

## CHAPTER 2

### ALTERNATIVES

#### ***2.1 Introduction***

This chapter describes four alternatives considered for management of light goose populations. The preferred alternative (Alternative B) describes how we propose to create additional regulatory tools and alter habitat management programs on some of our refuges for the purpose of reducing and stabilizing specific populations of light geese in North America.

#### ***2.2 Rationale For Alternative Designs***

All alternatives considered were evaluated in relation to their ability to reduce and stabilize light goose populations, and prevent further degradation of habitats important to light geese and other migratory birds. NEPA regulations require analysis of a No Action alternative. Three additional alternatives were developed as a result of our previous EA on light goose management, as well as input received during the scoping phase of the EIS.

#### ***2.3 Description of Alternatives***

##### **2.3.1 Alternative A. No Action. Continue to manage light goose populations through existing wildlife management policies and practices.**

Under the No Action alternative light goose populations would be allowed to increase in size. This alternative would continue to manage light geese through existing wildlife management policies and practices, with the exception of temporary light goose regulations implemented under the Arctic Tundra Habitat Emergency Conservation Act. Traditional harvest of light geese will continue during the regular season and will be managed using existing administrative procedures. Light goose hunting regulations adopted by States will be confined to Federal frameworks that provide for a maximum season length of 107 days, occurring during the period September 1 to March 10 as prescribed by the Treaty (U.S. Fish and Wildlife Service 1988). Existing hunt programs and existing administrative procedures for establishing new hunt programs, on national wildlife refuges administered by the Service will remain in place. Habitat

management programs on refuges would continue as normal with regard to the purposes for which each refuge was established.

### **2.3.2 Alternative B. (PREFERRED) Modify harvest regulation options and refuge management.**

This alternative would modify Title 50 Code of Federal Regulations (*CFR*) Part 20 to allow the use of additional hunting methods to hunt light geese within current migratory bird hunting-season frameworks. We would authorize the use of electronic calls and unplugged shotguns to harvest light geese during normal light-geese hunting seasons when all other waterfowl and crane hunting seasons, excluding falconry, are closed. Additional methods may be authorized to hunt light geese during normal hunting season frameworks if desired population reduction goals are not achieved within several years. Authorization of additional methods would be made following a public review process.

This alternative would also create a new Subpart to 50 *CFR* Part 21 specifically for the management of overabundant light goose populations. Under this new Subpart, we would establish a conservation order under the authority of the Migratory Bird Treaty Act with the intent to reduce and/or stabilize light goose population levels. The conservation order would authorize each State/Tribe in eligible areas to initiate aggressive light goose harvest strategies, within the conditions that we provide, with the intent to reduce the populations. The order will enable States/Tribes to use hunters to harvest light geese, by way of shooting in a hunting manner, during a period when all waterfowl (including light geese) and crane hunting seasons, excluding falconry, are closed, inside or outside the migratory bird hunting season frameworks. The order would also authorize the use of additional methods of take to harvest light geese during that period. Initially, the conservation order would authorize the use of electronic calls and unplugged shotguns, eliminate daily bag limits on light geese, and allow shooting hours to continue until one-half hour after sunset. Methods of take other than electronic calls and unplugged shotguns may be authorized during the conservation order if population reduction goals are not achieved within several years of implementation. Authorization of additional methods would be made following a public review process. The Service will annually assess the overall impact and effectiveness of the conservation order to ensure compatibility with long-term conservation of this resource. If at any time evidence is presented that clearly demonstrates that there no longer exists a serious threat of injury to the area or areas involved for a particular light goose population, we will initiate action to suspend the conservation order, and/or regular-season regulation changes, for that population. Suspension of regulations for a particular population would be made following a public review process. Specific details of light goose regulations under *CFR* Parts 20 and 21 are presented in Appendix 3.

