ENDANGERED SPECIES ACT: SECTION 7 CONSULTATION
BIOLOGICAL OPINION

Action Agency:	National Marine Fisheries Service
Activity:	Issuance of Annual Quotas Authorizing the Harvest of Bowhead Whales to the Alaska Eskimo Whaling Commission for the Period 2013 through 2018
Consulting Agency:	National Marine Fisheries Service, Office of Protected Resources
Date Issued:	DEC 17, 2012
Approved By:	for Jim Balsiger

The National Marine Fisheries Service (NOAA Fisheries), Office of International Affairs, requested formal consultation on issuance of a quota to the Alaska Eskimo Whaling Commission (AEWC) for their harvest of bowhead whales (*Balaena mysticetus*) for the period 2013-2018 by letter dated September 27, 2012. This opinion considers the effects of this action on threatened and endangered species under the jurisdiction of NOAA Fisheries. In formulating this Biological Opinion, NOAA Fisheries used information presented in a preliminary version of the 2012 Final Environmental Impact Statement for Issuing Annual Quotas to the Alaska Eskimo Whaling Commission for a Subsistence Hunt on Bowhead Whales for the Years 2013 Through 2013, reports from the International Whaling Commission, its Scientific Committee and its Subcommittee on Aboriginal Whaling, along with other research relating to bowhead whales and information provided by NOAA's National Marine Mammal Laboratory, the North Slope Borough, the Alaska Eskimo Whaling Commission, and the traditional knowledge of the Alaskan Eskimo community.

Consultation History

NOAA Fisheries has previously consulted on the issuance of strike quotas for bowhead whales. A Biological Opinion was signed on January 4, 2008 which described the effects of a 5-year quota for the years 2008 through 2012; an early consultation for a similar 5 year period was completed on February 20, 2003. Those consultations were preceded by preparation of an Environmental Assessment of the action released on December 9, 2002.

On September 28, 2012 and October 5, 2012, the Alaska Region, Protected Resources Division (PRD) received communications from the Office of International Affairs (OIA), requesting initiation of formal Section 7 consultation on the proposed issuance of a quota during 2013-2018 to the AEWC for harvest of bowhead whales, a species listed as "endangered" under the Endangered Species Act of 1972, as amended. On October 11, 2012 the Alaska Region

acknowledged receipt and initiated consultation with the OIA. The OIA concluded that the proposed action will have no effect on endangered humpback and right whales or to bearded and ringed seals (proposed for listing as threatened).

On October 2, PRD notified the State of Alaska of the proposed action and solicited information relevant to the action, including any results of studies that relate to the effects of the action and cumulative effects on the bowhead whale and its critical habitat. On October 16, 2012, the State replied offering support for the preferred alternative to issue a six-year quota, a belief that current levels of fisheries and harvest are not resulting in population level concerns, as well as other information considered later in this opinion.

A. Description of the Proposed Action

NOAA Fisheries proposes to issue annual quotas to the AEWC to allow continuation of their subsistence hunt for bowhead whales from the Western Arctic population[1] for the years 2013 through 2018 (NMFS 2012a). This action complies with section 101(b) of the Marine Mammal Protection Act (MMPA), section 10(e) of the Endangered Species Act (ESA), the Whaling Convention Act, and responsibilities under the auspices of the International Convention for the Regulation of Whaling (ICRW) by granting the AEWC a quota set by the International Whaling Commission (IWC) for taking bowhead whales for subsistence use.

Background

Eskimos have hunted bowhead whales along the coastlines of the Bering, Chukchi, and Beaufort Seas for at least 2,000 years (Stoker and Krupnik, 1993). This traditional harvest, often referred to as subsistence harvest, is the cultural and historical focal point for the indigenous Natives or Eskimos of Alaska[2]. In Alaska, 11 Native villages currently participate in subsistence whaling. Gambell, Savoonga, Little Diomede, and Wales are located in the Bering Sea; Kivalina, Pt. Hope, Wainwright, and Barrow are in the Chukchi Sea; and Nuiqsut and Kaktovik are in the Beaufort Sea.

The subsistence harvest of bowhead whales has been regulated by a quota system under the authority of the IWC since 1977. Quotas for aboriginal subsistence whaling are set based on cultural and subsistence need, provided that the quotas are either sustainable or low enough to allow populations to recover if they had previously been depleted by commercial whaling. The quota regulated through the IWC also allows Russian Natives to hunt bowhead whales from the Western Arctic population (IWC, 1998). The annual distribution of the quota between Russian and Alaska Natives is determined through a cooperative agreement between the U.S. and Russian Governments.

Alaska Native subsistence hunters take less than one percent of the population of bowhead whales annually. Since 1973, the number of strikes has ranged from 17 to 111 per year (Suydam

[1]Also referred to as the Bering-Chukchi-Beaufort Seas population and the Bering Sea Population.

[2]The Eskimo people of northern Alaska who traditionally hunt bowhead whales are Inupiat, while the Yupik Eskimos hunt bowheads from villages along the Bering Sea.

et al., 1997), depending in part on changes in management strategy as abundance estimates changed.

At its 49th annual meeting in 1997, the IWC approved a 5-year quota for the aboriginal take of the Western Arctic population of bowhead whales (IWC, 1998). The quota allowed for a combined total of up to 280 whales to be landed in the years 1998 through 2002 by Alaskan and Russian Natives. For those years, the number of bowhead whales struck was not to exceed 67 whales per year, except that any unused portion of a strike quota from any year could be carried forward and added to the strike quota of any subsequent year, provided that no more than 15 strikes were added to the strike quota for any one year (i.e., a maximum of 82 potential strikes). The 15 strike carry over was available each year during this 5-year block quota period; 5 to 7 strikes were annually provided to the Russian Natives of Chukotka, while NOAA Fisheries issued an annual quota to the AEWC between 75 and 77 strikes.

During the 59th meeting of the IWC held in May 2007, the IWC renewed these catch limits by consensus, allowing for a combined total of up to 280 whales to be landed in the years 2008 through 2012 by Alaskan and Russian Natives and maintained the 67 strike/year limit as well as the 15 strike carry over provision. During this 5 year period, 5 to 7 strikes were annually provided to the Russian Natives of Chukotka, while NOAA Fisheries issued an annual quota to the AEWC between 75 and 77 strikes.

At the 64th meeting of the IWC held June/July 2012 in Panama City, Panama, the IWC passed a proposal (IWC/64/10, Agenda item 7.3) to extend the catch limits to allow a combined total of up to 336 whales to be landed in the six year period of 2013-2018 (IWC, 2012a). For the years, 2013, 2014, 2015, 2016, 2017, and 2018, the total number of bowhead whales landed shall not exceed 336. For each of these years the number of bowhead whales struck shall not exceed 67, except that any unused portion of a strike quota from any year (including 15 unused strikes from the 2013 - 2018 quota) shall be carried forward and added to the strike quotas of any subsequent years, provided that no more than 15 strikes shall be added to the strike quota for any one year. This provision is subject to annual review by the Commission in light of the advice of the Scientific Committee. The IWC quota is divided between the U.S. and Russia; the respective strike limits determined at the beginning of each year after consultation with the AEWC and renewal of the U.S.-Russia bilateral agreement governing the strike allocation between the two countries . However, in no case may the total strike quota exceed the limits specified by the IWC.

This action would convey through the Federal Government the U.S. portion of the IWC quota that allows no more than 67 strikes annually and up to 15 unused strikes from any previous year to be added to this total, i.e., 82 total possible strikes. Of the eighty two (82) strikes, seven annual strikes are expected to be allotted to the Russian Federation through annual bi-lateral agreements as described above. Thus, the U.S./AEWC annual quota is anticipated to be 77 strikes, but in no case would exceed 82.

Alaska Eskimo Whaling Commission (AEWC)
The AEWC was formed in 1977 to represent the whaling communities of Alaska in an effort to convince the U.S. Government to take action to preserve the Eskimos' subsistence hunt of bowhead whales. The AEWC also agreed to cooperate with the U.S. in scientific research efforts and to develop a management plan to be followed by all of the whalers to help improve the efficiency of the subsistence hunt. The AEWC bylaws establish the commission's organizational structure and the AEWC management plan provides for enforcement actions, and sets permissible harvest methods to improve strike efficiencies, maintain the bowhead population, and reduce environmental impacts.

The members of the AEWC are the registered whaling captains and their crews from 11 whaling communities: Gambell, Savoonga, Wales, Little Diomede, Kivalina, Point Hope, Point Lay, Wainwright, Barrow, Nuiqsut, and Kaktovik. The AEWC is directed by a board of eleven Commissioners, one elected from each whaling village. Federal authority for cooperative management of the Eskimo subsistence bowhead whale hunt is shared with the AEWC through a cooperative agreement between the AEWC and the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA).

Federal Licenses Necessary to Implement the Proposed Action
A license is issued by the AEWC to whaling captains through the procedures set out in NOAA Fisheries' regulations (50 CFR 230.5) for aboriginal subsistence whaling allowed by the IWC. These procedures require that whaling may only be conducted in accordance with a cooperative agreement between the relevant Native American whaling organization and NOAA Fisheries. NOAA Fisheries must also annually publish aboriginal subsistence whaling quotas and any other limitations on such whaling in the Federal Register (50 CFR 230.6).

Currently, bowhead whale harvest in the United States is restricted to the 11 AEWC whaling villages along the northwest and arctic coastlines of Alaska. This Biological Opinion will address the effects of the subsistence harvest of 336 bowhead whales over a 6-year period, at a rate determined by the AEWC and IWC to be necessary to support the needs of these Alaskan Native communities. It provides an assessment of this harvest on the continued existence of the bowhead whale, as well as to provide measures to further the conservation of the species. This Biological Opinion incorporates information developed through the IWC and its committees, such as the Scientific Committee, the Aboriginal Subsistence Whaling Sub-Committee, and the Working Group on whale killing methods and associated welfare issues. Traditional knowledge and the observations of Eskimo hunters are presented, along with information gained through scientific research. This knowledge contributes, along with western science, to a more complete understanding of these issues. A reasonable assessment of potential effects can only be made by considering both these systems of knowledge.

Term of this Biological Opinion
This Biological Opinion will be valid upon issuance and remain in force throughout the 6-year quota period, or until re-initiation of consultation becomes necessary. NOAA Fisheries will re-initiate consultation in accordance with interagency cooperation regulations (50 CFR 402.16), particularly if there are significant changes in the health and status of the bowhead whale, if new

information indicates these actions are impacting the bowhead population to a degree or in a manner not considered in this Biological Opinion, if the action is modified in ways not considered in this Biological Opinion, or if new species or critical habitat become listed under the Act and may occur within the action area.

Action Area

The action area for purposes of this Biological Opinion is defined as waters within 50 miles of each of the 11 whaling communities (Gambell, Savoonga, Wales, Little Diomede, Kivalina, Point Hope, Point Lay, Wainwright, Barrow, Nuiqsut, and Kaktovik) in the Alaskan Bering, Chukchi, and Beaufort Seas. The direct and indirect effects of this action on the endangered bowhead whale are expected to be confined to the action area.

Listed Species Not Affected by this Action

In addition to the bowhead whale, humpback whales (*Megaptera novaeangliae*) and fin whales (*Balaenoptera physalus physalus* Gambell 1985) have been recorded in these waters, including the action area. In August 2007, a mother-calf pair of humpback whales was sighted from a barge approximately 87 km (54.1 mi) east of Barrow in the Beaufort Sea (Hashagen *et al.* 2009). Additionally, Ireland *et al.* (2008) reported three humpback sightings in 2007 and one in 2008 during surveys of the eastern Chukchi Sea. Humpback whales have been seen and heard with some regularity in recent years (2009-2011) in the southern Chukchi Sea, often feeding and in very close association with feeding gray whales. Sightings have occurred mostly in September, but effort in the southern Chukchi has not been consistent and it is possible that humpback whales are present earlier than September (Hashagen *et al.* 2009; Goetz *et al.* 2010; Clarke *et al.* 2011a; Crance *et al.* 2011; NMML and PMEL 2011). A single humpback was observed between Icy Cape and Wainwright feeding near a group of gray whales during aerial surveys of the northeastern Chukchi Sea in July 2009 as part of COMIDA (Clarke *et al.* 2011a). This may be a recent phenomenon as no humpback whales were sighted during the previous COMIDA surveys in the Chukchi Sea from 1982 through 1991 (Clarke *et al.* 2011a). Additional sightings of four humpback whales occurred in 2009 south of Point Hope, while transiting to Nome (Brueggeman 2010).

