



# INTEGRATED ECOSYSTEM-BASED MANAGEMENT OF THE U.S. ARCTIC MARINE ENVIRONMENT

## APPENDIX A: THE ARCTIC ECOSYSTEM AND HUMAN USES



2008

# Appendix A: The Arctic Ecosystem and Human Uses

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## Defining the U.S. Arctic

There is no single agreed upon area that is designated as the Arctic.<sup>1</sup> Some define the Arctic as the area north of the Arctic Circle at latitude 66° 33' 39." Others consider vegetation, sea ice extent, and political boundaries when defining the Arctic. Many people interviewed in this assessment view the marine environment of the U.S. Arctic as being north of the Bering Strait—i.e. the Arctic Ocean. For example, the North Pacific Fisheries Management Council is developing an Arctic Fishery Management Plan that considers fisheries north of the Bering Strait.<sup>2</sup> For the purpose of this assessment, ELI defines the Arctic to include the Bering, Chukchi and Beaufort Seas and coastal environments.

An important component of the Arctic is the sea ice coverage during the year, which at its peak in March can extend down to the Aleutian Islands in the Bering Sea including Bristol Bay.<sup>3</sup> Several marine species of particular concern for management and subsistence harvest associate with sea ice, including the bowhead whales (*Balaena mysticetus*), beluga whales (*Delphinapterus leucas*), narwhal (*Monodon monoceros*), bearded seal (*Erignathus barbatus*), ringed seal (*Phoca hispida*), walrus (*Odobenus rosmarus*), and polar bear (*Ursus maritimus*).<sup>4</sup> The vegetation near the coasts includes lowland and mountain tundra throughout northern Alaska and the terrestrial environment surrounding the U.S. Bering Sea.<sup>5</sup>

ELI chooses a broader definition of the U.S. Arctic based on social considerations, as well. The Inupiat people extend from the Canadian Border past the Bering Strait to the region of Nome, Alaska in the Bering Sea. Other Alaska Native people in the Bering Sea include the Central Alaskan Yupik and the Aleuts.<sup>6</sup> Some regional institutions align with this broad definition of the Arctic including the Inuit Circumpolar Conference that extends from Greenland to the Aleutian Islands<sup>7</sup> and the Arctic Council which considers the Bering Sea as part of the Arctic environment.

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<sup>1</sup> See, e.g., UNEP, *GRID Arendal, Definitions of the Arctic*, [http://maps.grida.no/go/graphic/definitions\\_of\\_the\\_arctic](http://maps.grida.no/go/graphic/definitions_of_the_arctic).

<sup>2</sup> Wilson, *supra* note 116.

<sup>3</sup> National Snow and Ice Data Center, *Arctic Sea Ice News and Analysis*, <http://nsidc.org/arcticseaicenews/>.

<sup>4</sup> Henry P. Huntington & Sue E. Moore, *Assessing the Impacts of Climate Change on Arctic Marine Mammals*, 18 *ECOLOGICAL APPLICATIONS* S1 (2008).

<sup>5</sup> UNEP & GRID Arendal, *Vegetation Zones in the Arctic*, [http://maps.grida.no/go/graphic/vegetation\\_zones\\_in\\_the\\_arctic](http://maps.grida.no/go/graphic/vegetation_zones_in_the_arctic).

<sup>6</sup> UNEP & GRID Arendal, *Demography of Indigenous Peoples of the Arctic Based on Linguistic Groups*, <http://maps.grida.no/go/graphic/demography-of-indigenous-peoples-of-the-arctic-based-on-linguistic-groups>.

<sup>7</sup> UNEP & GRID Arendal, *States, Organizations, and Strategical Issues in the Arctic: People Across Borders*, <http://maps.grida.no/go/graphic/states-organizations-and-strategical-issues-in-the-arctic-people-across-borders>

### **Bering Sea Currents<sup>8</sup>**

The Bering Sea stretches from the Bering Strait in Alaska and Northeast Siberia south to the Alaska Peninsula and the Aleutian Islands.<sup>9</sup> Large embayments include Bristol Bay, the Gulf of Anadyr, and Norton Sound. Notable islands include Nunivak, St. Lawrence, Hall, St. Matthew, and the Pribilof Islands.<sup>10</sup> The Bering Sea basin currents are generally cyclonic, with the Kamchatka Current flowing southward along the Kamchatka Peninsula. The Bering Slope Current carries water northwest along the ocean shelf and through the Bering Strait into the Chukchi Sea.<sup>11</sup>

### **Chukchi and Beaufort Seas Currents**

Cyclonic winds over the central Arctic predominate with anti-cyclonic winds alternating for 5-7 year periods.<sup>12</sup> In the Chukchi Sea, the Arctic Coastal Current flows northeast along the coast of Alaska. Waters from the Bering Sea and Gulf of Anadyr also move northwards into the Arctic basin.<sup>13</sup> The Siberian Coastal Current flows south through Long Strait between Wrangle Island and the coast of Russia.<sup>14</sup> The Beaufort Gyre moves water west and clockwise in the Beaufort Sea.

## **Human Use of Marine and Coastal Resources in the U.S. Arctic**

Major ocean industries in the U.S. Arctic include commercial fishing in the Bering Sea with potential expansion into the Arctic Ocean, commercial shipping with a potential Northwest Passage as sea ice retreats, and expanding offshore oil and gas development. Because captive farming of finfish is prohibited in Alaska's state waters, aquaculture in Alaska is limited to shellfish farming and salmon hatcheries.<sup>15</sup> While aquaculture is not prohibited in federal waters, federal laws do not facilitate its development. In Alaska, land-based sources of pollution that can impact the marine ecosystem come from mining operations and coastal villages that lack the infrastructure to dispose of hazardous and human waste.

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<sup>8</sup> For an excellent general description of the physical, biological and human environment of the Bering Sea, see TERRY JOHNSON, *THE BERING SEA AND ALEUTIAN ISLANDS: REGION OF WONDERS* (2003).

<sup>9</sup> NOAA's North Pacific Ocean Theme Page, *The Bering Sea*, <http://www.pmel.noaa.gov/np/pages/seas/bseamap.html> (last visited June 16, 2008).

<sup>10</sup> *Id.*

<sup>11</sup> United States Department of the Interior, Minerals Management Service, Proposed final program, *Outer Continental Shelf, Oil and Gas Leasing Program 2007-2012*, Environmental Impact Statement Vol.1 III- 85 (2006).

<sup>12</sup> *Id.* at 85.

<sup>13</sup> *Id.* at 12.

<sup>14</sup> University of Washington, *Circulation and Outflows of the Chukchi Sea*, [http://psc.apl.washington.edu/HLD/Chukchi/Chukchi.html#CHUKCHI\\_SEA\\_BASICS](http://psc.apl.washington.edu/HLD/Chukchi/Chukchi.html#CHUKCHI_SEA_BASICS) (last visited on June 16, 2008).

<sup>15</sup> Alaska Sea Grant Marine Advisory Program, *Aquaculture*, <http://seagrant.uaf.edu/map/aquaculture/index.html>.

