD), incorporate in 123
Estimate "K"	21	1	1 y	FWS NBS	MMC EWC		50				consider contract
Estimate MNPL	22	1	1 y								included w/ 21
Improve other parameter estimates needed for OSP determination	23	1	1 y	FWS NBS				10	10	10	1st yr w/21, review update w/in 24
Determine allowable take levels	24	1	ongoing	FWS NBS	EWC MMC		50				develop model 1st yr, then follow up
Plan response if population approaches or exceeds OSP	25	1	ongoing	FWS RF	EWC MMC						

WALRUS PLAN IMPLEMENTATION SCHEDULE						Est. Fiscal Year Costs					
	Task			Agency		(thousands of $)					
Brief Description of Plan Task	#	Priority	Duration	Lead	Coop	Year 1 (FY94)	Year 2	Year 3	Year 4	Year 5	Comments
Prepare stock assessment	26	1	.2 y	NMFS	FWS		5				Timing directed by 1994 MMPA; will need to be updated
Determine relationship between ice, oceanography, & distribution	31	2	5 y	NBS FWS	RF UAF NOAA		30	10	10	10	
Develop reliable satellite tag	321	2	3 y	NBS FWS	EWC RF		60	30	30		w/ other nations
Evaluate at-sea movements & habitat use	322	2	10 y	FWS RF	EWC ADFG					200	start-up dependant on success of 321
Prey distribution and status; determine primary feeding areas	33	3	10 y	FWS NBS RF	NPFMC NMFS EWC			400	200	400	coop. cruises every 2 yrs. tie in w/35 and 44
Monitor "old" haulouts	34	3	periodic	FWS	ADFG		15			10	tie in w/ 121 (abc)

WALRUS PLAN IMPLEMENTATION SCHEDULE						Est. Fiscal Year Costs					
	Task			Agency		(thousands of $)					
Brief Description of Plan Task	#	Priority	Duration	Lead	Coop	Year 1 (FY94)	Year 2	Year 3	Year 4	Year 5	Comments
Assess level & effects of competition with other marine mammals & fisheries	35	3	ongoing	FWS NMFS	NPFMC UAF		50				coordinate w/ 33, est. cruise cost incorporated w/ 33
Assess acoustics & habitat requirements	36	2	5 y	FWS MMS	NPFMC NMFS		30				1st yr contract; following w/in 411
Identify important habitat; synthesis of available data	37	2	ongoing	FWS NBS RF	UAF EWC		100	20	20	20	data from many tasks & sources
Establish GIS database	38	2	ongoing	FWS	MMC		50	50	25	25	data from 38
Bering Sea Ecosystem Studies	39	1	ongoing	FWS NBS	NMFS		200	200	300	350	some funds may come from tasks above
Monitor impact of fisheries at haulouts; assess closures	411	2	5 y	FWS	NPFMC NMFS		20	300	300	100	coordinate w/ 36 & 413, see also 13.
State & Federal regs. at haulouts	412	1	ongoing	FWS	ADFG	5	5	5	5	5	use 411 results

WALRUS PLAN IMPLEMENTATION SCHEDULE						Est. Fiscal Year Costs					
	Task			Agency		(thousands of $)					
Brief Description of Plan Task	#	Priority	Duration	Lead	Coop	Year 1 (FY94)	Year 2	Year 3	Year 4	Year 5	Comments
Assess impact of tourism, etc.	413	2	ongoing	ADFG FWS	EWC	40	40	40	40	40	coordinate w/ 411
US/Russia habitat protection	414	2	ongoing	FWS	RF	5	10	10	10	10	
Issue regulations under 101(a)(5)	421	1	ongoing	FWS	EWC & indus-try	50	50	50	50	50	
Issue LOA's	422	1	ongoing								included w/ 422
Clarify definitions in 101(a)(5)	423	1	ongoing	FWS							
Monitor effects of 101(a)(5) specific activities to walrus	424	1	ongoing	FWS MMS	EWC & indus-try						FWS costs w/422; MMS & industry fund through contracts
Assess effectiveness of regulations & LOAs	425	1	ongoing	FWS	MMC	25	25	25	25	25	incorporate 123, 15