Finally, this alternative would alter management practices on some Service national wildlife refuges to decrease the amount of sanctuary and food available to migrating and wintering light geese. The most likely action that a refuge would implement is creating new, or enlarging current, areas open to light goose

hunting. While some refuges may be opened for migratory bird hunting without area limitation, the National Wildlife Refuge System Administration Act of 1966 stipulates that only 40% of certain refuges may be opened to migratory bird hunting. The Fish and Wildlife Improvement Act of 1978 (Public Law 95-616) amended the 1966 Act to permit the opening of greater than 40% of certain refuges to hunting when it is determined to be beneficial to the species hunted. Following Executive Order 12996 issued on March 25, 1996, Congress enacted the National Wildlife Refuge System Improvement Act of 1997, amending the National Wildlife Refuge System Administration Act of 1966 to establish that compatible wildlife-dependent recreational uses involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation are the priority public uses of the Refuge System. In order to establish a refuge hunt program, a determination must be made that the program is compatible with the major purposes for which the refuge was established (U.S. Fish and Wildlife Service 1986b). Establishment of a hunt program includes preparation of the plan itself, an Environmental Assessment, Section 7 consultation in accordance with the Endangered Species Act, and Proposed and Final Rules in the Federal Register (U.S. Fish and Wildlife Service 1986b). Each year, we make new proposals for amendments to refuge-specific hunting regulations available for public review and comment in the Federal Register.

Due to the dynamic nature of annual migration and wintering patterns of light geese, we cannot provide a definitive listing of annual management actions that some refuges may implement. Changes to refuge management may also include alteration of habitat programs to reduce food availability for, and make habitats less attractive to, light geese. For example, many refuges have been undertaking reforestation programs. While such programs were not initiated in response to the light goose issue, they will have the added effect of reducing food available to light geese. Some refuges that harbor significant numbers of light geese may choose to alter impoundment water levels in order to create roosting areas and attract birds near hunted sites, or eliminate roosting areas to encourage birds to move to areas where hunting does occur. Reduction of areas planted to agricultural crops on some refuges will also decrease food available to light geese. Modification of prescribed burn programs may also be used to make certain areas on refuges more or less attractive to light geese depending on the size of the burn area. Any uses included with changes in management practices on a particular refuge will be permitted only after they have been determined to be compatible with the purposes for which the refuge was established, and due regard to potential impacts to special status (threatened or endangered) species has been made.

### **2.3.3 Alternative C. Implement direct light goose population control on wintering and migration areas in the U.S.**

We define direct control as the purposeful removal of large numbers of birds from a population using lethal means. This alternative would implement direct population control to achieve desired light goose population levels. Control efforts would be undertaken by wildlife agencies (State and/or Federal) on

light goose migration and wintering areas in the U.S. Under this alternative we would create a special light goose permit within 50 *CFR* Part 21 specifically for the reduction of light goose populations. Regulations governing the issuance of permits to take, capture, kill, possess, and transport migratory birds are authorized by the Migratory Bird Treaty Act and are promulgated in 50 *CFR* parts 13 and 21. The permit would allow State and Federal agencies responsible for migratory bird management, and/or their authorized designated agents, to initiate light goose population reduction actions within the conditions/restrictions of the program. Specific conditions/restrictions of this permit are outlined in Appendix 4.

Applications for the special light goose permit would require a statement from the agency that provides an estimate of the number of light geese expected to be found in the action area and the approximate number of light geese that are to be taken. Permit holders would be required to properly dispose of or utilize light geese killed under the program. Light geese killed under this permit could be donated for scientific and educational purposes, or be donated to charities for human consumption. In the absence of such disposal options, geese may be buried or incinerated. Light geese, and their plumage, taken under these permits may not be sold, offered for sale, bartered, or shipped for purpose of sale or barter. Control activities should be undertaken such that they do not adversely affect other migratory birds or any species designated under the Endangered Species Act as threatened or endangered.

