

Overview of planned seismic surveys offshore northern Alaska, July-October 2006

Sue E. Moore and Robyn P. Angliss¹

BACKGROUND

Oil and gas exploration and extraction in the United States is administered by the Minerals Management Service (MMS), US Department of the Interior (<http://www.mms.gov>). Offshore Alaska, the MMS Alaska Outer Continental Shelf Region sells leases to oil companies within designated planning areas (Fig. 1) where industry activity may be subsequently focused. Operators file requests to NOAA/Fisheries, Protected Resource Division (<http://www.nmfs.noaa.gov/pr/>) for Incidental Harassment Authorizations (IHAs) under the Marine Mammal Protection Act to permit disturbance to marine mammals during seismic surveys. In addition, discussions are held among representatives from NOAA Fisheries, industry and Alaskan whaling communities at annual Open Water Meetings to review upcoming activities and discuss proposed monitoring programs.

Oil and gas exploration has been conducted offshore northern Alaska since the late 1970s. During the open-water season (*ca.* July-September), seismic surveys are conducted by firing a towed array of airguns at roughly one second intervals, with broadband source levels averaging roughly 250 dB re.1 μ Pa-m (Greene and Moore 1995; Hildebrand 2005). After a period of intensive exploration offshore northern Alaska during the 1980s, seismic surveys subsided concomitant with the comparatively low price of oil. Now, after roughly a decade of quiescence, three oil and gas-related seismic surveys are planned in the Beaufort and Chukchi seas commencing in July 2006 (Table 1; Fig. 2). These surveys will be accompanied by increased supply ship, tug-barge and aircraft support activities. In addition, one research-related seismic survey is planned to the Chukchi Borderland, leaving and returning from Barrow, Alaska, mid-July through August 2006 (Fig. 2).

The effect of noise from seismic surveys on bowhead whales, and thereby on the Alaska Native subsistence hunt, was the focus of intense study in the 1980s (Richardson 1995). Bowhead whale responses to seismic operations have varied from little or no obvious changes in behavior (Reeves et al 1984; Fraker et al 1985) to changes in call rates (Koski and Johnson 1987), and deflection of the migration as far away as 35km (Miller et al 1999). Responses appear to be dependent on the behavior of the whales (e.g., feeding, migrating, etc) at the time the animal encounters the sounds from seismic operations. Most of these studies, including those that found a deflection distance of 35km, involved airgun arrays of 560ci to ~1,500ci. As some of the airgun arrays proposed for 2006 are at least 3,000ci, it seems likely that bowhead whales will avoid larger areas around seismic operations; however, it is unknown at what distance a bowhead whale might avoid these large sound sources. These and other results are taken into account in the preparation of monitoring and mitigation plans, as required by IHAs.

Recent reports show that airgun signals can be detected 1000s of kilometers from their source, as in the case whereby noise from seismic surveys conducted offshore Nova Scotia, the coast of western Africa and northeast of Brazil were a dominant feature of the underwater noise field recorded along the mid-Atlantic ridge (Nieukirk et al. 2004). Further, in a comparison of anthropogenic underwater sound sources, airgun arrays worldwide were estimated to introduce 3.9×10^{13} Joules of energy into the ocean, second only to underwater nuclear explosions and ranking above military sonars (Hildebrand 2005). Although the sounds from seismic operations can clearly be detected at great distances, it is not known whether the levels of sound are sufficient to cause important behavioral changes. However, these reports suggest that monitoring over broader areas may be needed to determine the scale of potential effect of seismic surveys on bowhead whales and Alaska Native whaling activities. Initial steps toward an approach scaled to the larger area of influence anticipated using larger seismic arrays were discussed at the 2006 Open Water meetings, held 18-

¹ NOAA/Alaska Fisheries Science Center, National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115, USA.

21 April in Anchorage, Alaska. We outline the rudiments of the planned program below and emphasize that planning is still underway and not finalized at this time.

SEISMIC SURVEYS AND MITIGATION PLANNED OFFSHORE NORTHERN ALASKA, 2006

Three companies will conduct seismic surveys in the MMS Beaufort and Chukchi planning areas during summer 2006 (Table 1; Fig. 3). While specific plans are proprietary, all three companies plan to use seismic surveys in the Chukchi Sea, and one company will survey both the Chukchi and the Beaufort Seas. Shell will use a smaller (*ca.* 2400 ci) airgun array to conduct a shallow hazards survey in the Beaufort Sea, and will use a larger array (3147 ci) for surveys in the central Chukchi Sea planning area. GX Technology and ConocoPhillips plan to use a ~3100 ci array to survey areas in the Chukchi Sea.

Standard mitigation protocol during seismic surveys will include:

1. Marine mammal observers on each seismic vessel, conducting watches for marine mammals using handheld binoculars.
2. Standard marine mammal shutdown radii based upon received levels of 180 dB and 190 dB.
3. Shutdown radii verification, which will occur within the first few days of the seismic program.
4. Documentation of marine mammal sightings and shut-down occurrences over the course of all seismic surveys conducted during the 2006 season.