WALRUS PLAN IMPLEMENTATION SCHEDULE						Est. Fiscal Year Costs					
	Task			Agency		(thousands of $)					
Brief Description of Plan Task	#	Priority	Duration	Lead	Coop	Year 1 (FY94)	Year 2	Year 3	Year 4	Year 5	Comments
Monitor & regulate incidental take	43	1	ongoing	NMFS	FWS	10	10	10	10	10	
Assess damage to benthic habitat	44	3	3 y	NMFS FWS NBS	NPFMC ADFG		25	250	100		results to 33 integrate w/ 411
US/Russia cooperation to reduce impact from commercial activities	45	2	ongoing	FWS RF	NPFMC EWC						included w/ 422 & 423
Identify & prosecute "poachers"	46	1	ongoing	FWS	EWC	50	350	150	150	150	
Assess cumulative impacts	47	2	ongoing	FWS							FWS program costs
Harvest Management: develop and implement a cooperative approach	51	1	ongoing	FWS EWC	many	10	40	45	50	55	integrate with 522 and 63
Develop and review long range plan for Harvest Monitoring Program	521	1	.3 y	FWS	ADFG MMC EWC UAF	5					

WALRUS PLAN IMPLEMENTATION SCHEDULE						Est. Fiscal Year Costs					
	Task			Agency		(thousands of $)					
Brief Description of Plan Task	#	Priority	Duration	Lead	Coop	Year 1 (FY94)	Year 2	Year 3	Year 4	Year 5	Comments
Monitor Native harvest	522	1	ongoing	FWS	EWC	100	200	300	300	300	Implementation of full 3 tier prog.
Compare monitoring & MTRP data	523	2	ongoing	FWS		10	15	15	15	15	
Cooperate w/ Russians on harvest monitoring and data exchange	524	1	ongoing	FWS RF	EWC	25	25	25	10	10	contributes to 722
Determine struck and lost	531	1	2-3 y	EWC	FWS NBS		50	40	60		
Incorporate struck & lost into 24	532	1	ongoing	FWS							included w/ 24
Reduce number of struck & lost	533	1	ongoing	EWC	FWS			10	10	10	monitor after 531
Harvest issues workshop and monitoring	54	1	ongoing	EWC	FWS MMC			50	10	10	after 531 hold workshop & monitor
Encourage non-wasteful take through I&E and expanded law enforcement	541	1	ongoing	FWS	EWC	400	1200	500	500	500	

WALRUS PLAN IMPLEMENTATION SCHEDULE						Est. Fiscal Year Costs					
	Task			Agency		(thousands of $)					
Brief Description of Plan Task	#	Priority	Duration	Lead	Coop	Year 1 (FY94)	Year 2	Year 3	Year 4	Year 5	Comments
Access to Round Is. for hunting issue; monitor if approved	55	1	??	ADFG	EWC FWS		20	20	20	20	monitor if approved
Closely regulate trade/expand L.E.	561	2	ongoing	FWS	ADFG	175	175	675	675	675	
Expand MTRP	562	2	ongoing	FWS	EWC	185	250	300	300	300	
Review/interact w/ CITES proposals	563	1	ongoing	FWS	EWC	10	10	10	10	10	
Develop, monitor procedures for import for cultural exchange	58	1	ongoing	FWS	INS						
Expand I&E programs for marine mam.	61	1	ongoing	FWS	EWC	5	50	25	30	40	
Multi-cultural I&E workshop	62	2	.5 y	EWC	FWS MMC		50				
Establish village I&E technicians	63	2	ongoing	EWC	FWS	10	50	100	150	200	

WALRUS PLAN IMPLEMENTATION SCHEDULE						Est. Fiscal Year Costs					
	Task			Agency		(thousands of $)					
Brief Description of Plan Task	#	Priority	Duration	Lead	Coop	Year 1 (FY94)	Year 2	Year 3	Year 4	Year 5	Comments
Develop I&E materials for schools	64	2	ongoing	FWS	EWC		100	50	50	50	
I&E outreach (Refuges, etc.)	65	3	ongoing	FWS	NPS			20	10	10	
Incorporate feedback from I&E	66	2	ongoing	FWS	EWC						included throughout
Walrus Management Coordinator	711	1	ongoing	FWS		25	25	25	25	50	
Hold Plan review meetings	712	1	ongoing	FWS	all	5	5	5	5	5	
Obtain necessary resources	713	1	ongoing	FWS NBS	EWC MMC NMFS NPFMC MMS						A PRIMARY PURPOSE OF THIS PLAN
Develop bilateral agreement with Russia for management, research & habitat protection of walruses	722	1	3 y	FWS	RF, EWC, State Dept.		30	30			

WALRUS PLAN IMPLEMENTATION SCHEDULE						Est. Fiscal Year Costs					
	Task			Agency		(thousands of $)					
Brief Description of Plan Task	#	Priority	Duration	Lead	Coop	Year 1 (FY94)	Year 2	Year 3	Year 4	Year 5	Comments
Increase Native participation in planning, conservation, & research	73	1	ongoing	EWC	FWS NBS		100	100	100	100	
Develop cooperative agreements	74	1	ongoing	FWS	all						approach included throughout plan

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