Agencies may use their own discretion for methods of take. Methods may include, but are not limited to, firearms, traps, chemicals or other control techniques that are consistent with accepted wildlife-damage management programs. The advantage of live-trapping is that non-target species would be released unharmed. Chemical control would be achieved by treating corn or other food with chemicals (e.g., DRC-1339, Avitrol, or alpha chloralose) and broadcasting the treated bait in areas where light geese are feeding. Currently, these chemicals are not registered for use on light geese. Under this alternative, agencies would apply to the Environmental Protection Agency for use of these chemicals on light geese under a Section 18 Specific Exemption, or a Section 24C registration, under the Federal Insecticide and Rodenticide Act. All control efforts would be used only in areas utilized by large flocks of light geese. This will increase efficiency of the control effort and minimize the take of non-target species, which tend to avoid sites used by large flocks of light geese (J. Cummings, U.S. Dept. Agriculture, personal communication).

Due to the dynamic nature of annual migration and wintering patterns of light geese, we cannot provide a definitive listing of sites where geese would be taken. By necessity, control efforts will have to be opportunistic with regard to daily movements of geese. Sites likely would include agricultural fields and roosting areas near wetlands, preferably on Federal or State wildlife areas where access would not be an issue. Control efforts may be undertaken on private lands utilized by geese if landowner consent was obtained. Prior to initiation of control efforts on any areas, the presence of threatened or endangered species would be determined in order to prevent potential impacts to such species.

Permit holders will be required to keep records of all activities performed under the permit and submit annual reports to us. We will annually review such reports and assess the overall impact of this program to ensure compatibility with the long-term conservation of this resource. If at any time evidence is presented that clearly demonstrates that there no longer exists a serious threat of injury to the area or areas involved for a particular light goose population, we will initiate action to suspend the special permits for that population. Suspension of permits for a particular population would be made following a public review process.

### **2.3.4 Alternative D. Seek direct light goose population control on breeding grounds in Canada.**

This alternative would achieve light goose population reduction through direct control on the breeding grounds in Canada. We do not have the authority to unilaterally implement direct population control measures in Canada. However, we have discussed the issue of direct population control with the Canadian Wildlife Service during meetings of the Arctic Goose Joint Venture. The Joint Venture has formed a working group to outline potential methods of direct control if such measures are ever deemed necessary. Although final reports from the direct control working groups are not available at this time, we believe that enough information is currently available to implement this alternative if it is chosen. This alternative may or may not involve U.S. wildlife agency participation, depending on the availability of funding and manpower in Canada. Regardless, the Canadian government would be the lead authority under this alternative.

Methods of control would include shooting, chemicals, or capturing. Shooting of birds by sharpshooters would most likely be conducted during the nest incubation period when birds are attentive to nests, and their movements are limited. Personnel would be flown into nesting colonies and conduct control efforts during the short nest incubation period of approximately 20 days. Sharpshooters would easily be able to identify bird species before shooting, and thus avoid take of non-target bird species. Capture methods would be employed during the birds' flightless period in summer when they are undergoing feather molt. In most instances, capturing of birds would be accomplished by driving birds into capture pens with the aid of helicopters. Birds would then be euthanized after being captured. Any non-target bird species caught incidental to light goose trapping would be released. Chemical control would also be employed during the flightless period when treated baits could be broadcast on sites utilized by large flocks of molting birds. Chemical types and methods of application would be similar to those outlined in Alternative C. The cost of conducting fieldwork in the Arctic under this alternative is much higher than control efforts in the U.S. To control costs, leaving goose carcasses in the field would be an option for consideration. Alternatively, carcasses could be collected and processed at the nearest available facility.