## Impacts to the U.S. Arctic

The Arctic is experiencing global warming to a greater degree than other areas of the world, and temperatures have increased by up to four degrees Celsius in some areas.<sup>16</sup> As a result, sea ice in the Arctic is markedly declining, both in extent and thickness.<sup>17</sup> Arctic sea ice has decreased by fourteen percent since 1978 and by 2100, scientists predict a decline of roughly ten to fifty percent in annual average sea ice extent.<sup>18</sup> Ice thickness during late summer and early autumn has declined by as much as forty percent since the 1960s.<sup>19</sup> Although annual snowfall has been increasing in the Arctic, annual snow cover has decreased due to more rapid melting in spring and summer.<sup>20</sup> As sea ice retreats, storm surges in open waters along the coast lead to greater flooding and erosion of coastal villages. Retreating sea ice also contributes to a decrease in subsistence hunting of sea ice-dependent species and a loss of cultural heritage. Sea level has risen ten to twenty centimeters over the past 100 years. Scientists predict an additional sea level rise of ten to ninety centimeters to occur during this century.

Native villages, which rely on marine and freshwater environments for subsistence, are usually located along the coast or next to rivers and streams, consequently facing increasing vulnerability in the event of erosion or flood.<sup>21</sup> With sea level rise and storm surge, low-lying Arctic areas will experience more frequent inundation. As sea ice retreats, the available range habitat for polar bears to hunt and eat is diminishing. Diminished ice cover restricts the movement of bears to denning areas and reduces the availability of suitable denning locations.<sup>22</sup> An increase in polar bear mortality has also been attributed to the longer distances they must swim to reach the ice packs.<sup>23</sup> The predictions of polar bear decline due to climate change led the U.S. Fish and Wildlife Service to list the polar bear as threatened under the Endangered Species Act. The loss of sea ice will also significantly impact pinnipeds. Walrus have started to haul out onto coastal land rather than sea ice, putting nearshore prey populations under greater predation pressure.<sup>24</sup>

As the world's oceans uptake greater amounts of carbon dioxide, the ocean becomes increasingly acidic. Scientists predict that the continued uptake of excess carbon dioxide will reduce the pH of the oceans' surfaces by 0.3-0.5 units in the next century.<sup>25</sup> The acidification of the Bering Sea is expected to negatively impact the ability of calcifying organisms, such as corals and mollusks, to make shells and skeletons.<sup>26</sup> Species that rely on mollusks as a food source will be impacted as population levels decline. Deep water corals provide shelter and habitat for many marine

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<sup>16</sup> ARCTIC CLIMATE IMPACT ASSESSMENT, IMPACTS OF A WARMING ARCTIC: ARCTIC CLIMATE IMPACT ASSESSMENT, Cambridge U.P. (2004).

<sup>17</sup> *Id.* at Key Finding 8, p. 6.

<sup>18</sup> *Id.* at Key Finding 1, p. 10.

<sup>19</sup> David A. Grossman, *Warming up to a not-so-radical idea: Tort Based Climate Change Litigation* 28 COLUM. J. ENVTL. L. 1, 14 (2003).

<sup>20</sup> *Supra* note 297 at 357.

<sup>21</sup> Grossman, *supra* note 300.

<sup>22</sup> RANGE-WIDE STATUS REVIEW OF THE POLAR BEAR (URSUS MARITIMUS) 24-5 (Scott Schliebe et al., eds., United States Fish and Wildlife Service Alaska 2006).

<sup>23</sup> Laura Navarro, *What about the Polar Bears? The Future of the Polar Bears as Predicted by a Survey of Success under the Endangered Species Act*. 19 VA. ENVTL. L. J. 169, 183 (2008).

<sup>24</sup> Jay and Fischbach, *supra* note 75.

<sup>25</sup> C.L. Sabine et al., *The Oceanic Sink for Anthropogenic CO<sub>2</sub>*, 305 SCIENCE 367 (2004).

<sup>26</sup> R.A. Feely et al., *Impact of Anthropogenic CO<sub>2</sub> on the CaCO<sub>3</sub> system in the oceans*, 305 SCIENCE 362 (2004).

species. The decline of corals will mean significant habitat loss for these species.<sup>27</sup> Ocean acidification may also affect egg adhesion and fertilization success rates of fish.<sup>28</sup>

While many agree that the North Pacific fisheries are managed better than any other fisheries in the U.S., negative impacts from fishing do occur. Currently, the Bering Sea is the only portion of the U.S. Arctic supporting commercial fisheries. Commercial fishing affects the Bering Sea ecosystem in myriad ways. In addition to the potential depletion of target stocks, non-target species can experience significant increases in mortality. The removal of a large marine biomass can create disequilibrium within the ecosystem.<sup>29</sup> Large-scale harvesting of lower trophic level fish means a decline in available prey for large marine predator species. A large removal of pollock in the 1970s in the Gulf of Alaska, for example, resulted in a decline in the Steller sea lion population.<sup>30</sup> Incidental bycatch of non-target fish species also impacts marine ecosystems. For example, declines in salmon seen returning to streambeds to spawn are attributed in large part to the increased bycatch of salmon in pollock nets.<sup>31</sup> Marine mammals, sea birds, and forage fish can also become tangled or caught in fishing gear.<sup>32</sup> Bottom trawl fishing, especially, can cause widespread disturbance to habitats.

With recent federal and state lease sales in the Bering, Beaufort, and Chukchi Seas, oil and gas development and production is likely to expand. Offshore oil developments can impact marine habitat in a variety of ways. Dredging for pipelines and construction of artificial islands disturbs the sea floor and increases suspended sediment in the water load, which in turn disrupts benthic invertebrate populations.<sup>33</sup> Like sediment suspension, sediment deposition can directly impact some fish and mobile shellfish species. Drilling discharges can negatively impact benthic invertebrates and demersal fishes.<sup>34</sup> Vessels associated with off-shore drilling arrive from remote ecosystems and may introduce invasive species.<sup>35</sup> Onshore developments related to exploration, production, and the operation of offshore activities can disturb and disrupt marine mammal haul-outs and sea bird colonies.

Oil development and commercial shipping brings the risk of oil spills. The Exxon-Valdez experience highlights the difficulty of cleaning up oil in ice-free areas,<sup>36</sup> and oil spilled on sea ice is even more difficult to clean up.<sup>37</sup> Exposure to petroleum hydrocarbons is acutely toxic to many fish. Fish populations suffer from increased mortality, abnormal development of eggs,

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<sup>27</sup> US Government White Paper, *AFSC Ocean Acidification Research Plan* (2006), available at [http://www.afsc.noaa.gov/HEPR/docs/ocean\\_acidification\\_%20research\\_%20plan.pdf](http://www.afsc.noaa.gov/HEPR/docs/ocean_acidification_%20research_%20plan.pdf).

<sup>28</sup> *Id.*

<sup>29</sup> COMMISSION ON GEOSCIENCES, ENVIRONMENT AND RESOURCES, *THE BERING SEA ECOSYSTEM* 211 (1996).

<sup>30</sup> F.L. Lowry et al., *Proceedings of the International Symposium on the Biology and Management of Walleye Pollock*, 701 (University of Alaska Sea Grant, 1989).

<sup>31</sup> *See, e.g.*, Jeanette J. Lee, *Pollock Fishery Under Scrutiny Due to Bycatch*, ANCHORAGE DAILY NEWS June 25, 2008, available at <http://www.adn.com/money/industries/fishing/story/445902.html>.

