

# Invasive Species

## ALASKA



### What Is an "Invasive Species"?

As legally defined, an invasive species is "An alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health . . . 'Alien species' means, with respect to a particular ecosystem, any species . . . that is not native to that ecosystem."<sup>1</sup> Alien species are also known as exotic, non-native, introduced, or non-indigenous species, and the term noxious or nuisance is sometimes used instead of "invasive" when these organisms cause harm. Since invasive species are only apparent to those few people who know their foreign origins, and because their spread can be slow, over years or even decades, we have tended to underestimate their impacts. Invasive species cause a range of problems. They can:

- threaten the survival of native plants and animals
- interfere with ecosystem functions
- hybridize with native species, resulting in negative genetic impacts
- spread easily in today's era of global commerce
- be difficult and costly to control
- impede industries and threaten agriculture
- be a significant drain on the economy
- endanger human health

### How Severe Is the Invasive Species Problem in the United States?

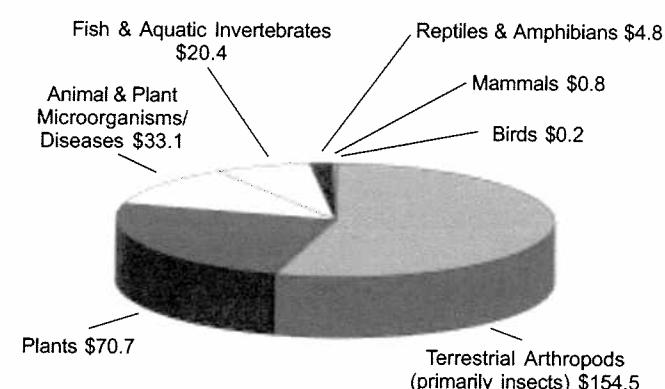
- Invasive species are a significant threat to nearly half of the native US species currently listed under the federal Endangered Species Act.<sup>2</sup>
- Costs of preventing, monitoring, and controlling invasive species in the United States—not to mention the costs of damage to crops, fisheries, forests, and other resources—are huge. The economic impact of invasive plants is thought to be at least \$13 billion per year.<sup>3</sup> Costs or losses due to our most expensive invasive species can top \$100 million annually per species.<sup>4</sup> In addition, invasive species can impose costs that are less readily quantified, such as damage to the small organisms that are the basis of all aquatic food webs.

### What Is an "Introduction"?

When an animal, plant, fungus, bacterium, or virus ends up in a new ecosystem, it is said that the organism has been "introduced" to that new ecosystem. Humans are responsible for introducing the vast majority of non-native species. We deliberately transport some organisms; others end up in a new ecosystem unintentionally.

Examples of deliberate introductions are plants that we import for gardens, fish that we keep as pets or put in pens

### Federal Funding for Categories of Invasive Species (Fiscal Year 1999, in Millions of Dollars)



Source: General Accounting Office

### Table of Contents

### Invasive Species – Alaska

THE EMERGING THREAT OF INVASIVE SPECIES IN ALASKA	3
HOW DO WE BRING INVASIVE SPECIES TO ALASKA?	5
HOW MUCH DO INVASIVE SPECIES COST ALASKANS?	6
THE WORST OF THE WORST	8
WHAT'S AT STAKE? IMPACTS ON ALASKA'S NATURAL AREAS AND RESOURCES	10
FINDING SOLUTIONS: WHO DEALS WITH INVASIVE SPECIES IN ALASKA?	12
ENDNOTES	14

### Various Ways that Unintentionally Introduced Species Arrive

- On imported nursery stock or soil**  
(e.g., balsam wooly adelgid, chestnut blight, mealybug)
- On imported fruits and vegetables**  
(e.g., Mediterranean fruit fly)
- In untreated, discharged ballast water of ships**  
(e.g., zebra mussel, Chinese mitten crab)
- In or on vehicles like boats, airplanes, trucks, ships, etc.**  
(e.g., Asian cockroach, poverty grass)
- In bilge water, live wells, bait buckets, and on fishing gear**  
(e.g., European shore crab)
- In packing material and shipping containers**  
(e.g., Asian long-horned beetle, wood-boring wasp)
- Mixed in with seed packets or shipments**  
(e.g., serrated tussock, corn brome)
- From people traveling for tourism, recreation, or commerce**  
(e.g., rust fungus)
- Through canals and other humanly produced paths**  
(e.g., sea lamprey)
- On imported or migrating animals** (e.g., whirling disease)

for aquaculture, animals for hunting, fish we stock in lakes, and animals and insects introduced into new ecosystems to control other organisms.

Examples of unintentional introductions are insects that cling to or burrow into wooden packing material used to protect imported goods, or insects and their eggs "hitchhiking" on imported plants, in soil, or on fresh produce. We accidentally take in huge numbers of small and microscopic organisms in ships' ballast water, and we transport them to new ports of call.

### When Introduction Becomes Harmful

The vast majority of species transported to a place other than their native ecosystem—whether intentionally or

### Some Means of Deliberate Introductions

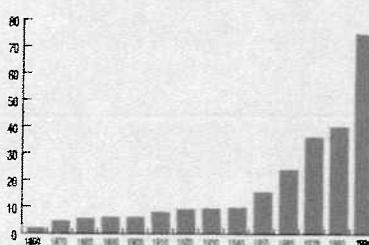
- Sport fishing** (e.g., largemouth bass, flathead catfish)
- Aquaculture** (e.g., Pacific oyster, Atlantic salmon, Pacific white shrimp)
- Home aquaria** (e.g., Asian swamp eel, hydrilla, zebra danio)
- Biological control** (e.g., grass carp, rosy wolfsnail)
- Research facilities** (e.g., giant tiger shrimp)
- Seeds/Gardens/Landscaping** (e.g., purple loosestrife, kudzu)
- Erosion control** (e.g., tamarisk [also known as saltcedar])
- Fur/silk production** (e.g., nutria, European gypsy moth)

accidentally—do not survive. Of those that do survive, scientists estimate that approximately 15% go on to become very harmful.<sup>5</sup> Plants and animals may escape from confined areas, or carry a wide variety of parasites or diseases that themselves may escape, to devastating effects. People may dump no-longer-wanted fish or aquarium plants into a nearby pond or river, or discard yard waste or garden clippings in a nearby park. The species that become invasive do succeed, in part, because the new ecosystems in which they find themselves offer favorable environmental conditions and lack the natural predators, competitors, and diseases that would normally keep their populations in check.

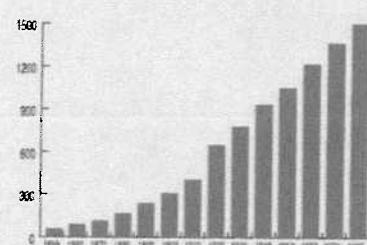
With increased global commerce and human exploration, rates of introduction and numbers of invasive species continue to rise. For example, ships only began to use water as ballast in the mid-1800s;<sup>6</sup> now transport in ships' ballast water and ballast sediments is the leading means of unintentionally moving a broad range of aquatic species throughout the world.<sup>7</sup>

### Cumulative Numbers of Non-Native Species

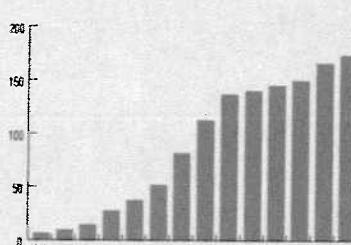
US Fish



North American Insects



US Plant Diseases



## The Emerging Threat of Invasive Species in Alaska

The wild beauty that draws many people to Alaska is under quiet siege. Dozens of harmful non-native organisms, including plants, animals, and microbes, have arrived in parts of Alaska from outside the state, or from other parts of the state, and are spreading throughout large areas. They cause a range of problems, from defoliating forests, to decimating seabird colonies, to killing fish. Yet, Alaska has the opportunity to avoid some of the worst problems that plague the lower 48 states and Hawai'i and to contain existing problem species before they become well established.

