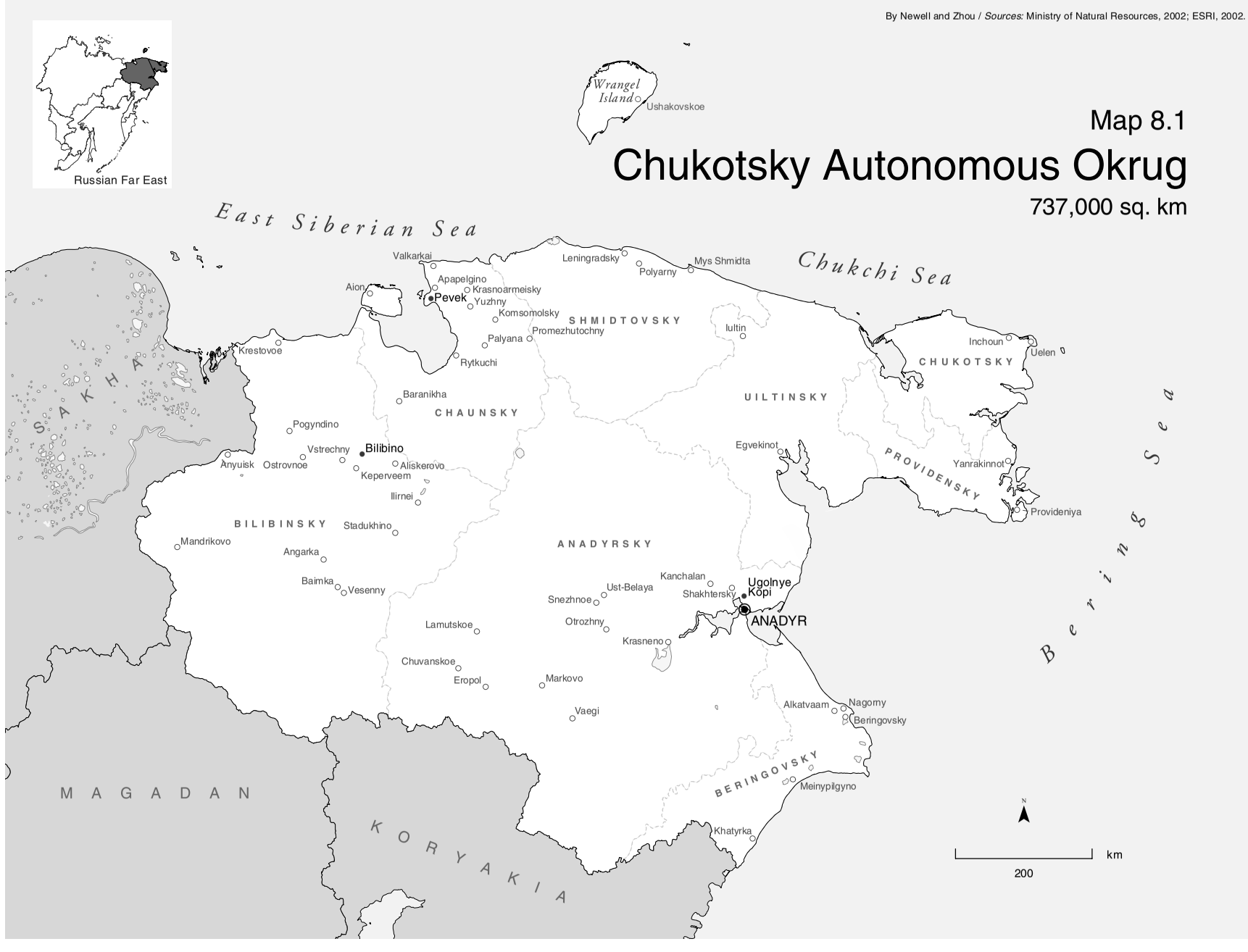


Newell, J. 2004. The Russian Far East: A Reference Guide for Conservation and Development. McKinleyville, CA: Daniel & Daniel. 466 pages

CHAPTER 8

Chukotsky Autonomous Okrug

(Chukotka)

Location

At the northeastern tip of Russia, the 85-km Bering Strait separates Chukotsky Autonomous Okrug (Chukotka) from Alaska. Ratmanov Island (Russia), the bigger of the two Diomede Islands, is less than five kilometers from the other Diomede Island, which belongs to the United States. Magadan Oblast and Koryak Autonomous Okrug border Chukotka to the south, while the Arctic Ocean (East Siberian Sea and Chukchi Sea) and the Pacific Ocean (Bering Sea) wash northern and eastern shores. Chukotka is nine time zones away from Moscow.

Size

About half the size of Alaska: 737,000 sq. km. The sixth largest administrative area of Russia, Chukotka has eight *raion*s.

Climate

Heavily influenced by the two great oceans that surround it, Chukotka's weather is unstable with strong, cold northerly winds that can quickly shift to southerly, wet storms. Cyclones occur frequently. Coastal areas have an average of 150 windy days per year. Precipitation averages between 200 to 400 mm per year. Navarin Cape has the highest incidence of hurricanes and storms in Russia. Ice covers the surrounding seas most of the year. Chukotka averages between 80 to 100 growing days per year.[1] January temper-atures average between –15°C and –35°C, with July temperatures averaging between 5°C and 14°C.

Geography and ecology

The region is mountainous. Chukotka's largest rivers, the Anadyr, Greater Anyui, Lesser Anyui, and Omolon, all flow from the mountainous western part of the peninsula, where peaks reach 1,800 m. The Anadyr River flows east, meandering through lowlands of marshes, plains, and riparian forests before emptying into Anadyr Bay and the Bering Sea. The Lesser and Greater Anyui Rivers flow north, through another lowland of plains and marshes, and cross the border into the Republic of Sakha before merging and emptying into the great Kolyma River. The third major lowland area is just south of Chaun Inlet, where numerous small rivers and streams flow north into this bay. Mountains, though not quite as high as those found in the west, dominate much of central and eastern Chukotka. The largest lakes are Krasnoe and Elgygytgyn.

The Bering Strait provides for the only exchange of water between the Pacific and Arctic Oceans in the northern hemisphere. The ocean current that flows north just

southeast of Navarin Cape to Anadyr Bay and through the western portion of the strait carries rich nutrients that fuel the production of massive amounts of phytoplankton and zooplankton, making the region one of the most productive marine areas in the world.[2]

Chukotka can be divided into four vegetation belts: arctic tundra, subarctic tundra, tundra woodland, and boreal forest. Arctic tundra, heavily influenced by the cold Arctic Ocean, includes Wrangel Island and nearby islands and a strip of coastline between the Kolyma River and Kolyuchinskaya Bay in the east. Vegetation similar to western Alaska, primarily mosses, lichens, and small shrubs, covers about half the region. Wrangel Island has especially diverse flora with many endemic, American, and steppe species. Subarctic tundra, with areas of tall shrubs and lichen grasslands, grows throughout much of Chukotka. It gradually turns into tundra woodland toward the southwest, and includes the extensive riparian forests of Anadyr basin. The tundra can be spectacular: "On this wild northern land neck, light plays in the green expanse of tundra in the summer time and highlights the bonfire of colors in early fall."[3] Tundra woodland, primarily Dahurian larch (*Larix gmelini*), willows (*Salix*), and poplars (*Populus*), grows in the lowlands of western Chukotka. Woodlands also exist in southern Chukotka although these elfin forests reach only 4 to 5 m in height. Tall boreal forests are mostly limited to the Omolon and Greater Anyui valleys in the western Chukotka.

Key issues and projects

Oil and gas development

In 2001, Russian industry giants Sibneft and Yukos began exploratory drilling in Chukotka. Development in this fragile region could affect the most important year-round habitat for polar bears in the circumpolar Arctic (see p. 305).

A floating nuclear power plant for Chukotka?

The government has ambitious plans to install a series of floating nuclear power plants along the coast of Chukotka. Aside from obvious concerns about nuclear waste and accidents, critics maintain that developing wind and solar energy sources would be cheaper and safer (see p. 304).

Flora and fauna

Chukotka is part of the ancient Beringia region (land and aquatic ecosystems on both the U.S. and Russian sides of the Bering Strait). The land bridge created unique plant communities in Chukotka; the region was a hotbed for species formation during the glacial and interglacial periods. Now Chukotka has 48 percent of the world's ninety-six endemic vascular plants of the Arctic; the most important regions are Wrangel Island with 17 percent of the total, Beringian Chukotka with 14 percent, and continental Chukotka with 12 percent.[4] In all, Chukotka has more than nine hundred species of vascular plants, about four hundred species of mosses, and four hundred species of lichens.

Fauna is also diverse with 220 bird species and 59 mammal species, 37 of which are terrestrial and the other 22 cetaceans and pinnipeds. Ten whale species frequent the coasts: gray (*Echrichtius robustus*), bowhead (*Eubalaena mysticetus*), humpback (*Megaptera novaeangliae*), fin (*Balaenoptera physalis*), sei (*B. borealis*), minke (*B. acutorostratus*), blue (*B. musculus*), beluga (*Delphinapterus leucas*), killer (*Orcinus orca*), and narwhal (*Monodon monoceros*). Of these, gray, bowhead, and beluga whales are the most regular visitors. Almost 80 percent of the populations of breeding polar bears (*Ursus maritimus*) in the Bering and Chukchi Seas den and give birth on Wrangel and Herald Islands.[5] About half of the world's population of Pacific walruses (*Odobeus rosmarus divergens*) frequent the rookeries along the coast. Fur (*Callorhinus ursinus*), harbor (*Phoca vitulina*), and spotted (*Ph. larga*)

seals are common in the southern part of the Bering Sea; ribbon (*Ph. fasciata*), ringed (*Ph. hispida*), bearded (*Erignathus barbatus*), and spotted (*Ph. largha*) seals are found in more northern waters.[6] Endangered Steller's sea lions (*Eumetopias jubatus*) also live in the west Bering Sea.

These marine mammals rely on Chukotka's fisheries; the Bering Sea alone has more than 450 fish and shellfish species. Mollusks and crustaceans are commercially important species and include crab, shrimp, and whelks. The Bering Sea boasts five species of Pacific salmon: chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), sockeye (*O. nerka*), chum (*O. keta*), and pink (*O. gorbuscha*). Chukotka also has large river and lake fisheries.

Thousands of migratory birds travel from wintering grounds in the Americas, Asia, and Europe to breed and feed in the region. Seabirds and waterfowl, which form huge bird colonies along the rocky shores, islets, sandy spits, and estuaries, include nearly 3.3 million seabirds on the eastern coast of Chukotka peninsula alone.[7] These include pelagic cormorants (*Phalacrocorax pelagicus*), guillemots (*Cepphus*), murres (*Uria*), auklets (*Aethia*), puffins (*Fratercula*), gulls (*Larus*), various ducks and waders.

Largest cities

Anadyr (pop. 13,000), the capital and largest city, serves as the administrative center. Pevek (pop. 11,000), established in the 1930s, is above the Arctic Circle and the most northern city in Russia. It was once a major seaport. Without the aid of icebreakers, ships can access the city only one hundred days per year; now only two or three ships arrive to bring supplies.[8] Bilibino (11,000), the site of the RFE's only nuclear power plant, is also a gold mining outpost.

Population

Chukotka's population is rapidly dwindling as a result of industrial decline and the loss of federal government subsidies. The population in 2001 was 75,300, down from 113,000 in 1995 and 157,000 in 1989.[9] Seventy-two percent of the residents live in cities. Most are immigrants, who came to the region because of high-paying jobs and other perks offered by the Soviet government. Approximately 17,000 indigenous peoples, primarily Chukchi and Yukagirs, Yupik Eskimos, Koryak, and Evens, make their home here.

Political status

In 1930, the USSR created Chukotka Autonomous Okrug, but for most of its history the *okrug* has been under the control of a neighboring administrative region. It was under jurisdiction of the Kamchatka Oblast administration until 1951, under Khabarovsk Krai from 1951 until 1953, and under Magadan Oblast from 1953 until 1993, when a Russian constitutional court finally allowed it to separate legally. Billionaire oligarch Roman Abramovich was elected governor in 2001.

Natural resources

Chukotka has the second largest gold reserves in Russia and numerous other mineral resources such as tin, mercury, coal, copper, tungsten (14 percent of all RFE reserves), and silver. Maiskoe gold reserve, located 280 km southeast of Pevek, is the largest in Chukotka.[10] Reportedly, the quality of gold deposits in Chukotka is much higher than that in nearby Kolyma reserves (Magadan Oblast).[11] Copper reserves are mainly in the

Peschanka field located 150 km south of Bilibino. Tin reserves are in the Pyrakaiskoe deposit located 80 km east of Pevek. Marine resources, mostly pollock, are also significant, but poor fishing practices have reduced salmon stocks by an estimated 50 to 75 percent of what they were in the 1940s.[12] Onshore and offshore oil and gas reserves have recently been discovered. The reserves include: Anadyr Reserve (onshore: 20 million metric tons; offshore: 110 million metric tons) and Khatyr Reserve (onshore: 25 million metric tons; offshore: 85 million metric tons).[13] Chukotka is the RFE's least forested region, with timber reserves averaging just eighteen cu. m per ha.[14]

Nikita Ovsyanikov

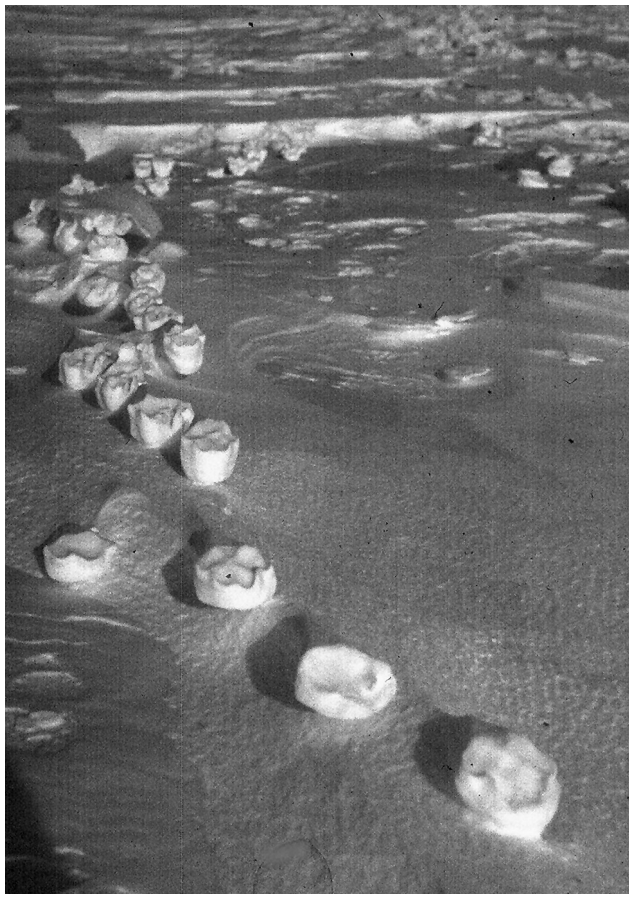
An Arctic fox (Alopex lagopus) *stretches amongst the Wrangel Island tundra.*

Main industries

The mining industry, particularly gold mining, has traditionally been the backbone of the economy, providing 71 percent of Chukotka's total industrial production. Gold mining takes place primarily in Bilibinsky, Schmidtovsky, and Chaunsky Raions, with tin mining in Chaunsky and Iultinsky Raions. In 2000, production was about one ton. During Soviet times, Chukotka accounted for 20 percent of the total USSR tin production, but now production has almost ceased.[15] Other major industries include power and energy (19 percent), primarily the Bilibino nuclear power plant (48 MW) and the Chaunsky power plant. The fuel industry (3 percent) is essentially coal production (1.1 million tons) near Anadyr and in Beringovsky. Oil and gas exploration is under way. Chukotka's ports serve as supply points for the Northern Shipping Route.