Fin whales are distributed widely in every ocean except the Arctic Ocean (where they have only recently begun to appear). In the North Pacific Ocean, fin whales occur in summer foraging areas in the Chukchi Sea, the Sea of Okhotsk, around the Aleutian Islands, and the Gulf of Alaska; in the eastern Pacific, they occur south to California; in the western Pacific, they occur south to Japan. Individual and small groups of fin whales seasonally inhabit areas within and near the Chukchi Sea Planning Area during the open water period (BOEM 2011a). Berzin and Rovnin (1966) indicate historically "In the Chukchi Sea the finbacks periodically form aggregations in the region to the north of Cape Serdtse-Kamon along the Chukotka coast." Fin whales have also been observed around Wrangel Island. Based on observations and passive acoustic detection (Delarue *et al.* 2010; Crance *et al.* 2011; Hannay *et al.* 2011) and direct observations from monitoring and research projects of fin whales from industry (Funk *et al.* 2010, Ireland *et al.* 2009) and government (Clarke et al. 2011b, Berchok *et al.* 2012), fin whales occur in very low densities but are regular visitors to the Alaska Chukchi Sea. Fin whales have not been documented to occur in the Beaufort Sea.

Neither humpback or fin whales are likely to be adversely affected by this action, and are not considered further in this opinion. There are several reasons supporting this determination. The numbers of sightings of both species are small, and may represent only a few animals. At this time, we have no data to determine if humpback whales are now seasonal residents in the action area, as opposed to extralimital occurrences which may have to do with the unusually sparse extent of sea ice experienced in recent years. Fin whales occur only in the Chukchi portion of the project area in very low numbers, primarily outside of the action area. Additionally, neither species is associated with sea ice as are bowheads, and would not be expected to be present or encountered during spring bowhead hunting along the ice leads. Fin whales have not been observed in the Beaufort Sea and humpbacks have not been observed east of Smith Bay in the Beaufort Sea, and would not be expected to be encountered by fall whalers from Kaktovik or Nuiqsut. Fall whaling at Barrow, Pt. Hope, and Wainwright would not begin until October, by which time any humpback whales are likely to have moved south in their seasonal migration. Finally, this action is specific to harvests within the Western Arctic population of bowhead whales. No whales other than bowheads are expected to be taken under this harvest quota, and only bowhead whales may lawfully be hunted or harvested. Eskimo whalers are highly specialized and experienced; any whales encountered that are not bowheads would not be pursued or otherwise "taken."

B. Status of Listed Species Affected by this Action

NOAA Fisheries has determined that the only threatened or endangered species under its jurisdiction that is present within the action area and likely to be adversely affected by the action is the endangered bowhead whale (*Balaena mysticetus*). No critical habitat for this species has been designated.

The bowhead whale was historically found in all arctic waters of the northern hemisphere. Five populations are currently recognized by the IWC (1992). Three of these populations are found in the North Atlantic and two in the North Pacific, some or all of which may be reproductively isolated (Shelden and Rugh, 1995). These include: a) the Spitsbergen population - found in the North Atlantic east of Greenland in the Greenland, Kara, and Barents Seas, b) the Davis Strait population - found in Davis Strait, Baffin Bay, and along the Canadian Arctic Archipelago (sseparated from the Bering Sea population by the heavy ice found along the Northwest Passage (Moore and Reeves, 1993)), c) the Hudson Bay population, also found in Foxe Basin (differentiated from the Davis Strait population by their summer distribution, rather than genetic or morphological differences (Reeves *et al.,* 1983)), d) the Okhotsk Sea population - in the North Pacific off the western coast of Siberia near the Kamchatka Peninsula, and e) the western Arctic population.

The bowhead whale was listed as a Federal endangered species on June 2, 1970 (35 FR 8495). These whales are of the Western Arctic population of the species; all further references to the bowhead whale in this document concern only the Western Arctic population.

The Western Arctic population of bowhead whales was reduced greatly by commercial whaling late in the 19th century, from an estimated original population of 10,400 to 23,000 (Woodby and Botkin, 1993) to a few thousand by about 1910. Whales taken by commercial whaling in the Bering Sea may have been representatives of a population that did not migrate (Bockstoce and Botkin, 1983; Bockstoce, 1986). Shore-based visual surveys conducted at Point Barrow from 1978 through 2001 provided abundance estimates that have risen at a rate of 3.3%. Shore-based counts of bowhead whales along the Chukotka Peninsula estimated 1,000 whales passed between mid-May and mid-June 2001. Because of the timing, many of these whales could not have been subsequently counted at Barrow before the end of that census (IWC, 2002 A). These ice based surveys have continued in recent years with the addition of an acoustic surveillance component (George et al. 2012):

> The 2011 survey identified a total of 3,379 new and 632 conditional whales – a result that ties the record raw number of new whales seen in a single season. The 2011 season was unusual in that visual, acoustic and aerial surveys were conducted in the same season. Seven acoustic recorders were deployed of which six provided excellent data. Acoustic analysis is currently underway but an initial examination suggests high daily call counts.
>
> Visual data from the ice-based survey and the simultaneous acoustics data will be used to estimate the 2011 abundance of the BCBS bowhead population. Due to the need for comprehensive data checking, compilation and "matching" of independent counts (e.g., George et al., 2011), the data were *not* available (under the IWC's Data Availability Agreement) for the 2012 bowhead *Implementation Review.* A preliminary ice-based population estimate should be available by June 2013.

IWC (2012b) notes:

> a new agreed abundance estimate is not required for completion of the BCB bowhead *Implementation Review*. When a new estimate becomes available it can be incorporated into the *Bowhead SLA* calculations to provide management advice. SC/64/AWMP5 incorporates the 1985 and 2004 abundance estimates from aerial photography by Schweder *et al.* (2010) into the ice-based survey estimates to obtain an updated ROI for 1978-2004. The Committee **endorses** this estimate (3.5% with 95% CI of (2.2%, 4.8%)) as the best available estimate of annual rate of increase for the BCB bowhead population. It also **agrees** that the best estimate of current abundance is 12,631 (95% bootstrap percentile CI 7,900 -19,700; 5% lower limit 8,400) for 2004 (Koski *et al.*, 2010 ; Schweder *et al.*, 2010).

NMFS (2012b) notes:

> The IWC scientific committee reported that the population "appears to be near MSY, and would very likely increase under catches of up to 108 animals" (IWC, 1999). The 2004 stock assessment of bowhead whales (IWC, 2005a) reported that the population was close to K with a high probability of being above the MSY level based on the most recent abundance estimate from the 2001 bowhead whale census.

In the North Pacific Ocean, bowhead whales are distributed in the seasonally ice-covered waters of the Arctic and near-Arctic, generally occurring north of 60°N and south of 75°N in the western Arctic Basin (Braham 1984, Moore and Reeves 1993). They have an affinity for ice and

are associated with relatively heavy ice cover and shallow continental shelf waters for much of the year. The largest population of bowhead whales can be found in the Bering Sea in winter, migrating north into through the Chukchi Sea in the spring to summer in the Beaufort Sea before returning to the Bering Sea in the fall (Allen and Angliss 2011). Some of the animals remain in the eastern Chukchi and western Beaufort seas during the summer (Clarke *et al.* 2011a, Ireland *et al.* 2009). The Okhotsk population has been observed in summertime along the western and northern portion of the Sea of Okhotsk, notably around the Shantar Islands (see Figure 5).

Bowhead whales are seasonal and transient in the western Beaufort Sea, migrating from west to east in spring and returning in fall (Figure 1). Most of the population winters along the ice front and in polynyas (irregular areas of open water) of the central and western Bering Sea (Moore and Reeves, 1993). About April or May, whales begin moving north past St. Lawrence Island and through Bering Strait into the southern Chukchi Sea, then north through nearshore lead systems to Point Barrow (Moore and Reeves, 1993). Some bowhead whales also move north along the Chukotka coast of Russia (Melnikov *et al.*, 1998). Behavior and timing are fairly consistent with bowheads passing Point Barrow in several "pulses": the first between late April and early May, a second about mid-May, and a third from late May through early June (Moore and Reeves, 1993; A. Brower in USDOI, 1986; B. Rexford in MBC, 1997). Whaling crews have observed that the migrating whales appear to have “scouts” which check ice conditions in advance of the main migration (C. Nageak in NSB 1981; W. Bodfish in NSB, 1981; L. Kingik in NSB, 1981). Whaling crews also have noticed that not all bowhead whales migrate into the Chukchi or Canadian Beaufort Seas, but that some bowheads remain near Barrow in summer (H. Brower, Jr. in USDOI, MMS, 1995).

Most bowhead whales move eastward from Point Barrow through offshore lead systems of the central Beaufort Sea (W. Bodfish in NSB, 1981). They appear in leads offshore of the Alaskan Beaufort Sea by early May (W. Bodfish in NSB, 1981), but apparently do not stop along the spring migration route (V. Nauwigewauk in NSB, 1981; A. Oenga in NSB, 1980). However, some whales feed opportunistically during spring migration (Shelden and Rugh, 1995; Carroll *et al.*, 1987), and the lead system may serve as an important feeding area when oceanographic conditions are favorable. Acoustic research associated with census efforts has indicated spring-migrating whales travel in groups that are dispersed over a wide area, separated from each other by distances (100-3000 m) that preclude the use of vision for coordinating movements, and calling is the vocal mechanism for doing so (Clarke and Bower, 1991).

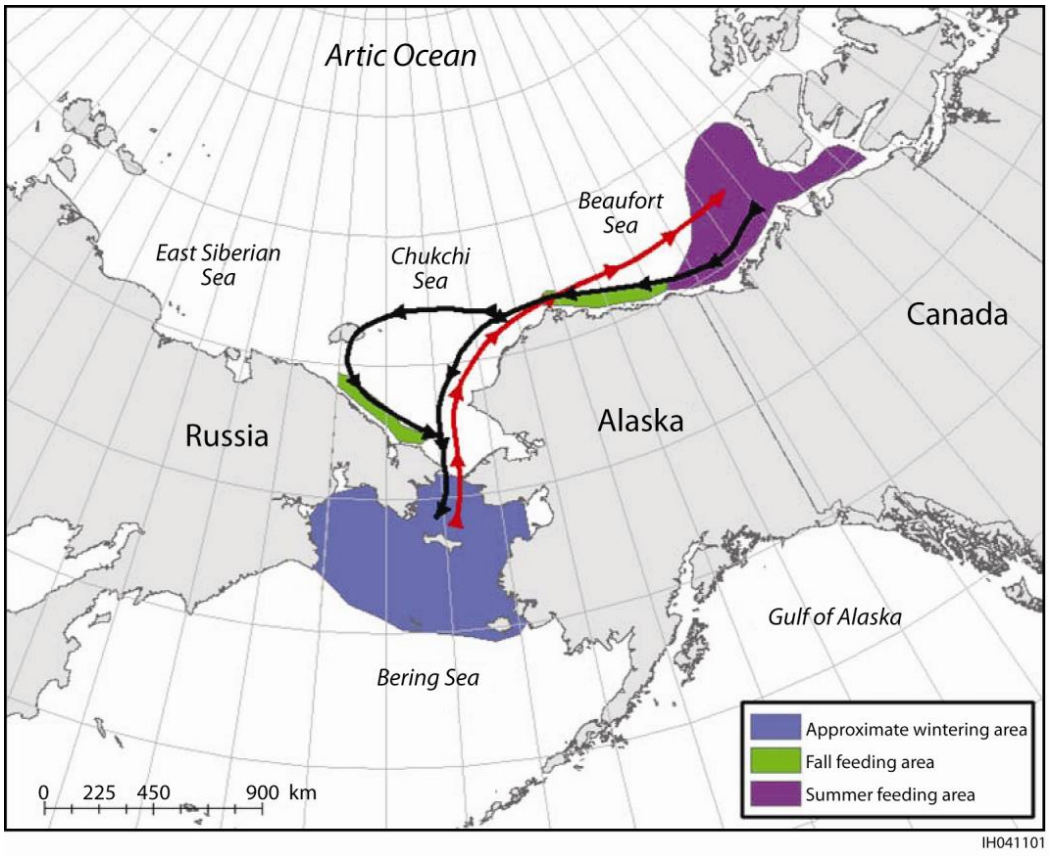

Figure 1. Generalized Migration Route, Feeding Areas, and Wintering Area for the Western Arctic Bowhead Whale (Source: Moore and Laidre 2006).