### 2.3.5 Light Goose Population Monitoring

Common to all analyzed alternatives is the existence of a variety of light goose population monitoring programs in North America. These programs include annual winter surveys, periodic photo surveys of nesting colonies, and marking of birds with leg bands to estimate goose distribution, and survival and recovery rates. Monitoring of annual light goose harvest would continue through our normal waterfowl harvest surveys and those conducted by the Canadian Wildlife Service. More detailed descriptions of several of these programs are presented in Chapter 3. Information from monitoring programs will enable us to monitor the response of light goose populations to each of the alternatives. For Alternatives B-D, existing population monitoring programs will be used to determine when population reduction programs should be suspended.

Alternatives B and D advocate light goose management on migration and wintering areas in the U.S. Under both of these alternatives, managers will minimize the risk of impacting lesser snow geese from Wrangel Island, Russia, which have experienced years of poor reproduction due to climatic conditions on their breeding areas. Monitoring of marked birds has indicated that birds from Wrangel Island that migrate to the Pacific Flyway through British Columbia and Washington are geographically separated from western arctic birds, which tend to migrate through Alberta and Saskatchewan (Armstrong et al. 1999). Harvest pressure on Wrangel Islands birds found in eastern Oregon can be reduced by delaying hunting seasons, or control efforts, in the fall. This is possible due to the tendency of Wrangel Island birds to arrive two weeks earlier than western arctic birds in such areas. Furthermore, potential light goose control efforts in the Imperial Valley of southern California will not impact Wrangel Island birds because the area is used primarily by birds from the western Arctic (Armstrong et al. 1999).

The Arctic Goose Joint Venture has prepared science needs documents for greater snow geese (Belanger and Sarrazin 2000) and lesser snow and Ross's geese (Arctic Goose Joint Venture Technical Committee 1998). These documents outline expenditures for existing population monitoring programs (described above) and those for programs to be developed in the next several years. New programs include expansion of population monitoring to other colony sites, vegetation mapping of previously un-mapped goose colony areas, vegetation monitoring, and monitoring biodiversity at colony sites. Information provided by such programs will be used in an adaptive management process, whereby managers will learn about the response of light goose populations and their habitats to whatever management alternative is implemented.

### 2.3.6 Current Light Goose Regulations

Under each alternative that is analyzed, traditional harvest of light geese will continue during the regular season and will be managed using existing administrative procedures. Light goose hunting

regulations adopted by States will be confined to Federal frameworks that provide for a maximum season length of 107 days, occurring during the period September 1 to March 10 as prescribed by the Treaty (USDI 1988). Existing hunting programs, and administrative procedures for establishing new hunting programs, on national wildlife refuges administered by the Service will remain in place.

### **2.4 Alternatives Considered But Eliminated From Detailed Study**

During preparation of our EA, and during the scoping process of this EIS, we received recommendations to consider an array of options for managing light goose populations. The following recommendations were considered but rejected because they did not have the capacity to address our responsibilities, and did not possess the potential to alleviate problems associated with large light goose populations. Many of the recommendations involved minor modification of existing migratory bird hunting regulations that would not significantly increase harvest. We chose not to analyze such alternatives because they would create unnecessary confusion to citizens concerning regulations without significantly decreasing light goose abundance.

#### **2.4.1 Establish a depredation order**

We issue depredation orders to permit the killing of migratory game birds that "...have accumulated in such numbers in a particular area as to cause or about to cause serious damage to agricultural, horticultural, and fish cultural interests..." (50 *CFR* Part 21.42). Much of the damage caused by light geese often is restricted to natural marsh and tundra habitats, which is not covered by depredation order regulations. However, light geese also cause damage to crops such as hay and cereal grains. In such cases, farmers would be eligible to apply for a depredation permit (50 *CFR* Part 21.41).

Restrictions on depredation orders require that take of depredating birds must occur on or over the threatened area or areas. We believe this restriction precludes the use of depredation orders as the sole means of controlling large populations of light geese that are highly mobile and which migrate thousands of miles during the annual cycle. Furthermore, only a small proportion of the total population may be depredating agricultural or horticultural interests at any particular time. Although depredation orders can still be issued to eligible individuals, depredation orders themselves would be an inefficient method of population control and will not be considered as an alternative.