Additional mitigation has been proposed in a draft Programmatic Environmental Assessment (PEA) developed by the MMS and NMFS. Proposed additional mitigation measures in the draft PEA include surveying for bowhead cow/calf pairs and feeding aggregations and shutting down operations if certain numbers of these sensitive groups are in the vicinity of the seismic operation. Monitoring over broader temporal and spatial scales will likely rely on a combination of visual surveys and passive acoustic detection of marine mammal calls and seismic sounds. Details of these operations are still in development, but may include:

1. Up to three autonomous recorders placed nearshore perpendicular to the coast at a series of stations from Pt. Hope to the Canadian border. Complementary recorders placed offshore; exact configuration of coastal and offshore arrays will be determined to achieve maximum capability to monitor sound fields in the MMS planning areas.
2. Three 3-day vessel surveys using a towed acoustic array to document bowhead whale distribution relative to sound fields.
3. Weekly nearshore aerial surveys (< 20 km from shore) in the Chukchi Sea planning area.
4. Documentation of marine mammal call detections, sound fields detailed as 'acoustic budgets' wherein sound sources and received levels are identified, as possible.

Combined, these proposed monitoring plans are robust and will provide an improved ability to assess potential for effects of seismic surveys on bowhead whales, the Alaska Native bowhead whale harvest, and the harvest of other subsistence resources. However, because the PEA is still in draft, and changes may be made to the proposed monitoring program, it is not yet known exactly what monitoring will be implemented in 2006.

LITERATURE CITED

- Fraker, M. A., D. K. Ljungblad, W. J. Richardson, and D. R. VanSchoik. 1985. Bowhead whale behavior in relation to seismic exploration, Alaskan Beaufort Sea, Autumn 1981. OCS Study, MMS 85-0077. Anchorage, AK: USDO, MMS, Alaska OCS Region, 40 pp.
- Greene, Jr. C.R. and S.E. Moore. 1995. Man-made noise. pp. 101-158 in *Marine Mammals and Noise*, W.J. Richardson, C.R. Greene, Jr., C.I. Malme and D.H. Thomson (eds.), Academic Press, San Diego, CA.
- Hildebrand, J.A. 2005. Impacts of anthropogenic sound. pp. 101-123 in *Marine Mammal Research: Conservation beyond Crisis*. J.E. Reynolds III, W.F. Perrin, R.R. Reeves, S. Montgomery and T.J. Ragen (eds.), The Johns Hopkins University Press, Baltimore, MD.
- Koski, W.R. and S.R. Johnson. 1987. Behavioral studies and aerial photogrammetry. In: *Responses of bowhead whales to an offshore drilling operation in the Alaskan Beaufort Sea, Autumn 1986*. Shell Western E&P, Inc., Anchorage, AK.

- Miller, G. W., R. E. Elliott, W. R. Koski, V. D. Moulton, and W. J. Richardson. 1999. Whales. In: Marine Mammal and Acoustical Monitoring of Western Geophysical's Open-Water Seismic program in the Alaskan Beaufort Sea, 1998. LGL and Greeneridge, eds. LGL Report TA 2230-3. King City, Ont., Canada: LGL Ecological Research Associates, Inc. 109pp.
- Nieukirk, S.L., K.M. Stafford, D.K. Mellinger, R.P. Dziak and C.G. Fox. 2004. Low-frequency whale and seismic airgun sounds recorded in the mid-Atlantic Ocean. *J. Acoust. Soc. Am.* 115 (4): 1832-1843.
- NRC (National Research Council). 2003. Ocean noise and marine mammals. National Academies, Washington, D.C. [<http://www.nationalacademies.org>]
- NRC (National Research Council). 2005. Marine mammal populations and ocean noise: determining when noise causes biologically significant effects. National Academies, Washington D.C. [<http://www.nationalacademies.org>]
- Reeves, R.R., D.K. Ljungblad and J.T. Clarke. 1984. Bowhead whales and acoustic seismic surveys in the Beaufort Sea. *Polar Record* 22(138): 271-280.
- Richardson, W.J. 1995. Documented disturbance reactions. pp. 241-324 in *Marine Mammals and Noise*, W.J. Richardson, C.R. Greene, Jr., C.I. Malme and D.H. Thomson (eds.), Academic Press, San Diego, CA.

Table 1. Summary of seismic surveys planned offshore northern Alaska, July-October 2006. Surveys are oil and gas (O&G) or research related; all have applied to NMFS/OPR for Incidental Harassment Authorizations.

Operator	Activity	Where	Equipment	Planned survey areas
Shell	O&G	Beaufort & Chukchi	3-D towed array; ~2400 & 3147 ci	Portions of Chukchi; portions of nearshore Beaufort
GX Technology	O&G	Chukchi	3-D towed array; 3320 ci	Entire Chukchi
Conoco-Phillips	O&G	Chukchi	3-D towed array; 3390 ci	Portions of Chukchi
USCG HEALY	Research	Chukchi	towed arrays; 2840 ci & 420 ci	RT Barrow-Chukchi Borderland

Figure 1. Minerals Management Service oil and gas lease planning areas offshore Alaska.



Figure 2: Areas of proposed industry and research seismic activity, 2006. Additional research details available on [<http://www.icefloe.net>].