The bowheads arrive in the Canadian Beaufort Sea from about mid-May through mid-June (Moore and Reeves, 1993:314). During migration, bowheads may swim under the ice for several miles, and can break through relatively thin ice (approximately 7 inches [18 cm] thick) to breathe (George *et al.*, 1989). It is possible that bowheads use ambient light cues and possibly echos from their calls to navigate under ice and to distinguish thin ice from thick, multi-year floes (MMS, 1995). The spring migration ends at Herschel Island in the Canadian Beaufort Sea (V. Nauwigewauk *in* NSB, 1981).

Most of the Western Arctic population is concentrated in the Canadian Beaufort Sea between Herschel Island and Amundsen Gulf during summer (Moore and Reeves, 1993). Whales begin moving westward between late August and early October (Richardson *et al.*, 1987; Miller *et al.*, 1996; I. Akootchook *in* USDOI, MMS, 1995). The fall migration, extending into late October some years (Moore and Clarke, 1992), also seems to occur in pulses, although the pattern is not as clear as in the spring migration (Ljungblad *et al.*, 1987; A. Brower in MMS, 1996; Treacy, 1988; 1989; 1990; Moore and Reeves, 1993). These pulses may constitute age segregations with smaller whales migrating earlier, followed by larger adults and females with young. The first pulse has been observed to consist of hundreds of bowheads "in schools like fish" (T. Napageak - Pers. Comm., Nuiqsut Whaling Captains Meeting, August 13, 1996). These whales are not

accompanied by calves (J. Tukle *in* USDOI, MMS, 1986). The second pulse is thought to consist of females with calves (J. Tukle *in* USDOI, MMS, 1986; T. Napageak - Pers. Comm., Nuiqsut Whaling Captains Meeting, August 13, 1996). Similar to the spring migration, Native hunters describe "leader whales" which establish the path for the migration. These lead whales are to be left alone, otherwise the main body of whales may turn around or migrate farther out (Isaac Akootchook *in* Richardson and Thomson, 1999).

Fall migration generally occurs south of the pack ice and closer inshore than the spring migration (Moore and Reeves, 1993). Bowhead whales apparently take their time returning westward during the fall migration, sometimes barely moving at all, with some localities being used as staging areas due to abundant food resources or for social reasons (W. Bodfish *in* NSB, 1981; S. Akootchook *in* USDOI, MMS, 1995). Kaktovik residents report offshore areas near that village are important bowhead whale feeding areas, and examinations of stomachs from harvested whales indicate recent feeding activity during fall migrations (Carroll *et al.*, 1987; Richardson and Thomson, 2002)

Fall surveys show that the median water depth at bowhead whale sightings (1982-1995) between 141° W from 146° W longitudes is 138 ft (42 m) (Treacy 1991; 1992; 1994; 1996). During fall migration, whales are found close inshore east of Barter Island and from Cape Halkett to Point Barrow (Moore and Reeves, 1993), generally in water depths less than 164 ft (50 m) (Treacy, 1991; 1992; 1994). Inupiat believe that whales follow the ocean currents carrying food organisms. If the currents go close to Cross Island, whales migrate near there (T. Napageak - Pers. Comm., Nuiqsut Whaling Captains Meeting, August 13, 1996). Bowheads reportedly travel on the inshore side of Cross Island (V. Nageak *in* Shapiro and Metzner, 1979). It has also been reported that whales are seen inside the barrier islands near Cross Island practically every year and are sometimes seen between Seal Island and West Dock (F. Long Jr. - Pers. Comm., Nuiqsut Whaling Captains Meeting, August 13, 1996). Bowhead whales may swim very close to shore on some occasions (B. Rexford in MBC, 1996a; I. Akootchook *in* USDOI, MMS, 1979). Bowheads have been observed feeding not more than 1,500 ft (457 m) offshore in about 15 to 20 ft (4.6 to 6 m) of water (A. Brower *in* USDOI, MMS, 1979; H. Rexford *in* USDOI, MMS, 1979). Smaller whales may swim in water depths of 14 to 18 ft (4.3 to 5.5 m) (T. Brower *in* NSB, 1980). Inupiat whaling crews have noticed that whale migration appears to be influenced by wind patterns, with whales moving when winds start up and stopping when they are slow (P. Tukle *in* USDOI, MMS, 1986). From Point Barrow, whales migrate back west and southward through the Chukchi Sea to wintering grounds in the Bering Sea (Moore and Clarke, 1992).

In general, bowhead whales seemed to migrate closer to shore in light ice years and farther offshore in heavy ice years, with distributions peaking at 19 to 25 miles (30 to 40 km) and 37 to 43.5 miles (60 to 70 km), respectively (Miller *et al.*, 1996). From 1979 to 1986, Ljungblad *et al*., (1987) observed that fall migration extended over a longer period, and sighting rates were larger and peaked later in the season in years of light ice cover compared to years of heavy ice cover (Moore and Reeves, 1993).

Further evidence that bowhead whales migrate at varying distances from shore in different years is provided by site-specific studies monitoring whale distribution relative to local seismic

exploration in nearshore waters of the central Beaufort Sea (Miller *et al.*, 1997; 1998; 1999). In 1996, bowhead sightings were fairly broadly distributed between the 10 m and 50 m depth contours. In 1997, bowhead sightings were fairly broadly distributed between the 10 m and 40 m depth contours, unusually close to shore. In 1998, the bowhead migration corridor generally was farther offshore than in either 1996 or 1997, between the 10 m and 100 m depth contours and approximately 10-60 km from shore. Most recently, Monnett and Treacy (2005) studies found the axis of the migration was relatively close to shore in 2002-2004; all mild ice years in the Beaufort Sea.

Data are limited on the bowhead fall migration through the Chukchi Sea before they enter the Bering Sea. Whales commonly are seen from the coast to about 150 km (93 miles) offshore between Point Barrow and Icy Cape, suggesting that most bowheads disperse southwest after passing Point Barrow and cross the central Chukchi Sea near Herald Shoal to the northern coast of the Chukotsk Peninsula. However, scattered sightings north of 72° N. latitude suggest that at least some whales migrate across the Chukchi Sea farther to the north (Moore and Reeves, 1993). After moving south through the Chukchi Sea, bowheads pass through the Bering Strait in late October through early November on their way to overwintering areas in the Bering Sea (Moore and Reeves, 1993).

Bowheads are extremely long-lived. Recent research has looked at the levels of aspartic acid in bowhead eyeballs (George *et al.*, 1999). This work, along with evidence from stone points and harpoons recovered from recently harvested bowhead whales suggest these animals may be the oldest mammals on earth; some of whom may live in excess of 200 years. Little is known regarding age at sexual maturity or mating behavior and timing for bowheads. It is assumed that mating takes place in late winter and spring (Koski *et al.*, 1993), perhaps continuing through the spring migration (Ljungblad, 1981; Koski *et al.*, 1993). Most calves are born from April through early June during the spring migration, with a few calves born as early as March and as late as August (Koski *et al.*, 1993). Calves are about 13 to 15 ft (4 to 4.5 m) at birth and reach 42 to 66 ft (13 to 20 m) as adults. Females produce a single calf, probably every 3 to 4 years (Koski *et al.*, 1993).

Bowheads are filter-feeders, sieving prey from the water by means of baleen fibers in their mouth. They feed almost exclusively on zooplankton from the water column, with primary prey consisting of copepods and euphausiids, as indicated from stomach analyses of whales taken in the Alaskan Beaufort Sea (Lowry, 1993; Richardson and Thomson, 2002). Other prey include mysids, hyperiid and gammarid amphipods, other pelagic invertebrates, and small fish. Bowheads feed heavily in the Canadian Beaufort Sea and Amundsen Gulf area during summer and fall migration through the Alaskan Beaufort Sea (Ljungblad *et al.*, 1987; Lowry, 1993). In surveys conducted from 1979 through 1987, concentrations of feeding bowheads were observed east of Point Barrow and just north of Harrison Bay (Ljungblad *et al.*, 1987). However, carbon isotope analysis of bowhead baleen has indicated that a significant amount of feeding may occur in wintering areas of the Chukchi and Bering Seas (Schell *et al.*, 1987; Schell, 1998). The barrier islands all along the Beaufort Sea coast are considered by local residents to be an important resource to the bowhead whale for use as staging and feeding areas (M. Pederson in USACE, 1996).

The summer distribution of bowheads within the Canadian Beaufort Sea is thought to be determined primarily by prey density and distribution, which in turn are responsive to variable current and upwelling patterns (LGL, 1987). Sub-adult bowheads were observed to feed in water depths less than 164 ft (50 m) in the Canadian Beaufort Sea (Richardson *et al.*, 1987). However, little is known about adult feeding behavior in the Canadian Beaufort.

Bowheads have extremely sensitive hearing. For example, they are capable of detecting sounds of icebreaker operations at a range of up to 31 miles (50 km) (Richardson, 1996). It has been suggested that such sensitive hearing also allows whales to use reverberations from their low frequency calls to navigate under the pack ice and to locate open water polynyas where they surface (Ellison *et al*., 1987). Bowheads exhibit avoidance behavior at many manmade sounds, but there is still considerable debate regarding their range of sound detection (Richardson et al., 1995a:263). It is well known among Inupiat hunters that bowhead whales are extremely sensitive to noise (H. Rexford *in* USDOI, MMS, 1979; R. Ahkivgak *in* NSB, 1980; H. Ahsogeak *in* NSB, 1980; T. Brower *in* NSB, 1980; H. Brower *in* USDOI, MMS, 1990). Communications among whales during migration and in response to danger also has been observed to alter migration patterns (A. Brower *in* USDOI, MMS, 1986; T. Napageak *in* USDOI, MMS, 1995). Whaling crews have observed that disturbances to migration as a result of a strike are temporary (J.C. George *in* USACE, 1996).

Generally, the vocalizations of bowhead whales are low, less than 400 hertz (Hz), frequency-modulated calls; however, their call repertoire also includes a rich assortment of amplitude-modulated and pulsed calls with energy up to at least 5 kilohertz (Wursig and Clark, 1993). Calls and songs have been suggested to be associated with different contexts and whale behavior. Observations have been made that support the theory that calls are used to maintain social cohesion of groups. For instance, loud frequency-modulated calls were heard as a mother and a calf rejoined after becoming separated during summer feeding (Wursig and Clark, 1993). Once the two were together again, calling stopped (Wursig and Clark, 1993). During spring migration off Point Barrow, there have been several instances when individual whales repeatedly produced calls with similar acoustic characteristics (Clark *et al.*, 1987). Bowhead whales have been noted to produce signature calls lasting for 3 to 5 minutes each and continuing up to 5 hours (Wursig and Clark, 1993). Different whales produce signature calls as they counter call with other members of their herd. It has been suggested that calling among bowhead whales may aid in migration of the herd and that the surface reverberation of the sound off the ice may allow these whales to discriminate among areas through which they can and cannot migrate (Ellison *et al.*, 1987; Wursig and Clark, 1993; Moore and Reeves, 1993). Although bowheads are morphologically adapted to their ice-dominated environment and can break holes in the ice to breathe, they may use vocalization to assess ice conditions in their path. For example, the intensity of reflected calls is as much as 20 decibels (dB) higher from ice floes with deeper keels than from relatively flat, thin ice (Ellison *et al.*, 1987). Bowheads may use such differences in intensity of reflected calls to differentiate between deep keel ice floes and flat, thin ice.