#### **2.4.2 Egg removal**

Removal or destruction of eggs on light goose breeding colonies has been suggested as a method to alleviate habitat damage. No field studies have been conducted in the Arctic that would provide information

on the effectiveness of such a program. However, results from modeling the population dynamics of lesser snow geese in the mid-continent region indicate that egg removal would be an inefficient method of causing a decrease in population growth, compared to methods that reduce adult survival (Rockwell et al. 1997a). A 5.7% reduction in adult survival would induce a decline in the population, whereas a 36% decline in fertility (an end result of egg removal) would be needed to achieve the same effect (Rockwell et al. 1997a). To equal the effect of removing an adult bird from a population, all eggs produced by that goose during its entire lifetime must be removed (Smith et al. 1999). Furthermore, egg removal efforts must be nearly complete in order to prevent recruitment from a small number of surviving nests that would offset control efforts (Smith et al. 1999). Rockwell et al. (1997a) estimated that 2.7 million eggs would need to be removed annually from nests at La Perouse Bay simply to reduce the population growth rate to just below 1.0. Costs for egg removal in the Arctic are not available; however Cooper and Keefe (1997) estimated that removal costs in Minnesota are \$6.38 per egg. Using the Minnesota egg removal cost estimate for La Perouse Bay translates to \$17 million per year to induce population decline at just one light goose colony site. Search time for egg removal in light goose colonies likely would be low due to high nest densities, but this savings would likely be offset by the high cost of conducting fieldwork in the Arctic. Even if complete egg removal could be achieved at a colony site, the large number of adult birds remaining in the population would continue to degrade habitats. Due to high costs and the large number of surviving adults, we do not view egg removal as a viable alternative for consideration.

### **2.4.3 Permit the use of lead shot to take light geese**

It has been suggested that light goose harvest can be increased by allowing the use of lead shot, which is perceived as being ballistically superior to other shot types. Lead shot has been demonstrated to be poisonous to birds once ingested, and was responsible for annual mortality of 2-3% of the fall waterfowl population (Anderson et al. 2000). Consequently, we prepared an EIS in 1976, and a Supplemental EIS in 1986, to require the use of steel (nontoxic) shot for hunting waterfowl and coots in the U.S. In 1991, we implemented a nationwide ban on the use of lead shot for hunting waterfowl and coots (50 *CFR* Part 20.21[j]). Following the 1991 ban, several alternatives in addition to steel shot have been approved for waterfowl hunting (e.g., bismuth-tin, tungsten-iron, tungsten-polymer, tungsten-matrix, tungsten-nickel-iron). Most waterfowl hunters now understand and support the need to use nontoxic shot and have adjusted well to the use of an alternative for lead. Legalization of lead shot to hunt light geese would result in massive deposition of lead in the environment that could be ingested by non-target species, which may include endangered or threatened species. Therefore, we consider the use of lead shot to increase the harvest of light geese to be unacceptable.



#### **2.4.4 Permit the use of rifles and/or pistols**

The use of rifles or pistols for migratory bird hunting was prohibited in 1935 (50 *CFR* Part 20.21[a]). Migratory bird hunters often hunt in close proximity to each other. Rifles and pistols have a significantly longer range than shotguns, and therefore present a human safety hazard for any persons inside or outside shotgun range. Additionally, there is no evidence to suggest that the use of rifles and pistols by hunters would increase harvest of light geese. Due to the safety risks associated with the use of rifles or pistols for migratory bird hunting, and to the lack of evidence that their use would increase harvest of light geese, we will not consider them as options for reducing light goose populations.