Commercial salmon fishing is centered on the mouth of the Anadyr River, where about 1,000 metric tons are caught yearly. Okrug government officials plan to develop the industry, as they receive annual quotas (2,000 tons of pollock and cod) from the federal government. However, they lack modern fishing equipment and sell most of the quota to foreigners. The *okrug* government wants to increase fishing production, particularly in Anadyr Bay. Over 1 million tons of fish are now harvested in the seas north and east of Chukotka.

Indigenous peoples have rights to harvest 169 whales, 10,000 ringed seals, and 3,000 walruses yearly. By-products from these marine mammals are used to feed cultivated pelt-bearing animals such as foxes. Food production is limited due to the harsh climate; most vegetable cultivation is done in greenhouses. Reindeer breeding is in steep decline, with reindeer decreasing from 464,457 in 1985 to just 148,000 in 1998.[16]



Vladimir Dinets

In winter, Arctic foxes become nomadic. Some remain in the tundra, others travel for hundreds of miles into the forests or across frozen seas. Their tracks often look like "negatives," as wind blows away the softer snow around them.

Infrastructure

To move resources, goods, and people within, to, and from Chukotka, a complicated system of marine ports, rivers, ice and gravel roads, and airports are used. Chukotka's eight seaports (Anadyr, Beringovsky, Egvekinot, Lavrentia, Zelyony Mys, Provideniya, Mys Shmidta, and Pevek) primarily service the Northern Shipping Route, which goes from Murmansk to the Pacific, to export gold and tin and to bring supplies to mining settlements. Most roads link interior cities and settlements with ports along this shipping route. Bilibino has access to the sea by a 300 -km ice road and riverway to Zelyony Mys. Pevek port services the nearby Komsomolsky gold field, the Valkumei tin mine, and the Krasnoarmeisky tin deposits.[17] A road connects the town of Iultin, which produces tin and tungsten, to Egvekinot port. The primarily ice or dirt roads, rather than gravel, limit year-round access. Chukotka has no highways or railways, but does have a number of decaying but functioning airports, including those located in Anadyr, Pevek, Markovo, and Provideniya. During the Soviet period, transport between the large settlements and cities was by air, but now most people travel by ground, mainly on river routes and by *vezdekhod* (passenger tank).

Foreign trade

Chukotka imports most food products, particularly meat and vegetables from Alaska, making the cost of living one of the highest in the RFE. Experts maintain that foreign trade is underreported. The sale of fish quotas and shipments of gold are not registered as trade. One journalist quipped that Chukotka must import everything from "toilet paper to light bulbs" and pay for them with earnings from the raw materials it exports.[18]

Economic importance in the RFE

Since the 1930s, Chukotka has served mainly as a source of tin and gold, as a base port for the Northern Shipping Route, and as a strategic military territory because of its proximity to the United States.

General outlook

Chukotka needs to resolve its persistent energy crisis. Power cuts and blackouts are common. In the winter of 1999, power was shut off for four hours a day.[19] Reduced coal production because of declining federal government financing and rising costs to import coal have led pleas by the *okrug* government for more support from Moscow. The peninsula also relies on the aging Bilibino nuclear plant, which many local residents and ecologists believe to be unsafe. They point to the spent fuel and liquid waste that has accumulated

at the plant, to the high radiation doses noted among plant personnel, and to the plant's inefficient filtering systems. However, the real radioactive waste disaster so far has been the leakage from RITEGs (radioisotopic thermoelectric generators) that power shipping beacons for the Northern Shipping Route. Scientists have classified fifty-seven of these RITEGs as radioactive waste. Reportedly, lack of funds has slowed their removal.

The government plans to build a number of floating nuclear power plants, the first to be installed by 2006 near the town of Pevek. Aside from obvious concerns about an accident, critics maintain that the cost of generating such energy is much higher than the cost of wind or solar power. Scientists estimate that Chukotka can generate 1.5 trillion kW annually, or about 14 percent of all commercially viable wind energy resources in Russia. Rather than promoting outdated forms of power generation, environmentalists would like to see the Chukotka administration and the master planners in Moscow promote renewable sources. Energy development has been tied to mining of the peninsula's mineral resources and thus has focused on supplying power to mining settlements and ports. Moscow has had little interest in developing sustainable, inexpensive energy sources for the citizens of Chukotka, particularly for the numerous small fishing, hunting, and reindeer herding settlements that dot the peninsula's coastline.

To reinvigorate the economy, the government is trying to attract foreign investment in the mining sector, but interest has been limited because of the high operating costs in the region and lack of a stable energy supply. Open-cast mining along the river valleys has destroyed large areas of land including productive reindeer pastures. Portions of the northern coastal region of Chukotka have been destroyed by the Komsomolsky, Peveksky, and Polyarninsky mining ventures. Placer deposit mining, specifically quarry and dredge mining, in the Ichuveem River basin has created artificial floodplains and river terraces. In the river basins that flow straight into the Chukchi Sea, about 60,000 ha of soil and vegetation have been partially or totally destroyed. These rivers are a constant source of pollution in the Arctic Sea, increasing the possibilities of serious destruction of the marine ecosystems.[20] In this extreme environment, effective technology is essential to restore these destroyed lands.

The government also has ambitious plans to increase the harvest of bioresources, particularly coastal fisheries, and is already developing oil and gas reserves. Fisheries resources in the Bering Sea continue to be mismanaged with overfishing, bottom trawling, use of drift nets, and poaching. The government is also pondering the introduction of hatcheries, which could lead to competition with native species and genetic pollution from these nonnative stocks.[21] Environmentalists would rather see support for adventure tourism, the reindeer herding industry, and sustainable but limited fisheries development.

The election of Roman Abramovich in 2001 as governor has led to increased optimism among residents about Chukotka's future. He has made some important gestures, including delivering food supplies, increasing the reindeer stocks, paying back wages, and increasing tax collection. It remains to be seen whether his efforts will have lasting impact. Critics would like to see more emphasis on development of alternative energy sources and small businesses, rather than oil and gas extraction and expansion of gold mining.

Population and industrial decline is leading to lower anthropogenic pressure on ecosystems, but is also leading to increased poaching as a result of unemployment and the lack of an adequate food supply. Therefore, stabilizing the economic situation of Chukotka is critical to ensuring protection of the region's ecosystems.

Sea ice in the Bering Sea has diminished by about 5 percent over the past thirty years.[22] Scientists fear that this diminishing ice cover, caused by global warming, will lead to a decline of microalgae, which live on the underside of or in the ice itself. These algae are the foundation for the Arctic food chain. The reduced ice cover also means reduced habitat for polar bears, seals, and other marine mammals and may disrupt weather patterns, leading to an increase in storms.

The introduction of alien species, such as rats and marine organisms, is also a threat: ships along the Northern Shipping Route transport these species on hulls, in ballast tanks, and on anchors. Other urgent environmental issues to address include limiting the impact of all-terrain vehicles on the fragile tundra, establishing waste-treatment centers in towns and settlements, particularly for petroleum products, and developing international programs to conserve marine mammals and migratory birds. Protected areas cover 8.3 percent of Chukotka's landmass, and funding is needed to support these reserves and to create new ones. Much of Chukotka's rare endemic flora remains unprotected.

—Josh Newell

NASA

Arctic pack ice breaks up and rushes southward through the Bering Strait (pictured here slightly above center).

Ecology

Gennady Smirnov, Maxim Litovka, Dmitry Naumkin

Mountainous Chukotka Autonomous Okrug lies in the extreme northeast of the RFE, divided from Alaska by the Bering Strait. Three mountain ranges, reaching 1,800 m in height, dominate the topography:

1. The Kolyma-Chukotka mountainous region, including the Anyui Plateau and the northern part of the Chukotka Plateau, which stretches east toward the Bering Strait.
2. The Okhotsk-Chukotka mountainous region, which includes the Anadyr Plateau and the southern part of the Chukotka Plateau.
3. The Anadyr-Koryak mountainous region, located in the southeast of the *okrug*, which includes the Chukotka section of the Koryak Plateau.

The three geographically separate lowlands areas (Anyui, Chaun, and Anadyr) are primarily plains, marshes, and lakes.

The East Siberian and Chukotka Seas, part of the Arctic Ocean, surround Chukotka to the north and northeast, while the Bering Sea, part of the great Pacific Ocean, lies to the east. The coldest is the East Siberian Sea with depths averaging between 60 and 70 m. The Chukotka Sea is the shallowest, with average depths of between 40 and 60 m. Ice covers them in winter, but melts partially in summer. Because of these ice conditions, shipping is sporadic. The Bering Sea, the warmest of the three seas, is most suitable for shipping, although the northern section also freezes in winter. Ice in Anadyr Bay is thickest in March; it begins to melt by the end of April and is usually gone by July.

Chukotka's seas teem with fish. The Bering Sea alone has more than four hundred fish species from sixty-five families; of these, fifty species from fourteen families are commercially valuable. The most important are walleye pollock (*Theragra chalcogramma*), Pacific cod (*Gadus macrocephalus*), Arctic cod (*Boreogadus saida*), Pacific herring (*Clupea pallasi*), smelts (*Osmerus*), capelin (*Mallotus villosus*), halibuts (*Hipoglossus*), and rockfish (*Sebastes*). Aquatic invertebrates are also plentiful. Mollusks and crustaceans are the most commercially important species and include crabs (*Callinectes, Paralithodes,* and *Cancer*), shrimp, squid, and whelks.

Seabirds and waterfowl form huge colonies along the rocky shores, islets, sandy spits, deltaic formations, and estuaries. Notable species include cormorants, guillemots, auklets, puffins, gulls, ducks, and waders. Twelve cetacean and eight pinniped species live in the Chukotka seas. Pacific walruses form sixteen rookeries during the thaw period. Three species of Phocidae inhabit the coastal zone: bearded, ringed, and spotted seal. The pelagic ribbon seal, usually seen in the sea, is rare here.

Winters are long and summers are short. In northern Chukotka, in January, temperatures reach as low as –28°C; in July they hover between 4°C and 8°C. Annual precipitation, mainly snow, is between 150 and 400 mm. Average wind speeds on the coast are 10 to 15 m per second, and reach 30 to 35 m per second during storms. Snow cover of 600 mm is continuous from the end of September to mid-July. More than 150 days of the year are without true sunlight.

A continental climate dominates the western and central portion of Chukotka. Annual precipitation ranges between 300 and 500 mm. Snow cover is heaviest in the east, averaging 1 m, but declines in the west to as little as .3 m. The Koryak Plateau and the Penzhina-Anadyr lowlands, with an annual average of 300 to 500 mm of precipitation, are in the moderate continental and maritime climate zones. Snow cover ranges between .5 m and 1 m. Winter winds, from the north, have an average speed of 9 m per second. January temperatures reach –36°C in the continental zone and –25°C in the moderate continental zone. July temperatures reach 14°C.

Influenced by a monsoon maritime climate, southeastern coastal Chukotka has the warmest temperatures and heaviest rainfall (700 to 900 mm annually) in the *okrug*. Snow cover reaches 1.5 m in the mountains and in the south. Temperature extremes here are –13°C to 15°C and 8° to 9°C, in January and August, respectively.

Vladimir Dinets

Thamnolia (elongated one on top of photo), Cetraria (all others), Cladonia, and other tundra lichens are the primary food sources of wild and domestic reindeer.

Vegetation

The arctic tundra region, influenced by the cold northern seas, includes Wrangel Island, other nearby islands and a thin strip of coastline between Kolyma River and Kolyuchinskaya Bay. The coarse, acidic, and organically deficient soils support a paucity of vegetation and low basal area coverage (50 to 70 percent.) Plants are primarily chamaephytic, with a prostate habit that allows them to survive the severe winter. Plants include mosses, lichens, some species of grasses, saxifrages (*Saxifraga*), mountain avens (*Dryas*), *Vaccinum* berries, Labrador tea (*Ledum*), bearberry (*Arctostaphylos*), dwarf birches (*Betula*), and dwarf versions of other shrubs. In a few locations, hot springs and thermal vents support associations of other plants that depend on this harsh habitat. Flora is more diverse in river valleys. Wrangel Island has unique flora that developed independently from the paleo-Beringia landmass and is rich in endemics. Vegetation of this arctic tundra is similar to that of western Alaska.

Terrestrial vertebrates living in the arctic tundra include brown (*Lemmus trimucronatus*) and collared (*Dicrostonyx torquatus*) lemmings, arctic fox (*Alopex lagopus*), snowy owls (*Nyctea scandiaca*), rock ptarmigan (*Lagopus mutus*), snow geese (*Anser caeruleus*), all species of eiders (*Somateria*), long-tailed duck (*Clangula hyemalis*), various species of gulls (*Larus*) and sandpipers (*Calidris*), jaegers (*Catharacta*), snow buntings (*Plectrophenax nivalis*), and Lapland longspurs (*Calcarius lapponicus*).

Subarctic tundra. Chukotka's subarctic tundra has more vegetation than the more northern tundra, and the river valleys contain sparse larch stands, willow and poplar forests in riparian areas, and birch. Here plant cover is almost continuous, interrupted only on steep or windswept slopes. Diverse grass beds rich in lichen, prime feeding grounds for reindeer, cover the uplands.

Insect diversity is insignificant. Hymenopterans, Dipterans, Lepidopterans, and Coleopterans are the common groups. A number of species of spiders live in the tundra. Common animals include gray wolf (*Canis lupus*), ermine (*Mustela erminea*), variable hare (*Lepus timidus*), Arctic ground squirrel (*Spermophilus parryi*), brown lemming, forest lemming (*Myopus schisticolor*), voles (*Microtus*), raven (*Corvus corax*), willow ptarmigan (*Lagopus lagopus*), sandhill crane (*Grus canadensis*), greater white-fronted goose (*Anser albifrons*), bean goose (*A. fabalis*), ducks (*Anas*), gulls (*Larus*), dunlin (*Calidris melanotos*), hoary redpoll (*Acanthis hornemanni*), snow bunting, and Lapland longspur.