### Non-native and Invasive Animals and Plants in Alaska

Native and non-native species in Alaska's vast landscape have not been well catalogued. However, experts have counted almost forty species thought to be invasive, and many more established non-native species that may become invasive.<sup>1</sup>

The species of greatest concern include:

- One mammal species (Norway rat)
- Two bird species (pigeon in Anchorage<sup>2</sup> and starling as far north as Fairbanks<sup>3</sup>)
- One non-native fish species (Atlantic salmon) plus one Alaskan fish species (northern pike) moved beyond its native range
- At least eight insect species (larch sawfly in southcentral Alaska, strawberry root weevil, western tent caterpillar,



*Introducing foxes to Alaskan islands for the fur trade has had disastrous consequences for many native bird populations.*

white pine weevil, wooly alder sawfly, imported currant worm, ugly nest caterpillar, and amber-marked birch leaf miner)<sup>4</sup>

- Another invertebrate species (European black slug, a crop pest in Anchorage)<sup>5</sup>
- At least 11 terrestrial plant species out of approximately 170 established non-native and non-cultivated plant species<sup>6</sup> (Canada thistle, reed canary grass, garlic mustard, orange hawkweed,<sup>7</sup> white sweetclover,<sup>8</sup> perennial sowthistle, hawksbeard, tufted vetch, Japanese knotweed, hempnettle, and oxeye daisy)
- At least six aquatic plant species (such as common brassbuttons and several species of red and brown algae)<sup>9</sup>
- At least seven aquatic invertebrate species (such as a softshell clam, rope grass hydroid, and boring sponge)<sup>10</sup>

As in many places, there are differing views regarding which species are native, since some, like one subspecies of bison, went extinct long ago, but another was reintroduced. In addition, there are various perspectives on which non-natives have become established in Alaska (e.g., raccoons). Nor is there always agreement on which species are truly harmful (e.g., starlings), or valuable (e.g., game species introduced in the past for subsistence and sport), since these designations are somewhat subjective. These distinctions sometimes affect management and policy choices. In general, however, there is broad consensus among Alaska's experts on the seriousness of the risk posed by many of these species.

Some intentional introductions, such as many food crops and farm animals, are beneficial. However, there are disas-



*Campers, such as these at the Arctic National Wildlife Refuge, can unknowingly bring invasive species into pristine wilderness areas.*

trous exceptions. Foxes, brought to more than 450 Alaskan islands for fur trapping and farming—plus the animals introduced as food sources for the foxes—have devastated native bird populations and disrupted island ecosystems.<sup>11</sup> As recently as 1987 the Alaska Department of Fish and Game introduced elk for hunting on Etolin Island. Elk have spread, probably by swimming, to other islands and areas in the Southeast, affecting native plants and animals. Less clear is the pre-statehood introduction of brook trout from outside the territory, and grayling and rainbow trout from other parts of the state, to southeast Alaska for food and sport fishing. The populations are self-sustaining but usually not considered invasive, although brook trout may be preying on salmon fry or hybridizing with native Dolly Varden char.<sup>12</sup> Alaska blackfish have been moved to the Anchorage area and

may also be affecting salmon fry.<sup>13</sup>

Numerous pathogens and parasites have been introduced to Alaska but have not yet been well studied. Known problems include lice from domestic dogs that have infested wolves on the Kenai Peninsula<sup>14</sup> and black knot, a fungus so far affecting only ornamental cherry trees in Anchorage.<sup>15</sup>

### Where Are Invasive Species a Problem?

Four elements of Alaska's landscape are most vulnerable to invasive species: ports, islands, waterways, and disturbed or reclaimed areas.

- Commercial ports, especially those in the southcentral and southeast regions, are continually exposed to new species, especially from the Pacific corridor as far south as Mexico.

## An Ounce of Prevention: A Sampling of Worrisome Potential Invaders

Invasive species are a global problem, and Alaska is susceptible to many harmful invaders, particularly as global climate change is projected to warm Alaska. (Alaska has already experienced a 4°F increase in average temperature during the past 50 years, while the global average has increased only 1°F).<sup>16</sup> The following species are particularly harmful and are already wreaking economic and ecological damage in the lower 48 states and Canada. Some of these species have been found in Alaska, but none is yet thought to be established.



Asian gypsy moth

Invader	Impacts	Where Found
Asian gypsy moth	Defoliates trees	Pacific Northwest
Asian longhorned beetle <sup>17</sup>	Kills hardwood trees	Chicago, New York region; intercepted at West Coast ports
European green crab	Competes with native crabs such as Dungeness and other shellfish	West Coast to Vancouver Island
Zebra mussel <sup>18</sup>	Competes with native mussels, alters nutrient balances, clogs pipes	Eastern North America waterways; population found in Kansas in 2003
New Zealand mudsnail	Concern about effects on native species (e.g., aquatic insects, native snails), fisheries (especially native trout), and aquatic ecosystems	Western US (including three national parks); population found in Lake Ontario in early 1990s
Yellow perch	Competes with native fish, restricts salmon reproduction	Widespread in northern US and Canada; eradicated from Kenai Peninsula lake
Russian knapweed	Invades riverbanks, may affect moose forage	Western US and Canada, including Yukon Territory
Purple loosestrife	Aggressively outcompetes native wetland plants	Widespread in lower 48 states including Pacific Northwest; grown in Anchorage gardens
Fire blight	Destroys apple crops, may affect related trees such as native mountain ash	Globally widespread; found in Alaska in 2000

- Islands are particularly vulnerable and some have been hard hit because they typically have unique species that have evolved without grazing pressure and other predation; some have been hit hard. Dutch Harbor and other islands in the Aleutian chain, the Alexander Archipelago, and the Kodiak Archipelago are of special concern.<sup>19</sup>
- Waterways, including Alaska's vast rivers, streams, lakes, and wetlands, provide relatively hospitable temperatures for many aquatic invaders. Low-gradient floodplain communities with road crossings in southcentral and interior Alaska, as well as spits, barrier beaches, and coastal marshes, are especially vulnerable, as are floodplains and karst-rich sites in southeast Alaska.<sup>20</sup>
- Disturbed and reclamation areas associated with mining, trails, recreation, agriculture, the Alaska pipeline, and roadways commonly contain invasive plants.<sup>21</sup>

## How Do We Bring Invasive Species to Alaska?

Fortunately, Alaska's historically low population and geographic isolation have kept introductions of new invasive species relatively low. However, increased commercial traffic (both from the continental United States and abroad) and further development increase the risk of new introductions.

**Shipping:** The large amount and diversity of ship traffic in Alaska—oil tankers, commercial freighters, military vessels, fishing vessels, and chip, pulp, and timber barges—bring invasive species in ballast water, bilge water, or live wells.