#### **2.4.5 Remove the Federal migratory bird hunting stamp requirement during normal season frameworks**

All hunters 16 years of age and older must possess a valid Federal migratory bird hunting and conservation stamp (duck stamp) as prescribed in the Migratory Bird Hunting Stamp Act of 1934, as amended (16 U.S.C. 718 [a]) in order to hunt waterfowl during normal hunting season frameworks. Congressional action would be required to amend the Migratory Bird Hunting Stamp Act of 1934, and waive the Federal duck stamp requirement. Citizens that would hunt light geese during normal season frameworks likely would have already purchased a duck stamp to hunt other waterfowl species. Therefore, we do not believe that waiver of the duck stamp requirement would recruit additional hunters to harvest light geese during normal season frameworks.

#### **2.4.6 Permit the use of reciprocal State hunting licenses**

Federal regulations do not prohibit reciprocal licensing between States. Reciprocal licensing agreements between States would expand opportunities to take light geese for non-resident hunters. Reciprocal licensing would permit an individual holding a valid hunting license in one State to hunt light geese within one or more cooperating States. Whereas we have jurisdiction over the broader waterfowl hunting frameworks within which States operate, we must defer to State sovereignty where State hunting licenses are concerned (50 *CFR* Part 10.3). Therefore, we have no jurisdictional authority regarding State regulations or statute requirements for State migratory bird hunting licenses. Individual States must enter into a reciprocal licensing agreement on their own authority.

#### **2.4.7 Permit the use of live decoys to hunt light geese**

The use of live birds as decoys to attract and hunt waterfowl was prohibited in 1935 (50 *CFR* Part 20.21[f]). There is a risk of transmitting certain avian diseases to wild birds from captive-reared or domestic

birds. We believe the use of live decoys to attract wild light geese would enhance that risk, and therefore this alternative will not be considered.

#### **2.4.8 Permit the use of baiting to hunt light geese**

Baiting is the direct or indirect placing, exposing, depositing, distributing, or scattering of salt, grain, or other feed that could lure or attract migratory game birds to, on, or over any areas where hunters are attempting to take them. The use of baiting to hunt migratory birds was prohibited in 1935 (50 *CFR* Part 20.21[i]), and has continued to be a source of controversy. Field studies on light goose wintering and migration areas indicate that light geese may be less likely to be attracted to baited trap sites than other waterfowl species (R. Cox, U.S. Geological Survey, personal communication). Such results suggest that baiting would not be a successful tool for attracting light geese for hunting purposes. Therefore, we do not believe that authorization of baiting to hunt light geese will result in a significant increase in harvest, and will not consider its use.

#### **2.4.9 Apply dove baiting regulations to regulations for hunting light geese**

Baiting regulations were modified in the early 1970s to distinguish those pertaining to dove hunting from those for hunting waterfowl (50 *CFR* Part 20.21[i]). Baiting regulations were modified again in 1999 to clarify which plant and soil management practices are legally compatible with dove and waterfowl hunting, respectively. One of the primary differences between dove and waterfowl baiting regulations is that doves may be hunted over areas where grain or feed has been distributed or scattered solely as the result of the manipulation of an agricultural crop or other feed on the land where grown (50 *CFR* 20.21[i][2]). Light geese and other waterfowl may not be hunted over such areas. Some State waterfowl management plans include objectives of providing high-energy foods during winter and migration periods after normal hunting seasons have ended. Taking light geese over such areas during a conservation order would create a baited situation, and would be illegal. Therefore, States must choose between providing for the needs of many waterfowl species during critical periods, or allow increased harvest of light geese to control their population size.

We do not believe that waterfowl baiting regulations prevent States from simultaneously providing high-energy foods and allowing increased take of light geese. Waterfowl may be hunted on or over the following lands or areas: where standing crops or flooded standing crops (including aquatics); standing, flooded, or manipulated natural vegetation; flooded harvested croplands; or lands or areas where seeds or grains have been scattered solely as the result of a normal agricultural planting, harvesting, post-harvest manipulation or normal soil stabilization practice (50 *CFR* 20.21[i][1][i]). Unless agricultural crops are

manipulated, much of the food provided will be unavailable to waterfowl. In order to make agricultural foods available to birds other than light geese, crops could be manipulated in limited areas and be closed to light goose hunting so that a baiting situation does not arise. Management of natural vegetation can provide food to birds and still be manipulated and hunted over. We believe that further modification of baiting regulations for the sole purpose of light goose management will create unnecessary confusion and burden to the hunting public that must understand and abide by such regulations. Therefore, this alternative will not be analyzed.