<sup>32</sup> *Id.* at 218

<sup>33</sup> MMS, *supra* note 249 at 128.

<sup>34</sup> *Id.*

<sup>35</sup> *Id.* at 172.

<sup>36</sup> T.R. Loughlin, *Marine Mammals and the Exxon Valdez*, (1994).

<sup>37</sup> National Research Council, *Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope*, 100 (2003).

inability to access breeding grounds, and displacement from their preferred habitat.<sup>38</sup> Previous oil spills show that most marine mammals do not avoid affected areas.<sup>39</sup> Oil contamination of marine mammals results in agitation and death through a variety of mechanisms.<sup>40</sup> Sea birds are especially vulnerable to oil spills and many species are not expected to survive contact with oil.<sup>41</sup> Oiled eggs have significantly reduced hatching success and birds feeding their young are unable to forage for uncontaminated food.<sup>42</sup> Steller's eider and the short-tailed albatross, both on the federal endangered species list, could be severely impacted by a large oil spill.<sup>43</sup>

Increases in oil and gas exploration and increased traffic from potential shipping lanes could lead to increases in incidents of ships striking marine mammals. Ship strikes are a significant cause of mortality for several species of marine mammal, including northern right whales, beluga whales, harbor seals, and Pacific walrus.<sup>44</sup> Additionally, noise generated during offshore exploration activity has physical and behavioral effects on marine mammals. Seismic surveys are expected to damage the hearing organs of adult and juvenile fish and kill fish eggs and larvae.<sup>45</sup> Noise from air guns and ships disrupts marine mammals that are using ice floes for hauling out, birthing and rearing young.<sup>46</sup> Noise can cause marine mammals to be diverted from their migratory path to areas of increased ice cover and away from traditional feeding grounds.<sup>47</sup> Displacement of marine mammals from traditional routes may negatively impact subsistence communities. Subsistence hunters may lose whales or be forced to hunt in more dangerous environments.<sup>48</sup>

### **Bering Sea**

In the Bering Sea, a shift to warmer temperatures occurred in the late 1970s and again in 2000.<sup>49</sup> The change in sea temperature is having ecosystem-wide effects in the Bering Sea. Sea ice in the Bering Sea has begun to thin and has declined by approximately five percent over the last 40 years.<sup>50</sup> A reduction in sea ice favors biological productivity in the upper ocean at the expense of bottom species.<sup>51</sup> The biomass of spawning benthic flatfish including arrowhead flounder and rock sole has been in decline since the mid 1990s, while pelagic fish such as the walleye pollock show an increase in population growth in areas of the Bering Sea.<sup>52</sup> Sea birds abandon eggs and

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<sup>38</sup>MMS, *supra* note 249 at 175.

<sup>39</sup>Loughlin, *supra* note 36 at 257.

<sup>40</sup>National Research Council, *supra* note 37 at 100.

<sup>41</sup>R. T. Paine et al., *Trouble on Oiled Waters: Lessons from the Exxon Valdez Oil Spill*, 27 ANNUAL REVIEW OF ECOLOGY AND SYSTEMATICS, 197, 219 (1996).

<sup>42</sup>*Id.*

<sup>43</sup>*Id.*

<sup>44</sup>MMS, *supra* note 249 at 139; Kraus, *Northern Right Whales in Crisis*, 309 SCIENCE 561 (2005).

<sup>45</sup>MMS, *supra* note 249 at 115.

<sup>46</sup>*Id.*

<sup>47</sup>COMMISSION ON GEOSCIENCES, ENVIRONMENT AND RESOURCES, *supra* note 29 at 100.

<sup>48</sup>Ahmaogak, Maggie, Alaska Eskimo Whaling Commission – Overview and current concerns, [http://www.uark.edu/misc/jcdixon/Historic\\_Whaling/AEWC/aewc\\_maggie%20presentation.htm](http://www.uark.edu/misc/jcdixon/Historic_Whaling/AEWC/aewc_maggie%20presentation.htm).

<sup>49</sup>National Oceanic and Atmospheric Administration, *Current State of the Bering Sea*, [http://www.beringclimate.noaa.gov/bering\\_status\\_overview.html](http://www.beringclimate.noaa.gov/bering_status_overview.html) (last visited on June 25, 2008).

<sup>50</sup>Arctic Climate Impact Assessment, *supra* note 297.

<sup>51</sup>*Supra* note 330.

<sup>52</sup>James E. Overland & Phyllis J. Stabeno, *Is the Climate of the Bering Sea Warming and Affecting the Ecosystem?*, 85 EOS 309, 310 (2004).

chicks in areas of depleted resources in order to forage for food.<sup>53</sup> Many marine mammal populations are migrating north in reaction to the warming temperatures. Fin and humpback whale numbers have increased in the Bering Sea. Walrus populations, who breed and nurse on sea ice, have moved north as sea ice has thinned in the southern regions.<sup>54</sup>

Future climate change will continue these trends. Warmer summers and reduced sea ice give the ocean an increased capacity to absorb solar energy and resist the formation of sea ice in the winter.<sup>55</sup> Warmer temperatures should favor species such as pollock over those fish species requiring colder conditions to survive.

Trawling, among other fishing types, significantly impacts benthic communities in the Bering Sea.<sup>56</sup> The disruption due to trawling increases the mortality rates of benthic species; destroys biogenic structures and other benthic habitat;<sup>57</sup> and can injure or kill marine mammals.<sup>58</sup> A depleted benthic community in turn adversely affects larger fish, marine mammals and seabirds.<sup>59</sup> Trawling activities can directly injure and kill marine mammals.<sup>60</sup> Fishing activities can also alter pinniped behavior, causing populations to abandon certain areas.<sup>61</sup>

A major shipping route, the North Pacific Great Circle Route, moves across the Southern Bering Sea near the Aleutian Islands. In 2004, the Selendang Ayu, a Malaysia vessel, lost power and crashed into the northern shore of Unalaska spilling over 350,000 gallons of fuel. The accident is considered the worst oil spill in Alaska since the Exxon Valdez and it resulted in the newly released recommendations for the design of a comprehensive risk assessment.<sup>62</sup>

Contaminants can bioaccumulate especially in top predators, causing detrimental effects.<sup>63</sup> Mining activities also result in the fragmentation of aquatic ecosystems which affect anadromous fish upon their return to freshwater.<sup>64</sup>

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<sup>53</sup> J.F. PIATT ET AL., *Effects of oil pollution on marine bird populations*, in THE EFFECTS OF OIL ON WILDLIFE: RESEARCH, REHABILITATION AND GENERAL CONCERNS, PROCEEDINGS FROM THE OIL SYMPOSIUM, WASHINGTON D.C., OCTOBER 16-18, 1990.125, 129 (J. White ed., Sheridan Press, Hanover 1991).

<sup>54</sup> B. P KELLY, *Climate change and ice breeding pinnipeds*, in G.-R. "FINGERPRINTS" OF CLIMATE CHANGE: ADAPTED BEHAVIOUR AND SHIFTING SPECIES' RANGES 43-55 (Walther, C. A. Burga & P. J. Edwards, eds., Kluwer Academic/Plenum Publishers, New York & London 2001).