Bowhead whales have no known predators in the Bering Sea, except perhaps killer whales (*Orcinus orca*). Such attacks in the Bering Sea have occurred, but their frequency is reported as

low. The frequency of attacks by killer whales in the Beaufort Sea is not well documented (George *et al*., 1994). Little is known about naturally occurring disease and death among bowhead whales. While certain viral agents are present in this population, it is unknown how much they may contribute to natural mortality or reduced reproduction (Philo *et al.*, 1993).

In addition to subsistence harvest by Alaskan Natives in the Beaufort, Bering, and Chukchi Seas, other man-induced impacts may contribute to morbidity and mortality. Commercial fishing occurs in the Bering Sea and elsewhere within the range of this population. Interaction with fishing gear is rare; however, whales with ropes caught in their baleen and with scarring caused by rope entanglement have been reported (Philo *et al.*, 1993; NMML, unpubl. data). The North Slope Borough estimates that entanglements or scarring attributed to ropes may include over 20 cases (J.C. George, Dept. Wildlife Management, North Slope Borough, pers. Comm. 2007). The average rate of entanglement in crab pot gear for the period 1999-2003 was estimated to be 0.2 whales per year (Angliss and Outlaw, 2005). George *et al.*, (1994) report three documented ship strike injuries observed among 236 bowheads taken in subsistence hunts. One whale was reported with boat propeller marks off Katovik in 2004 and 3 additional line entanglements have been reported between 2004-2011 (George, pers. comm. in NMFS 2012b.) Man-made noise in the marine environment is increasing with industrialization of the Alaskan arctic. Research in the Beaufort Sea has shown bowhead whale behavior is affected by noise, as behavior such as breathing rates, dive times, calling rates, swimming speed, and direction have changed when exposed to various man-made disturbances. Exposure to oil spills could have direct adverse consequences to bowheads, and may predispose some whales to infection or injury.

C. Environmental Baseline

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area. The occurrence, numbers, and habitat use of the bowhead whale have been described above. There are several anthropogenic factors which have affected and may continue to affect the bowhead whale within the action area. These include climate change, subsistence hunting, commercial fishing, oil and gas activity within Federal and State of Alaska waters and along the Alaskan North Slope, and shipping and vessel traffic.

Climate Change

There is now widespread consensus within the scientific community that atmospheric temperatures on earth are increasing (warming) and that this will continue for at least the next several decades (IPCC 2001, Oreskes 2004). There is also consensus within the scientific community that this warming trend will alter current weather patterns and patterns associated with climatic phenomena, including the timing and intensity of extreme events such as heat waves, floods, storms, and wet-dry cycles.

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

climate variations that have been recorded in the past and evaluated the influence of natural phenomena such as solar and volcanic activity.

Based on their review, the IPCC concluded that natural phenomena are insufficient to explain the increasing trend in land and sea surface temperature, and that most of the warming observed over the last 50 years is likely to be attributable to human activities (IPCC 2001). Climatic models estimate that global temperatures would increase between 1.4 to 5.8°C from 1990 to 2100 if humans do nothing to reduce greenhouse gas emissions (IPCC 2001). These projections identify a suite of changes in global climate conditions that are relevant to the future status and trend of endangered and threatened species (Table 7).

The strongest warming is expected in the north, exceeding the estimate for mean global warming by a factor or 3, due in part to the "ice-albedo feedback," whereby as the reflective areas of arctic ice and snow retreat, the earth absorbs more heat, accentuating the warming (NRC 2003).

Changes in sea level, snow cover, ice extent, and precipitation are consistent with a warming climate near the Earth's surface. The IPCC (2001) noted "Examples include…increases in sea level and ocean-heat content, and decreases in snow cover and sea-ice extent and thickness" and consider their statement that "rise in sea level during the 21st century that will continue for further centuries" to also be a "robust finding." However, they highlight the uncertainty of understanding the probability distribution associated with both temperature and sea-level projections.

Climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine, coastal, and terrestrial ecosystems in the foreseeable future (Houghton *et al.* 2001, McCarthy *et al.* 2001, Parry *et al.* 2007). The direct effects of climate change would result in increases in atmospheric temperatures, changes in sea surface temperatures, changes in patterns of precipitation, and changes in sea level. Oceanographic models project a weakening of the thermohaline circulation resulting in a reduction of heat transport into high latitudes of Europe, an increase in the mass of the Antarctic ice sheet, and a decrease in the Greenland ice sheet, although the magnitude of these changes remain unknown.

The indirect effects of climate change would result from changes in the distribution of temperatures suitable for calving and rearing calves, the distribution and abundance of prey, and the distribution and abundance of competitors or predators. For example, variations in the recruitment of krill (*Euphausia superba*) and the reproductive success of krill predators have been linked to variations in sea-surface temperatures and the extent of sea-ice cover during the winter months. Although the IPCC (2001) did not detect significant changes in the extent of Antarctic sea-ice using satellite measurements, Curran (2003) analyzed ice-core samples from 1841 to 1995 and concluded Antarctic sea ice cover had declined by about 20% since the 1950s. Moore and Laidre (2006) examined the possible consequences of reduced sea ice cover to the Western Arctic bowhead and concluded that reductions will increase their prey availability.

Table 1. Phenomena associated with projections of global climate change including levels of confidence associated with projections (adapted from IPCC 2001).

Phenomenon	Confidence in Observed Changes (observed in latter 20th Century)	Confidence in Projected Changes (during the 21st Century)
Higher max temperatures and greater number of hot days over almost all land areas	Likely	Very likely
Higher min temperatures with fewer cold days and frost days over almost all land areas	Very likely	Very likely
Reduced diurnal temperature range over most land areas	Very likely	Very likely
Increased heat index over most land areas	Likely over many areas	Very likely over most areas
More intense precipitation events	Likely over many mid-to-high latitude areas in Northern Hemisphere	Very likely over most areas
Increased summer continental drying and associated probability of drought	Likely in a few areas	Likely over most mid-latitude continental interiors (projections are inconsistent for other areas)
Increase in peak wind intensities in tropical cyclones	Not observed	Likely over some areas
Increase in mean and peak precipitation intensities in tropical cyclones	Insufficient data	Likely over some areas

Subsistence hunting.
The hunting of bowhead whales by Alaska Eskimos is believed to date back several thousand years with the use of harpoons and lances fashioned from stone, ivory, and bone. Although early historical records were not kept, it is estimated that Alaska Eskimos may have taken 20 whales in an average year (Ellis, 1991). Rice (1964) estimated an annual average of 10 bowhead whales and "poggies" (*Ingutuk*, or yearling bowheads; Jarrell 1981) were killed and recovered each year, while another 3-4 whales were struck but lost for each one landed (i.e., 40-50 strikes per year). IWC catch limits began in 1978, allowing 12 landed or 18 struck. The number of whales/strikes provided under the quota has increased steadily, up to the numbers associated with the current action. Between 1974 and 2011, 1149 whales were landed at Alaskan Native villages; an average of 31.1 whales/yr (Suydam and George, 2012)

IWC (2012c) provides the most recent details of harvest data from the aboriginal hunt for the Western Bowhead whales in Alaska:

> In 2011, 51 bowhead whales were struck resulting in 38 animals landed. Total landed and efficiency (# landed / # struck) of the hunt (75%) for 2011 was similar to the past 10 years (2001-2010: mean of landed = 40.0; *SD* = 7.8: mean of efficiency = 76%; *SD* = 0.08%). Of the landed whales, 20 were females, 16 were males, and sex was not determined for two animals. Based on total length, eight of the 20 females were presumed mature (>13.4 m in length). Two of the seven mature females that were examined were pregnant. This includes, a 17.5m female landed in the spring at Barrow that was pregnant based on the presence of a large corpus luteum (~20cm in diameter) although a fetus was not detected because it was not possible to examine the uterus. A 15.9m female landed at Nuiqsut in the autumn was carrying a ~1.5m fetus (sex not determined). One calf was inadvertently harvested at Kaktovik in the autumn. It was a 6.6m female and was determined to be a calf based on its length, short baleen (~30 cm), and milk in the stomach.

The average number of Western Arctic bowhead whales landed by Alaska Natives over the ten year period of 2002-2011 was 38.8 whales, not including struck and lost (Suydam and George 2012). Available data indicate that Barrow takes the most whales, followed by Point Hope, and Wainwright. The total available strikes within any of the 5-year quota blocks has never been exceeded (George et al. 2012)

Oil and Gas Activities

There have been ten Federal oil and gas leases sales within the Alaskan Beaufort and Chukchi Seas beginning with the Joint State Federal Sale held in December 1979. The most recent Federal sale in the Beaufort Sea was Sale 202 in July 2007. Prior to 2000, no permanent facilities, or oil production, existed on the Beaufort Outer Continental Shelf (OCS) outside of State waters. The environmental baseline for this Biological Opinion now includes offshore production facilities in the Beaufort Sea.

Three federal lease sales for the OCS were in the Chukchi Sea planning area between 1979 and 2008. Most recently, Chukchi Sea Lease Sale 193 was held in February 2008, and resulted in the sale of 487 leases totaling approximately 2.8 million acres in the Chukchi Sea planning area (Bureau of Ocean Energy Management, Regulation and Enforcement [BOEMRE 2011a]). As a result of a lawsuit challenging the sale, the U.S. District Court for the District of Alaska remanded Sale 193 for further analysis pursuant to NEPA. After issuance of a Supplemental Environmental Impact Statement (SEIS) (OCS EIS/EA BOEMRE 2011a) in August 2011, the Department of the Interior filed a Record of Decision affirming the sale of the 487 leases under Lease Sale 193.

Options for the Federal OCS Lease Sales during the five year period from 2012-2017 include one lease sale in the Beaufort Sea Planning Area proposed for 2015. The lease sale area would establish a bowhead whale migration deferral zone comprised of the following areas:

- The Barrow Subsistence Whaling Area that defers 49 whole or partial blocks located at the western border of the planning area; and
- The Kaktovik Subsistence Whaling Area that defers 28 whole or partial blocks located offshore of Kaktovik (BOEM 2011).

Likewise, the options for leasing during the five year period from 2012-2017 include one lease sale in the Chukchi Sea Planning Area to occur in 2016. The lease sale area would establish a 40 km (25 miles [mi.]) buffer deferral corridor along the Chukchi Sea coast, which would provide additional protection from potential impacts to bowhead whales during their spring migration (BOEM 2011).

Five exploration wells were drilled in the Chukchi Sea planning area between 1989 and 1991, but as of December 2011, no commercial oil production has occurred in the Chukchi Sea. An exploration drilling program was conducted at sites in the Beaufort and Chukchi Sea in 2012. These wells were not completed, but temporarily abandoned due to regulatory requirements and the limitations due to ice. The wells are expected to be completed in 2013.