Port Valdez, in Prince William Sound, receives the third largest volume of tanker ballast water of US ports.<sup>1</sup> About one-half of this ballast water is oily and is processed at a treatment facility. The rest is discharged into the port's waters, releasing many non-native species. One study of

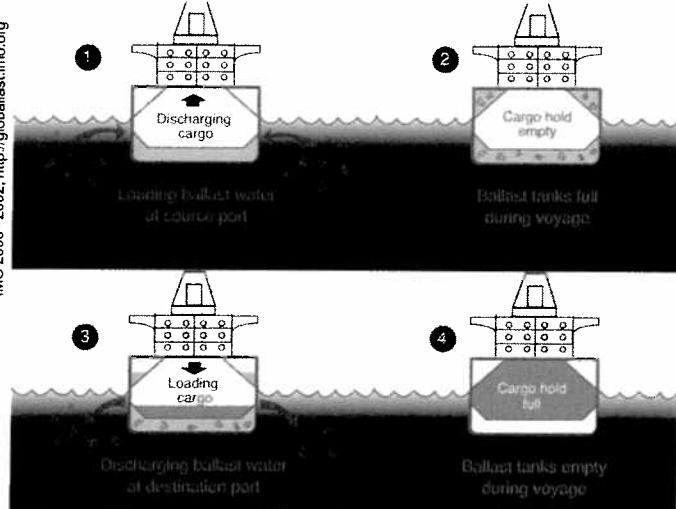
organisms in ballast water of oil tankers arriving at Valdez found 13 species of non-native crustaceans, one fish species, as well as enormous numbers of potentially damaging smaller organisms.<sup>2</sup> Ships' hulls may also carry a variety of organisms, and rats, mice, other mammals, and insects arrive in cargo.

**Aquaculture:** Fish farming can result in severe damage to native ecosystems and fisheries when fish or hitchhiking organisms escape. Of current concern are escaped Atlantic salmon arriving in Alaskan waters from British Columbia and Washington State fish farms.

**Agriculture and Horticulture:** Only a very small percentage of Alaska's acreage is agricultural, but farms, nurseries, and state agencies import plants, seeds, and other products, which can either be invasive themselves or carry damaging hitchhikers. An example is Canada thistle, found in Fairbanks and southcentral Alaska, which is thought to have arrived as seed within root balls of tree-planting stock.<sup>3</sup> Other invasive plants, such as perennial sowthistle, are thought to have arrived as contaminants in seed mixtures. Nurseries, in most cases, are not prohibited from selling invasive plants.



Canada thistle seeds are thought to have arrived in Alaska through the horticulture industry.



*We unintentionally move thousands of aquatic species in ships' ballast water and ballast sediments.*

**Recreation and Tourism:** There have been intentional efforts to import species such as European grouse as game birds.<sup>4</sup> Pack animals, dogs, vehicles, and people can all transport seeds to backcountry areas unintentionally. In addition, hay brought in to feed horses or to use as sled dog bedding can be contaminated with weed seeds. Invasive plants have affected ostensibly pristine areas such as Denali National Park, the Tongass and Chugach National Forests, and numerous other sites in southern Alaska. Many weeds are found around roadsides, trailheads, campgrounds,



*Roads and vehicles can unintentionally bring invasive species into previously undisturbed areas.*

parking lots, and other disturbed recreation-related areas.<sup>5</sup> While cruise ships do not usually transfer ballast water in Alaska, ships coming directly from Far East Asia or Japan do.<sup>6</sup> Like other ships, all can carry invaders on their hulls, in their holds, or on their decks.

**Construction, Mining, and Restoration:** These activities transport weed seeds, as well as other organisms, when equipment and machinery are moved without cleaning.<sup>7</sup>

**Aquarium and Pet Trades:** Aquarium fish and plants, as well as other pets, have occasionally turned up in the wild and could become a problem, especially if they carry diseases.

## How Much Do Invasive Species Cost Alaskans?

In states where invasive species are a bigger problem than in Alaska, losses to industries and costs of control have skyrocketed. Alaska has a unique opportunity to avoid costly losses by focusing on preventing the introduction of additional invasive species while controlling those already established.

The costs of invasive species in Alaska take many forms, including labor and pesticides associated with eradication and control efforts, losses to fisheries and crops, and loss of native species and ecosystems.

Alaska's largest industries bring in more than \$1 billion per year. Invasive species are taking a bite out of each, and costs are likely to rise.

**FACT: State, federal, and private groups spend millions to manage or remove established invaders.**

- Since 1949, the US Fish and Wildlife Service (FWS) has spent roughly \$3 million to remove arctic and red foxes from some 40 islands where the federal government had originally introduced them to help early settlers economically.<sup>1</sup>
- FWS spent at least \$400,000 in a two-year effort to remove abandoned reindeer that had seriously overgrazed Hagemeister Island in the Alaska Maritime National



*Fisheries and the seafood industry would likely suffer if invasive species took hold.*

Wildlife Refuge.<sup>2</sup> Other islands have also been cleared of reindeer, cattle, and similar animals.

- FWS is now beginning to tackle the extensive problem of Norway rats and other rodents on more than 20 islands, projected to be even more expensive than the other mammal removals.<sup>3</sup>
- To assess the extent of the aquatic nuisance problem, the Prince William Sound Citizens Advisory Council, California Sea Grant, FWS, and other agencies have spent an estimated \$500,000 on a study of ballast water introductions into the Sound, which includes the port of Valdez, and a small subset of other key Alaska ports.<sup>4</sup>
- Alaskan officials estimate that the state's overall aquatic nuisance species plan will cost \$373,000 in 2003, increasing to \$690,000 and \$760,000 during the next two fiscal years.
- The Alaska Department of Fish and Game has identified the need for an estimated \$200,000 emergency fund that would allow a quick response to newly identified invasions of aquatic nuisance species. Half of this money is included in the latter two estimates above. However, the fund's establishment requires new state legislation.<sup>5</sup>

**FACT: Three of Alaska's major industries, commercial fishing, sport fishing, and tourism, risk economic losses from invasive species.**

- If northern pike, Atlantic salmon, or other invasive fish continue to encroach on native salmon habitat, the \$216 million salmon fishery—already experiencing four years of low prices<sup>6</sup>—could further decline.
- Potential invasion of the European green crab could be costly to the \$117 million shellfish industry.<sup>7</sup>
- Tourism brings the state almost \$1 billion annually from 1.4 million visitors,<sup>8</sup> who come expressly for Alaska's untrammeled natural beauty and wildlife. In a study of perceptions of bark beetle damage, visitors ranked views of natural scenery and wildlife as most important for their visit, and judged scenic value to



*European green crab*

Washington Department of Fish and Wildlife



*Alaska's robust tourism industry relies upon the health of the state's natural treasures. Here, a tourist observes wildlife at Alaska Maritime National Wildlife Refuge.*

decline significantly as tree damage increased.<sup>9</sup> Invasive species able to defoliate forests or eliminate bird, fish, or marine mammal populations would likely reduce visitor interest and spending.

**FACT: Forestry, agriculture, and other industries suffer from invasive species.**

- Logging and related industries generated \$64 million in wages in 2000.<sup>10</sup> From 1996 to 2001, almost five million out of the total 129 million forested acres in Alaska suffered insect damage from both native and non-native pests.<sup>11</sup>
- Agriculture in 1997 accounted for \$53.4 million of the state's economy.<sup>12</sup> Losses from pest species are not currently quantified, but a significant proportion of agricultural weeds, insects, and diseases are non-native. Examples are sowthistle, hempnettle, and the potato late blight that was found in the Matanuska Valley in 1995 and 1998, requiring expenditures for quarantine<sup>13</sup> and fungicides.
- Many other industries are negatively affected by invasive species. For example, trappers experience financial losses when wolf pelts are damaged by dog lice, not to mention the substantial costs incurred by state agencies in medicating sick animals and trying to stop the infestation from spreading.