Tundra woodland and boreal forests. Western Chukotka has scattered areas of woodlands, which are primarily Dahurian larch and Japanese stone pine and, in floodplains, chosenia (*Chosenia arbutifolia*) and poplar. Tundra grows at higher elevations where there is little winter snow cover. River valleys have sphagnum bogs and sedge tussock meadows, while lichen and Japanese stone pines cover the higher elevations. Tall boreal forests are mostly limited to the Omolon and Greater Anyui valleys. Dahurian larch is the canopy species in the larch forests. The upper understory is Japanese stone pine, birch, and alder shrubs. Green mosses and shrubby lichens grow along the ground. Larch forests are important in part because of their relatively fast circulation of biomass. Larch trees drop their needles annually, and the needles are rapidly processed by microorganisms. Stands of Japanese stone pine that fail to grow higher than 2 m form thickets. In southern Chukotka this growth forms elfin forests, with heights up to 5 m. These trees retain their needles for between five and eight years, and a slow detritus cycle prevents undergrowth from developing. Fires are frequent here because of large quantities of easily combustible matter.

Bark-eating beetles, longhorn beetles, and leafcutters live in the larch, Japanese stone pine, and alder trees. Bloodsucking Dipterans, mosquitoes, and midges are the most common insect fauna. The main vertebrate animals are brown bear (*Ursus arctos*), moose (*Alces canadensis*), wolverine (*Gulo gulo*), sable (*Martes zibellina*), variable hare, voles, golden eagle (*Aguila chrysaetos*), Northern goshawk (*Accipiter gentillis*), scoters (*Melanitta*), Eurasian magpie (*Pica pica*), spotted nutcracker (*Nucifraga caryocatactes*), wagtails (*Motacilla*), common redpoll (*Acanthis flammea*), leaf warblers (*Phylloscopus*), pipits (*Anthus*), and bluethroat (*Luscinia svecica*).

Rivers and lakes. Chukotka's larger rivers are the Anadyr, Amguema, Greater Anyui, Lesser Anyui, and Omolon. The rivers freeze over completely, with ice covering them up to eight months a year, and large ice floes at higher elevations do not melt for years. Snowmelt is the primary source of water for these Arctic rivers, with precipitation and groundwater as lesser secondary sources. Groundwater, surface water, and precipitation feed the rivers that flow into the Pacific. The headwaters of Chukotka's rivers have velocities of up to 4 m per second. Riverbeds are rocky with little sediment. The upper reaches of rivers contain little plankton. In the lower reaches, plankton biomass increases and benthic organisms decrease. Aquatic invertebrates include crustaceans that make use of the slower water and silt of the lower reaches and estuaries. The small lakes in the tundra freeze completely and plankton biomass is insignificant even during peak productivity in the summer when the water is warmest. Typical organisms are copepods and water fleas. The only amphibian is Siberian salamander (*Salamandrella kesserlingii*) found in shallow lakes of the south and west.

Forty-four species of fish from ten families live in the rivers and lakes. Salmon and whitefish (*Coregonus, Prosopium,* and *Stenodus*) species are the most important commercially, but the chum fishery in Anadyr Bay is the largest and widely considered the best in the RFE. There are also three species of char (*Salvelinus*), one of them endemic to Lake Elgygytgyn. Other typical ichthyofauna include the Arctic grayling

(*Thymallus arcticus*), burbot (*Lota lota*), sculpins (*Cottidae*), three species of lamprey (*Lampetra*), Northern pike (*Esox esox*), sticklebacks (*Gasterosteidae*), and Alaska blackfish (*Dallia pectoralis*).

Two hundred and twenty species of birds live in Chukotka. There are fifty-five species of mammal, thirty-seven of which are terrestrial (insectivores, rodents, lagomorphs, ungulates, and carnivores.) The remaining eighteen are cetaceans and pinnipeds.

Protected area system

Until 1976, Chukotka's protected area network consisted of five regional-level *zakaznik*s (Tundrovy, Tumansky, and Avtatkuul in the Lower Anadyr lowlands, Ust-Tanyurersky located on a main tributary of Anadyr River, and Teyukuul on the eastern shore of Chaunskaya Inlet) and one federal-level *zakaznik* on Wrangel Island.

The rapid industrialization of Chukotka during the 1970s brought vigorous mining and intensified prospecting for oil and gas. Settlements were erected and new roads were built. Use of heavy-tracked vehicles increased abruptly, scarring formerly pristine tundra areas throughout Chukotka. The wave of migrants from the central regions of the country were mostly interested in the promise of quick and easy earnings. These circumstances drastically increased the threat to the natural ecosystems of Chukotka.

Anticipating this threat, environmentalists raised awareness in media and through scientific publications of the need to establish new protected areas. Of particular concern were population declines, and in some cases disappearance, of rare and endangered species: emperor goose (*Anser canagicus*), lesser white-fronted goose (*A. erythropus*), tundra bean goose (*A. fabalis serrirostris*), black brant (*Branta nigricans*), Steller's sea eagle (*Haliaeetus pelagicus*), and others. With these continued efforts and the signing of Soviet-Japanese and Soviet-American treaties to protect migratory birds and their habitats, the reserve system was expanded. In 1976, the *zakaznik* on Wrangel Island was declared a *zapovednik*.

In 1977, the Chukotka Okrispolkom (*okrug* executive committee) approved a plan to create fifteen new reserves. However, biased Party technocrats, Soviet leaders, and mining and agricultural companies continually opposed implementing this program, and this opposition delayed the process. The first of the planned reserves, Omolonsky, was not created until 1980, and only in 1984 was the federal *zakaznik*, Lebediny, approved.

Perestroika brought social and political reforms that led to an explosion of grassroots environmental activity in Chukotka. Local ecologists and activists managed to prevent construction of Amguema Hydroelectric Power Station, which would have flooded large areas of reindeer grazing grounds and relict poplar stands.

In 1990, then-Presidents Mikhail Gorbachev and George Bush agreed to create an international park, Beringia, to allow collaboration between Russian and American scientists and nature conservation specialists. This plan was discussed regularly during Gore-Chernomyrdin Commission meetings. In 1993, the Chukotka government established Beringia, a regional-level nature-ethnographic park. On August 14, 1994, the Russian prime minister, Viktor Chernomyrdin, instructed the minister of the environment to develop the Russian portion of Beringia Park. However, from the outset, progress was stymied by endless debate within executive and legislative branches of government on all levels. Suddenly, many opposed creating the park. The *okrug* administration was particularly opposed, as exemplified by statements from the former governor, Alexander Nazarov.

In 1994, the Russian government approved an ambitious plan to create a number of new protected areas throughout Russia by 2005. Two were planned for Chukotka: a national park, Tsentralno-Chukotsky (Lake Elgygytgyn

Vladimir Dinets

There are seven species of lemmings in the RFE. Their numbers peak sharply every few years; this cycle is extremely important for all other inhabitants of the tundra. When abundant, lemmings become bold and sometimes aggressive.

basin region), and a *zapovednik*, Pribrezhny, in the Meinypilgyn lake and river region). The Chukotka Committee on Environmental Protection completed a feasibility study to create the national park, but plans changed to designate it as a regional park. Implementation of this study is indefinitely delayed due to lack of funds. In 1995 environmentalists had great expectations for the presidential decree No. 1032, dated May 10, 1995, which guaranteed financial support to *zapovednik*s and national parks through 2005. However, these hopes were quickly dashed when former President Yeltsin annulled the decree.

The *okrug* government has adopted its own document on the expansion of protected areas, which included two *zapovednik*s, five national parks, and twenty-four *zakaznik*s. If the plan is implemented, 15 to 20 percent of Chukotka will be protected. In 1995, responding to demands of the indigenous village, Rytkuchi, and, at the initiative of the Chaunsky Raion administration, the regional government created the Chaunskaya Guba (Chaun Inlet) Zakaznik to stem further decline of game populations. Game decline can be traced to opening the Bilibino-Pevek highway, which in turn, led to increased poaching. This *zakaznik* is the only regional *zakaznik* to be created in Chukotka in the post-Soviet era.

The protected area system in Chukotka is not expanding because of political and economic difficulties both in Russia and in Chukotka. The total area protected in some form in Chukotka amounts to 5,533,000 ha (8.3 percent of the *okrug* territory). Ostrov Vrangelya (Wrangel Island) Zapovednik totals 1.1 percent of the territory, one regional nature park totals 4.2 percent, one federal and six regional *zakaznik*s total 2.8 percent, and twenty natural monuments make up 0.2 percent.

Maintaining the protected area system in Chukotka is becoming increasingly difficult. This is particularly apparent on Wrangel Island, the most inaccessible and geographically isolated of the reserves. This *zapovednik* is also responsible for the welfare of the island's only village, Ushakovskoe. Supplying the settlement with adequate food, heating and electricity, communications, and utilities is beyond the reserve's meager budget. Deteriorating social and economic conditions on the island have produced a flood of complaints from the residents; in response, *okrug* authorities decided to return the *zapovednik* to the local jurisdiction of Chukotsky Autonomous Okrug.

Financing for Lebediny Zakaznik, which has federal status, is also inadequate. It does not even appear as a separate item in the game department's budget. Salaries for the reserve director and the only ranger are repeatedly delayed. Of the six regional reserves, only three (Chaunskaya Guba, Omolonsky, and Ust-Tanyurersky) have any staff (one ranger each) and they receive their salaries sporadically. All the protected areas lack proper transport equipment, spare parts, communication equipment, and field gear. Most, as a result, have been left defenseless to poachers and other forms of illegal activity.

With industrial development and shipping activity down because of the economic decline, there is a general feeling

Table 8.1
Protected areas in Chukotsky Autonomous Okrug

Type and name	*Size (ha)*	*Raion*	*Established*
Zapovednik			
Ostrov Vrangelya (Wrangel Island)	759,650	Ushakovsky	1976
Zakazniks			
Tundrovy (Tundra)	500,000	Anadyrsky	1971
Ust-Tanyurersky	450,000	Anadyrsky	1974
Tumansky	389,000	Anadyrsky	1971
Lebediny (Swans)	250,000	Anadyrsky	1984
Chaunskaya Guba (Chaun Inlet)	210,500	—	1974
Omolonsky	160,000 (32,000 in Chukotka)	Bilibinsky, Magadan Oblast	1980
Avtatkuul	159,700	Beringovsky	1971
Regional Nature-Ethnographic park			
Beringia	3,000,000	Providensky, Chukotsky	1993

Source: Chukotka Committee on Environmental Protection, 2000.

that creating new protected areas is less urgent. However, it is only logical to expect new industrial expansion in Chukotka, particularly the exploitation of land, marine, and oil and gas resources. Preemptive action should be taken, the most important of which is to create new *zapovednik*s, national parks, and *zakaznik*s.

Zapovedniks. Chukotka has just one *zapovednik*, Ostrov Vrangelya. Wrangel Island, 170 km north of the mainland, is divided latitudinally by a 1,100-meter mountain range. North of this range is the tundra and wetland ecosystem known as Akademy Tundra. To the south of the range, the tundra is drier and higher in elevation. Herald Island, 12 sq. km in size, lies 60 km northeast of Wrangel and only has sparse alpine tundra.

Wrangel Island has relict populations of more than seventy species of plants characteristic of ancient Beringia, when the two continents were connected. Plant species of both continents are found on the *zapovednik*; six North American species that do not grow anywhere else in Asia have been found on the island. Arctic endemism, with twenty-five endemic species, is highest on Wrangel Island. In total, the reserve has 380 species of plants.

There are only six terrestrial animals on the islands: polar bear, arctic fox, brown and Vinogradov (*Dicrostonyx vinogradovi*) lemmings, musk ox (*Ovibos moschatus*), and reindeer. According to some sources, gray wolves and wolverines have made periodic visits to the island from the continent. Vinogradov lemming is endemic to the island. There are two hundred musk ox, introduced in 1976, and a herd of domestic reindeer, introduced in the 1930s, on the island. Paleontologists believe that the last woolly mammoths (*Mammothus primigenius*) lived on the island during the Holocene Era (8,000–3,000 years ago). Bones and tusks are still frequently found. Scientists also believe that a population of wild reindeer lived on the island until fairly recently.

About 80 percent of the populations of polar bears in the Bering and Chukchi Seas den and give birth to cubs on Wrangel and Herald Islands. Between three hundred and four hundred polar bear females annually hunker down on Wrangel Island in snow caves on the slopes of low mountains. The highest density of such birthing dens are on five sites of the reserve: 1) Bezymyannye (Nameless) Mountains; 2) Vostochnoe (Eastern) Plateau; 3) Gavai; 4) Medvezhya (Bear) River; and 6) between the Neizvestnaya and Pestsovaya Rivers. During winter the polar bears feed on the large populations of ringed and bearded seals. The world's largest walrus rookeries are found in ice-free years on Cape Blossom and the sandbar, Davydova Kosa. Bowhead, humpback, gray, and beluga whales feed near the islands.

Fifty species of birds nest on the island. Snow geese breed on the island, and several thousand black brant come to Wrangel in late summer from North America. About five hundred thousand seabirds of eight species nest on the islands and feed on the rich fish and marine life. Bird endemism is not significant, but island subspecies of the red knot (*Calidris canutus*) and black guillemot (*Cepphus grylle*) nest here. Nesting colonies of thousands of snow geese and black brants congregate annually on Tundrovaya and Gusinaya Rivers and in the Akademy Tundra. Ross's gull (*Larus roseus*) can also be seen here. Eiders nest in colonies on Cape Zapadny (Western) and Cape Warring.

The *zapovednik* has a marine buffer zone of between 25 and 50 km around the islands. The World Conservation Union (IUCN) has proposed the area as an international biosphere reserve. Threats include a new shipping route planned to go near the island, climate change, ocean debris, and uncontrolled poaching.

Zakazniks. *Zakaznik*s occupy an area of 2.1 million ha and include the following:

Lebediny. The vegetation in this reserve, which is located between the Anadyr and Main Rivers, is tundra woodland with Japanese stone pine, upland marshes, sedge and cotton-grass tundra, thickets of shrub alder, and reeds. The abundant lakes are interconnected by meandering streams and provide prime conditions for nesting, molting, and feeding waterfowl including whooper swan (*Cygnus cygnus*), greater white-fronted goose, bean goose, lesser white-fronted goose, pintail (*Anas acuta*), Northern shoveler (*A. clypeata*), Eurasian wigeon (*A. penelope*), and common teal (*A. crecca*). Moose, wild reindeer, and brown bear are typical land mammals found in the reserve; less commonly sighted are gray wolf and wolverine.

Avtatkuul. This *zazaznik*, consisting of primarily meadows and coastal tundra, has swamps and lakes that provide migratory and nesting places for numerous types of birds including Northern pintail, Eurasian widgeon, four species of geese (greater white-fronted, bean, emperor, and black brant), three species of swan (whistling [*Cygnus columbianus*], Bewick's [*C. bewickii*], and whooper), Sabine's gull (*Larus sabini*), sandhill crane (*Grus canadensis*), and spoonbill sandpiper (*Calidris pygmaeus*).