Extensive information about the effects of oil and gas activities on bowhead whales is discussed in several documents: (1) a Biological Opinion prepared by NMFS for the MMS pursuant to Section 7 of the ESA on Oil and Gas Leasing and Exploration Activities in the Beaufort Sea, Alaska (NMFS, 2006); (2) Environmental Impact Statement (EIS) prepared pursuant to the National Environmental Policy Act (NEPA) for the Beaufort Sea Planning Area, Oil and Gas Lease Sale, Sales 186, 195, and 202 (MMS, 2003); (3) an Environmental Assessment (EA) prepared by the MMS for proposed Outer Continental Shelf (OCS) Lease Sale 202 - Beaufort Sea Planning Area (MMS, 2006a); (4) Final Programmatic EA Arctic Ocean OCS Seismic Surveys 2006 (MMS, 2006b); (5) Final EIS for the Chukchi Sea Planning Area Oil and Gas Lease Sale 193 and Seismic Surveying Activity in the Chukchi Sea (MMS, 2007a); (6) Environmental Assessment – For the Issuance of Incidental Harassment Authorizations to Take Marine Mammals by Harassment Incidental to Conducting Open Water Seismic and Marine Surveys in the Beaufort and Chukchi seas. July 2010 (NMFS 2010); and (7) Draft EIS – Outer Continental Shelf Oil and Gas Leasing Program: 2012-2017 (BOEM 2011), (8) Draft EIS – Effects of Oil and Gas Activities in the Arctic Ocean (NMFS 2011), and (9) the Final Draft NMFS Arctic Regional Biological Opinion and Conference Report (NMFS 2012a). Additional information is presented on the Bureau of Ocean Energy Management (BOEM) Alaska OCS Region website: http://www.boem.gov/About-BOEM/BOEM-Regions/Alaska-Region/Index.aspx.

The potential effects of those projects, and leasing and development of the OCS of the Alaska Chukchi and Beaufort Seas have been considered in detail by the 2011 DEIS on Effects of Oil and Gas Activities in the Arctic Ocean and by the 2006 and 2012 NMFS biological opinions. As of July 1, 2012, there are 183 active leases in the Beaufort Sea. Most of these were issued in Lease Sales 186, 195, and 202 and remain to be tested by exploration drilling. These active leases are in the central and eastern part of the Beaufort Sea Planning Area (Figure 2). As of July 1, 2012, there were 487 leases as a result of Chukchi Sea Lease Sale 193 (held February 2008) (See Figure 2). These leases are commonly more than 50 miles from shore in water depths

of 100 to 200 ft.

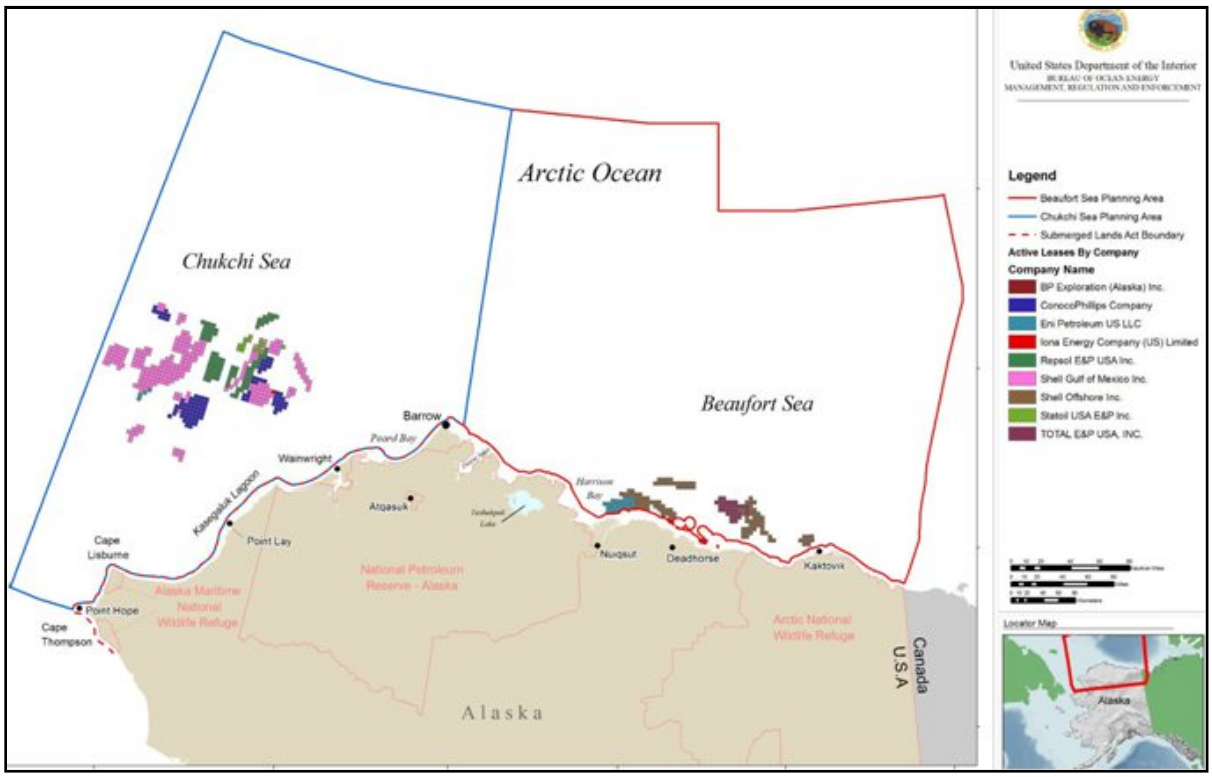

Figure 2. Active Leases in the Chukchi and Beaufort Sea Planning Areas (BOEM 2011a)

Oil and gas activities introduce noise into the marine environment which may disturb bowhead whales. Based upon the predicted acoustics of the Northstar project, one of the activities covered under the 2006 biological opinion, and the bowhead whales' migrational pathways, NOAA Fisheries estimated up to 1,533 whales per year could be "taken" as they detect and react to this noise during their annual fall migrations. There is considerable variability associated with any such estimate; NOAA Fisheries would not expect this number of whales to be harassed year after year. No estimation of bowhead whale takes due to noise from the Endicott project, another activity covered by the 2006 biological opinion, is available. However, Endicott is near shore and in relatively shallow waters, through which noise propagation into areas used by bowhead whales would be greatly attenuated. Two additional offshore production facilities (Oooguruk and Nikaitchuq Islands) have been constructed in nearshore waters of the western Beaufort Sea. Neither of these facilities is expected to have resulted in takes of bowhead whales. Current State leases with production, such as Endicott, Oooguruk and Nikaitchuq Islands, are well removed from the normal fall migration route of the bowhead whale. Bowhead whales are not likely to be affected by noise from these facilities due to their distance from the bowhead's fall migration route, and the limited distance into the marine environment that noise travels from gravel structures in shallow water.

There could be a number of effects on bowhead whales as a result of other oil and gas activities (NMFS 2012a). Noise and the effects of an oil spill are the most problematic with respect to the well-being of the Western Arctic population of bowhead whale. Considered individually, these

and other anthropogenic events such as aircraft or ship operations would be expected to have low-level behavioral impacts to bowhead whales which would not have significant biological consequences, while others, such as oil spills, may have injurious or lethal effects.

Bowheads are not affected much by most aircraft overflights at altitudes above 600 meters (Richardson and Malme, 1993). Below this, changes in whale behavior are likely to increase as altitudes decrease, depending on the type of aircraft and the responsiveness of the whales in the vicinity. Marine-vessel traffic, especially between mid-August and mid-to-late September, may disturb bowhead whales. Fleeing behavior from vessel traffic generally stops within minutes after a vessel has passed, but whales may remain scattered for a longer period.

Elevated noise levels in the marine environment could alter the hearing ability of whales, causing temporary or permanent threshold shifts (Finneran *et al.*, 2000). Noise has also been shown to cause avoidance in migrating bowhead whales (Richardson, 1999a). Seismic actions, and the possible use of ice breakers to support OCS activities, present the highest probability for avoidance of any of the activities associated with oil exploration. Studies have shown noise from ice breakers may be detected at distances exceeding 50 km (Richardson *et al.*, 1995; NMFS 2003). It is reasonable to assume that bowheads could also detect this noise at this distance, however the distance at which bowheads may react to such noise is poorly understood.

Marine geophysical research is now ongoing within the Alaskan Chukchi and Beaufort Seas (NMFS 2012a). Offshore seismic work in the Arctic has traditionally been conducted in ice-free months (July through November); although this analysis addresses the possibility of surveys utilizing an icebreaker and potentially continuing through mid-December. Seismic surveys are also conducted on-ice in areas where there is bottom fast ice in the winter. These surveys generally occur from January through May. Each survey takes between 30 and 90 days, depending on ice conditions, weather, equipment operations, size of area to be surveyed, timing of subsistence hunts, etc. Because of the limited time period of open water, it is likely that concurrent surveys would be conducted in the same general time frame and may overlap in time, but will not overlap in space (i.e. within a minimum of approximately 24 km [15 mi] of each independent survey operation) for reasons regarding data integrity. It is assumed for analytical purposes that one of the authorized 2D/3D seismic surveys in the Beaufort Sea and in the Chukchi Sea may utilize an ice breaker.

Activities involving seismic airguns may introduce significant levels of noise into the marine environment and have been demonstrated to alter the behavior of bowhead whales (Richardson and Malme, 1993; MMS, 2006b). Research on the effects of offshore seismic exploration in the Beaufort Sea, supported by the testimony of Inupiat hunters based on their experience, has shown bowhead whales avoid these operations when within 20 km of the source and may begin to deflect at distances up to 35 km (Richardson, 1999a). Davies (1997) concludes bowheads avoided an active drilling rig at a distance of 20 km. Sound levels received by bowhead whales at 20km ranged from 117-135 dB re 1 µPa rms [1]and 107-126 dB re 1 µPa rms at 30km

[1] The decibel (dB) is a logarithmic comparison of intensities whose value is relative to a reference sound intensity level or pressure. The in-water reference standard is one micro-pascal (1 µPa). In-air standards are normally referenced to 20 µPa. This means a measurement of 80dB in air has less energy than 80 dB in water. Roughly, the

(Richardson, 1999a). The received sound levels at 20-30km are considerably lower levels than have previously been shown to elicit avoidance in bowhead or other baleen whales exposed to seismic pulses. High noise levels may cause temporary or permanent effects to bowhead whale hearing, or impact their use of sound to communicate or navigate (Richardson and Malme, 1993). Recent monitoring studies indicate that bowhead whales during the fall migration avoid an area around a seismic vessel operating in nearshore waters by a radius of about 20 km (Richardson, 1999a). Avoidance did not persist beyond 12 hours after the end of seismic operations. This work also found that bowhead whales may begin to deflect around a seismic source at distances up to 35 km.

It appears that the reaction and persistence of any disturbance to bowhead whales is heavily influenced by the whale's current behavioral state. Fall-migrating whales exposed to seismic impulse noise in the U.S. Beaufort Sea have been shown to avoid these sources at distances of 20 km and received levels between 116 and 135dB re 1µPa rms depending on ambient noise conditions. Some avoidance was observed at distances up to about 30 km (Richardson, 1999). However, monitoring of bowhead whales in the Canadian Beaufort Sea has indicated those whales have a smaller zone of reaction (e.g. 2 km) to similar noise levels (Miller and Davis, 2002). This difference in reaction may have to do with behavior, as the bowhead whales in Canadian waters may have been feeding, rather than migrating, at the time the observations were made. During seismic operations in 2007, bowhead whales were observed on three occasions within 2km of an active array. At these distances, these whales would have been exposed to noise exceeding 180 dB re 1µPa rms. These also may have been feeding whales with lowered sensitivity to noise and disturbance. Feeding activity by bowhead whales was regularly observed in the U.S. Beaufort Sea in 2007 (MMS, pers. comm.); however the specific behavior of these whales at the time they were observed is unknown.