# The Worst of the Worst

## Norway Rat (*Rattus norvegicus*)



Rats are considered one of the most harmful invasive species in the world and one of the first to be transported almost everywhere that humans settle. Norway rats prey on wild birds and their eggs, kill poultry and livestock, and can transmit diseases to humans and animals. They also damage—sometimes to the point of extinction—invertebrates, reptiles, birds, and other wildlife, as well as plants. They eat stored grain and seeds and contaminate with droppings whatever they don't eat. Norway rats are especially devastating when introduced to oceanic islands. A Japanese shipwreck in 1780 introduced the first Norway rats to Alaska,<sup>1</sup> and by 1790 one of the

Aleutians was named Rat Island. Today, rats have invaded some 30 Alaskan islands and many additional areas, coastal and otherwise. Rat "spills" (rats swimming to land from shipwrecks or walking from docked ships to land on ropes or gangplanks) are considered to be more ecologically damaging than oil spills.<sup>2</sup> Active efforts are in place to try to prevent further rat introductions and to control current populations.

## Northern Pike (*Esox lucius*)

Although northern pike are native to northern Alaska, they have become an invasive species in southcentral Alaska, specifically in the Anchorage Bowl, Matanuska-Susitna Valley, and Kenai Peninsula. Northern pike were intentionally introduced by unknown individuals, presumably for sport fishing. These predatory fish consume salmon fry and are invading vast systems of streams and lakes. The Alaska Department of Fish and Game has found lakes (e.g., Trapper, Alexander, and Red Shirt) devoid of once-healthy trout and salmon populations and abundant with pike. Pike are also having an impact on native suckers and whitefish as well as ducklings and other waterfowl.<sup>3</sup> Fish, wildlife, and game managers consider established pike populations difficult to remove and their potential impact on native salmon and other fish in the Southeast to be "immense."<sup>4</sup>



## Atlantic Salmon (*Salmo salar*)



water, but several pen-reared salmon have been found in fresh water streams. In 1998, an Atlantic salmon—sexually mature and thought to have been with a mate—was recovered north of Ketchikan at Ward Creek.<sup>6</sup> If such salmon successfully spawn and become established, they could compete for limited food and spawning habitat with native fish such as steel-

Although finfish farms are banned in Alaska, hundreds of thousands of Atlantic salmon raised in fish farms in British Columbia and Washington State have escaped from their pens, some reaching waters near Ketchikan and Yakutat and as far north as the Bering Sea.<sup>5</sup> Scientists used to believe that Atlantic salmon would not venture into fresh

head, cutthroat trout, Dolly Varden char, and coho salmon. Farmed fish also present a risk in that they could spread disease and parasites. For example, scientists speculate that escaped sea lice from open net Atlantic salmon farming pens in British Columbia's Broughton Archipelago infested juvenile wild pink salmon, causing that native species' population in the province to decline sharply.<sup>7</sup>

#### Amber-marked Birch Leaf Miner (*Profenus a thomsoni*)



Most likely introduced from Europe to the northeastern United States in the 1920s, this insect—a defoliator of birch—has spread throughout southern Canada and into Alaska. It was accidentally introduced in Anchorage during the mid-1990s, most likely on ornamental birches.<sup>8</sup> These pests are especially damaging in Alaska, where they have no natural enemies. The larvae of the amber-marked birch leaf miner defoliated more than 30,000 acres throughout the Anchorage Bowl in 2002, have been found in the Matanuska-Susitna Valley, and were detected in 2002 in the birch-abundant area of Fairbanks.

Hardest hit have been urban paper birch. Chemical treatment is the

only currently available control method (for urban trees); using a certain parasitic wasp as a possible biological control agent is under investigation.<sup>9</sup>

#### Japanese Knotweed (*Polygonum cuspidatum*)

Native to eastern Asia, Japanese knotweed has spread to 37 US states with the help of gardeners who plant knotweed as an ornamental. In Alaska, Japanese knotweed was first reported in the 1940s in Sitka, although it probably arrived earlier.<sup>10</sup> It is now found in communities in southeastern Alaska as well as in Anchorage. Roadside planting by the Department of Transportation as well as landscaping have contributed to its spread.<sup>11</sup> Japanese knotweed is difficult to remove, since fragments regenerate readily and send up new shoots from rhizomes. The weed aggressively crowds out native plants along roadsides, stream banks, and woodland edges, destroying habitat for native insects, fish, birds, and other animals. It may also become an agricultural weed,<sup>12</sup> and increase fire risks, as it has in other states.<sup>13</sup> Experts recommend monitoring for new instances of Japanese knotweed and when found, thoroughly removing and carefully disposing of the plants, including all root fragments, so that the plants cannot become established.<sup>14</sup>



## What's at Stake? Impacts on Alaska's Natural Areas and Resources

In Alaska, healthy ecosystems contribute an estimated \$1.2 to \$1.6 billion per year in basic ecosystem services, like nutrient cycling, waste treatment, and regulation of floods.<sup>1</sup> As the largest state, Alaska has an immense and diverse landscape, including tundra, wetlands, waterways, forests, farmland, coastlines, islands, and urban areas. Nearly all these types of areas show signs of emerging or well-established invasions.

**FACT: Invasive species are a growing problem in areas of traffic and disturbance.**

- In many national parks, forests, and wildlife refuges, non-native weeds have gained purchase in areas of human activity.
- Alaskan ecosystems support populations of large predators, such as bears and wolves. Yet, even Denali National Park—a crown jewel of the national park system—is facing pressure from proposed additional roads and



traffic,<sup>2</sup> which would likely bring invasive species that spread disease or compete with these predators' food sources.

- In heavily traversed Prince William Sound, the proportion of aquatic non-native species is small, but increasing. The effects are only beginning to be studied. However, in other parts of the country, aquatic environments and water-based industries have been hard hit by invasives as commercial traffic grows.

**FACT: Invasive species threaten Alaska's rare and unusual animals and plants, and impact the functioning of whole ecosystems.**

- Roadsides in southcentral and interior Alaska are commonly filled with white sweetclover and tufted vetch, two hard-to-remove non-native weeds. These legumes alter the nitrogen balance in soils, negatively affecting organisms adapted to lower nitrogen levels, and also threaten to invade Alaska's forests, riparian areas, and non-forested wetlands.<sup>3</sup>
- On Kiska Island, a popular cruise ship destination, Norway rats are threatening the survival of one of the world's largest auklet colonies.<sup>4</sup>

*The auklet-filled sky as these birds arrive at Sirius Point on Kiska Island to mate and raise their young. Auklet populations, though still in the millions, are threatened by Norway rats, accidentally introduced to Kiska and many other islands. The rats roam from bird to bird, killing them and eating very little of each.*

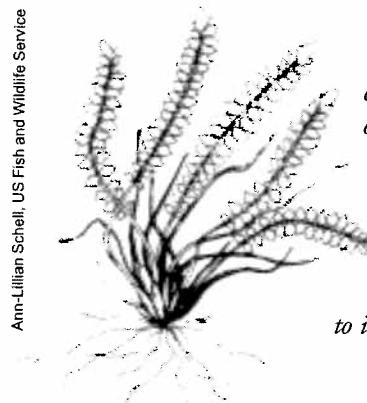


Photographs: Ian L. Jones



Even Denali National Park is not immune to potential new invaders.

- Alaska's island ecosystems contain many unique forms of plants and birds, such as the Aleutian Canada goose. The populations of these geese and nesting seabirds have declined where arctic foxes were introduced. Even where foxes have been removed, some island species have not fully recovered.<sup>5</sup>
- Some habitat for salmon and other native fish is being degraded and diminished from introduced northern pike in southcentral Alaska. Salmon play a crucial part in sustaining watersheds, add nutrients to aquatic systems, and are an important food for bears, eagles, and other wildlife.