Tumansky. Typical coastal tundra, the reserve provides habitat for migrating and nesting birds, including large nesting colonies of eiders, black brant, emperor goose, and swans. Sandhill crane, bean goose, lesser white-fronted goose, Northern pintail, and waders are found throughout the reserve.

Tundrovy. The reserve protects migrating and nesting waterfowl, including bean goose, greater white-fronted goose, sandhill crane, swans, spoonbill sandpiper, Eurasian widgeon, and others. Predatory animals include red fox (*Vulpes vulpes*), gray wolf, wolverine, and, in summer, brown bear.

Ust-Tanyurersky. This reserve is located on the transitional zone between tundra woodland and subarctic tundra, with

hilly sedge-cotton grass tundra, cranberry swamps, and abundant lakes. Whooper swans are common, and other birds include ducks, sandpipers, bean goose, greater white-fronted goose, and other migratory birds. Sandhill crane also nest here in large numbers.

Chaunskaya Guba. Situated on the eastern and southeastern shores of Chaun Inlet, the landscape is typical coastal tundra and, like many of the other reserves described, was established to protect waterfowl and shorebirds. The *zakaznik* consists of two parts: one part (200,000 ha) is on the eastern shore of Chaun Inlet near Komsomolsky and Krasnoarmeisky settlements, and the second part (10,500 ha) is on the southern shore of the bay, between the mouths of the Pucheveem and Chaun Rivers.

Omolonsky. This *zakaznik*, the only one to protect boreal forests, was established to protect and restore moose and sable populations. The reserve provides high-quality habitat for wolverine, gray wolf, brown bear, and variable hare. The *zakaznik* also has allowed for the regeneration of valuable fur species including sable, American mink (*Mustela vison*), wolverine, river otter (*Lutra lutra*), and Eurasian lynx (*Felis lynx*). Future plans include expanding the reserve boundaries and redesignating it as a national park. Currently, the *zakaznik* is under the jurisdiction of the Chukotka Hunting Service.

Regional nature park. There is one such park in Chukotka, the Beringia Regional Nature-Ethnographic Park. The purpose of the park is to preserve and enhance the Bering Sea hunting cultures of the Chukchi and Eskimo peoples, protect the biological diversity of the plant and animal life, and preserve the fragile Chukotka landscape. The park is a refuge and habitat for unique communities of animals and plants. Relict and *Red Data Book* flora and fauna species are observable everywhere. Numerous species of rare migratory waterfowl nest here, including sandhill crane, emperor and white-fronted geese, and sandpipers. Huge colonies of nesting birds and rookeries are found on the coast alongside marine mammal breeding grounds and resting places. Notable marine species include walrus, ringed seal, bearded seal, and whales (gray, humpback, beluga [*Delphinapterus leucas*], minke, killer [*Orcinus orca*] and others).

Notable sites:

- Arakamchenchen Island, one of the largest walrus breeding grounds in Chukotka, also has hot thermal springs. Of special archeological significance is Kitovaya Alleya (Whale Lane), an ancient architectural monument built five centuries ago out of bones of bowhead whales.
- The upper basin of the Chegutun River, which protects snow sheep (*Ovis nivicola*), a very rare, *Red Data Book* species.
- Litke and Bennet Islands, Lavrenty Bay, and a number of other areas are slated to receive *zapovednik* status.

Other protected areas. Chukotka has twenty natural monuments with a combined area of 13,700 ha. Most of these protect either poplar stands in river valleys, ancient settlements, rare species and unique animal communities, or relict botanical plant communities. Whether there will be adequate protection of natural monuments is cause for concern. The natural monuments have not been officially protected since Chukotka broke off from Magadan Oblast in 1992 and the Raion Council of the All-Russian Nature Conservation Society broke up; this council once played an active role in protecting the monuments.

Biodiversity hotspots

Gennady Smirnov, Maxim Litovka

1. Lake Elgygytgyn (arctic and wetland)

Located on the northern Anadyr plateau approximately 500 m above sea level, Lake Elgygytgyn, 11 km in diameter, is almost perfectly round. The maximum depth is 169 m. Formed between 3 and 5 million years ago in an impact crater, this lake is the largest freshwater reservoir in northeast Asia. Mountains surround the lake. The tallest peaks are Akademik Obruchev and Ostantsovy, 600 and 1,000 m, respectively. The Enmyvaam River flows from the southern part of the lake and numerous small streams flow into the lake. Three species of char (*Salvelinus*) live in the lake, one of them endemic and one endangered throughout the region. The algae are also remarkable and there are endemic crustaceans and oligochaetes.

The lake is part of a larger basin that has diverse vegetation and 249 vascular plant species. Most of the plants are circumpolar alpine species, and some are relic and endemic species. Wild reindeer and snow sheep breed near the lake, and several rare and endangered bird species live here. Within the lake basin and the headwaters of the Enmyvaam River, many bird species thrive. There are particularly high densities of peregrine falcon (*Falco peregrinus*), gyrfalcon (*F. rusticolus*), golden eagle, and yellow-billed loon (*Gavia adamsii*).

Geological research here began in the 1930s with expeditions by Sergei Obruchev. The area and its geological history are well documented in scientific literature. The basin's biological diversity is not, however, well known. The first studies of diatoms of the lake were made in 1956. Studies of terrestrial fauna began in the late 1970s, and botanical research began in the 1980s.

Threats. The basin is isolated and remote but vulnerable. In 1950, the area was completely pristine, but overfishing,

uncontrolled mining, illegal archeological excavation, and dumping of waste have had an impact, particularly on char and wild reindeer populations. Tourists, fishermen, and hunters frequent the beautiful lake.

Existing protection measures. In 1986, the Magadan branch of Glavrybvod (Okhotskrybvod) banned the commercial and sportfishing of char for five years, and in 1991, the ban was extended for five more years. At that time, three species of lake char were recommended for inclusion in the Russian *Red Data Book*. In 1993, the lake was declared a regional natural monument by the Magadan administration, which had jurisdiction of Chukotka at that time. In 1994, the Chukotka Committee on Environmental Protection began to implement a plan to create the Tsentralno-Chukotsky Zakaznik, as stipulated in the government resolution On the Creation of Protected Areas in the Russian Federation in 1994–2005.

Recommendations. The following actions should be taken:

- Establish the Tsentralno-Chukotsky Zakaznik. The regional governor has approved plans to establish this reserve, but there are no funds, at present, to implement the plan.
- Work toward UNESCO World Heritage site status for this unique lake. However, the *zakaznik* must be established first.

2. Lower Anadyr lowlands (arctic and wetland)

The Anadyr lowlands are primarily glacial and marine ecosystems. Tributaries of the Anadyr River, including the Velikaya, Tumanskaya, and Avtatkuul Rivers, run through the region. There are numerous lakes of thermokarst and oxbow origin, some of which are of significant size. Tundra dominates the landscape, specifically sedge and cotton-grass tundra and moss and grass swamps. In the river valleys, there is shrubby vegetation with some small willow and alder trees.

This territory is valuable primarily because of the wetlands and the nesting and breeding birds that depend on them. The main species include several species of goose: great white-fronted, bean, emperor, and black brant. Snow geese and lesser white-fronted geese migrate here every year. Spoonbill sandpipers and Aleutian terns (*Sterna kamtschatica*) nest along the seashore. According to ornithologists from the Institute of Biological Problems of the North (IBPN), Avtatkuul Zakaznik is the largest remaining goose-breeding ground between the Indigirka River in eastern Sakha and the Bering Strait, supporting a population of approximately five thousand of three different species. In the southwestern edge of the Anadyr River estuary there is a large colony of king eiders (*Somateria spectabilis*). During the molting seasons, there are approximately ten thousand eiders, greater scaups (*Aythia marila*), and scoters (*Melanitta*) in Glubokaya Lagoon, and geese and their fledglings and male river ducks (*Anas*), two species of shorebirds, and two species of swans are found along the entire shoreline of the Anadyr Estuary. White-tailed sea eagles (*Haliaeetus albicilla*) nest here and peregrine falcon, gyrfalcon, and Steller's sea eagle have also been spotted. Considerable numbers of sandhill cranes nest in the marine tundra of the Anadyr lowlands. Overall, eighteen species of nesting and migrating birds listed in the *Red Data Book* can be seen in this area.

In 1992, after the foundation of the Chukotka research center, several groups from the IBPN conducted multidisciplinary research here. Scientists from the Okhotskrybvod have studied fisheries of the Anadyr, Velikaya, and Tumanskaya basins. Since 1994, researchers from the Laboratory of Anadromous and Freshwater Fish of the Chukotka division of the Pacific Institute of Fisheries and Oceanography (TINRO) have done research. Foreign scientists are also working here.

The Anadyr Estuary and lower streams of the Anadyr and Velikaya Rivers also have rich fisheries. The area is a migratory route for chum salmon and serves as an upwelling area for game fish including whitefish and smelt. Salmon fishing is a big commercial business. Oil and gas was found here and in Anadyr Bay in the late 1980s.

Threats. Untreated sewage waste from Anadyr city is dumped directly into the sea. Oil development poses a threat for several reasons: land development and road construction, the inevitable land and water pollution from petroleum products, and human and technical intervention, which increasingly disturb the nesting birds.

Existing protection measures. In 1992, the Chukotka administration established three *zakaznik*s on the Lower Anadyr lowlands: Tundrovy, Avtatkuul, and Tumansky. Several resolutions made by the Soviet of the Ministers of the USSR are designed to protect the fauna of these *zakaznik*s: On Protection Measures of Migrating Birds and Their Habitat after the Soviet-American Convention (No. 195, March 1975, and No. 255, March 19, 1979); On Protection Measures of Migratory Birds and Their Habitat (No. 196, April 11, 1979); and On the Approval of the List of Rivers, Their Tributaries and Other Water Sources Serving as Spawning Grounds for Salmon and Sturgeon Fish Species (No. 554, October 26, 1973).

Recommendations. The following actions should be taken:

- Make both Avtatkuul and Tumansky Zakazniks Ramsar sites. IBPN has already prepared the necessary documents.
- Merge the two *zakaznik*s and give them higher protection status.
- Tightly control all economic activity, particularly in summer.

3. Meinypilgyn riparian zone (arctic and wetland)

The Meinypilgyn lake and river system is located on the Koryak shore of the Bering Sea, in Beringovsky Raion. Primarily a series of large lagoon lakes, Pekulnei and Vaamechgyn interconnect with each other and with the sea by straits and the system of tributaries flowing into them—Vaamechgyn, Vaapveem, Kakanaut, Pekulveem, and others that originate on the southern slopes of the Koryak Range.

Japanese stone pine form tall bushes on the lower mountain slopes; mountain pine tundra grows on the upper slopes. Lichen rock tundra and meadows are prevalent in the mountains. In the lowlands, sparse forests, sedge, and swamps dominate the landscapes. Tall willow and alder groves are common along the rivers.

Common mammals (brown bear, moose, and ermine) and rare mammals (snow sheep and black-capped marmot [*Marmota kamchatica*]) frequent the area. The birds are those that frequent the tundra. There are a number of types of fish, including chum, chinook, and pink salmon, which are fished commercially. The chum salmon is considered the most valuable, and this particular stock is one of the richest in all of northeast Asia. Indigenous people rely on this species, as do seals, killer whales, beluga whales, bowhead, and migrating gray whales, which are regularly spotted.

Threats. The area has seen little industrial development. The primary problem is garbage found around settlements. Due to economic hardship, locals also collect common eider eggs in the Ankave Bay and Pekulnei Lake. Future threats include development of the Khatyrsky oil reserves; 90 percent of this field is located in the Bering Sea. Development of the field could damage marine life, especially the migration routes of Pacific salmon. Oil development may also threaten the remarkable bird colonies on Navarin Cape.

Existing protection measures. Researchers at the Chukotka Scientific Center and the Chukotka branch of TINRO have studied the region. For this review, we have used the field data compiled by E. V. Oschepkova in the 1997 field season. In July 1997, A. V. Kondratev, an IBPN researcher, did a waterfowl census by airplane. The Russian government has formally proposed establishing Pribrezhny Zapovednik to protect this region.

Recommendation. Get formal approval from the federal government to establish the *zapovednik* and then create it.

4. Walrus rookeries (arctic and marine)

This proposed protected territory combines six of the largest walrus rookeries: Blossom Cape, Somnitelnaya Spit, Inchoun Cape, Arakamchenchen Island, Rudder's Spit, and Kosa Meechkyn Island. Adult walruses of all ages stop here once the ice melts. In some years more than half of the world's walrus population rests here. Walruses stay at the rookeries for as long as five or six months, depending on ice-floe formation and the melting period. Walruses need to rest between feeds. Normally, walruses stay on land for between four and six days, then leave for the sea to get food, and return again to rest.

Threats. Storms, attacks by polar bears and brown bears, and various human activities disturb the normal rhythms of walrus communities. Walrus rookeries have always attracted people. For Chukchi and Eskimos, walruses were a primary source of meat supply. Commercial walrus hunting began in earnest in the second half of the nineteenth century, when American whalers exterminated almost all the shore-based walrus colonies in the Bering Sea. Currently, walrus poaching in the rookeries is limited, but there is a growing tendency, which has increased owing to extreme poverty in the area, to poach the animals for the illegal sale of walrus tusks. Hunters often drive walruses to sea to get to the tusks of dead ones. Tourists often disturb the walruses by getting too close, but most harmful are the unsanctioned plane and helicopter flights over the rookeries. Panic among the walrus herd can be extremely destructive. In Somnitelnaya Bay, 102 walruses were killed when the herd panicked at the noise from a low-flying airplane.

Existing protection measures. Insufficient numbers of rangers and lack of transportation and communication equipment have left the rookeries virtually unprotected. These walrus rookeries play a critical role in preserving the endemic Pacific subspecies of walrus. Walrus rookeries, unique natural treasures of Chukotka, symbolize the pristine nature of the territory. Walrus research has decreased significantly over the past ten years. The Okhotskrybvod's monitoring stations for marine mammals have been shut down. The research expeditions of TINRO, its Magadan division (MagTINRO), and other scientific institutions have been suspended. Recent research documents steep decline of local walrus populations in the northwestern part of Anadyr Bay due to depletion of the food base. There is no information on seasonal gatherings of walrus on the northern and eastern coasts of Chukotka. Exact counts of Pacific populations are also unknown, which makes it impossible to develop regulations for walrus protection and hunting.

Regional fisheries protection authorities and the staff of Ostrov Vrangelya Zapovednik are in charge of protecting walruses. The Chukotka governor issued the decree On the Protection and Hunting of Walrus in Chukotka Autonomous Okrug on March 10, 1998; this document describes twenty rookeries and lists measures for walrus protection and hunting. The rookeries in Blossom Cape and Somnitelnaya Spit are the best protected because of the efforts of *zapovednik* rangers. Manned protection points have also been set up at the rookeries at Arakamchenchen Island and Rudder's Spit.