<sup>55</sup> *Supra* note 333.

<sup>56</sup> NORTH PACIFIC FISHERY MANAGEMENT COUNCIL, BERING SEA HABITAT CONSERVATION, [http://www.fakr.noaa.gov/npfmc/current\\_issues/BSHC/BSHC\\_background.pdf](http://www.fakr.noaa.gov/npfmc/current_issues/BSHC/BSHC_background.pdf)

<sup>57</sup> COMMISSION ON GEOSCIENCES, ENVIRONMENT AND RESOURCES, *supra* note 29 at 216.

<sup>58</sup> North Pacific Fishery Management Council, *supra* note 56.

<sup>59</sup> *Id.* at 337.

<sup>60</sup> *Id.* at 337.

<sup>61</sup> *Id.* at 337.

<sup>62</sup> COMMITTEE FOR RISK OF VESSEL ACCIDENTS AND SPILLS IN THE ALEUTIAN ISLANDS, A STUDY TO DESIGN A COMPREHENSIVE RISK ASSESSMENT (2008), <http://onlinepubs.trb.org/Onlinepubs/sr/sr293.pdf>.

<sup>63</sup> COMMISSION ON GEOSCIENCES, ENVIRONMENT AND RESOURCES, *supra* note 29 at 207.

<sup>64</sup> William Hauser, Fish Talk Consulting, *Potential Impacts of Proposed Pebble Mine on Fish Habitat and Fish Resources of Bristol Bay* (2007), available at <http://www.savebristolbay.org/atf/cf/%7BE729E68D-22F3-4596-950354FE676F2264%7D/HauserSep07.pdf>.

### *Bristol Bay Considerations*

Climate change will impact Bristol Bay in a variety of ways. Melting sea ice and rising sea levels may result in increased storm surges and erosion.<sup>65</sup> Marine mammals associated with sea ice may decline in the Bay due to increased mortality or movement north with the sea ice retreat. Fish populations are also likely to be impacted by increased temperatures, including impacts to the sock-eye salmon population, which forms the basis of Bristol Bay's economic fishery.<sup>66</sup> These losses and changes in spatial patterns and abundance of species will certainly negatively impact subsistence harvesters if new or different species do not become available.

Fishing also impacts the ecosystem of Bristol Bay. The major commercial fishery is salmon, which have been declining in Bristol Bay.<sup>67</sup> Declines are attributed to targeted fishing efforts combined with non-target mortality to salmon caused by pollock fishing in the Bering Sea. The non-target bycatch of salmon has led to discussions of reducing offshore harvest efforts to prevent overfishing of the salmon population.

Although many Alaskans favor oil and gas development as a way to boost the local economy, many conservationists, fishers, and local residents fear the industry will irreversibly impact the marine environment.<sup>68</sup> Benthic environments will be disturbed through dredging, pipeline construction, and drilling discharges.<sup>69</sup> Noise and other disturbances from exploration will disrupt and displace fish, sea birds and marine mammals both offshore, and at onshore developments.<sup>70</sup> An increase in ship traffic may lead to an increase in marine mammal mortality from ship strikes.<sup>71</sup> Imported oil and gas equipment may bring invasive species into Bristol Bay.<sup>72</sup>

Like oil and gas development, the development of the Pebble Mine project has divided constituencies. Stakeholders in Bristol Bay are concerned that contaminants such as arsenic, sulfuric acid, cyanide and heavy metals from mining will make their way through the watershed and enter the Bering Sea.<sup>73</sup> Researchers and other stakeholders are particularly concerned that Bristol Bay's large salmon stocks will decline as siltation and fragmentation of aquatic ecosystems alter upstream freshwater spawning habitats.<sup>74</sup>

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<sup>65</sup> Arctic Climate Impact Assessment, *supra* note 50; Blier et al., *Storm Surges in the Region of Western Alaska*, 125 AMERICAN METEOROLOGICAL SOCIETY 12 (1997).

<sup>66</sup> Finney et al., *Impacts of Climatic Change and Fishing on Pacific Salmon Abundance over the Past 300 years*, 290 SCIENCE 795 (2000).

<sup>67</sup> Julian V. Minghi, *The Problem of the Conservation of Salmon with Special Reference to Bristol Bay, Alaska*, 36 LAND ECONOMICS, 380-384 (1960).

<sup>68</sup> See H.R. 1957--110th Congress (2007): Bristol Bay Protection Act (aiming to permanently prohibit oil and gas leasing in the North Aleutian Basin Planning Area, and for other purposes).

<sup>69</sup> MMS, *supra* note 249 at 114.

<sup>70</sup> MMS, *supra* note 249 at 181.

<sup>71</sup> Reeves et al., *Dolphins, Whales, and Porpoises: 2002-2010 Conservation Action Plan*, 16 (IUCN 2003).

<sup>72</sup> MMS, *supra* note 249 at 172.

<sup>73</sup> Bristol Bay Alliance, *The Mining Industry's Record of Destruction*, [http://www.bristolbayalliance.com/record\\_of\\_destruction.htm](http://www.bristolbayalliance.com/record_of_destruction.htm) (last visited on June 26, 2008).

<sup>74</sup> Hauser, *supra* note 345.



## Chukchi and Beaufort Seas

In the Chukchi Sea, in areas historically covered by ice, six out of the past nine years have been ice free for periods from one week to two and a half months.<sup>75</sup> This leads to movement of marine species towards the pole. For example, gray whales, previously only found south of the Bering Strait, are now been found north of it.<sup>76</sup> The Northern Alaskan Arctic is characterized by one of the highest rates of coastal erosion in the world. Erosion rates in Barrow, which lies at the meeting of the Chukchi and Beaufort Seas, have been as high as three meters a year.<sup>77</sup> Flooding and erosion affect eighty-six percent of native villages to some extent.<sup>78</sup> Inupiat villages in Northern Alaska are often built around the subsistence harvest of the bowhead whale and located close to the ocean, making them particularly vulnerable to flooding and erosion. Erosion threatens some archeological sites and native cultural heritage sites,<sup>79</sup> as well as public and private infrastructure.<sup>80</sup>

Retreating sea ice and the loss of ice edges will have significant effects on the ecosystem of the Chukchi and Beaufort Seas. Ice algae, which lives along ice edges, forms the base of the food chain, and is critical to Arctic cod.<sup>81</sup> Additional climate change effects may include increased human-polar bear interactions, and increased disturbance to bowhead whale populations.<sup>82</sup> Warming seas from climate change will likely result in the northward migration of commercial fish species. Fisheries in the Chukchi and Beaufort Seas are currently small and largely limited to subsistence harvesting. An increase in commercial fishing activities is predicted in the region, which could alter food web dynamics, deplete target and non-target species, and damage habitat.

Expanding oil and gas operations are predicted to increase disturbance of the sea floor, and introduce drilling discharges, sediment deposition, and the introduction of invasive species.<sup>83</sup> The climatic conditions of the Chukchi and Beaufort Seas necessitate infrastructure and operations not needed or used in the Bering Sea. This may exacerbate the impacts of oil and gas development. The construction of ice roads and ice islands, further impact the turbidity of the marine waters and add increased sedimentation.<sup>84</sup> Migration patterns of fish may also be

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<sup>75</sup> CHADWICK V. JAY & ANTHONY S. FISCHBACH, PACIFIC WALRUS RESPONSE TO ARCTIC SEA ICE LOSSES, U.S. GEOLOGICAL SURVEY FACT SHEET 2008-3041 (2008), <http://pubs.usgs.gov/fs/2008/3041/>.