*The Aleutian shield fern—endemic to Alaska and found only on one or two Aleutian islands—is the only federally listed endangered plant in Alaska. Grazing by introduced caribou is considered a potential threat to its survival in the wild.*

*Alaska's salmon industry is already struggling. With the added pressure of invasive species, many fishing vessels, like this salmon gillnetter in Bristol Bay, may find it even more difficult to keep their businesses afloat.*

### Who's Tracking What's Rare?

The Alaska Department of Fish and Game lists five endangered species (identified by Alaska's Commissioner of Fish and Game as being in danger of extinction in Alaska) and 16 "species of special concern" (identified by Alaska's Commissioner of Fish and Game as declining in abundance or vulnerable to decline in Alaska).<sup>6</sup> Likewise, the US Fish and Wildlife Service and the Department of Commerce's National Marine Fisheries Service maintain lists for rare animals under their respective jurisdictions. These include 27 species or distinct populations considered "endangered" or "threatened." The Alaska Natural Heritage Program, the US Forest Service, the Conservation of Arctic Flora and Fauna Working Group, and other agencies all track rare plants. Together, there are several dozen such plant species. Only one—the Aleutian shield fern—is a federally listed endangered species. Invasive species affect a number of these rare species.



Karen Ducey, National Marine Fisheries Service, National Oceanic and Atmospheric Administration/Department of Commerce

# Finding Solutions: Who Deals with Invasive Species in Alaska?

## Alaska's Opportunity

Alaska is blessed with abundant natural beauty and resources, which can and should be protected for the benefit of all Alaskans. Because the state currently has a relatively small problem with invasive species, it is well positioned to prevent the worst invaders from becoming established, learning from successes and failures in the lower 48 states, Hawai'i, and around the world. Alaska's two recent statewide plans are examples of strong coordinated approaches. However, more work is needed to strengthen efforts if Alaska is to protect its natural resources and economic interests.

## Alaska's Cooperative Approach

In many ways, Alaska is a national leader. It has combined the expertise of federal, state, tribal, international, and private groups to produce two strategic plans. Taken together, these plans express the need for well-coordinated action to prevent and manage not only aquatic but also terrestrial invasive species, along with more effective and comprehensive planning, legal authority, enforcement, and funding to back it up.

One cooperative effort resulted in the 2001 *Strategic Plan for Noxious and Invasive Plants Management in Alaska*.<sup>1</sup> This plan makes a series of recommendations to heighten awareness of invasive plant problems in the state and to halt these plants' introduction and spread. Committee members from the broad-based Alaska Committee for Noxious and Invasive Plants Management have marshaled resources and implemented a number of the recommendations.

Another effort, led by the Alaska Department of Fish and Game, resulted in the 2002 *Alaska Aquatic Nuisance Species Management Plan*.<sup>2</sup> The federal Aquatic Nuisance Species Task Force approved this plan, as stipulated by federal law, so implementation of the plan qualifies for federal cost sharing of up to 75%. The plan's focus is on identifying and responding to the highest priority threats.<sup>3</sup> It concludes that, "It is in the best interest of Alaska and Alaskans that both purposeful and unintentional introductions of invasive species not be tolerated."<sup>4</sup>

Both of the state plans highlight the need for better public education to prevent new species' arrivals and to curb the spread of existing ones. Without public support and cooperation, resource managers will be combating not only accidental introductions, but intentional ones, such as the dandelions planted by a visitor in a national forest<sup>5</sup> and northern pike.

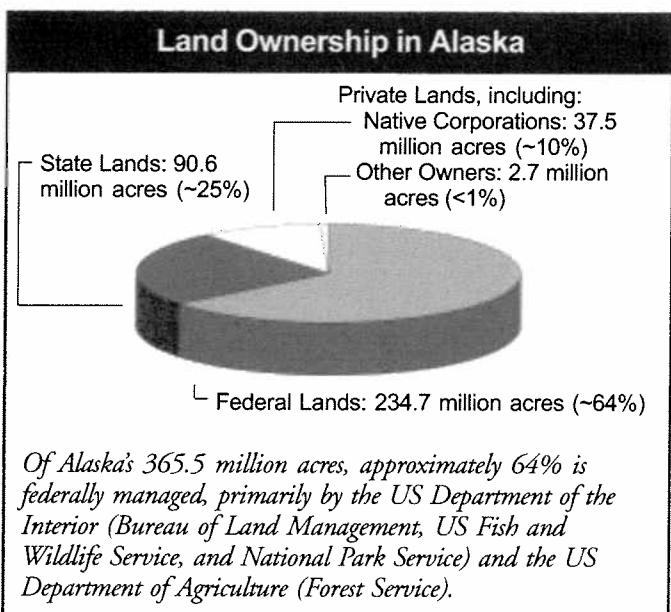
Some urgently needed education efforts are underway. The Alaska Department of Fish and Game Sport Fish Division, for example, produced television spots on aquatic invasive species and, with the US Fish and Wildlife Service, is producing identification cards with warnings about Atlantic salmon and European green crabs.<sup>6</sup> The Forest Service, Bureau of Land Management, Smithsonian Environmental Research Center, University of Alaska Cooperative Extension Program, Sea Grant, The Nature Conservancy, Regional Citizens' Advisory Council of Prince William Sound, and the Alaska Natural Heritage Program are also working to educate the public about non-native species. Some of these entities have substantial educational materials available to the public.

## Federal and State Efforts

Implementing the above plans falls to individual state and federal agencies. Some of their most significant work is described below.

### Federal Efforts

Under the new Department of Homeland Security (DHS), the Coast Guard is responsible for monitoring ships' compli-



ance with voluntary ballast water exchange practices and related requirements. The DHS Bureau of Customs and Border Protection and US Department of Agriculture's Animal and Plant Health Inspection Service share responsibility for protecting agriculture at and near approximately a dozen ports of entry. DHS officers inspect incoming passengers and cargo while USDA retains other key functions, such as monitoring the effectiveness of inspections, conducting emergency responses to newly detected pests, and a much-expanded effort to detect such pests, which also involves the Alaska Department of Natural Resources.

The USDA Forest Service is responsible for surveying, monitoring, and managing non-native species in national forests. In 2002, the USFS Forest Health Protection Program and the US Geological Survey Alaska Science Center launched a project to create a statewide database for invasive plants. The database incorporates data from field collaborators from federal and state agencies, universities, private consulting firms, and other interested groups.<sup>7</sup> Similarly, the USFS Tongass National Forest's Ecology Department recently completed an invasive plant management plan for this 17-million-acre forest to prioritize prevention/education, inventory, control, and monitoring over the next five years. That plan addresses specific stakeholders and suggests partnerships to work cooperatively. Some specific projects include efforts to eradicate or control weeds such as tansy ragwort and Japanese knotweed. In addition, the USFS has worked with other agencies, the Kake Tribal, Inc., and the Organized Village of Kake to control Japanese knotweed in the Petersburg area.<sup>8</sup>

The US Fish and Wildlife Service in Alaska has undertaken extensive efforts to eliminate harmful invasive species from islands in the Alaska Maritime National Wildlife Refuge, where recovery of bird populations has been dramatic. Efforts are underway elsewhere to prevent widespread rat populations from spreading. One area of particular concern is the Pribilof Islands.

Other federal agencies, including the Bureau of Land Management, the Department of Defense, and the National Park Service, are involved in surveying, monitoring, and managing non-native species in the large holdings for which they are responsible. For instance, the National Park Service hires seasonal technicians to do an extensive survey for exotic plants throughout Alaska's park system, to pull weed species, and to restore native species in Denali National Park at an estimated cost of \$50,000 annually.<sup>9</sup>



Crondahs Bed & Breakfast (<http://www.juneaucrondahs.com>)

#### *State Law and State-based Efforts*

Sizable groups of officials and other experts are working to strengthen the state's legislation and policies. The two interagency invasive species plans described above provide a strong framework for this process, as well as specific, high-priority recommendations.