The Kaira Club (a Chukotka nongovernmental organization) and the Association of Chukotka Indigenous Peoples studied and reconstructed a model of a traditional walrus economy of the Chukchi and Eskimos in the Meechkyn rookery. Local indigenous groups have already used this model to restrict walrus hunting. The native peoples in Inchoun Village appointed a villager, Alexei Agranaut, as the guardian of the Inchoun rookery.

Recommendation. Find $50,000 to permit the Chukotka division of TINRO to develop a project for the long-term monitoring of walrus rookeries. As part of this project, native people would be hired as permanent observers and guardians of the rookeries. The exchange of information between Russian and American scientists is also proposed to improve the management of the entire Pacific walrus population.

5. Chaun Inlet (marine and wetland)

On the Arctic shore of western Chukotka (Chaunsky Raion), the plain gradually slopes down to Chaun Inlet on the East Siberian Sea. The southeast coast of the bay is somewhat hilly, with rare grasses. In the southern part of the lowland, there are picturesque rocks reaching 700 m. Swamps around the hills are covered with sedges and *Arctophila*. The lowland is traversed by many rivers, which, in their lower reaches, become a mesh of straits and tributaries. The main rivers are the Palyavaam, Chaun, and Pucheveem. The numerous thermokarst lakes occupy approximately 50 percent of the tundra area. Vegetation is typical for Chukotka with sedge and hummocky tundra with willows, dwarf birch, and berry bushes. Areas of large-shrub tundra grow along river valleys on well-drained river terraces. The main species are willow and alder, which grow as high as three meters.

Geese and plovers both nest and migrate here. Other shorebirds include tundra swan, snow goose, lesser white-fronted and bean geese, Arctic loon (*Gavia arctica*), three species of eider, and Ross's gull. Pink salmon, Dolly Varden (*Salvelinus malma*), and whitefish in the rivers of the Chaun lowland are commercially valuable.

Threats. Native peoples rely on reindeer pastures and fishing in the Chaun lowland. The existing *zakaznik* does not protect the lowland's ecosystems from the growing human impact, mainly from mining. The mining industry creates a lot of waste, and the heavy machinery is also destructive. There is no recultivation of mined lands. Additional problems may occur when the Komsolmosky-Bilibino winter road is improved.

Existing protection measures. Chaunskaya Guba Zakaznik was created in 1995. The Chaun lowland is listed as one of the most important national wetlands of the former USSR.

Recommendation. Create a federal-level *zakaznik* in Chaun lowland, taking into account comprehensive work done by a West Siberian hunting research expedition. According to I. A. Chereshnev, anadromous Dolly Varden in local rivers urgently need protection due to heavy overfishing.

6. Omolonsky Zakaznik (arctic and forest)

The Omolon River, the primary tributary in the Kolyma and Omolon basins, is one of the largest ecological gems in subarctic East Asia. The southern part of the river flows through the subalpine landscapes of Kolyma Plateau, the middle reaches run primarily through boreal forests, and the lower part of the river has relic lake ecosystems typical of northeastern Sakha. Mixed forests of chosenia, poplar, birch, and larch are found in the floodplains and valleys.

These tundra and forest valleys are rich with birds and animals. Common bird species include black capercaillie (*Tetrao parvirostris*), hazel grouse (*Bonasa bonasia*), ptarmigans, curlews (*Numenius*), whooper swan, and Northern pintail. Rare species include white-tailed sea eagle, lesser white-fronted goose, eagle owl (*Bubo bubo*), great knot (*Calidris tenuirostris*), little curlew (*Numenius minutus*), and gyrfalcon. Bewick's swan, bean goose, different shorebirds, and Ross's gull migrate through this region. Mammals include Eurasian squirrel (*Sciurus vulgaris*), moose, wild reindeer, brown bear, ermine, and wolverine. Kolyma moose reach record density levels (between 14 and 18 per sq. km) in the Omolon basin. The Omolon Valley is the shortest migratory route between the north shore of the Sea of Okhotsk and the arctic tundra of Sakha. Fish species include Arctic grayling, Northern pike, longnose sucker (*Catostomus catostomus*), and whitefish.

Since the early 1970s, IBPN has had a biological station in the region. Long-term studies of flora, fauna, and landscape structures of the Omolon River basin have resulted in a series of scientific publications. These publications emphasize the high biodiversity, uniqueness, and productivity of the region's ecosystems, including the presence of unusual plant communities, endemic plants and animals, and migration routes of Arctic birds.

Threats. The Chukchi peoples are the original settlers in the Omolon basin. Russian settlements appeared in the 1940s (Scherbakovo) and 1960s (Mandrikovo). Uncontrolled poaching for ungulates and fur-bearing mammals quickly led to a decline of the originally abundant moose, sable, and wolverine populations. The basin was most heavily affected in the 1970s and 1980s, when industrial waste polluted rivers, forest fires occurred frequently, and poaching flourished. Currently, due to the crisis in the mining industry, unemployment, and the closure of some settlements (villages), poaching has reached unprecedented levels as nature-protection agencies are poorly equipped to control the problem.

Gold mining ventures, located both upstream and downstream and, in particular, the Kubaka project in adjacent Magadan Oblast, are constant threats.


Vladimir Dinets

The Omolon River Valley has the best forests on Chukotka.

Existing protection measures. In 1980, in response to IBPN's proposal to the Magadan Hunting Service, Omolonsky Zakaznik was created in the lower reaches of the Omolon River. This was done primarily to protect the largest habitat of the threatened Kolyma population of moose.

The associations of Indigenous Peoples of Chukotka in the Omolon and Bilibino regions required an ecological-economic justification (*obosnovanie*) for the enlargement of the *zakaznik*. In the future, the *zakaznik* should be granted regional status and later become a national park. With the closure of several gold mines and nearby villages, poaching increased. This led to a complete ban on hunting in the Bilibinsky Raion, which is still in effect. The *okrug* hunting service prepared a decree draft for the governor that would enlarge the *zakaznik* without changing its current status.

Recommendation. Enlarge the Omolonsky Zakaznik and change its status, while allowing some restricted, sustainable land use. IBPN proposes three options to change the borders: minimal, moderate, and maximum. Local protection authorities would like to enlarge the reserves as much as possible. The Chukotka-Magadan border currently runs through the *zakaznik*. Only people in the Bilibinsky Raion use the Omolon floodplain. Rassokhino reindeer herders use the Monakova and Namyndykan River watersheds. Coordinated action between Magadan and Chukotka authorities is needed to enlarge the *zakaznik*. If this occurs, the ambitious enlargement plan calls for protected strips between 30 and 50 km in length along portions of the Omolon's left bank to include the floodplain forests of the Kedon, Aihenny, Namyndykan, and Mangazeika Rivers in the lower reaches.

7. Botanical natural monuments (forest and wetland)

Two natural monuments need urgent protection:

Tnekveemskaya Roshcha (Tnekveem Grove). This grove, located in the northern Anadyr lowland in the floodplain of the eastern tributary of Kanchalan River, is the only large poplar and willow grove, with trees between 16 and 18 m tall. The grove is the heart of a diverse floodplain community of the Tnekveem River forest, which contrasts with the surrounding tundra. A refuge for boreal plants, the grove is a place where reindeer calve, and it is a tree-seed bank. Since July 8, 1983, as a result of Magadan regional government resolution No. 296, the grove has been a regional natural monument.

Professor B. A. Yurtsev of the Botanical Institute of the USSR Academy of Sciences studied the region in the 1960s and 1980s. At present, however, no scientific research is under way.

Threats. The nearby native village of Kanchalan and reindeer grazing routes mean that the grove may be used for firewood. Another potential threat is the Valunisty gold mine.

Recommendations. The following actions should be taken:

- Create a botanical *zakaznik* in the grove to prevent any logging.
- Educate the local population.

Telekaiskaya Roshcha (Telekai Grove). Telekai Grove, the largest and most northern grove of chosenia, is located in the central Chukotka plateau in a deep valley where the two Telekai Rivers converge. Growing on a vast gravel area, the trees reach between 12 and 15 m high. There are isolated trees further up the valley and downstream. Other plants include isolated occurrences of *Salix udensis* and *Poa ursulensis*. Beyond the floodplain there are three species of birch: *Betula cajanderi*, *B. middendorfi*, and *B. extremorientalis*, and common juniper (*Juniperus communis*). The mountain slopes have remnant steppe vegetation.

The northerly location and size of the grove make it particularly interesting. Floral diversity is also high, making it valuable scientifically and aesthetically.

In 1939 a research group led by K. F. Yakovlev documented the grove, but this research was lost. Later A. P. Vaskovsky "rediscovered" the grove by airplane, and Y. P. Kozhevnikov studied it in 1974.

Threats. Grazing reindeer and logging for firewood are the major threats.

Existing protection measures. Since July 8, 1983, the grove has been a regional natural monument, thanks to Magadan regional government resolution No. 296.

Recommendations. The following actions should be taken:

- Create a botanical *zakaznik* to protect the grove.
- Research the area fully.
- Limit grazing and logging.

Economy

Gennady Smirnov, Maxim Litovka, Dmitry Naumkin

Until the seventeenth century, the economy was based on hunting, fishing, and gathering, primarily by indigenous peoples. Small populations of nomadic and settled indigenous tribes lived well on account of tremendous populations of reindeer and walruses, abundant fish in the rivers and seas, and the summer fruit gathered in the tundra. From the thirteenth to the seventeenth century, reindeer-herding practices developed. The first indication of environmental damage caused by human interference was the loss of reindeer feeding areas because of overgrazing.

In the first half of the seventeenth century, Russian explorers reached Chukotka and established trade with the native peoples. In the late-nineteenth century, trade also began with Americans. Desire for wealth led to a search for new walrus breeding grounds and the opening of the Bering Strait in 1648 by Semyon Dezhnev and Fedot Alexeev. Soon after, the huge breeding grounds at the Anadyr estuary mouth were discovered, and within several years, Dezhnev's Cossacks had killed the entire walrus population there. The intensive commercial exploitation of walrus began in earnest, with trade in their tusks bringing fabled riches from the Asian markets. The population of Pacific walruses has been intensively hunted for the past three centuries—at first by Russian whalers and later by American, Norwegian, and British whalers, who collectively killed an estimated 130,000 walruses between 1869 and 1980. The population is now a third of its former size. Foreign whaling ships began hunting bowhead whales in the middle of the nineteenth century; the western Arctic population of this species has still not fully recovered.

The extinction of walrus and whale populations at their traditional hunting grounds rapidly brought hunger, disease, and increased mortality to native Chukchi and Eskimo peoples. In one of the first conservation efforts by the Russian government, military ships were sent to the Bering and Chukotka Seas to limit the excessive hunting of marine animals.

Industrial development in Chukotka is connected with the gold rush, which penetrated Chukotka from nearby Alaska. The first prospectors arrived in 1890 and began extracting gold from the Zolotoy and Pekulin mountain ridges in 1904. Other geological expeditions to the area soon followed and, by the 1930s, coal was being mined near Ugol (Coal) Bay. The construction of seaports began at present-day Anadyr, and a fish factory and airports were built. Just prior to World War II, geologists discovered large deposits of tin near Pevek and Iultin and began mining them during the war. Continued geological prospecting during this period yielded deposits of gold and other precious metals of commercial significance. Gold has been the leading industry since commercial mining began on the Ichuveem River in 1958. Processing facilities, commercial enterprises, company towns, minefields, and local power stations were built. The population increased rapidly with the inflow of labor from central regions of the Soviet Union, and 90 percent of those living in Chukotka in 1989 were immigrants. Mining reached its peak in the late 1980s and early 1990s.

In the post-Soviet period, restructuring as a result of privatization and other conditions of the market economy is beginning to dictate conditions for the mining industry. No longer profitable, tin and tungsten mining have ceased. Coal mining is also decreasing steadily and even gold mining is becoming unprofitable. Numerous small ventures, that operate for one or two years on the most productive sites, are replacing the large, previously state-owned enterprises. Decline of the mining industry, which for years had been the primary employer in the *okrug*, has led to the massive emigration of workers and closure of a number of settlements. The population of Chukotka has fallen to almost half of what it was in 1989.

All levels of society, from individual prospectors to *okrug* officials, are discussing the plight of the mining industry. Elena Masyuk, a popular television journalist, commented that it is cheaper to buy gold abroad than to mine it in Chukotka. Nevertheless, all *okrug* governmental plans for improving the economy are based on increasing gold and coal production and to a lesser degree other minerals.

Environmental impact. Many of Chukotka's environmental problems are related to mining. Open-pit mining, the most harmful, visibly damages the landscape, eliminates reindeer pastures, ruins wildlife migration routes, causes sedimentation of rivers by run-off, and poisons groundwater. Open-pit mining has damaged more than 75,000 ha. of land in Chukotka. Every year, accidental spills pollute river systems. According to government regulators, sixty-two such spills released 1,417 tons of pollutants in 1995 and 1996. Giant

caterpillar and truck machinery used in mining destroys large tracts of tundra; experts estimate that approximately 80,000 ha have been damaged by this practice.

Oil and mechanical debris in all the major seaports is a major cause of water pollution. In November 1994, the punctured tanker *Kansk* spilled 115 tons of oil near Beringovsky port and caused an estimated 2.55 million rubles ($8,500) in damage. Rapidly rising car use has led to higher air pollution levels in major towns and cities. Around populated areas, tractors and all-terrain vehicles have sliced up the fragile tundra and the unsightliness of metal drums, scrap heaps, and city garbage is matched only by the stench of fires at dump sites.

Research on environmental pollution in Chukotka, conducted in 1991 and 1992 by the Analit Institute, led to the following findings:

1. The main environmental pollutants in populated areas are energy systems (atmospheric deposition, slag piles, coal dumps, dumps from fuel and gas stations); the construction industry (construction platforms, storage of construction materials, construction debris); and vehicles.

2. The soil top layer in many areas has heavy concentrations of Ca, Mg, Ba, Be, Cu, Pb, Zn, Ni, Co, Mo, Cr, Ti, Ga, Ge, Mn, and Zr, caused by microrelief, wind erosion, and the wide distribution of pollutant sources.

3. The peat-gley soils of the tundra tend to salinize and alkalize under anthropogenic influences. Corresponding geochemical barriers and paragenetic associations of elements that concentrate on them are alkalinity (Ba, Zn, Pb, Cu, Ni, Co, Mn), acidity (Mo, Ga, Cr, Ge), gley concentration (Cu, Mo, Cr), and hydrogen sulfide concentration (Zn, Cu, Pb, Ag, Ni, Co).

4. Twenty-five percent of the *okrug* has anomalous quantities of toxic substances. Within these anomalies, there is an excess of allowable concentrations (1–6 mpc of soil) for Cr, Ni, Co, Be, Ba, Pb, Cu, and Zn.