### **2.4.10 Allow rallying or herding of light geese with the aid of a motorized vehicle or device**

Migratory bird hunting regulations prohibit the take of migratory birds by means or aid of any motor-driven land, water, or air conveyance, or any sailboat used for the purpose of or resulting in the concentrating, driving, rallying, or stirring up of any migratory bird (50 CFR Part 20.21 [h]). Additionally, migratory birds may not be hunted by means, aid, or use of aircraft of any kind (50 CFR Part 20.21 [d]). Rallying with the aid of a powered device presents a potential safety hazard to hunters and any person within range. Furthermore, rallying of birds may result in “flock-shooting” which may cause wounding of large numbers of birds that subsequently are not retrieved. Although the use of these techniques may cause a slight increase in harvest of light geese, we feel that the risk to human safety and the potential for wounding losses of birds are too great to allow their authorization.

### **2.4.11 Provide supplemental food to light geese on breeding areas**

A recommendation was made to alleviate light goose damage to arctic and sub-arctic habitats by providing supplemental food supplies to geese on their breeding grounds. There is no evidence to suggest that light geese will abandon the consumption of preferred natural foods during the breeding period in favor of food supplied artificially. Furthermore, if supplemental food sources are utilized by light geese, it is likely that high population levels will be maintained and recovery of natural vegetation in damaged habitats will be impossible. Maintenance of large, mobile goose populations will also increase the likelihood that intact habitats will be damaged in the future. Therefore, we will not analyze this alternative.

### **2.4.12 Alter U.S. farm policies to promote reduction of foods available to light geese on wintering and migration areas**

The agricultural sector is a critical component of the U.S. economy. In 1999, approximately 143.8 million acres were planted to corn, rice, and wheat alone, producing a total crop value of over \$25 billion (U.S. Dept. Agriculture 2000). In the Mississippi and Central Flyways, approximately 124 million acres

were planted to corn, rice, and wheat, and produced \$22 billion worth of crops. Reduction of the availability of post-harvest waste grain to light geese on private land would entail significant reductions in the total area planted to such crops. These reductions would not only seriously impact U.S. farmers, but the U.S. economy in general. The Service has no regulatory control over U.S. farm policies and programs and therefore cannot manipulate the availability of agricultural foods to light geese. Furthermore, the potentially large negative impact of this alternative on the U.S. economy makes it impractical. Therefore, this alternative will not be analyzed.

### **2.4.13 Control light goose populations through use of reproductive inhibitors**

Conjugated linoleic acid has been demonstrated to reduce goose egg hatching rates in the laboratory when supplied consistently to birds during the egg formation period (Hill and Craven, unpublished data). However, no effective delivery mechanism has been successfully developed for use in remote field situations on a broad scale. Therefore, researchers have suggested that reproductive inhibitors currently are not a practical method for controlling wild goose populations. Even if reproduction could be prevented, existing goose populations would remain high for many years due to the long life span of adult birds.