When Alaska became a state, it prohibited the introduction of out-of-state fish for rearing or stocking in state waters, creating one of the strongest such laws in the country. The strength of the state's approaches to other types of introductions varies, and some important policy areas are not addressed at all.<sup>10</sup> For example, Alaska is the only west coast state that has not recently updated its legislation regarding non-native species in the ballast water of ships; instead, Alaska's ballast water law focuses solely on preventing discharges of petroleum.<sup>11</sup> State law does not authorize specific funds to implement statutes and regulations that address invasive species, nor does it have emergency powers to

address sudden outbreaks that can quickly cause widespread damage.<sup>12</sup>

### Alaska Department of Fish and Game: Fish, Game, and Aquatic Plants

Responsibility for fish, wildlife, game, and aquatic plants falls to the Alaska Department of Fish and Game.<sup>13</sup> The release of fish and other aquatic animals is prohibited by law and regulated by the Board of Fisheries. Similarly, game species are prohibited without a permit from the Department of Fish and Game, unless the animal is on a “clean list” of domesticated animals, such as farm animals.

After an extensive permitting and planning process, the Alaska Department of Fish and Game has extended the natural range of some native fish, like rainbow trout and arctic grayling, by stocking hatchery-grown fish in certain lakes to enhance fishing.<sup>14</sup> Populations of non-native yellow perch and goldfish, which have the potential to become invasive, were chemically eradicated by the Alaska Department of Fish and Game and the US Air Force, respectively.<sup>15</sup>

### Alaska Department of Natural Resources: Weeds, Seeds, Coasts, and Habitat

The Alaska Division of Agriculture has responsibility to prevent the arrival and spread of pests considered “injurious to the public interest, and for the protection of the agricultural industry.”<sup>16</sup> It prohibits seeds (but not plants) of 14 noxious weeds and restricts the allowable amount of 10 other

#### Alaska's Prohibited Noxious Weed Seeds

Austrian fieldcress	Horned nettle
Blue-flowering lettuce	Leafy spurge
Canada thistle	Perennial sowthistle
Field bindweed	Quackgrass
Galinsoga	Russian knapweed
Hemp nettle	Whitetops (three species)

#### Alaska's Restricted Noxious Weed Seeds

(only small amounts allowed):

Annual bluegrass	Tufted vetch
Blue burr	Wild buckwheat
Buckhorn plantain	Wild oats
Mustard (two species)	Yellow toadflax
Radish	

weed species in seed mixes. The regulated weeds all affect agricultural lands, although natural areas are far more extensive in the state. Alaska needs explicit regulatory action for these kinds of weeds, such as Japanese knotweed, white sweetclover, and garlic mustard, which have recently arrived in the state or are currently spreading.

The Department of Natural Resources also implements a coastal management program, which is the basis for controlling certain non-agricultural invasive plants. Also, recent legislation made the Office of Habitat Management and Permitting responsible for protecting both aquatic and terrestrial habitat via state habitat standards.

## ENDNOTES

### INTRODUCTION

<sup>1</sup>Executive Order 13112, 1999.

<sup>2</sup>Wilcox DS, Rothstein D, Dubow J, Phillips A, Losos E. 1998. Quantifying threats to imperiled species in the United States. *BioScience* 48:607-615.

<sup>3</sup>Westbrooks RG. 1998. Invasive Plants: Changing the Landscape of America. Washington, D.C.: Federal Interagency Committee for the Management of Noxious and Exotic Weeds.

<sup>4</sup>Union of Concerned Scientists (UCS). The Science of Invasive Species. 2001. On the Web at [www.ucsusa.org/publication.cfm/publicationID=451](http://www.ucsusa.org/publication.cfm/publicationID=451).

<sup>5</sup>Office of Technology Assessment. 1993. Harmful Non-indigenous Species in the United States. OTA-F-565. US Government Printing Office: Washington, D.C. On the Web at [www.princeton.edu/~ota/](http://www.princeton.edu/~ota/).

<sup>6</sup>Great Barrier Reef Marine Park Authority. 1998. The Treatment of Ships' Ballast Water to Remove Exotic Marine Pests: Research in North Queensland. *Reef Research*, 8 (2). On the Web at [www.gbrmpa.gov.au/corp\\_site/info\\_services/publications/reef\\_research/issue2\\_98/2ballast.html](http://www.gbrmpa.gov.au/corp_site/info_services/publications/reef_research/issue2_98/2ballast.html).

<sup>7</sup>Carlton JT. 1996. Nonindigenous Species (NIS) Invasions: The Economic and Environmental Issues. Proceedings of the National Forum on Nonindigenous Species Invasions in US and Marine Fresh Waters. Washington, D.C.: Northeast-Midwest Institute, pp. 14-15.

### THE EMERGING THREAT OF INVASIVE SPECIES IN ALASKA

<sup>8</sup>Adapted and updated from Koons, D. 2001. Threats to the Last Frontier: A report of invasive species to Alaska, Compiled for the Union of Concerned Scientists. For the list used in the text with scientific names, email [invasives@ucsusa.org](mailto:invasives@ucsusa.org).

<sup>9</sup>“A pigeon problem,” *Anchorage Daily News*. 2000. On the Web at [www.adn.com/wildcity/story/630474p-674680c.html](http://www.adn.com/wildcity/story/630474p-674680c.html). Accessed August 7, 2003.

<sup>10</sup>US Fish and Wildlife Service, Alaska Region, Invasive Species Priority List, May 9, 2000.

<sup>11</sup>USDA Forest Service, The Larch Sawfly, August 2001. On the Web at [www.fs.fed.us/r10/pf/ffp/leaflets/larsaw.htm](http://www.fs.fed.us/r10/pf/ffp/leaflets/larsaw.htm). Accessed October 30, 2002; USDA Forest Service, Alaska Region, State of Alaska Department of Natural Resources, Division of Forestry, 2002. Forest Health Protection Report, Forest Insect and Disease Conditions in Alaska—2001, General Technical Report R10-TP-102; and Holsten, E. Personal communication, October 4, 2001. Ed Holsten is with the USDA Forest Service.

<sup>12</sup>USDA Forest Service, Alaska Region. 2002. As in citation 4 above.

<sup>13</sup>Alaska Committee for Noxious and Invasive Plants Management, *CNIPM News*. 2003. On the Web at [www.cnipm.org/cnipmnews.html](http://www.cnipm.org/cnipmnews.html). Accessed August 11, 2003; and Shephard M. Personal communications, November 15 and 27, 2002. Michael Shephard is with the USDA Forest Service.

<sup>14</sup>Pyle B. Personal communication, December 2, 2002. Bill Pyle is with the US Fish and Wildlife Service, Kodiak National Wildlife Refuge.

<sup>15</sup>Shephard M, Rose C, Burnside R. 2002. Strategies for Managing Noxious and Invasive Plants in Alaska, Forest Health Management posters.

<sup>16</sup>Hines AH and Ruiz GM. 2000. Biological Invasions of Cold-Water Coastal Ecosystems: Ballast-Mediated Introductions in Port Valdez/Prince William Sound, Alaska, Final Project Report.

<sup>17</sup>Ibid.

<sup>18</sup>Burris OE and McKnight DE. 1973. Game Transplants in Alaska, Wildlife Technical Bulletin 4, Alaska Department of Fish and Game, December 1973; and Bailey EP. 1993. Introduction of Foxes to Alaska Islands—History, Effects on Avifauna, and Eradication. US Fish and Wildlife Service, Resource Publication 193.

<sup>19</sup>Hines AH and Ruiz GM. 2000. As in citation 9 above.

<sup>10</sup> Ibid.

<sup>11</sup> US Fish and Wildlife Service, Alaska Region, Invasive Species Priority List, May 9, 2000.