5. Near populated areas, including river watersheds, the natural environment is subjected to dissolved forms of Be, Ba, Pb, and Zn. The natural water around Anadyr has heightened concentrations of Ba, Pb, and Zn.

The main water pollutants come from settlements and the energy and mining industries. The total water discharge in 1996 was 31.81 million cu. m, including 28.95 million cu. m of sewage dumped into the surface water. Discharge of most pollutants has decreased; ammonium nitrate and other nitrate emissions have, however, increased.

Fires, in the 1990s, were especially severe. Five hundred and forty fires burned 927,789 ha of land between 1990 and 1997. Analysis indicates that humans caused more than half of these fires. Because of a drought in 1993, fires destroyed more 525,000 ha of forests and tundra.

River flooding has increased, and this threatens nearby storage and waste facilities. Seven oil and gas storage terminals with a capacity of 1,600 tons and seven open retention basins that contain suspended sediment and petroleum discharges are within the spring and summer floodplains. Fall storms along the coast have led to sharp rises in sea levels and lowland flooding. Water levels in the Anadyr Estuary reached 722 cm, exceeding the annual average by 3 m. In Anadyr, floods ravaged a reserve electrical substation, two twelve-unit apartment houses, port facilities, a church, and a store. Water and heating pipes were also disrupted. Apartments, factories, coal and fuel depots, food storage warehouses, electrical plants, and boilers and other facilities were also flooded in many communities. Estimated damage was 70 billion rubles ($230,000). The impact of petroleum products that washed into the rivers, lakes, and seas is impossible to assess.

With the collapse of many local industries and mining companies, some Chukchi have returned to their traditional lifestyle.

Mining

Chukotka is blessed with large reserves of gold, tin, tungsten, silver, and platinum. Fueled by continuous increases in world gold prices and with strong government backing, gold mining reached its peak in the late 1980s and early 1990s, with annual outputs reaching 30 tons. However, the quality of remaining alluvial deposits has steadily deteriorated, and as mining costs have risen, the gold mining industry has declined. Other factors include industry restructuring and the introduction of new forms of property ownership. Despite this, however, the local administration still views the expansion of the mining industry as a means of achieving rapid economic growth.

In the Soviet era, the mining industry included five mining and enrichment *kombinats* (GOK), geological mining enterprises, commercial enterprises, and prospecting cooperatives. The Bilibino, Polarninsk, and Komsomolsk GOKs and the large Otrozhny mine extracted alluvial gold. The Pevek and Iultin GOKs extracted gold, tin, and tungsten. All these enterprises, which belonged to the government, were part of the large interregional entity known as Severovostokzoloto (Northeastern Gold).

With one mine, several pits, and three large prospecting cooperatives, Polarninsk GOK produced about 40 percent of the *okrug*'s gold. Three rich, closely located alluvial deposits in Schmidtovsky Raion were mined. Centrally located, this profitable GOK primarily mined underground, which minimized the environmental impact. Surface land affected never exceeded 50 ha, about seven times less than land used in the Bilibino or Komsomolsk GOKs.

Bilibino GOK, with five mines and six prospecting cooperatives, mined about 30 percent of the *okrug*'s gold. The resource base of the GOK included about two hundred shallow, small, and low-yielding alluvial deposits scattered throughout Bilibinsky Raion.

Producing about 20 percent of the *okrug*'s gold, Komsomolsk GOK operated the oldest gold mining site (the large alluvial deposits on the Ichuvei and Raucha Rivers) in Chukotka. There were two mines and two large prospecting cooperatives in this GOK. The most profitable area now, with reserves to last until 2005, is near Ichuvei River. Near the village of Komsomolsk is Maiskoe, one of the largest gold deposits in Chukotka. Regional government and industry representatives are attempting to attract foreign investors to this site.

Once Chukotka's largest tin producer, Pevek GOK includes the Valkumei mine. In 1992–1993, the mine ceased producing tin and shifted to gold. Iultin GOK produced tin, tungsten, and gold. The gold division included the Vostochny mine and four prospecting cooperatives.

The Otrozhny mine, based in the city of Anadyr, is essentially two deposits, Otrozhny and Bystry. The GOK included two pit mines and three small prospecting cooperatives, with gold output slightly less than 10 percent of the *okrug* total. The deposit will continue to provide stable production until about 2005.

In 1992–1993, gold mining was still marginally profitable. However, during privatization, prospecting cooperatives left the GOKs. *Kombinats* were auctioned off or reformed. The production share of gold and other metals by private enterprises has steadily increased. The major gold producers in Chukotka include joint-stock companies of the GOKs (Komsomolsk, Polarninsk, Bilibino), *artel*s Chukotka and Polarnaya, and a host of other firms that mined small amounts (less than 500 kg).

Many industry specialists pin their hopes on the Karalveemskaya mine, which has an annual projected capacity of 100,000 tons, resources projected to last for decades, and net cost and labor requirements that are approximately five times and two times more favorable, respectively, than those of other similar ventures that also mine alluvial gold deposits. In 2000, the mine produced about 30 percent of total production in Chukotka.

Environmental impact. Open-pit mining, widely practiced in Chukotka, is the most harmful type of mining and directly damages the landscape, eliminates reindeer pastures, and ruins seasonal migration routes of wildlife. The most heavily damaged areas are in Bilibinsky, Chaunsky, and Schmidtovsky Raions. Most of the land mined is not restored. Only land believed to be completely spent and some reindeer migration areas are recultivated. Remote sites are often left alone to regenerate naturally, in the belief they will become adequate reindeer habitat in ten or fifteen years.

Fragile tundra is destroyed by heavy machinery. Destruction of underground rock formations during mining alters groundwater flows, leading to a decrease in permafrost depths and changes hydrothermic regimes (water temperatures increase and the relative humidity at and above soils decreases).

Perhaps the most serious effect of mining is the widespread practice of mining along river valleys. Chukotka's terrestrial and marine biodiversity largely depends on the health of the river systems, which are often irreparably damaged by mining. Gold mining in small river channel beds and in surrounding basins moves thousands of tons of gravel; this process causes sediment to leak into river systems and destroys freshwater fauna and flora. Degradation of river systems can be minimized somewhat by sealing off drainage points and using retention basins. Mining companies often accidentally discharge such sediment. Environmental regulations are enforced at only half of the industry sites. Actual pollution levels are higher than those documented by regulators; periodic inspections of process facilities have repeatedly proven this. The Omolon, Lesser Anyui, Greater Anyui, Kanchalan, and Anadyr River basins are at greatest risk.

Cyanide is increasingly used to extract gold. There have been no reported incidents of river contamination, but such cases are numerous across the globe. Some countries, such as

the Czech Republic, have ceased gold mining entirely because of the high risks of cyanide use.

To become more environmentally sustainable, the Chukotka mining industry should:

- Construct permanent (year-round) automobile roads to protect the fragile tundra from caterpillar-track vehicles.
- Develop small, compact but valuable ore deposits rather than alluvial deposits.
- Stop using cyanide. Less harmful technologies can be applied; ore enrichment technology by gravitation only, developed in St. Petersburg, is one example.
- Restore damaged mining lands. Restoration can be profitable, in some instances, if perennial grasses and annual types of feed grasses or fodder (oats, rapeseed, and legumes) are planted. Climatic conditions in the continental areas of Anadyrsky and Bilibinsky Raions are the most suitable sites for restoration.
- Mine previously developed reserves rather than focusing primarily on new ones.
- Promote underground mining operations.
- Develop closed water cycles and build water-treatment facilities.

Energy

Electrical power in Chukotka is supplied by the Bilibino nuclear power plant (BAES) by large coal, diesel, and turbine electrical plants in *raion* centers, by small diesel and coal stations in towns and villages, and by a large powerline (Pevek-Bilibino-Zelyony Mys).

Concerns abound about the safety of the Bilibino plant, which began operating in 1974. Huge amounts of spent fuel and liquid waste have accumulated at the plant. High radiation doses have been noted on plant personnel, and there are indications that the plant's filtering systems are becoming less efficient. Radionuclide contamination around the plant is an obvious indication of the failure of the plant's purification and filtration systems.

Federal and *okrug* authorities link future development of industry with an expansion of nuclear power. Plans to rebuild the nuclear plant and build a second station were completed long ago. The government also wants to build several floating nuclear power plants along the coast, the first to be built near Pevek. The economic crisis and rising public resistance to nuclear power have to date held this project back. There are also plans to convert the Anadyrskaya Power Station, and possibly the Egvekinotskaya Station, from coal to gas, which would be extracted from the Anadyr lowlands.

Coal and diesel fuel, the primary sources of power, become more expensive each year and transporting them is problematic. Planned government countermeasures to resolve the energy crisis are risky. Nuclear power poses a threat not only to Chukotka residents, but also to those living in Sakha, Magadan, Kamchatka, and Alaska. Chukotka must develop an environmentally safe means of using renewable sources of energy. In this way, we can prevent nuclear pollution, preserve the ecosystems of the Anadyr lowlands, and develop business opportunities through sale of small wind and hydropower stations to other northern regions. Demand for this type of energy will rise as energy prices from conventional sources, such as oil and coal, increases.

> The power requirements [to] support the intensive resource development of Chukotka [have] led to a variety of power projects. It seems that many Western (Moscow) policy decisions on the direction of the development of electrical power systems are being forced upon the Northeast. The Anadyrskaya Power Station is a good example of how large scale development projects can go awry. Anadyr is a city with two satellite towns, the airport/military base and the coal mining town, that lie across Anadyr River. In winter, an ice road connects these suburbs with the regional center of Chukotka. In the summer a half-hour ferry ride will get you from the airport to Anadyr proper. Fall and spring often requires great patience, as the MI-8 helicopters that fly about twenty people at a time are often grounded by fog. Anadyr has a relatively new thermal heat-and-power plant that is engineered to operate at a minimum of five times over the power requirement of the city. While coal is hauled in from the coal mine across the river, no transmission line passes power back over to the mining town and airport/military base, about half the population of the area.[23]

Nuclear. In 1974, one of the first atomic power plants in the USSR was built in Chukotka at Bilibino (BAES). On the one hand, of all the plants in the *okrug* today, BAES, with a capacity of 48 MW and four EGP-6 reactors, may be the most economical. On the other hand, it is also the most costly because fundamental components are outdated and the plant needs to be retrofitted. The plant provides thermal power to Bilibino and electrical energy to villages in Bilibinsky and Chaunsky Raions.

Many specialists believe the plant is unsafe. The following excerpt is from 1995 and 1996 reports by the Chukotka Committee on Environmental Protection: "The plant has accumulated 510 tons of spent fuel and 685 cubic meters of liquid waste. In light of this situation, it is impossible to exclude a possible accident at BAES within the next 10 to 15 years (the time required for construction of the second stage of BAES). Accidents can be radioactive, nonradioactive, or a mixture of both. The highest levels of radionuclides are found in the soils and estuaries downwind from the area adjacent to BAES. A similar picture is observed in drainage water sediment from BAES grounds."

Over the past twenty-five years, no serious accidents or

radiation of personnel have occurred. However, the discovery that several plant personnel have been exposed to excessive dosages, rising repair costs, and maintenance problems worry residents living near the plant. In 1992, Atomenergoproekt Institute developed a safety plan for BAES, but it was not enacted due to lack of funds. The plant must be reconstructed and filtering systems must be improved to comply with safety measures recommended by the Gosatomnadzor (Federal Atomic Energy Committee). Staff of the Chukotka Citizen Safety Committee maintain that an accident could contaminate more than 1,300 sq. km and expose a hundred thousand citizens to radiation. When the slow regeneration of Chukotka's ecosystems is taken into account, a nuclear accident of even moderate size could become a catastrophe.

In 1995, hydrometeorological and environmental protection agencies in Pevek and Kolyma studied radiation levels throughout the *okrug*. Results showed that radiation levels in Chukotka are safe and have not increased. The same year, a scientific research expedition from Saint Petersburg took samples in Chaunsky and Bilibinsky Raions. Although acceptable, levels of cesium 137 and strontium 90 in the plants of Bilibinsky Raion were 2.4 and 2.0 times higher than analogous levels in the Chaunsky Raion. Strontium 90 concentrations are between five and six times higher in the bones of Chukotka's indigenous peoples than in those of the residents of central Russia. The average annual dose of radioactivity for indigenous peoples is 0.5 rem per year; the average for the *okrug* is 0.4. This is explained primarily by the concentration of radioactive particles in the trophic moss-reindeer-human chain, and the poor ability of the human organism to excrete radioactive strontium from the bones.

Nuclear tests on Novaya Zemlya Island conducted in the 1950s and 1960s are the main source of higher radioactivity in Chukotka. Westerly Arctic winds carried the radioactive fallout and contaminated the northern coast with isotopes. Even small amounts of radioactive materials tend to accumulate in soils, especially in tundra lichen. They pose a genetic and a medical threat to people's health through the moss-reindeer-human chain. Radioactive contamination has had the most severe effect on indigenous peoples of Chukotka, who depend on the reindeer.

In Chukotka, radioisotopic thermoelectric generators (RITEGS) pose one of the greatest dangers to the environment. Eighty-five of these generators were built along the coast to power lighthouses and shipping beacons. The total radioactivity of these generators comprises 5.8 million curies, or 99.9 percent of all of the ionizing radiation registered in the *okrug*. As of September of 1996, fifty-seven of the generators were labeled as radioactive waste and slated for removal. Several of them have leaked and continue to do so because the hydrographic service still has not removed them, reportedly because of lack of funds. Unfortunately, both people and animals are exposed to these RITEGS. In Vankarem, a remote Chukchi village, one case of infant leukemia was registered and, although scientists have not traced the death of the three-year-old girl to the nearby RITEG, there is widespread speculation that this was the cause.

Since the 1940s uranium ore development sites have remained uncultivated in the villages of Zapadny and Severny (Chaunsky Raion). Radon concentrations in the tailings are hundreds of times higher than background radiation levels.

A floating nuclear power plant

The Russian government plans to build a series of floating nuclear power plants along Chukotka's coast to supply remote ports and mining settlements with energy. The first of those floating plants, to be installed near the city of Pevek, will contain two KLT-40-C-type reactors that are currently used on board icebreakers and will generate about 60 MW.[24] The plants are expected to be in operation for forty years, will cost about U.S.$254 million, and will have about sixty full-time staff. Economic recession and growing environmental concerns have delayed construction of the plant, and it will likely be finished only by 2006.

According to the environmental organization the Bellona Foundation, high construction costs will be twice that of developing the same amount of energy from new wind or solar power sources. In addition to the high costs, critics also maintain that plant construction violates international nuclear nonproliferation treaties as well as the Russian Federal Law on Environmental Expertiza.