### **2.4.14 Allow commercial harvesting of light geese**

The Treaty currently prohibits the sale of migratory birds, their nests, and their eggs; except under certain conditions by Aboriginal peoples. Article II of the Treaty states that Aboriginal people in Canada may sell down and inedible by-products of their traditional harvest of migratory birds, but only within or between Aboriginal communities. Article II also provides for the limited sale of inedible by-products of migratory birds taken by indigenous inhabitants of Alaska, if such by-products are incorporated into authentic articles of handicraft. The harvest of such items must be consistent with the customary and traditional uses by such indigenous inhabitants for their own nutritional and other essential needs. Such limitations on commercial sale of light geese prevent this alternative from being an effective avenue for disposing of large numbers of light geese. Expansion of commercial sale of migratory birds by Aboriginal people, or authorization of commercial harvesting by non-Aboriginal people, would require a change in the Treaty. Such changes would entail time-consuming negotiations between the U.S. and Canadian Federal governments, with uncertain results. Many light goose populations would continue to increase during the negotiation period, thus making control more difficult if and when expanded commercial harvesting is eventually authorized. Therefore, we have chosen not to analyze this alternative.

### **2.4.15 Allow predators to control light goose populations**

Major predators of light goose eggs and young include Arctic fox (*Alopex lagopus*), red fox (*Vulpes fulva*), herring gulls (*Larus argentatus*), glaucous gulls (*L. hyperboreus*), and parasitic jaegers (*Stercorarius parasiticus*; Mowbray et al. 2000, Sovada et al. 2001). Other predators include polar bear (*Ursus maritimus*), black bear (*U. americanus*), gray wolf (*Canis lupus*), coyote (*C. latrans*), common raven (*Corvus corax*), sandhill crane (*Grus canadensis*), long-tailed jaeger (*Stercorarius longicaudus*), snowy owls (*Nyctea scandiaca*), and caribou (*Rangifer tarandus*; Mowbray et al. 2000, Sovada et al. 2001). Adult geese do not commonly fall prey to predators (Sargeant and Raveling 1992). The nesting period in the Arctic typically is short and highly synchronized among individuals. The rapid increase in eggs and young available to predators during the nesting season likely overwhelms the ability of predator species to take full advantage of the new food supply (Sovada et al. 2001). Therefore, predation likely has little potential to limit growth of most light goose populations and we have chosen not to analyze this alternative.

## **2.5 Comparison of Analyzed Alternatives**

All of the alternatives we analyzed would allow harvest of light geese (Table 2.1). Alternative A (no action) would maintain normal light goose hunting seasons that are regulated through existing administrative procedures. Alternative B seeks to control light goose populations by increasing harvest within and outside normal hunting season frameworks, and by altering habitat management practices on Service-owned national wildlife refuges. Implementation of a conservation order would allow take of light geese outside of normal hunting season frameworks, while geese are still present on wintering and migration areas in the U.S. Authorization of new methods of take would increase the effectiveness of hunters during normal hunting seasons, as well as the effectiveness of participants in conservation order activities. Alteration of goose habitats and hunt programs on national wildlife refuges would slightly decrease the amount of food and sanctuary available to light geese on winter and migration areas in the U.S. Alternatives C and D involve direct control of light geese by removing large numbers of birds from the population(s) in a short period of time. The primary difference between the alternatives is whether control of birds occurs in the U.S. or Canada.

Table 2.1. Summary of management alternatives to be analyzed.

Issue	Alternative A. No Action.	Alternative B. (PREFERRED). Modify harvest regulation options and refuge management.	Alternative C. Direct control of light goose populations on wintering and migration areas in U.S.	Alternative D. Direct control of light goose populations on breeding areas in Canada.
Light goose populations	Allowed to increase.	Reduced through harvest.	Reduced by wildlife agencies in U.S.	Reduced by Canadian agencies on breeding grounds with possible U.S. assistance.
Existing light goose harvest regulations	Remain in place.	Remain in place.	Remain in place.	Remain in place.
New light goose regulations	No new regulations.	New methods of take and creation of a conservation order.	Creation of special light goose permit.	No new U.S. regulations.
Refuge hunt programs	Remain in place. Normal changes occur using existing administrative process.	Expanded where compatible with refuge purposes.	Remain in place. Normal changes occur using existing administrative process.	Remain in place. Normal changes occur using existing administrative process.
Refuge habitat management	Unchanged	Modified when compatible with refuge purposes.	Unchanged	Unchanged