<sup>76</sup> S.E. Moore et al., *Gray Whale Distribution Relative to Forage Habitat in the Northern Bering Sea: Current Conditions and Retrospective Summary*, 81 CANADIAN JOURNAL OF ZOOLOGY 734, 736 (2003).

<sup>77</sup> J.J. Kelly et al., *Climate Change Effects of the Alaska Coastal Environment of the Beaufort Sea*, 5 EUROPEAN GEOPHYSICAL SOCIETY, 8230 (2003).

<sup>78</sup> Robert A. Robinson, Managing Director Natural Resources and the Environment, Testimony before the committee on Appropriations at the United States Senate: Alaska Native Villages, Villages Affected by Flooding and Erosion Have Difficulty Qualifying for Federal Assistance (2004) (transcript available at <http://www.gao.gov/new.items/d04895t.pdf>).

<sup>79</sup> Lori Townsend, *Alaska Coastal Erosion Washes Away the Past*, INDIAN COUNTRY NEWS (May 2007), available at [http://indiancountrynews.net/index.php?option=com\\_content&task=view&id=2300&Itemid=1](http://indiancountrynews.net/index.php?option=com_content&task=view&id=2300&Itemid=1).

<sup>80</sup> Coastal Storm Damage Reduction Feasibility Study, Barrow, Alaska, (Information Packet for the Public Meeting) (April 2005), available at [http://www.poa.usace.army.mil/en/cw/barrow/Coastal\\_Storm\\_Damage\\_Reduction\\_Feasibility\\_Study\\_%20Informati\\_on\\_Packet\\_for\\_Public\\_Meeting\\_06Apr05\\_sent\\_%2014Mar05.pdf](http://www.poa.usace.army.mil/en/cw/barrow/Coastal_Storm_Damage_Reduction_Feasibility_Study_%20Informati_on_Packet_for_Public_Meeting_06Apr05_sent_%2014Mar05.pdf).

<sup>81</sup> R. Gradinger, *Climate Change and Biological Oceanography of the Arctic Ocean* 352 PHILOSOPHICAL TRANSACTIONS: PHYSICAL SCIENCES AND ENGINEERING, 277 (1995).

<sup>82</sup> MMS, *supra* note 249 at 124.

<sup>83</sup> MMS, *supra* note 249 at 8-10.

<sup>84</sup> *Id.* at 106.

impacted by disturbance and the construction of ice roads.<sup>85</sup> Bowhead whales have been found to abandon areas disturbed by construction and drilling activities, moving two kilometers away.<sup>86</sup> Changes in migration patterns by bowheads will, in turn, negatively impact Iñupiat subsistence communities.<sup>87</sup> Onshore developments impact marine mammals. Spotted seals use coastal beaches for sunning and resting, and polar bears forage inland and have inland maternity dens.<sup>88</sup> Walrus, which are beginning to haul out on coastal areas as a result of thinning sea ice, may also be impacted.<sup>89</sup>

Oil spills in the Beaufort Sea have so far been limited.<sup>90</sup> However, a large oil spill in this region has the potential to cause devastating effects on the ecosystem. Arctic conditions result in slow volatilization and mixing of waters. Cleanup of oil spills in the Arctic region is limited due to the extreme climatic conditions. Ice crystals reduce oil flow into recovery devices, oil adhesion to recovery units is much decreased, and a high percentage of water remains in the recovered product as the oil mixes with ice and snow.<sup>91</sup> Experiments have demonstrated that polar bears and ringed seals have high mortality rates following exposure to crude oil.<sup>92</sup> Oil also poses significant threat to the organs of bowhead whales.<sup>93</sup> Iñupiat elders fear that the International Whaling Commission will decrease whale harvest quotas should an oil spill occur.<sup>94</sup>

Receding Arctic ice raises the prospect of greater maritime traffic through the Northwest Passage, an area that has been historically closed to shipping. With the ice retreating at record rates, some countries—including Canada and Russia—have attempted to make claims over the passage. The United States and the European Union, on the other hand, have taken the position that these are international waters. Given that opening the Northwest Passage could shorten the shipping distance by 9,000 kilometers between Asia and Europe, increased access into the Northwest Passage will likely amplify potential conflicts among user groups. This raises the concerns described previously that come with shipping—spills, accidents, collisions with whales, and noise. According to the Arctic Climate Impact Assessment, new regulation for ships, offshore structures, port facilities, and coastal activities must be designed and tested to reduce the risk of environmental degradation from shipping in the Northwest Passage.<sup>95</sup>

Noise from seismic surveys in the Chukchi and Beaufort Seas causes hearing loss, injury, and discomfort to marine mammals. Beluga and killer whales leave sites of seismic exploration. Humpback, bowhead and fin whales can experience long term hearing loss<sup>96</sup> and noise and disturbance may affect the migration patterns of several species of marine mammal.<sup>97</sup> Polar bears, a species that swim with its head above the water, are unlikely to suffer any hearing loss,

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<sup>85</sup> North Slope Borough Coastal Management Plan, *supra* note 287.

<sup>86</sup> MMS, *supra* note 249 at 117.

<sup>87</sup> National Research Council, *supra* note 37 at 139.

<sup>88</sup> *Id.* at 118.

<sup>89</sup> Jay and Fischbach, *supra* note 75.

<sup>90</sup> National Research Council, *supra* note 37 at 76.

<sup>91</sup> MMS, *supra* note 249 at 113.

<sup>92</sup> National Research Council, *supra* note 37 at 104.

<sup>93</sup> *Id.* at 102.

<sup>94</sup> *Id.* at 135.

<sup>95</sup> Arctic Climate Impact Assessment- Key Finding 6, *supra* note 297.

<sup>96</sup> MMS, *supra* note 249 at 116.

<sup>97</sup> North Slope Borough- Coastal Management Plan, *supra* note 287 at 115.

however; female bears may abandon maternity dens due to noise, leading to increased cub mortality rates.<sup>98</sup>

Pollutants from Red Dog Mine enter the watershed and flow into the Chukchi Sea through the Wulik River. Elevated dust from mining transports heavy metals including lead, zinc and cadmium into the marine ecosystem.<sup>99</sup> Chemical changes in the marine environment resulting from these pollutants can affect marine mammals, fish, and other marine species.<sup>100</sup> Placer mining can result in increased siltation and turbulence in upstream areas and affect the spawning sites of anadromous fish.<sup>101</sup>

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<sup>98</sup> *Id.* at 97.

<sup>99</sup> Alaska Division of Spill Prevention and Responses, Contaminated Sites Program, *Red Dog Mine*, <http://www.dec.state.ak.us/spar/csp/sites/reddog.htm> (last visited on June 25, 2008).

<sup>100</sup> North Slope Borough- Coastal Management Plan, *supra* note 287 at 132.