The Russian nuclear industry would like to overcome stagnation and expand its export possibilities. Should such desires endanger international security and create new environmental risks? Safety measures listed in official documents are merely references about the past safety histories of other reactors. These data are, however, hard to verify as such information was secret under the Soviet regime. Other risks and costs, such as deconstruction expenses, are not even mentioned in project documents. This leads one to conclude that taxpayers may have to pay for these unseen expenses. A comprehensive report is needed to list all the potential dangers of the project. The obvious ones are:

- Threat of nuclear accidents, which could cause irreparable damage to the fragile Arctic ecosystems
- Threat of nuclear terrorism; spent nuclear fuel from these plants could conceivably be used to manufacture nuclear weapons.

Other serious nuclear waste issues affecting Chukotka include the RITEGs and the Bilibino nuclear power plant.

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Despite dangers of nuclear power, *okrug* and federal government officials look at development of the Chukotka energy sector only through the prism of nuclear expansion. In addition to plans to reconstruct the Bilibino plants, the federal government plans to build a number of floating nuclear power plants along the coast of Chukotka, the first one to be in Pevek. This project has been delayed because of the economic crisis and greater environmental awareness among residents. Plans call for installation by 2004, but it is unlikely to be finished before 2006. People keep wondering, when exactly will the station be built? They would like to know so they can leave before it happens.

These grandiose plans by the nuclear industry seem irrational and unfounded compared to potential renewable energy sources, which are virtually untapped. Small, heavily worn wind-power stations at meteorological stations and reindeer herders' camps are the only exceptions. In 1995, basic equipment for a wind-powered station was installed in the village of Nagorny (Beringovsky Raion), but the station was never completed. Wind energy resources alone in Chukotka can generate 1.5 trillion kW annually, more than 14 percent of Russia's wind energy resources. Microhydropower plants would be more suitable than conventional energy in the continental parts of the *okrug,* where the number of windless days is greater than along the coast. The energy crisis in Chukotka is getting progressively more severe. Alternative energy sources are becoming attractive, as the delivery of conventional fuels (coal, oil, and nuclear) becomes more expensive and difficult.

Oil and natural gas. Many low-elevation areas of Chukotka and huge expanses of the continental shelf beneath the Chukotka, East Siberian, and Bering Seas have accessible oil and natural gas deposits. In the 1980s, scientists confirmed these reserves when exploratory drilling in the Anadyr basin led to discovery of the Verkhnetelekaisk oil and gas condensate, the Verkhnechinsk oil, and the Zapadno-Ozernoe gas deposits. These reserves, if developed, would be commercially valuable for between thirty and forty years.

In 1995, the Russian Government opened tender bids for these deposits, which the Chukotka Trading Company won. Prior to the bid contract, however, the Council of Federal Environmental Expertiza tried to stop the project because of its failure to comply with a number of environmental regulations. First, the deposits are within the boundaries of three *zakaznik*s, which are habitat for migratory birds. These areas also have some protection under two bilateral migratory bird treaties (one between the USSR and Japan, and the other between USSR and the United States). The Russian Federation legally must abide by these USSR treaties. Displeased with the assessment, the *okrug* government disbanded the council and created a new, more compliant one. Soon after, the Chukotka Trading Company won the contract. Sibneft then purchased the rights in 2001.

Sibneft begins drilling for oil

The Russian firm Sibneft began test drilling for oil in the Mochalivy Island concession (150 km southeast of Anadyr) in late 2001. The company expected to spend about U.S.$50 million on the test well. Sibneft has also teamed up with Russia's second largest company, Yukos, to do seismic studies of Chukotka's offshore fields. Sibneft holds the exploration and production licenses to three oil and gas blocks in the Anadyr basin and another block (Uglovoe) in the Khatyr basin.

Many ecologists based in Magadan consider the proposed oil and gas extraction projects along the Sea of Okhotsk and Bering Sea coasts to be the greatest ecological threat to the region. There is concern about the environmental impacts of construction of drilling platforms, underwater pipelines, tanker terminals, and airports. The natural conditions of this region are particularly hostile, with extremely icy conditions. What measures would protect marine mammals (polar bears, walrus, whales, and seals) who depend on this ocean habitat?

The nature reserve on Wrangel and Herald Islands, together with the surrounding waters, forms the most important year-round habitat for polar bears in the circumpolar Arctic. The polar bears in the Chukchi Sea move freely between Russia and the United States. Polar bear populations would be threatened by an oil spill. According to Dr. Nikita Ovsyanikov, a research scientist affiliated with the Wrangel Island reserve, "some 80 percent of female polar bears in the region come to den on Wrangel and Herald Islands each year. The mother bears are extremely cautious at this time and will often abandon their dens and cubs when disturbed. Together with increased poaching … additional mortality could send polar bear populations plummeting."

– JN

Scientists estimate that these are only about 3 to 4 percent of total recoverable reserves of Anadyr basin. Geologists believe that these reserves are the outer edges of much larger shelf deposits, with estimates reaching billions of tons of oil, beneath the Bering, Chukotka, and East Siberian Seas. These deposits have high paraffin concentrations, but several companies want to extract and refine them.

The Khatyrsky basin, located in southern Chukotka in the Meinypilgin network of rivers and lakes, is fairly well explored. During oil exploration, at depths reaching 1,650 m, an accidental underwater oil spill of more than 200 cu. m occurred. The productive wells are on the Bering Sea coast, particularly attractive to industry because of the easy access to nearby export markets.

Oil spills, which can be lethal to marine and terrestrial ecosystems, will be inevitable in offshore and gas oil extraction. The famous example is the *Exxon Valdez* spill in Alaska. Alaskan Inuit remembered this spill when they refused to allow British Petroleum to extract oil in the Beaufort Sea, near Barrow, but nobody bothers to ask the native people of Chukotka for their permission.

Agriculture

Agriculture includes reindeer breeding and the cultivation of some plants, the latter limited by the harsh weather. Agricultural organizations, enterprises, and individuals use about 68 million ha of land; 60 percent (40.7 million ha) of which is used to herd reindeer. The richest pastures are in the Anadyrsky and Bilibinsky Raions, where more than half of Chukotka's reindeer graze. Reindeer herding is the most important agricultural activity, providing jobs, income, and playing a key role in indigenous culture. Agroforestry, mainly hay production, occupies 8,700 ha (0.01 percent) of the land.

Pigs and livestock are an insignificant part of the *okrug* economy, and cattle breeding is declining. Small herds of Yakut horses are kept in the Anadyrsky and Bilibinsky Raions. Raising pigs is generally most successful when done by private owners. Until recently Anadyrsky Raion's farming collective Severny raised fowl, but high costs to transport the feed and high mortality rates led to the closure of the farm.

Until the early nineties, most coastal dwellers on the peninsula raised silver and arctic foxes in animal farms. Despite cheap animal feed, mainly unwanted by-products from marine animal harvesting, caged animal production cost from between three and five rubles for every ruble of profit. Nevertheless, animal farms grew in number as they and the intensive harvest of whales, walruses, and seals were supported by government subsidies. The native peoples sold the whale blubber and ate the seal and walrus meat or fed it to the caged animals. When subsidies ended, most of the farms closed, and the remaining ones will likely close soon. However, hundreds of gray whale skeletons and long rows of collapsing sheds with their fox skeletons will remain for many years to remind us of the senseless sacrifice done for the benefit of an ideological economy.

Hunting and fishing

Native people still largely depend on hunting and fishing of marine resources. The diet of coastal Chukchi and Eskimo depends on the meat of marine mammals and fish, sometimes from marine invertebrates and plants of the tundra. They earn some limited income from minor trade in furs, walrus tusks, and other products derived from hunting and fishing. Hunting wild ungulates and small game is also important. Low international demand for fur products has hit hunters and trappers hard; the industry was once a major source of income.

Commercial fishing centers around the west Bering Sea (from Cape Rubicon to Cape Dezhnev) and in the rivers. Because of the shortage of boats, the *okrug* government sells a large portion of the annual quota to outside fishing enterprises. A Chukotka fishing company has been formed and will likely increase harvest levels; fish processing may be developed. The main fish processing operation in the region, which is now closed, was in Anadyr and included several factories where fish was processed, cooked, and canned, and caviar was salted. The regional economic collapse closed the facility. A Chukotka trading company recently purchased the assets.

Overfishing, poaching, and pollution of watersheds are the primary environmental problems associated with the industry. Rapacious overfishing in the 1950s and 1960s led to a collapse in fish stocks, and despite years of reduced fishing quotas, there are no indications thus far of a population recovery. Illegal sockeye salmon (*Oncorhynchus nerka*) caviar production conducted in the spawning grounds of the Meinypilgyn network of rivers and lakes threatens this fish population. The fisheries' enforcement agencies are inadequately equipped to stop the rampant poaching.

Light industry is underdeveloped and produces goods only for local markets. This includes a leather factory in Provideniya, a bone-cutting shop in Uelen, and small sewing shops near collective farms and in homes. Animal hides, fur, bones, and tusks are used as raw materials. Despite minimal profits, outdated equipment, and difficulties with product delivery, these enterprises do in fact have some future and the resource base they depend on is fairly large and stable.

In 1993, meat and milk production employed 6 percent of the workforce and generated about 3 percent of national production; almost every *raion* center in Chukotka had meat and milk facilities, and several agricultural and mining enterprises produced food. This industry was always unprofitable and subsidized, but now the high costs of importing materials to produce the food, energy price increases, and production costs have exacerbated this unprofitability. Between 1990 and 1996, the production of sausages fell by 90 percent, milk by 87 percent, and baked goods by 50 percent. Despite these problems, food production has significant possibilities. Enterprises that produce high-quality fish products and reindeer meat, in particular, have good potential.

Until 1990, construction was one of the region's fastest growing industries, employing 2.7 percent of the population and generating 2.9 percent of the industrial production. Primarily in Anadyrsky Raion, this industry included construction materials, sand and gravel mixes, construction sand, clay bricks, and concrete. Loss of state subsidies has led to decline of this industry as well.

Transport

The transport sector employs almost 10 percent of the workforce. Sea shipping moves 90 percent of all cargo. The primary seaports are Pevek, Mys Shmidta, Provideniya, Beringovsky, Anadyr, and Egvekinot. Most goods come from the southern RFE (Vladivostok and Nakhodka), rather than from the west (St. Petersburg, Arkhangelsk, and Murmansk). Airplanes and helicopters move people to and from Chukotka. The largest airports are in Anadyr, Pevek, and Mys Shmidta, with airplanes such as the Ilyushin 62, the Ilyushin 76, the Tupolev 154, and the AN 12 landing there. Travel within the *okrug* is by old MI-8 helicopters. Automobile transport is insignificant. There are 2,400 km of roads, most of which are gravel. Only 700 km of the roads can be used year-round. Heavy use of the roads in winter damages tundra and reindeer pastures.

Toward sustainable development

Gennady Smirnov, Maxim Litovka, Dmitry Naumkin

Increasing use of renewable energy resources is the first thing that comes to mind when pondering alternative forms of economic development for Chukotka. Scarcely used, renewable energy resources have great potential. However, aside from a few small wind-powered generators at meteorological stations and the partial construction of the wind power station in Nagorny Village, little effort has been made. This issue is also urgent because of rising costs to deliver coal and oil to the region, and the great risks of nuclear power. Wind and hydroelectric power stations for individual and community use must be developed. Initially, a demonstration facility should be built in Anadyr. Support from environmental organizations and foundations could help offset the costs of building such a facility.

Learning from indigenous peoples. All forms of traditional nature use follow with the principles of sustainable development. For thousands of years, Chukotka's indigenous peoples have raised reindeer, which can adapt to a range of environmental conditions and thus are able to thrive in the far north. Reindeer meat is of high quality, the skin can be used for a variety of purposes, and the antlers (*panty*) can be used in medicines and liqueurs. Unlike the raising of other domesticated herd animals, a practice alien to traditional Chukotka peoples, reindeer herding requires no transport of feed, and there are no special labor or capital requirements. Currently, as there are enough natural resources to feed reindeer, herding is the most promising industrial enterprise for Chukotka. Products from marine mammals may also be useful for the pharmaceutical industry. Some experts estimate that the potential value of biologically active substances, enzymes, and endocrine secretions available from marine mammal organs could exceed the revenue from Chukotka's entire gold mining industry. However, the hunting of marine mammals is first and foremost a way of life for the native coastal peoples, with complex principles that may not always be comprehensible to outsiders. These principles must be protected and respected and never sacrificed for other businesses.

Fishing

The fishing industry of Chukotka, if done sustainably, also has a potentially good future. Marine resources are, however, being sold off to foreign fishing companies because Chukotka does not have a commercial fishery fleet and processing is poorly developed.

Hunting

The potential for hunting lies in the harvest of wild reindeer and improvement of meat processing and production facilities in Anadyrsky, Bilibinsky, and Chaunsky Raions. Fur production has some potential, particularly if the *okrug* government supports fur-processing factories in remote areas; this would give native peoples a steady source of income.

Ecotourism

Ecotourism, although fairly well developed on nearby Kamchatka Peninsula, is undeveloped in Chukotka. Tourists who visit Chukotka leave inspired and impressed; few places remain where nature exists on such a grand and pristine scale. The diversity of ecosystems, alternating valley and mountain landscapes, and an unfamiliar intensity of colors matched by the rich wildlife present great possibilities for adventure tourism. Possible tours include sea and river cruises, river rafting, and dog sledding.

Ecological monitoring and assessment

Ecological monitoring is inadequate. An environmental impact assessment system is completely undeveloped. Mining, fishing, and other enterprises are often not inspected. Specialists feel that monitoring and controlling radiation in coastal areas is particularly important (the RITEGS are an obvious example). An independent environmental assessment is urgently needed for the Bilibino nuclear power plant, for the planned floating nuclear power plant in Pevek, and for the proposed onshore and offshore oil and gas projects. Greater regulation of land and water pollution caused by the mining industry is needed. Widening and modernizing the network of meteorological stations is important to predict natural

disasters. Chukotka's unusual geographic position allows for a great scientific opportunity to monitor marine ecosystems in the Bering Strait.

Water quality

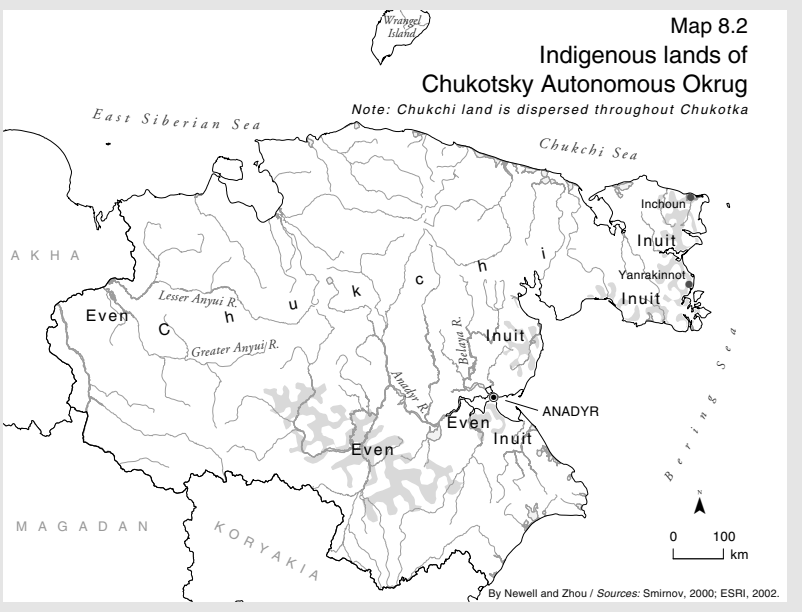
Water treatment facilities need to be constructed in all medium and large towns and cities.