Though these observations indicate behavioral responses to anthropogenic sounds, the most common effects are expected to be temporary and unlikely to prevent the survival and recovery of this species. This is because the majority of bowhead whales which may encounter seismic noise are migrating to summering or wintering habitats. While feeding does occur in the U.S. Beaufort Sea, it seems to occur primarily during fall migrations and does not appear to be critical to survival. Research has found that most of the annual metabolic budget of bowhead whales is derived from the Bering Sea, and that the contribution of prey from feeding within the U.S. Beaufort Sea is small. A multi-year research effort of bowhead feeding within the U.S. Beaufort Sea concluded that bowhead whales derive 2.4% of their annual energetic requirements from these waters in an average year, and 7.5% or more in one of the five years studied (Richardson and Thompson, 2002). The study noted that utilization of the study area varies widely in time and space depending on zooplankton availability and other factors. 2007 appears to have been a particularly important year for bowhead feeding in the eastern Beaufort Sea, as recorded by aerial surveys (MMS, pers. comm.).

Mitigation measures have been typically included in Incidental Harassment Authorizations for oil and gas activities in the U.S. Arctic. NMFS expects that these measures will be included in its future MMPA authorizations for similar activities. These measures are intended to reduce the

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in-water equivalent of 80 dB in air would be 142dB.

duration and intensity of potential adverse effects to bowhead whales and other marine mammals. Generically, these measures include (NMFS 2012a):

A) Detection-based measures intended to reduce near-source acoustic exposures and impacts on marine mammals under NMFS' authority within a given distance of the source

B) Non-detection-based measures intended to avoid disturbance impacts on marine mammals from aircraft operations.

C) Measures intended to reduce/lessen non-acoustic impacts on marine mammals

Oil Spills

Oil spills can occur during seismic exploration, exploratory drilling, construction and operation of offshore platflorms and from subsea pipelines. It is difficult to accurately predict the effects of oil on bowhead whales (or any cetacean) because of a lack of data on the metabolism of this species and because of inconclusive results of examinations of baleen whales found dead after major oil releases (Bratton *et al.*, 1993; Geraci, 1990). Nevertheless, some generalizations can be made regarding impacts of oil on individual whales based on present knowledge. Oil spills that occurred while bowheads were present could result in skin contact with the oil, baleen fouling, ingestion of oil, respiratory distress from hydrocarbon vapors, contaminated food sources, and displacement from feeding areas (Geraci, 1990). Actual impacts would depend on the extent and duration of contact, and the characteristics (age) of the oil (Albert, 1981). Bowhead whales could be affected through residual oil from a spill even if they were not present during the oil spill. Also, response actions may impact whales due to intensive vessel traffic or specific technologies, such as *in situ* burning of oil.

If an oil spill were concentrated in open water leads, it is possible that a bowhead whale could inhale enough vapors from a fresh spill to affect its health. The effects of oil contacting skin are largely speculative, but may include pre-disposing whales to infection. It has been suggested that if oil gets onto the eyes of bowhead whales it would enter the large conjunctival sac (Zhu, 1996) and move "inward" 4 to 5 inches (10 to 13 cm) and get "behind" most of the eye (Albert, pers. comm., 1997). The consequences of this event are uncertain, but some adverse effects are expected.

Bowhead whales may ingest oil encountered on the surface of the sea during feeding, resulting in fouling of their baleen plates. Albert (1981) suggests that broken off baleen filaments and tar balls are of concern because of the structure of the bowhead's stomach; causing a blockage within the very narrow passages of the digestive system.

Engelhardt (1987) stated that bowhead whales are particularly vulnerable to effects from oil spills due to the whales' use of ice edges and leads where spilled oil tends to accumulate. The impacts of oil exposure to the bowhead whale population would also depend upon how many animals contacted oil. If oil found its way into leads or ice-free areas frequented by migrating bowheads, a significant proportion of the population could be affected.

Contaminated food sources and displacement from feeding areas also may occur as a result of an oil spill, but NOAA Fisheries has concluded (NOAA Fisheries, 2001) it is unlikely that the availability of food sources for bowheads would be affected if there was a limited oil spill, given the abundance of plankton resources in the Beaufort Sea (Bratton *et al.*, 1993).

The Inupiat view an oil spill, especially within the spring lead system or under broken ice conditions, as having serious consequences to bowhead whales is based on knowledge that most of the bowhead whale population travels to and from the Canadian Beaufort Sea in a relatively narrow migration corridor during a fairly short time. That a large number of bowheads could be affected by even a relatively small oil spill is illustrated by observations of a whaling captain from Barrow. During a bowhead whale hunt off Barrow in 1976, about 150 to 200 whales were observed in one spot (J. Tukle *in* USDOI, MMS, 1987). Residents have recorded seeing 300 bowhead whales migrating past Barrow in a day, and in 1980, 95% of the population came through in 6 days (G. Carroll *in* USDOI, MMS, 1986). There is general agreement among Inupiat people testifying at various hearings since 1979, that an oil spill would have severe consequences to the bowhead whale population because effective cleanup methods of oil spill in ice-covered waters have not yet been developed and proven (J. Loncar *in* USDOI, MMS, 1983). One elder hunter has stated "I believe the only thing that is going to destroy the bowhead is oil - oil spill during migration" (Hopson, 1990).

In summary NMFS (2012a) has concluded:

> Most whales exposed to spilled oil could be expected to experience temporary, nonlethal effects from skin contact with oil, inhalation of hydrocarbon vapors, ingestion of oil-contaminated prey items, baleen fouling, reduction in food resources, or temporary displacement from some feeding areas. A few individuals may be killed as a result of exposure to freshly spilled oil. However, the combined probability of a spill occurring and also contacting bowhead habitat during periods when whales are present is considered to be low, and the percentage of the bowhead whale stock so affected is expected to be very small. Contaminated food sources and displacement from feeding areas also may occur as a result of an oil spill, but NMFS has concluded it is unlikely that the availability of food sources for bowheads would be affected given the abundance of plankton resources in the Beaufort Sea (Bratton et al., 1993; NMFS, 2001a).

In summary, our review of the above baseline conditions, indicates that while the Western Arctic bowhead whale population may have been subjected to a variety of stressors, these have not had measurable adverse consequence to this population's general abundance, growth, or distribution. In fact, population assessment data collected over the past 3 decades (e.g., Allen and Anglis, 2011) indicates the population is healthy, has been growing steadily and may have reached a level of abundance where it can be considered to be "recovered."

D. Effects of the Proposed Action

Issuance of a quota, as proposed, would result in the setting of target limitations for both the landing and striking of the endangered bowhead whale. The IWC has passed the 6-year block quota for this population, allowing a total of 336 bowhead whales to be landed. Annual strike

quotas would be established at 67 bowhead whales struck, with an allowance for the carry-over of 15 unused strikes from any previous year (or 15 unused strikes from the 2013-2018 block quota). Thus, it would be possible for as many as 82 strikes to occur in any given year, unless the landed limit of 336 had been met. The IWC has sanctioned the aboriginal harvest of whales from this population by both the United States and Russia. Through separate agreements, Russia is expected to receive an annual strike limit of 5, and the AEWC will receive 77 (82 - 5 = 77) annual strikes.

Section 10(e) of the ESA exempts Alaskan Natives from the ESA for the taking of listed animals primarily for subsistence purposes. Up to 82 (but more probably 77 or fewer) whales might be "struck" annually. The term "strike" means hitting a whale with a harpoon, lance, or explosive device (50 CFR 230.2). An undetermined number of whales may be approached while being actively pursued by whaling crews during a hunt, but not "struck." Finally, bowhead whales might be startled by the noise created by hunting vessels or detonation of explosive bombs/grenades during hunting.

Modern subsistence whale hunting practices in Alaska preserve many of the traditional methods and equipment, while also borrowing from the experience of commercial whalers (e.g., the shoulder gun) and employing modern technologies to increase strike efficiency (e.g. outboard motors, penthrite explosives, radio transmitters in floats attached to the harpoons) and safety (radios, helicopter rescue options). An excellent account of modern whaling is presented in Stoker and Krupnik (1993). Whales are hunted from seal skin or walrus skin-covered whaling vessels known as umiaks, as well as small, motorized aluminum skiffs. Skin boats are quieter than metal boats when operated among ice, and are used primarily during spring hunts.

Once sighted, whales are approached by the whaling crew. When the whale is judged suitable for harvest (not too large and no calf is present), and has not sounded (gone into a deep, long dive), a harpoon with line and float attached is used to strike the whale. This device normally includes an explosive device, triggered by a push-rod and firing an 8-gauge brass-cased bomb (a darting gun). These bombs were traditionally charged with black powder. Once the darting gun is thrown, a shoulder gun to project bombs is almost always used as a back-up.

Suydam and George (2012) review AEWC efforts to improve strike efficiencies and the humaneness of killing techniques. These authors noted that

> "In response to concerns expressed by the IWC, the efficiency (# of whales landed/# of whales struck) of the harvest has increased… for several reasons: (1) enhanced training conducted by senior captains of the AEWC on where to strike a whale, (2) improved communication for alerting other crews that a whale had been struck, (3) efforts by some captains to only strike smaller whales, (4) enhanced efforts to locate and retrieve struck whales using (a) aircraft to spot struck whales and (b) dive teams to help retrieve whales that sank, and (5) a program to improve the weaponry."

The penthrite bomb, developed as a replacement for black powder, delivers a high-energy concussive shock which results in greater strike efficiency. This device underwent extensive

field-testing and modification based on those tests up to 2004. In 2005, this new weapon was approved by AEWC for distribution and use by participating villages (IWC 2007). The penthrite grenade has now been used in several villages, although the use of traditional black powder devices continues.

Bowhead whale meat provides an important source of vitamins and protein. The skin and blubber, known as maktak, are either eaten raw or boiled in salted water. Native handicrafts are still fashioned from baleen. While edible portions of bowhead whales taken in this harvest may be provided to communities outside of the ten AEWC villages, the sale of bowhead meat, maktak, or products other than handicraft, is prohibited by Federal law and the AEWC Management Plan (AEWC, 1995).

The harvest consists mostly of immature whales, approximately evenly distributed between sexes (Philo *et al.*, 1993). Eskimo hunters prefer smaller whales (the post-weaned *Ingutuk* is prized), and the harvest of immature animals may have positive consequence on the population; therefore some selection likely underlies these statistics. Larger whales are typically landed in the western (Bering and Chukchi Seas) AEWC villages.

Direct Effects on Bowhead Whales

This action will directly affect bowhead whales as Native hunting crews pursue, strike, kill, and process the whales as previously described. Individual whales might be lethally taken through the use of explosive devices and/or harpoons. Some whales will be struck (i.e., hit with a harpoon or explosive device) but subsequently lost. A portion of these struck and lost whales would be expected to survive, depending on the severity of the strike injury. Aerial photography has revealed several whales with healed wounds that appear to have been caused by bombs that did not penetrate deeply (NMFS, unpubl. data). Several records exist of harvested bowhead whales found to have old wounds from previous hunting efforts. Some of these discoveries are remarkable; a bowhead whale landed at Barrow in 1992 was found with a healed wound, beneath which a slate point was found (George *et al*., 1999). A 17.7 meter bowhead whale taken near Wainwright in 1981 had an ivory harpoon head imbedded in the blubber behind the blowhole (Philo *et al.* 1993).

Strike efficiency is a major determinant in the AEWC's Management Plan. The 2001 harvest resulted in a 65.3% efficiency. It was noted that the 2001 efficiency was reduced by poor ice conditions. Records on strike efficiencies have been kept since 1977; before 1978 the efficiency was about 50%; in the last ten years efficiency has averaged 77% (Figure 3.5.2-2) (Suydam et al., 2011). In 2006 the efficiency of the hunt reached 79.5 % (Suydam *et al*., 2007). However, in 2010, the rate declined to 63%. The decline in harvest efficiency in 2010 was considered an anomaly, and could be attributed to difficult environmental conditions in the spring of 2010, including ice conditions, struck whales escaping under the shorefast ice, and equipment failures. The fall hunting conditions are generally better, with more open water, so the sea ice is less of an influence on harvest efficiency (Suydam et al., 2011).