<sup>101</sup> *Id.*

# Appendix B: Arctic EBM Examples

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## **Barents Sea Regional Integrated Management Plan**

Located in Norway, the Barents Sea is known for its biodiversity. It is home to large fish stocks, cold water coral reefs and sponge colonies, internationally important sea bird colonies and populations of marine mammals.<sup>102</sup> Primary human uses of the area include commercial fishing of cod, capelin, and herring; oil and gas exploration; marine transportation; marine bioprospecting; subsistence harvesting; and tourism.<sup>103</sup>

Norway developed an MSM approach to managing the Barents Sea in recognition of the need to reduce the complexity of sectoral-based government institutions and create a new framework to increase cooperation and coordination across sectors.<sup>104</sup> The program is based upon the development of a regional integrated management plan for the Barents Sea that identifies particularly productive and vulnerable areas, such as key spawning, molting and wintering areas; coral reef and sponge communities; and areas of high phytoplankton productivity.<sup>105</sup>

The Plan provides a framework to increase resource production in the area over time through a holistic and ecosystem-based approach that manages all regional activities. The program includes increased monitoring and the use of indicators, reference values, and action thresholds to provide a basis for a systematic evaluation of the marine ecosystem.<sup>106</sup> It takes a precautionary approach to petroleum development, where vulnerable areas are either banned from development or strictly regulated.<sup>107</sup> A mandatory routing and separating scheme for marine traffic 30 miles of the coast is set in place to reduce the effects of pollution and disturbance from marine transport.<sup>108</sup>

The Plan builds on already existing international and national laws and calls for inter-agency coordination and transboundary coordination, particularly with Russia and international law.<sup>109</sup> For example, the United Nations Convention on the Law of the Sea provides the initial legal framework—creating a 12 nautical mile territorial limit and 200 nautical mile exclusive economic zone. Norway also has a 200 nautical mile fisheries protection zone around Svalbard.<sup>110</sup> The Plan builds on the invasive species prevention requirements established under the Ballast Water Convention of the International Maritime Organization by ratifying the Convention and

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<sup>102</sup> The Royal Norwegian Ministry of the Environment, *Integrated Management of the Marine Environment of the Barents Sea and the Sea Areas off the Lofoten Islands*, 26 (2006).

<sup>103</sup> *Id.* at 40.

<sup>104</sup> *Id.* at 117.

<sup>105</sup> *Id.*

<sup>106</sup> *Id.* at 121.

<sup>107</sup> *Id.*

<sup>108</sup> *Id.* at 54.

<sup>109</sup> *Id.*

<sup>110</sup> *Id.* at 47.

implementing national measures. Additional measures relate to seabird bycatch and fisheries management.

Norway's Barents Sea program is managed under a system of cooperation among governance institutions and stakeholders. The Institute of Marine Research leads the Advisory Group on the Monitoring of the Barents Sea—a body with a broad membership and expertise from different sectors.<sup>111</sup> The group is charged with coordinating monitoring schemes and producing annual reports based on threshold action values, indicators and reference values. The Coastal Administration is the lead agency for the Forum on Environment Risk Management. This Forum provides information on risk trends, particularly with regards to acute oil pollution.<sup>112</sup> The Norwegian Polar Institute leads the Management Forum, which is responsible for the implementation of all scientific aspects of the plan and compiling regular status reports.<sup>113</sup> The Reference Group brings together different interest groups, including representatives from Sami communities.<sup>114</sup> Norway's Ministry of Environment is responsible for coordinating all government control and administrative follow-up.<sup>115</sup>

### **Beaufort Sea Integrated Management Planning Initiative**

The Beaufort Sea is a shared sea between the U.S. and Canada. Activities in Canada's Beaufort Sea include subsistence fishing and hunting, oil and gas exploration, marine transport, and a small amount of tourism. Under Canada's Ocean Plan, the region has been identified as one of five implementation areas.<sup>116</sup> Like the Barents Sea program in Norway, Canada's Beaufort Sea Program brings together coordinating bodies and working groups to develop a comprehensive management plan.

The Oceans Programs Division of Fisheries and Oceans Canada leads a multi-stakeholder, intergovernmental approach to developing the Integrated Ocean Management Plan for the Beaufort Sea that will provide an integrated, ecosystem-based, and adaptive framework for the management of marine activities.<sup>117</sup> Management goals focus on conservation and sustainable use of ocean resources, restoration and maintenance of biodiversity and biological productivity, and economic diversification so that coastal communities and stakeholders can continue to thrive.<sup>118</sup>

The Regional Coordination Committee leads the program and is co-chaired by the Inuvialuit Regional Corporation, Inuvialuit Game Council, and Fisheries and Oceans Canada.<sup>119</sup> The Committee includes 11 organizations representing federal regulators, territorial governments, and Inuvialuit.<sup>120</sup> The Committee coordinates the development of the integrated ocean management plan. The Beaufort Sea Partnership is the primary mechanism for stakeholder

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<sup>111</sup> *Id.*

<sup>112</sup> *Id.*

<sup>113</sup> *Id.* at 118.

<sup>114</sup> *Id.* at 119.

<sup>115</sup> *Id.* at 119.

<sup>116</sup> Michelle Schlag, *Integrated Oceans Management in the Beaufort Sea*, Fisheries and Oceans Canada (2002).

<sup>117</sup> Beaufort Sea Partnership Website, <http://www.beaufortseapartnership.ca> (last visited on June 20, 2008).

<sup>118</sup> *Id.*

<sup>119</sup> *Id.*

<sup>120</sup> *Id.*

engagement.<sup>121</sup> It serves as a network for the efficient use of resources, limiting duplication of efforts and promoting collaboration.<sup>122</sup> Working Groups identify and collect data related to the biophysical environment, community, geography, society, culture, and economy, and traditional knowledge.<sup>123</sup>

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<sup>121</sup> *Id.*

<sup>122</sup> *Id.*

<sup>123</sup> *Id.*

# Appendix C: Laws Protecting to Alaska Native Rights

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Special status is given to Native subsistence harvesting of wildlife on federal lands in Alaska by the Alaska National Interest Lands Conservation Act (ANILCA).<sup>124</sup> ANILCA provides that fish and wildlife taken on federal public land for non-wasteful subsistence purposes shall be afforded priority over the taking of fish and wildlife for all other purposes. ANILCA’s applicability to marine species in Alaska is limited to only those species which are not endangered species, marine mammals, or migratory birds, such as marine and anadromous fish and marine invertebrates.<sup>125</sup> Together, the U.S. Fish and Wildlife Service, National Park Service, Bureau of Land Management, Bureau of Indian Affairs, and the U.S. Forest Service constitute the Federal Subsistence Board, a body that administers subsistence harvest of fish and wildlife on federal public lands in Alaska.<sup>126</sup>

Two years after Congress passed ANILCA, the State of Alaska promulgated Alaska’s subsistence statute. The statute gave subsistence hunting and fishing priority over other uses of fish and game stocks. In 1986, the state amended its subsistence statute to reflect ANILCA’s rural priority. The statute provided “rural residents” special preference to harvest fish and wildlife for subsistence purposes.<sup>127</sup> In *McDowell v. State of Alaska*, the Alaska Supreme Court found, however, that preferential allocations based on rural residency was unconstitutional under the Alaskan Constitution.<sup>128</sup> In 1992, the state amended its subsistence law to grant *all* Alaska residents who qualify as subsistence users—whether urban or rural—priority over other users. As a result of the *McDowell* case, Alaska state law differs from ANILCA in that it does not provide overt preference to Alaska Natives or rural residents. Instead, Alaska state law utilizes a number of factors to determine eligibility as a subsistence hunter, including: the number of years an individual spends hunting, the amount of time during the year he or she spends hunting, access to alternative sources of game, and the cost of groceries.<sup>129</sup> These changes in Alaska state law subsequent to the *McDowell* case resulted in federal control over the implementation of the subsistence provisions in ANILCA.