<sup>12</sup> Holsten E. Personal communications, October 4, 2001, and January 10, 2003. Ed Holsten is with the USDA Forest Service.

<sup>13</sup> National Assessment Synthesis Team, US Global Change Research Program. 2000. Climate Change Impacts on the United States—The Potential Consequences of Climate Variability and Change. Overview: Alaska. On the Web at [www.usgcrp.gov/usgcrp/Library/nationalassessment/overviewalaska.htm](http://www.usgcrp.gov/usgcrp/Library/nationalassessment/overviewalaska.htm). Accessed on March 28, 2003; and Overview: Looking at America's Climate. On the Web at [www.usgcrp.gov/usgcrp/Library/nationalassessment/overviewlooking.htm](http://www.usgcrp.gov/usgcrp/Library/nationalassessment/overviewlooking.htm). Accessed on August 12, 2003.

<sup>14</sup> Holsten E. Personal communications, October 4, 2001, and January 10, 2003. As above.

<sup>15</sup> Alaska Department of Fish and Game. 2002. *Alaska Aquatic Nuisance Species Management Plan*, Juneau.

<sup>16</sup> Pyle B. General Status of Introduced Species in the Kodiak Archipelago, Alaska. No Date; and Piorkowski R. 2003. Personal communication, February 12, 2003. Robert Piorkowski is with the Alaska Department of Fish and Game.

<sup>17</sup> Hagenstein R. Personal communication, November 14, 2002. Randall Hagenstein is with the The Nature Conservancy, Alaska.

<sup>18</sup> US Department of the Interior, Bureau of Land Management. BLM-Alaska Weed Management Plan. On the Web at [www.ak.blm.gov/ak930/weedpin.html](http://www.ak.blm.gov/ak930/weedpin.html). Accessed on November 14, 2002; and USDA Forest Service, Alaska Region. 2002. As in citation 4 above.

## HOW DO WE BRING INVASIVE SPECIES TO ALASKA?

<sup>1</sup> Hines AH and Ruiz GM. 2000. Biological Invasions of Cold-Water Coastal Ecosystems: Ballast-Mediated Introductions in Port Valdez/Prince William Sound, Alaska. Final Project Report.

<sup>2</sup> Ibid.

<sup>3</sup> US Department of Agriculture, Forest Service-Alaska Region. 2003. Canada Thistle, brochure, July 2003, leaflet R10-TP-118.

<sup>4</sup> Brock T. Personal communication, September 14, 2001. Terry Brock is retired from the USDA Forest Service; and Spencer P. Personal communications, November 8, 2002 and June 19, 2002. Page Spencer works for the National Park Service.

<sup>5</sup> Chugach National Forest. 1998. Kenai Peninsula Weed Survey, Draft, A Report for the USDA Forest Service.

<sup>6</sup> Alaska Department of Fish and Game. 2002. *Alaska Aquatic Nuisance Species Management Plan*, Juneau.

<sup>7</sup> Brock T. Personal communication, September 14, 2001. As above.

## HOW MUCH DO INVASIVE SPECIES COST ALASKANS?

<sup>8</sup> Byrd V. Personal communications, November 14–15, 2002, and January 8, 2003. Vernon Byrd is with the US Fish and Wildlife Service.

<sup>9</sup> Archibeque A. Personal communication, November 13, 2002. Aaron Archibeque works at the Togiak National Wildlife Refuge.

<sup>10</sup> Byrd V. Personal communications, November 14–15, 2002, and January 8, 2003. As above.

<sup>11</sup> Sonneil G. Personal communications, August 7, 2001, and November 13, 2002. Gary Sonneil is with the US Fish and Wildlife Service.

<sup>12</sup> Alaska Department of Fish and Game. 2002. *Alaska Aquatic Nuisance Species Management Plan*, Juneau.

<sup>13</sup> Alaska Department of Fish and Game, Division of Commercial Fisheries 2002 Overview. On the Web at [adfg.state.ak.us/geninfo/about/budget/02overvw.pdf](http://adfg.state.ak.us/geninfo/about/budget/02overvw.pdf). Accessed November 5, 2002.

<sup>14</sup> Ibid.

<sup>15</sup> Alaska Travel Industry Association, Alaska Tourism Industry Crisis Recovery Plan, December 6, 2001. On the Web at [www.governor.state.ak.us/tourism\\_recovery.pdf](http://www.governor.state.ak.us/tourism_recovery.pdf). Accessed November 4, 2002.

<sup>16</sup> Daniel TC, Hetherington J, Orland B, and Paschke JL. 1991. Public Perception and Attitudes Regarding Spruce Bark Beetle Damage to Forest Resources on the Chugach National Forest, Alaska. Final Report prepared for USDA Forest Service, Forest Pest Management, Region 10.

<sup>17</sup> Alaska Department of Labor. On the Web at [alms.labor.state.ak.us](http://alms.labor.state.ak.us). Accessed November 18, 2002.

<sup>18</sup> USDA Forest Service, Alaska Region, State of Alaska Department of Natural Resources, Division of Forestry. 2002. Forest Health Protection Report, Forest Insect and Disease Conditions in Alaska—2001, General Technical Report R10-TP-102.

<sup>19</sup> Alaska Department of Natural Resources, Division of Agriculture. On the Web at [www.dnr.state.ak.us/ag/ag\\_mi.htm](http://www.dnr.state.ak.us/ag/ag_mi.htm). Accessed November 5, 2002.

<sup>20</sup> Ibid.

## THE WORST OF THE WORST

<sup>21</sup> US Fish and Wildlife Service, Alaska Region, Invasive Species Priority List, May 9, 2000.

<sup>22</sup> Byrd V. Personal communications, November 14–15, 2002, and January 8, 2003. As above.

<sup>23</sup> Rabe M. Personal communications, November 9 and 13, 2002. Mary Rabe is with the Alaska Department of Fish and Game, Division of Wildlife Conservation.

<sup>24</sup> Stocked fish upset Lake Tahoe ecosystem. *The Mercury News*, August 7, 2002. On the Web at [www.bayarea.com/mlld/bayaread/3818103.htm](http://www.bayarea.com/mlld/bayaread/3818103.htm). Accessed August 12, 2003.

<sup>25</sup> Alaska Department of Fish and Game. 2002. *Alaska Aquatic Nuisance Species Management Plan*, Juneau.

<sup>6</sup> Atlantic salmon caught in Alaskan waters. *Bangor Daily News*, August 28, 2000. On the Web at [www.merpi.org/files/19957.htm](http://www.merpi.org/files/19957.htm). Accessed August 12, 2003.

<sup>7</sup> Wild Pink Salmon Crash Blamed on BC Fish Farm Lice, Environment News Service. On the Web at [enews.com/enr/nov2002/2002-11-25-01.asp](http://enews.com/enr/nov2002/2002-11-25-01.asp). Accessed January 13, 2003.

<sup>8</sup> USDA Forest Service. 2003. Amber-marked Birch Leaf Miner, Leaflet R10-TP-114. On the Web at [www.fs.fed.us/r10/pfiftp/leaflet/Birchmin.htm](http://www.fs.fed.us/r10/pfiftp/leaflet/Birchmin.htm). Accessed August 12, 2003.

<sup>9</sup> Ibid; Holsten E. Personal communication, November 27, 2002. As above; and Forest Health Protection Report, Forest Insect and Disease Conditions in Alaska—2002, General Technical Report R10-TP-113. On the Web at [www.dnr.state.ak.us/forestry/pdfiftp/condis\\_rept\\_2002.pdf](http://www.dnr.state.ak.us/forestry/pdfiftp/condis_rept_2002.pdf). Accessed on August 12, 2003.