In a technical report submitted to the Scientific Committee of the IWC, Suydam and George (2012) reported that the current efficiency, as of 2011, is 75%. In addition, this report summarized the factors leading to improved efficiency over the years as follows:

1. enhanced training conducted by senior captains of the AEWC on where to strike a whale,
2. improved communication for alerting other crews that a whale had been struck,
3. efforts by some captains to only strike smaller whales,
4. enhanced efforts to locate and retrieve struck whales using (a) aircraft to spot struck whales and (b) dive teams to help retrieve whales that sank, and
5. a program to improve the weaponry.

The AEWC report on weapons and harvest techniques (AEWC 2012) summarizes the history of participation by the AEWC in IWC workshops on Whale Killing Methods and Associated Welfare Issues in 2003, and again in 2006. The report describes AEWC efforts in the following areas:

1. Introduction of a penthrite explosive projectile into the bowhead whale subsistence hunt.
2. Ongoing hunter training in the use of the new equipment.
3. Ongoing hunter training in shot-placement and accuracy.
4. Ongoing upgrades to traditional hunting equipment to improve the performance of the penthrite projectile and to enhance hunter safety, animal welfare, and hunting efficiency.

Some whales will be seen and pursued by whaling crews, but not struck. This may happen due to the whale diving or otherwise avoiding the whalers, or because of a decision by the whaling captain not to take a particular animal, e.g., if the whale is determined to be a calf or female with calf, or in a situation where the whale might be lost after striking. The number of whales which are hunted but not struck varies by village, ice conditions, safety concerns for the crew, and other circumstances. In Barrow, it was estimated that 5 bowhead whales are hunted for every 1 struck (E. Brower, pers. com.)

The impact of the proposed action (i.e., the effects of this level of harvest) on the Western Arctic population of bowhead whales has been assessed (NMFS, 2012b; IWC, 2012b). The effect of any harvest is determined by the population's present abundance and productivity (a stock assessment output). Recent IWC stock assessments have been based on age- and sex-structured population models and incorporate density-dependence. Management-related parameters such as replacement yield, RY, and the related but slightly different quantity, Q_0, (Wade and Givens, 1997) have been estimated using the Bayesian method. RY is the number of animals that can be removed from the population which leaves the population at the end of the year the same size as at the start of the year. Q_0 accounts for populations above Maximum Sustainable Yield Levels (MSYL), the population level which results in the maximum sustainable yield and is defined to be 90% of MSY when a population is above MSYL. Bayesian methods provide a framework for using prior information in an assessment and allow different types of data to be incorporated in the assessment. With Bayesian methods, realistic probability statements can be made with

respect to the various output parameters from population modeling (e.g., historical abundance, population growth rate, and replacement yield (RY or Q_0)).

Stock assessments of bowhead whales usually provide estimates for a number of parameters associated with population productivity (e.g., rate of increase (ROI) and a measure of population productivity, MSYR, the Maximum Sustainable Yield Rate as a fraction of the MSYL). The most important parameter used by the Scientific Committee (SC) of the IWC to provide management advice to the Commission is the replacement yield, since it estimates the number of animals that can be taken. This value keeps the population at the same size at the end of the year as it was at the start of the year. The 1998 management advice of the IWC SC was based on the lower 5th percentile of the RY and Q_0 values (thus implying that there is an equal or greater than 95% probability that the true RY or Q_0 is equal to or greater than the 5th percentile value). This was based on four combinations of assessment methods from two assessments of the status of the Western Arctic bowhead population. Therefore, the assessment is a conservative estimate of RY. The lowest RY value was 108 (range: 108-123), and the lowest Q_0 value was 102 (range: 102-120). The IWC scientific committee reported that the population "appears to be near MSY, and would very likely increase under catches of up to 108 animals" (IWC, 1999). The 2004 stock assessment of bowhead whales (IWC, 2005a) reported that the population was close to K with a high probability of being above the MSY level based on the most recent abundance estimate from the 2001 bowhead whale census. Therefore, the use of Q (estimated to range between 137 and 324 animals, capped at 90% of MSY) was more appropriate than RY. After further analyses, the best estimate of Q was determined to be 257 bowhead whales (range: 155-412 animals; Brandon and Wade, 2006). While this range satisfies the principles for setting catch limits under sub-paragraph 13(a) of the IWC Schedule, the annual number of whales landed and struck has always fallen well below this number (Figure 3).

The proposed action would authorize a maximum annual mortality of 67 whales plus 15 carried over or 82 bowhead whales per year over a six year period. This would be 56% of the Q_{low} value of 155 whales per year, which is rate of harvest at which population growth may be impeded. Thus the overall impact of the proposed action (in terms of mortality) is considered negligible at the population level (NMFS 2012b).

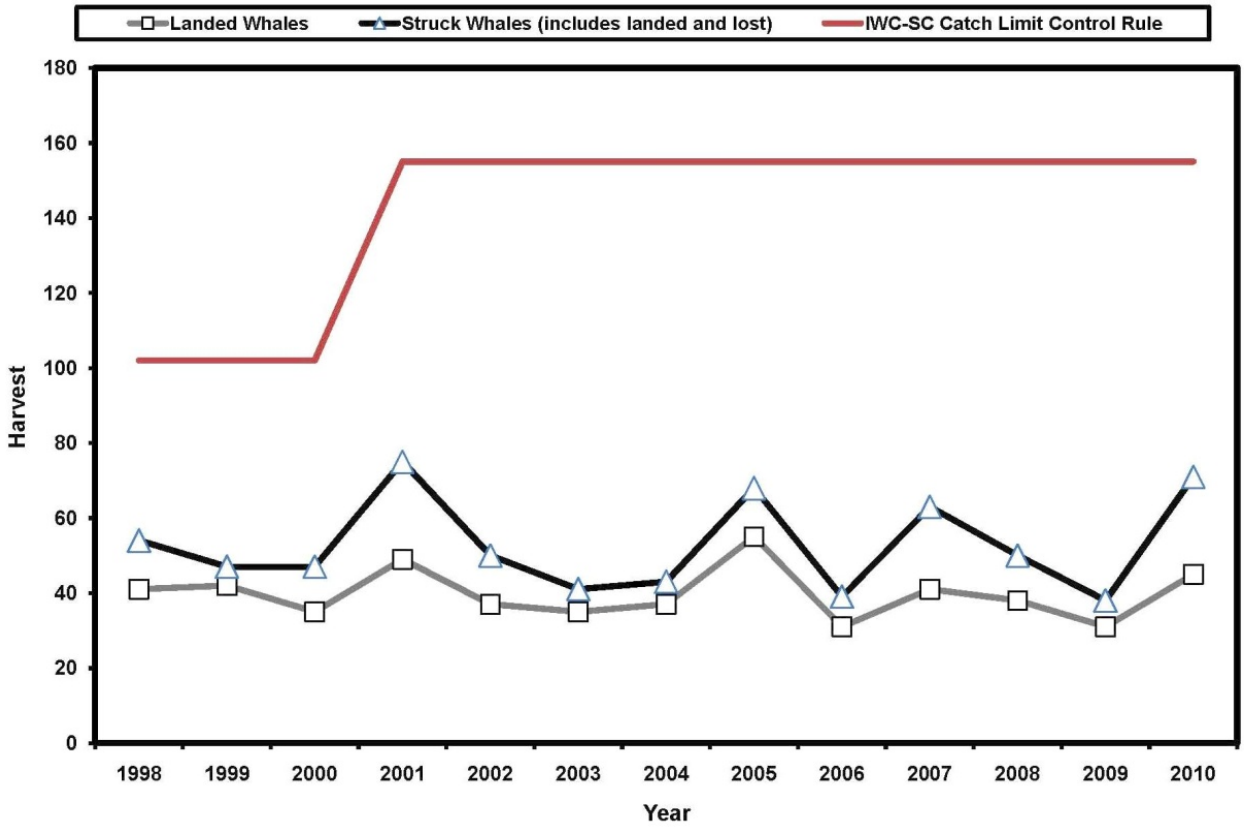

Figure 3. Annual number of Western Arctic bowhead whales landed and struck by Eskimo villages in Alaska, 1998-2010, compared to the IWC-SC catch limit control rule for the population Q1998-2001 = 102 whales (lower bound) and Q2002-2006 = 155 whales (lower bound).

Indirect Effects on Bowhead Whales

Hunting actions have the potential to harass bowhead whales which are not being pursued, by the presence of vessels or underwater noise. The sound of one or more bomb detonations during a strike is audible for some distance. Acousticians listening to bowhead whale calls as part of the census report that calling rates drop after such a strike (IWC, 2002) The range at which whales may be affected is unknown, and is likely to vary with environmental conditions (e.g., depth of water, ambient noise levels, ice conditions, bottom structure) and the depth at which the bomb detonates.

Whaling crews have observed that whales may act "skittish" and wary after a bomb detonates, or may be displaced further offshore (E. Brower, pers. comm.). However, disturbances to migration as a result of a strike are temporary (J. George *in* USACE, 1996), as evidenced when several whales may be landed at Barrow in a single day. There is some potential that migrating whales, particularly calves, could be forced into thicker offshore ice as they avoid these noise sources. The experience of Native hunters suggests that the whales would be more likely to temporarily halt their migrations, turn 180 degrees away from the disturbance (i.e. move back

through the lead systems), or become highly sensitized as they continue moving (E. Brower, pers. com.).

Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as (Interagency Cooperation on the Endangered Species Act of 1973, as amended): "...those effects of future State or private activities not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation." Reasonably foreseeable future Federal actions and potential future Federal actions that are unrelated to the proposed action are not considered in the analysis of cumulative effects because they would require separate consultation pursuant to section 7 of the ESA. Most structures and major activities within the Beaufort Sea Outer Continental Shelf (OCS) require Federal authorizations from one or more agencies, such as the MMS, Army Corps of Engineers, and the Environmental Protection Agency. Such projects require consultation under the ESA on their effects to the bowhead whale, and are therefore not addressed here as cumulative impacts.

State of Alaska: The State of Alaska is currently leasing State lands for oil and gas exploration and production, including approximately 2,000,000 acres within the Beaufort Sea. The State of Alaska has scheduled lease sales that would offer exploration rights in certain regions including the Beaufort and Chukchi seas nearshore areas. If any of the scheduled sales occur, additional effects similar to those described below for OCS lease sales could occur. Activities in these areas are considered reasonably foreseeable; however, the exact locations and amount of acreage available for leasing are yet to be determined. The North Slope Borough plans to drill exploration and development wells in their East Barrow, South Barrow, and Walakpa gas fields during 2012 (Petroleum News 2011).

There are a number of onshore and nearshore exploration wells being proposed on State oil and gas leases in the Beaufort Sea region, primarily onshore, for the 2012 winter drilling season. For example: Pioneer Natural Resources proposes to drill two wells at the eastern edge of the Collvile River Delta, one onshore and one in nearshore waters.

In the past, many oil industry applicants have applied for MMPA authorization for proposed activities on State leases creating a federal nexus for ESA consultation. Also depending on the proposed activity and location there may be a nexus through wastewater discharge or federal air permits, or dredge and fill permits. Whether or not there will be a federal nexus for ESA consultation is not known at this time, so we will consider these activities under cumulative effects.

Canada. Bowhead whales will likely be disturbed during the summer in the Canadian Beaufort Sea, if more offshore oil and gas exploration and development and production activities occur there in the future. The main area of industry interest to date has centered on the Mackenzie River Delta and offshore of the Tuktoyaktuk Peninsula. Research activity in this area has been on-going. A geophysical (seismic) program was conducted during the late summer and fall of 2001 (LGL, 2002), in 2006, and 2007. ION conducted additional surveys in the Canadian Beaufort during 2011 and 2012. Additionally, development and production of natural gas

reservoirs in the McKenzie Delta is being pursued, with pipeline corridors presently being evaluated. This may induce additional oil and gas development offshore. While these activities are anticipated to continue into the future, there is little information on specific plans. The large estuarine front associated with the Mackenzie River Delta and upwellings near the Tuktoyaktuk Peninsula provide conditions which concentrate zooplankton (Moore and Reeves, 1993). These areas are important feeding habitat to the Western Arctic population of bowheads. Possible disturbance to bowhead whales from helicopters, vessels, seismic surveys, and drilling would be as described below.