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<sup>124</sup> 16 U.S.C.A § 3114.

<sup>125</sup> 16 U.S.C.A § 3125.

<sup>126</sup> 36 C.F.R § 242.10.

<sup>127</sup> *McDowell v. State* 785 P.2d 1 (Alaska, 1989), (An Act Relating to the Taking of Fish and Game for Subsistence and Personal Use), 1986 Alaska Sess. Laws ch. 52 (current version codified at Alaska Stat. §§ 16.05.258-.259 (1992)).

<sup>128</sup> Alaska Const. art. VIII, § 3 (providing that “[w]herever occurring in their natural state, fish, wildlife, and waters are reserved to the people for common use,”) and Alaska Const. art. VIII, § 15 (providing that “[n]o exclusive right or special privilege of fishery shall be created or authorized in the natural waters of the State”).

<sup>129</sup> 5 AK ADC 92.070.

In subsistence areas, the Board of Fish and Game must identify fish and game populations customarily used for subsistence use and determine the harvestable portion—with preference given to subsistence uses over other consumptive uses.<sup>130</sup> The Boards of Fish and Game are responsible for the conservation of all harvestable populations. In enacting conservation measures, they must exercise all practical options for restricting non-subsistence harvest of the stock before they limit subsistence consumptive uses.<sup>131</sup> Within the Department of Fish and Game, the Subsistence Division researches and quantifies customary subsistence use of fish and wildlife in order to provide scientific information for future management programs.<sup>132</sup>

Federal laws, including the Endangered Species Act, the Marine Mammal Protection Act, and the Migratory Bird Treaty Act, have specific provisions to protect Alaska Native subsistence rights. Under the Endangered Species Act, any Alaskan Native, or non-native who permanently resides in an Alaskan village, is exempt from the “take” prohibition. The take must be for subsistence purposes, and not accomplished in a wasteful manner.<sup>133</sup> Subsistence use is defined to include the sale of edible produce sold for native consumption in native villages and towns in Alaska.<sup>134</sup> An exemption for non-edible by-products, made into native artifacts allows them to be sold in interstate commerce.<sup>135</sup> Taking regulations can only be imposed if the species in question is being negatively affected by subsistence harvest.<sup>136</sup> Such regulations must be preceded by public notice and hearings, and must be removed once it has been determined such regulations are no longer needed.<sup>137</sup> Some interviewees pointed out that while the potential listing of the Cook Inlet beluga whale would result in regulations imposed upon subsistence harvest, other Arctic species including the polar bear are not threatened by subsistence harvest.<sup>138</sup>

The Marine Mammal Protection Act includes similar exemptions for Alaska Natives.<sup>139</sup> Any Alaskan Native who dwells along the coast of the North Pacific or the Arctic Ocean is exempt from the moratorium on the taking of marine mammals, and may take marine mammals for subsistence consumption<sup>140</sup> and to create native articles of handicraft.<sup>141</sup> The Marine Mammal Protection Act provides that edible portions of marine mammals may be sold in native villages and towns for native consumption and that native handicrafts may be sold in interstate commerce.<sup>142</sup> Regulations may be imposed if the Secretary decides a stock of marine mammal is becoming depleted.<sup>143</sup> Such regulations may only be prescribed after public notice and a hearing, and the Secretary must demonstrate that the determination and regulations regulation are

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<sup>130</sup> Subsistence Use and Allocation of Fish and Game, AS 16.05.258 *available at* <http://touchngo.com/lglcntr/akstats/Statutes/Title16/Chapter05/Section258.htm>.

<sup>131</sup> 5 AK ADC 99.010 (c).

<sup>132</sup> Duties of Section of Subsistence Hunting and Fishing, AS 16.05.094 *available at* <http://touchngo.com/lglcntr/akstats/Statutes/Title16/Chapter05/Section094.htm>.

<sup>133</sup> 16 U.S.C.A. §§ 1539 (e) (1)-(2) [include language of take prohibition].

<sup>134</sup> 16 U.S.C.A. § 1539 (e) (3) (i).

<sup>135</sup> 16 U.S.C.A. § 1539 (e) (1) (B).

<sup>136</sup> 16 U.S.C.A. § 1539 (e) (4).

<sup>137</sup> *Id.*

<sup>138</sup> Interviews, Jun 9-13, 2008 (on file with ELI).

<sup>139</sup> 16 U.S.C.A. § 1371 (b).

<sup>140</sup> 16 U.S.C.A. § 1371 (b) (1).

<sup>141</sup> 16 U.S.C.A. § 1371 (b) (2).

<sup>142</sup> 16 U.S.C.A. § 1371 (b) (2).

<sup>143</sup> 16 U.S.C.A. § 1371 (b) (3).



supported by substantial evidence. Regulations must be removed once it is determined they are no longer needed. The Marine Mammal Protection Act also includes provisions for cooperative marine mammal management arrangements between the Federal Government and Alaska Native Tribes.<sup>144</sup> Significant appropriations were approved for fiscal years 1994-1999 so that grants could be given to Alaskan Native organizations engaging in the monitoring and research of marine mammals and the creation of management plans.<sup>145</sup>

The Migratory Bird Treaty Act forbids the taking of any migratory birds native to the United States, and their eggs.<sup>146</sup> The Act includes several seabirds and shorebirds found in Alaska.<sup>147</sup> The Treaty was amended in 1978 to allow subsistence harvest and allows the Secretary of the Interior to issue regulations permitting Alaska Natives to take migratory birds and their eggs for subsistence purposes.<sup>148</sup> In addition to usual hunting allowances in the open season, Alaska Natives within subsistence areas are allowed to harvest migratory birds and their eggs in the closed summer season.<sup>149</sup> The methods and means of hunting are strictly regulated,<sup>150</sup> and harvesting is limited to subsistence use for human consumption.<sup>151</sup> Regional regulations are set in place in accordance with region-specific concerns, limiting the ‘open season’ for specific species, and setting in place harvest quotas.<sup>152</sup> Emergency closure of areas from subsistence harvesting is permitted when there is an imminent threat to any migratory bird population.<sup>153</sup> The regulations also create the Alaska Migratory Bird Co-management Council, which consists of Alaskan Natives and federal and state representatives who work together as equals to develop regulations and guidelines governing subsistence harvest of migratory birds.<sup>154</sup>

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<sup>144</sup> 16 U.S.C.A. § 1388.

<sup>145</sup> 16 U.S.C.A. § 1388 (b), (d).

<sup>146</sup> 16 U.S.C.A. § 703.

<sup>147</sup> 50 C.F.R. § 10.13.