Indigenous peoples

Gennady Smirnov, Maxim Litovka, Dmitry Naumkin

Most of Chukotka's ancestral peoples (the Chukchi, Koryaks, Kereks, Eskimos, and Yukagirs) have paleo-Asiatic origins. The exceptions are the Evens, a Tungus-Manchurian group, and the Chuvans, a racially mixed group formed in the seventeenth and eighteenth centuries. Unlike other well-known groups of early settlers with Russian origins such as the Kamchadals and Kolymchans, the Chuvans were recognized as an indigenous group and thus paid regular *yasak* (fur tribute) to the tsar's treasury.

A single ancestral nation of Eskimos and Aleuts are believed to be the oldest inhabitants of northeast Asia and islands in the Bering Sea. Here Eskimos, living on the northeast tip of Asia, developed their marine hunting culture that spread to the northern coasts and Arctic islands of America and Greenland. Ancestors of modern-day Chukchi, Koryaks, and Kereks migrated from southern regions of Eastern Siberia, arriving in Chukotka much later than the Eskimos.



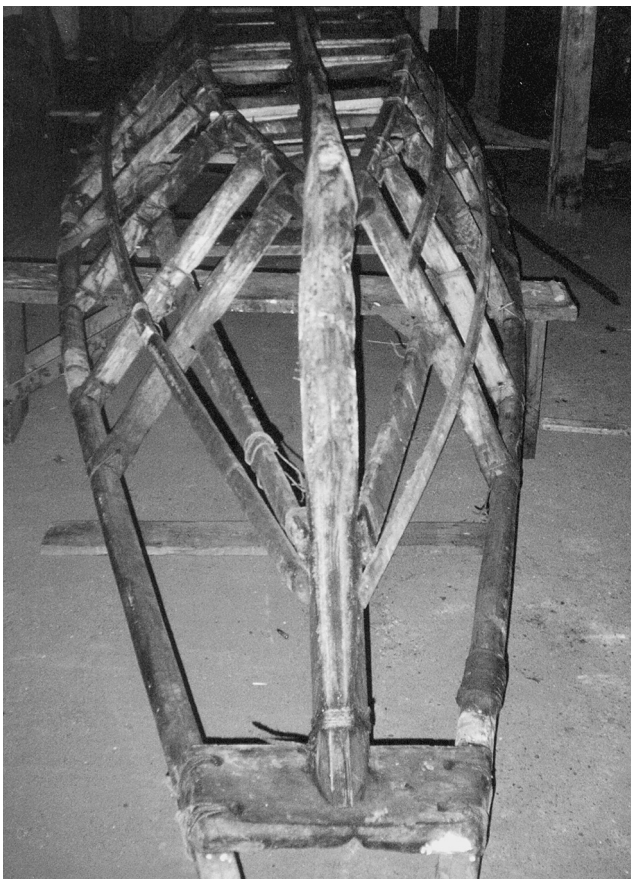
Archeological evidence indicates the Kereks were hunting seabirds and mammals in the region by 1000 B.C. and that an early Koryak group was living in the region as early as 3000 B.C. Evens, primarily reindeer herders and hunters, appeared much later, migrating from northern Khabarovsk Krai and settling part of the Anadyr basin in the nineteenth century. Horseless hunters of the taiga, the Yukagirs (Hodyns, Chuvans, and Anauls) are more difficult to categorize ethnographically. Some scholars place their ancestral roots in the Altai Range (Southern Siberia); others trace their origins to the Kolyma, Omolon, Greater Anyui, and Lesser Anyui River basins in northeastern Russia.

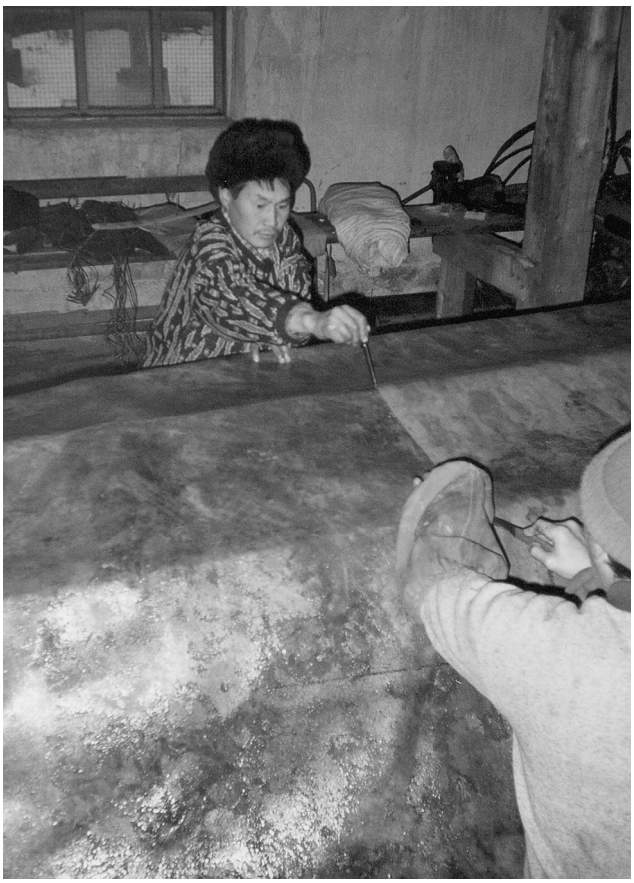
Indigenous peoples live on reindeer herding, hunting, and fishing. For centuries, the Chukchi, Koryaks, and Evens have been reindeer herders in the tundra; Chaplino Eskimos also did a small amount of herding. Before the development of herding, they hunted migrating wild reindeer at river crossings. In the same region, Yukagirs and Chuvans hunted ungulates and traded sable and squirrel pelts. The sable trade expanded greatly in the seventeenth century, as Russian explorers imposed the *yasak* system. Trade expanded with Russian and American traders, who sought other species in addition to sable. The fur trade ensnared all of Chukotka.

Management of large reindeer herds, as practiced today in Chukotka, began in the eighteenth century. Chukchi and Koryaks, who considered herders with fewer than two hundred head to be poor, often had herds of more than one thousand animals. Even herders grazed their smaller herds primarily in boreal forest and southern tundra; the more forested region necessitated smaller herds. The Evens also used dogs to assist in herding, unlike the Chukchi and Koryaks. Evens rode on and carried loads on the reindeer, while Chukchi and Koryaks harnessed theirs to various types of sleds.

Marine mammals, mostly whales and walruses, provided for all the material and spiritual needs of the Eskimos and coastal Chukchi (the Ankalins). Bearded seals were also hunted, as were smaller pinnipeds. Until the appearance of firearms, whales and walrus were hunted with traditional weapons; this required great physical and spiritual stamina, including the mastery of hunting skills and sophisticated esoteric rituals that brought a certain spirituality and gratitude to killing the animals. These practices likely led to formation of secret clans of men, analogous to those described in literature about *Kitovaya Alleya* (Whale's Patch). Chukchi and Eskimo consciousness and culture, as a result, were inextricably linked with sea hunting, nature, and natural spirits.

Contact between native peoples and Russian explorers brought conflict.





Among many traditional arts and crafts none is as important for seafaring Chukchi and Eskimos as the art of building baidar*, walrus skin boats.*

Written accounts by Semyon Dezhnev, Kurbat Ivanov, and other explorers, describe violent and cruel skirmishes with the natives. Dezhnev and his army of Cossacks destroyed tribes that refused to submit and slaughtered huge walrus populations at their breeding grounds, which had been protected by Eskimo and Chukchi tribes. Yet the natives resisted; their perseverance is evidenced by the fact that three centuries of missionaries were unable to convert either Chukchi or Eskimo to Christianity.

Mid-nineteenth-century expansion of American, Norwegian, and British whaling ships almost destroyed bowhead whale and Pacific walrus populations; the species completely disappeared from some parts of Chukotka. Hunger and death afflicted the native whalers, and many settlements were abandoned during this period.

Soviet control of Chukotka led to *razkulachivanie*, the destruction of the resource-owning class. Owners of large reindeer herds were targeted. Forced collectivization followed, as did the expansion of towns and cities. Reindeer herding, under the iron hand of the government, was reduced to mere meat production. In the late 1960s, Magadan Soviet officials proclaimed that Chukotka must expand the reindeer herd to one million head. Despite obvious lack of grazing land, the government forged ahead. By 1971, the herd peaked at 576,000 and began its inevitable decline. Epizootics increased, as did depleted grazing areas. With the industrialization of Chukotka, the migration of people from other parts of the Soviet Union became a form of governmental politics. By the middle of the 1980s, there were nine times as many immigrants as native residents. Intensive industrialization on the lands of the indigenous peoples, forced acculturation with the European way of life, and the massive immigration permanently disrupted the region. The essential material, social, and spiritual aspects of Arctic civilization and ecology began to disappear, despite the need for balanced development in these fragile polar ecosystems. Many accounts remain of the native people's resistance to incessant Soviet attempts to stamp out their balanced way of life. To a large extent, the truth about this Soviet period is no longer accessible.

The Soviet government eliminated traditional forms of hunting in favor of captive-animal husbandry to provide centralized employment opportunities in growing villages and cities; this increased meat production levels, but the product could not be processed or stored properly. Tractors dragging unused whale skeletons to discard them in the tundra became an increasingly common sight. *Kolkhoz* and *sovkhoz* storage sheds were packed with thousands of untreated seal pelts, which often went unused and were destroyed. In areas around large towns, gigantic dumps of construction material and domestic refuse grew, as did huge whale graveyards. During this era of "developed socialism," Chukotka's native peoples suffered greatly; in particular, most hunters of marine mammals lost their spiritual reverence of the prey that they killed.

After the dissolution of the USSR, reforms brought an end to the regular government subsidies that the villagers depended on. *Sovkhoz* collectives became small farms, which were initially welcomed by native peoples as an opportunity to develop economic independence. However, privatized reindeer herders now find themselves in dire straits because of the collapse of industry, the disruption of economic ties, and high transport costs. Decline in medical services and shortages of basic staples (food and household goods) have become severe. Most reindeer herding farms situated near populated areas have failed and many of the herders and farmers feel they lack true ownership. Reindeer are sold for a fraction of their value, grazing areas are left unprotected, money from sales goes for alcohol, and many of the herders have become *oleneedy* (reindeer eaters). The lack of laws protecting herding lands hastens this degradation of herding culture and the economy. The ancient culture of the herdsman of the tundra is at risk of extinction.

Lacking money, coastal native peoples have again turned to the sea as a source of food, which ironically is bringing them closer to nature. Most now survive exclusively on marine mammal meat, fish, and marine invertebrates. Small surplus quantities of fish and meat, and sewn goods and handicrafts, are sold to tourists, or traded in nearby *raion* centers. Residents are reviving some traditional practices, such as building leather *baidar* (kayaks) or training sled dogs. Some are starting to practice forgotten spiritual traditions, based on exalting the sea hunt and hunter. Hunting at sea is once again becoming a prestigious calling in coastal cultures.

Chukotkan natives and American Inuit are participating in scientific research on bowhead whales. From data collected through this collaboration, the International Whaling Commission (IWC) granted Russia rights to hunt up to five bowhead whales, although in 2002 the IWC revoked this right. Leaders and activists are appearing among the native peoples and are forming nongovernmental organizations (NGOs). The Association of Native Minorities of Chukotka (AMKNCh), with branches in every *raion*, is the first of these new NGOs to develop quickly. The Eskimo Society of Chukotka, a member of the Inuit Circumpolar Conference (ICC,) reindeer herder organizations, such as the Association of Reindeer-Herders of Chukotka, and marine mammal hunters' associations, such as the Union of Marine Mammal Hunters of Chukotka, have been formed. These organizations include in their lists of goals the need to restore traditional forms of resource use and to conserve the environment. Some projects are becoming a reality, thanks to grants from international NGOs and foundations.

The bowhead whale research project began in the early 1990s at the initiative of the North Slope Borough Corporation of Alaska, the national cooperative Naukan, and the Eskimo Society of Chukotka. In addition to research, this project has also helped resolve some social problems of Chukotka indigenous peoples. The project has developed

a creative and committed group of people and a wealth of experience, both valuable assets for future work.

In 1996–1997, Kaira Club and AMKNCh developed the project Meechkyn (Hope of sea hunters of Cross Bay), which studies ecological aspects of the worldviews of sea hunters and the role of the master at the Meechkyn walrus breeding grounds. Also, the group collected extensive information on past and present conditions of traditional resource use; these findings were included in a list of resolutions passed by the Chukotka government concerning the long-term future of the native marine hunting industry. The most significant accomplishment of the project was encouraging citizen activism at Cross Bay, which led to a national movement to protect these important walrus breeding grounds. In this region, Chukchi and Eskimos have already selected people in Inchoun and Yanrakinnot villages to protect these grounds.

Native peoples are beginning to manage marine mammal populations again. In addition to the work on bowhead whales, coastal Chukchi and Eskimos are working on similar projects to study and protect Pacific walruses and polar bears. They are also sharing reindeer herding experiences with counterparts in Finland and Norway.

Effective traditional resource use by native populations in Chukotka, as in the rest of Russia, ultimately depends on resolving issues of land ownership. Much paper has been devoted to prolonged discussion of Territories for Traditional Nature Use (TTP) legislation. This discussion will probably not be decided in favor of the native population as long as allies of industrialization in Chukotka dominate administrative and legal structures. And until the reindeer herder feels himself to be a master of the lands that his ancestors carefully lived on and cared for, reindeer herding as a form of material and spiritual culture will be at risk.

Legal issues

Gennady Smirnov

Despite adequately strong regulations for natural resource use, in practice, poaching levels and other violations remain high. Most of the population does not respect the laws. Many environmental violations and crimes remain hidden because of pressure from *okrug* and *raion* authorities on the regulators. It is difficult to find examples, as such cases are usually not made public. However, through personal contact, we have discovered this to be the case. Attempts to pursue these violators, in defiance of government will, are severely resisted. As mentioned earlier, in 1995, a Chukotka Council for Environmental Expertiza recommended against developing the Anadyrsky oil and gas project, arguing it was a threat to Ostrov Vrangelya Zapovednik. The *okrug* government's immediate response, however, was to disband this disobedient council and appoint a new, more malleable one. One can repeat the common saying in Russia: "Why make new laws, when the old ones aren't followed?"

There has been a gradual departure of the more principled and highly qualified specialists from resource agencies. Lack of professionals in this area is one of the primary problems facing all *okrug* agencies.