Russia. Oil and gas exploration has also occurred in offshore areas the Russian Arctic and in areas around Sakhalin Island to the south of the Bering Straits. These activities are anticipated to continue into the future. There is little information on specific plans, but the effects of these activities are expected to be similar to those resulting from activities occurring in the Alaska Arctic OCS.

Some effects on bowhead whales may occur because of lease sale activities within State waters (within 3 miles of shore). Bowhead whales remain far enough offshore to be found mainly in Federal waters, but they may occur in State waters in some areas, such as the Beaufort Sea southeast of Kaktovik and near Point Barrow. If exploration and development and production activities occur on leases from previous or proposed State sales, noise effects on whales may occur as described previously. These effects could include behavioral responses, including local avoidance to noise from aircraft and vessel traffic; seismic surveys; exploratory drilling; construction activities, including dredging; and development drilling and production operations that occur within several miles of the whales.

These projects would require equipment and supplies to be transported to the site by barge or sealift if development and production plans proceed. The process modules and permanent living quarters and other equipment and supplies likely would be transported to these sites on seagoing barges during the open-water season. Barge traffic around Point Barrow is likely to be limited to a short period from mid-August through September and should be completed before the bowhead whale migration reaches this area unless it encounters severe ice conditions. Barge traffic continuing into September is likely to disturb some bowheads during their migration. Whales may react briefly by diving in response to low-flying helicopters and would also avoid vessels as discussed below.

In the event an oil spill occurred on State leases during the fall bowhead migration, the effects of an oil spill on bowheads would be as have been described earlier in this document. These effects include inhalation of hydrocarbon vapors, a loss of prey organisms, ingestion of spilled oil or oil-contaminated prey, baleen fouling with a reduction in feeding efficiency, and skin and/or sensory organ damage. These effects could lead to death and would be most pronounced whenever whales were confined to an area of freshly spilled oil. Of course, if the spill occurred over a prolonged period of time, more individuals could be contacted. Some individuals could be killed as a result of prolonged contact with freshly spilled oil, particularly if spills were to occur within ice-lead systems.

An oil spill reaching into the spring lead system has the potential to impact a significant number of whales within the Western Arctic population. Several coincidental events would be necessary for this scenario: the spill would have to coincide with the timing of the seasonal migration; the spill would have to occur in or be transported to the area the whales occupy (e.g., the migrational corridor or spring lead system); and clean-up or response efforts would have to have been at least partially unsuccessful. The impact of such an event would be significant, yet the statistical probability for the coincident occurrence of these events would be low. It must also be recognized that the spring lead system is not static, as leads open and close and whales navigate not only through the leads but surrounding ice (Clark and Ellison, 1988). Because of this, it is difficult to assess the potential number of whales which could be impacted.

Activities that are not oil and gas related could also continue to affect bowhead whales, although the incidental take of bowhead whales associated with such activities is uncommon. A young bowhead was reported to have died after being entrapped in fishing net in Japan and another in northwest Greenland in a net used to capture beluga whales (Shelden and Rugh, 1995). Between 1976 and 1992, only three ship-strike injuries were documented out of a total of 236 bowhead whales examined from the Alaskan subsistence harvest (George *et al.*, 1994). The low number of observed ship-strike injuries suggests that bowheads either do not often encounter vessels or they avoid interactions with vessels, or that interactions usually result in the death of the animals.

Vessel traffic through the Bering Strait has risen steadily over recent years according to USCG estimates, and Russian efforts to promote a Northern Seas Route for shipping may lead to continued increases in vessel traffic adjacent to the western portion of the project area. Noise associated with these increasing activities could affect bowheads to an undeterminable degree.

An analysis done by Shell Oil as part of a Revised Outer Continental Shelf Lease Exploration Plan for the Chukchi Sea (Shell 2011b) indicated that barge traffic passing through the Chukchi Sea during the month of July through October has increased from roughly 2000 miles of non-seismic vessel traffic in 2006 to roughly 11,500 miles of non-seismic vessel traffic in 2010. In comparison, the same analysis estimated that vessel miles associated with seismic surveys in 2006 were roughly 70,000 miles, compared to roughly 30,000 miles in 2010.

Vessel traffic within the project area can currently be characterized as traffic to support oil and gas industries, barges or cargo vessels used to supply coastal villages, smaller vessels used for hunting and local transportation during the open water period, military vessel traffic, and recreational vessels such as cruise ships and a limited number of ocean-going sailboats. Barges and small cargo vessels are used to transport machinery, fuel, building materials and other commodities to coastal villages and industrial sites during the open water period. For example, villages along the Beaufort and Chukchi sea coasts are serviced by vessels from Crowley Alaska and or Northern Transportation Company. Additional vessel traffic supports the Arctic oil and gas industry, and some activity is the result of emergency-response drills in marine areas.

In addition, research vessels, including NSF and USCG icebreakers, also operate in the project area. USCG anticipates a continued increase in vessel traffic in the Arctic. Cruise ships and private sailboats sometimes transit through the proposed action area. Changes in the distribution

of sea ice, longer open water periods, and increasing interest in studying and viewing Arctic wildlife and habitats may support an increase in research and recreational vessel traffic in the proposed action area regardless of oil and gas activity.

Increased barge traffic would occur if the Point Thomson Project or the Alaska Pipeline Project were constructed during the time period covered under this opinion. Coastal barges would support these projects by delivering fuel, construction equipment, and materials and sea lift barges would deliver modules for processing and camp facilities. If realized, this would result in additional barge traffic transiting through the project area but potential for congestion would only be expected near Prudhoe Bay docks and only during construction. Offshore oil and gas exploration drilling would also result in some additional tug and barge, support, icebreaker, and other vessel traffic (Petroleum News 2011) that could contribute to congestion if they used Prudhoe Bay area docks.

The cumulative effects of noise on bowheads from offshore oil and gas activities and related transportation activities would be similar to that described for existing projects (see biological opinions of oil and gas leasing activities in the Beaufort Sea (NOAA Fisheries, 2006 and 2012)). Some bowhead whales could be exposed to spilled oil, resulting in temporary, nonlethal effects, although some mortality might result if there was a prolonged exposure to freshly spilled oil. Overall, bowhead whales exposed to noise-producing activities and oil spills associated with future and existing projects within the Arctic region, combined with the other activities within the range of the migrating bowhead whale, most likely would experience temporary, nonlethal effects. However, exposure to oil spills could result in lethal effects.

Since offshore oil and gas activities in State waters are generally well shoreward of the bowheads main migration route, and some of the activities occur inside the barrier islands, the overall effects on bowheads from activities on State leases is likely to be minimal. These impacts could be magnified, however, if construction activity associated with additional development projects were to occur simultaneously, rather than consecutively.

E. Summary of the Effects of the Action

This Biological Opinion has considered the effects of issuance of annual quotas over a 6-year period for the subsistence harvest of bowhead whales by Alaska Natives, as well as the contribution of this action to cumulative impacts to this population. The proposed action will result in direct, indirect, and lethal impacts to bowhead whales.

The effects of subsistence harvests from this population have been assessed by the IWC, who determined a catch limit of 102 whales annually was sustainable without causing the population to decline. The proposed action would allow a level of take well below 102. Annual quotas would be set at a maximum of 67 to 82 strikes for the United States (most probably 77 strikes). Often, this limit is not reached due to the success of the hunters or shortened hunting seasons due to the limitations of weather and ice. Not all strikes result in the death of the whale. Hunting activities result in a number of whales being pursued but never struck. This potential harassment is not likely to result in injury. Similarly, some whales will be exposed to increased noise due to detonation of bombs or operation of vessels during whale hunting. Again, it is unlikely this

exposure would cause injury, although individual whales may alter their behavior for a brief period of time.

An accounting of the probable level of removals associated with other anthropogenic actions (e.g., ship strikes, fishery gear entanglements) and a projection of the cumulative impacts to this population do not indicate that the current trends in this population would be altered. While it is not possible to accurately predict quantitatively the level of removal from activities which might be associated with the non-hunting factors, the probability of such events resulting in a measureable affect is very low; in addition it would be highly unlikely for any one such event to impact any more than a very minimal portion of the population. Thus we conclude that all the adverse effects (direct, indirect, and cumulative) are very unlikely to exceed the RY or Q_{low} for the Western Arctic bowhead whale population. Indeed, the IWC Strike Limit Algorithm incorporates a factor for other removals due to ship strikes, gear interaction, and similar events, providing further confidence in that conclusion.

F. Conclusion

After reviewing the current status of the Western Arctic population of bowhead whales, the environmental baseline for the action area, the biological and physical impacts of subsistence harvests, and cumulative effects, it is NOAA Fisheries' biological opinion that issuance of annual quotas to the Alaska Eskimo Whaling Commission for the subsistence harvest of bowhead whales over the 6-year period 2013-2018 is not likely to jeopardize the continued existence of the species. No critical habitat has been designated for this species, therefore none will be affected.

G. Incidental Take

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying-out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the ESA provided that such taking is in compliance with the terms and conditions of an incidental take statement.

Native subsistence hunting may result in harassment to bowhead whales due to noise from whaling vessels and explosive devices. Section 10(e) of the ESA exempts subsistence hunting by Alaska Natives from the "take" prohibitions of the ESA. As discussed any "take" associated with the proposed permit is part of the intended purpose of the activities that would be authorized by the permit and, therefore, is not incidental take. Therefore, NMFS does not expect the proposed action to incidentally take threatened or endangered species and consequently an Incidental Take Statement will not be included under this consultation.

H. Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and

threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. NOAA Fisheries recognizes the voluntary efforts of the AEWC to develop improved means of harvesting bowhead whales through their Weapons Improvement Program to increase efficiency and reduce time to death. The AEWC Management Plan has promoted additional means to conserve these animals, such as prohibiting the sale of edible portions and requiring whales to first be stuck with a harpoon and attached float to improve chances of recovery, rather than to be shot at prior to harpooning. We believe these programs and efforts should continue, and present the following additional conservation recommendations:

1. NOAA Fisheries and the AEWC should continue to cooperatively manage the Western Arctic population of bowhead whales and continue efforts to improve strike efficiencies. NOAA Fisheries should review other Marine Mammal Protection Act and ESA programs to reduce individual and cumulative impacts to this population.

2. The AEWC should restrict the use of motorized vessels during the hunt whenever practical. In particular, the use of motorized vessels in the spring hunt at Barrow (i.e. within the spring lead system) should be limited to that necessary to establish or supply hunting camps and to retrieve struck whales and tow these to the flensing site.

3. The AEWC should continue to work to fully implement the distribution, training, and use of the penthrite grenade under the Weapons Improvement Program throughout the AEWC villages at the earliest time allowable by safety concerns.

4. Upon learning of any unauthorized take of bowhead or other endangered whales which occurs as a result of subsistence hunting activities (e.g. exceeding annual quotas, striking a calf, striking a cow accompanied by a calf), the AEWC should immediately notify the assistant Regional Administrator for Protected Resources at (907) 586-7235 of this taking to determine the appropriate and necessary course of action.

I. Reinitiation of Consultation

This concludes formal consultation on this action. As provided in 50 CFR §402.16, reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained and if: (1) new information reveals effects of this action that may affect listed species or critical habitat in a manner or to an extent not previously considered in this biological opinion; (2) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this biological opinion; or (3) a new species is listed or critical habitat designated that may be affected by the identified action. Normally, in instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease, pending reinitiation. However, because Alaskan Natives participating in the traditional subsistence harvest of bowhead whales are exempted from the "take" prohibitions of the ESA, including prohibition of incidental take, this requirement would not apply.

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