<sup>148</sup> 16 U.S.C.A. § 712.

<sup>149</sup> 50 CFR § 93.3.

<sup>150</sup> 50 CFR § 92.20.

<sup>151</sup> 50 CFR § 92.6.

<sup>152</sup> 50 CFR § 92.31.

<sup>153</sup> 50 CFR § 92.21.

<sup>154</sup> 50 CFR § 92.10.

# Appendix D: State and Federal Agencies

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Under state law, the **Department of Environmental Conservation** is to develop, review, and revise a “a statewide environmental plan for the management and protection of the quality of the environment and the natural resources of the state.”<sup>155</sup> The Department complies with this requirement with the submission of its annual budget document.<sup>156</sup> In compliance with state statute, the Department ranks its program priorities based on environmental protection and protecting Alaskans from unsafe sanitary practices.<sup>157</sup> Climate change is ranked third on the list. Water quality and monitoring is tenth. Nonpoint source pollution permitting and protection is ranked number eleven. The Ocean Ranger program to protect against cruise ship pollution is last on the list at number twenty-four.

Together, the U.S. Coast Guard and the State of Alaska Department of Environmental Conservation are conducting a multi-stage comprehensive risk assessment of maritime transportation in the Bering Sea and the Aleutian Islands.<sup>158</sup> The first phase was recently completed with the release of a National Academies risk assessment design report.<sup>159</sup>

**The Environmental Protection Agency (EPA)** develops and enforces national air and water quality standards. Under the Clean Air Act, the EPA has established National Ambient Air Quality Standards (NAAQS) which are imposed to regulate emissions from stationary and mobile sources to protect public health and welfare.<sup>160</sup> The Supreme Court has recently ruled that the EPA can regulate greenhouse gases responsible for climate change under the Clean Air Act.<sup>161</sup>

Under the Clean Water Act, the EPA regulates water pollutant discharge through the National Pollutant Discharge Elimination System (NPDES), which requires a permit for any discharge of any pollutant into navigable waters.<sup>162</sup> Alaska is one of the few states which are not

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<sup>155</sup> Alaska Environmental Plan, AS § 46.03.040 available at <http://touchngo.com/lglcntr/akstats/Statutes/Title46/Chapter03/Section040.htm>.

<sup>156</sup> Personal comm. (on file with author).

<sup>157</sup> Alaska Department of Environmental Conservation, *State of Alaska FY2009 Governor's Operating Budget* at 19 (2007).

<sup>158</sup> Coast Guard, *Press Release* (2006), available at [http://www.dec.state.ak.us/spar/perp/ai\\_risk/pr\\_08dec2006.pdf](http://www.dec.state.ak.us/spar/perp/ai_risk/pr_08dec2006.pdf).

<sup>159</sup> TRANSPORTATION RESEARCH BOARD OF THE NATIONAL ACADEMIES, *RISK OF VESSEL ACCIDENTS AND SPILLS IN THE ALEUTIAN ISLANDS: DESIGNING A COMPREHENSIVE RISK ASSESSMENT – SPECIAL REPORT 293* (forthcoming 2008).

<sup>160</sup> 42 U.S.C. §7401 et seq.

<sup>161</sup> *Massachusetts v. Environmental Protection Agency (EPA)*, 549 U.S. 497 (2007).

<sup>162</sup> 33 U.S.C. §1342.

authorized to implement this permit program through a state program.<sup>163</sup> The EPA also regulates quality standards for surface waters, mandating that each state develop a list of impaired water bodies. For these impaired water bodies, states must establish a Total Maximum Daily Load (TMDL)—the maximum amount of pollutants a water body can receive and still meet water quality standards.<sup>164</sup> In 2006 Alaska contained 33 impaired water bodies.<sup>165</sup>

**The Alaska Division of Oil and Gas**, housed in the Alaska Department of Natural Resources, is responsible for encouraging exploration and development of Alaska's oil and gas resources and aims to maximize revenue and benefits from oil and gas production. The Division conducts geological field work, prepares materials to promote exploration, and reaches out to potential explorers. The Division is also responsible for the sale and administration of oil and gas leases within the state of Alaska, and assists with the oil and gas permitting process.<sup>166</sup>

The Alaska Division of Natural Resources is also home to the **Alaska Division of Mining, Land and Water**. The Division manages most of the state-owned land in Alaska including the non-petroleum minerals found beneath the surface of these lands. The Division also manages Alaska's tidelands, shorelands, and submerged lands and has jurisdiction over all of the State's water resources. All mining claims, and plans for the operation of mineral development are the responsibility of the Division, which also administers coal and mineral leases, and access to coal and mineral reserves. The aim of the Division is to maximize use of the land and waters of Alaska consistent with the public interest. Land-use plans are required to guide land use and development according to these aims. The Division is also responsible for the reclamation of abandoned mine land that becomes a public health or safety hazard.<sup>167</sup>

**MMS** in the U.S. Department of Interior is responsible for leasing the outer continental shelf for oil and gas development and other activities under the Outer Continental Shelf Lands Act. The oil and gas development process includes: (1) creation of a five-year plan by MMS to assess timing, location, and size of oil and gas leases; (2) oil and gas lease sales; (3) exploration drilling after the plan of operations is approved; and (4) oil and gas development once appropriate permits are acquired.<sup>168</sup> In developing its five-year plans, the MMS leasing program must take into consideration the ecology of the region, other existing or anticipated uses, and environmental sensitivity and productivity of the regions, among other things.<sup>169</sup> It also must fulfill its obligations under the National Environmental Policy Act.

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<sup>163</sup> Environmental Protection Agency, *National Pollutant Discharge Elimination System (NPDES), State Program Status*, <http://cfpub.epa.gov/npdes/statestats.cfm> (last visited on July 22, 2008).

<sup>164</sup> 33 U.S.C. §1313.

<sup>165</sup> Environmental Protection Agency, *2006 Section 303(d) List Fact Sheet for Alaska*, [http://iaspub.epa.gov/waters10/state\\_rept.control?p\\_state=AK&p\\_cycle=](http://iaspub.epa.gov/waters10/state_rept.control?p_state=AK&p_cycle=) (last visited on July, 22, 2008).

<sup>166</sup> Kevin Banks, State of Alaska, Division of Oil and Gas, *Oil and Gas Activities* (2008).

<sup>167</sup> State of Alaska, Division of Mining Land and Water, *Responsibilities*, <http://www.dnr.state.ak.us/mlw/aboutus.htm> (last visited July, 22, 2008).

<sup>168</sup> Information from interviews (on file with authors); *See also* MMS, Offshore Energy and Minerals Management, <http://www.mms.gov/offshore/>.

<sup>169</sup> U.S. Department of Interior, Minerals Management Service, *Leasing Oil and Natural Gas Resources: Outer Continental Shelf* (date not provided), *supra* note 249.

The planning and NEPA requirements provide the legal basis for an ecosystem-based management approach to oil and gas development on the outer continental shelf. However, several people interviewed made comments concerning the role of MMS in advancing integrated EBM. For example, one person noted that while the agency is mandated to consider a range of factors, it has a great deal of discretion in its decision-making. Another person stated that MMS has a rigid structure in practice that does not adequately address local concerns.