<sup>10</sup> Hebert M. 2001. *Strategic Plan for Noxious and Invasive Plants Management in Alaska*. Cooperative Extension Service, University of Alaska Fairbanks. On the Web at [www.cnipm.org/strategic.pdf](http://www.cnipm.org/strategic.pdf). Accessed on January 8, 2003.

<sup>11</sup> Shephard M, Rose C, and Burnside R. 2002. *Strategies for Managing Noxious and Invasive Plants in Alaska*. Forest Health Management posters.

<sup>12</sup> Japanese Knotweed Finding Its Way Into Missouri Crop Fields, *Integrated Pest & Crop Management Newsletter*, 8 (10), University of Missouri-Columbia, June 12, 1998. On the Web at [ipm.missouri.edu/ipm/archived/v8n10ipmtr5.htm](http://ipm.missouri.edu/ipm/archived/v8n10ipmtr5.htm). Accessed October 30, 2002.

<sup>13</sup> Washington State Noxious Weed Control Board. 2003. Japanese knotweed. On the Web at [www.wnuc.ws.gov/weed\\_info/jknotweed.html](http://www.wnuc.ws.gov/weed_info/jknotweed.html). Based on Ahrens JE. 1975. Preliminary results with glyphosate for control of *Polygonum cuspidatum*. Proceedings of the Northeastern Weed Science Society 29: 326 (not seen).

<sup>14</sup> Seiger L. 1991. Element Stewardship Abstract for *Polygonum cuspidatum*. Japanese knotweed, Mexican bamboo. The Nature Conservancy, Arlington, Virginia.

## WHAT'S AT STAKE? IMPACTS ON ALASKA'S NATURAL AREAS AND RESOURCES

<sup>15</sup> Colt S. 2001. The Economic Importance of Healthy Alaska Ecosystems. Institute of Social and Economic Research, University of Alaska Anchorage.

<sup>16</sup> Denali National Park and Preserve—Park Description, National Parks Conservation Association. On the Web at [www.npca.org/across\\_the\\_nation/ten\\_most\\_endangered/denali.asp](http://www.npca.org/across_the_nation/ten_most_endangered/denali.asp). Accessed January 15, 2003.

<sup>17</sup> USDA Forest Service, Alaska Region, State & Private Forestry. 2002. A Chance to Catch the Problem Early. On the Web at [www.fs.fed.us/r10/pfiftp/Success/Noxious\\_Weed\\_Story\\_2002.pdf](http://www.fs.fed.us/r10/pfiftp/Success/Noxious_Weed_Story_2002.pdf). Accessed August 29, 2003.

<sup>18</sup> Byrd V. Personal communications, November 23, 2002. As above.

<sup>19</sup> Ibid.

<sup>20</sup> Alaska Department of Fish and Game. 1998. Endangered Species in Alaska. On the Web at [www.state.ak.us/adfg/wildlife/geninfo/game/s\\_home.htm](http://www.state.ak.us/adfg/wildlife/geninfo/game/s_home.htm). Accessed January 15, 2003.

## FINDING SOLUTIONS: WHO DEALS WITH INVASIVE SPECIES IN ALASKA?

<sup>21</sup> Hebert M. 2001. *Strategic Plan for Noxious and Invasive Plants Management in Alaska*. Cooperative Extension Service, University of Alaska Fairbanks. On the Web at [www.cnipm.org/strategic.pdf](http://www.cnipm.org/strategic.pdf). Accessed on January 8, 2003.

<sup>22</sup> Alaska Department of Fish and Game. 2002. *Alaska Aquatic Nuisance Species Management Plan*, Juneau. On the Web at [www.anitakforce.gov/AK-Final-ANS%20plan%20gov%2010-4%20final.htm](http://www.anitakforce.gov/AK-Final-ANS%20plan%20gov%2010-4%20final.htm).

<sup>23</sup> Knowles T. 2002. Governor Submits Plan to Combat Invasive Species. Press release of October 11, 2002. On the Web at [www.usitnews.net/1002news/10102\\_invasive\\_species.html](http://www.usitnews.net/1002news/10102_invasive_species.html). Accessed August 12, 2003.

<sup>24</sup> Alaska Department of Fish and Game. 2002. As in citation 2 above.

<sup>25</sup> Chugach National Forest. 1998. Kenai Peninsula Weed Survey, Draft, A Report for the USDA Forest Service.

<sup>26</sup> US Fish and Wildlife Service Western Regional Panel Update, *Nuisance Notes*, No. 13, Spring 2002.

<sup>27</sup> Alaska Exotic Plant Information Clearinghouse (AKEPIC) Mapping Project. On the Web at [agdc.usgs.gov/akepic](http://agdc.usgs.gov/akepic). Accessed November 14, 2002.

<sup>28</sup> Needham CA. Personal communication, September 26, 2003. Cathy Needham is with POWTEC, LLC, Environmental Services.

<sup>29</sup> Spencer P. Personal communications, November 8, 2002 and June 19, 2002. As above; and Shephard M. Personal communications, November 15 and 27, 2002. As above.

<sup>30</sup> Alaska Department of Fish and Game. 2002. As in citation 2 above.

<sup>31</sup> Ibid.

<sup>32</sup> Environmental Law Institute. 2002. Halting the Invasion: State Tools for Invasive Species Management. Washington, D.C.

<sup>33</sup> Alaska Department of Fish and Game. 2002. As in citation 2 above.

<sup>34</sup> Alaska Department of Fish and Game. Sport fish hatchery program. On the Web at [www.adfg.state.ak.us/statewide/Hatchery/HTML/HATCHERY.htm](http://www.adfg.state.ak.us/statewide/Hatchery/HTML/HATCHERY.htm). Accessed August 13, 2003.

<sup>35</sup> Alaska Department of Fish and Game. 2002. As in citation 2 above.

<sup>36</sup> Alaska Statute Title 3, Chapter 5, Section 10.

## Thank You!

The Union of Concerned Scientists (UCS) produced this document with generous support from The George Gund Foundation, The David and Lucile Packard Foundation, Environmental Defense's Environmental Science Program, and other generous supporters.

Deborah Koons and Christine Mlot - Writers  
Catherine Rauschuber - Graphics research

Special thanks to Deborah Koons and Michele Hebert of Fairbanks for gathering and synthesizing much of the information for this report and to Anita Spiess for initial editing.

*UCS Staff:*

Andrea Shokin - Biodiversity Outreach Specialist, Global Environment Program  
Phyllis Windle - Senior Staff Scientist, Invasive Species, Global Environment Program  
Teri Grimwood - Layout, Global Security Program  
Heather Tuttle - Assistant Editor, Communications

*Sincere thanks to the following individuals who provided useful information and/or invaluable review of these materials:*

Aaron M. Archibeque - Refuge Manager, Togiak National Wildlife Refuge, US Fish and Wildlife Service, Dillingham, AK

Sharon Atkinson - University of Alaska, Seward, AK

Keith Bogs - Program Manager, Alaska Natural Heritage Program, University of Alaska Anchorage, Anchorage, AK

Karen Bosworth - Botanist and Wetland Ecologist, Bosworth Botanical Consulting, Juneau, AK

Robert Bosworth - Program Director, Southeast Alaska Office, The Nature Conservancy, Juneau, AK

Terry Brock - Alaska Regional Soil Scientist (retired), USDA Forest Service, Juneau, AK

Vernon Byrd - Supervisory Wildlife Biologist, Alaska Maritime National Wildlife Refuge, US Fish and Wildlife Service, Homer, AK

John DeLapp - Cook Inlet Coastal Program, US Fish and Wildlife Service-Ecological Services, Anchorage, AK

Faith L. Duncan - Disturbance Ecologist, Office of Planning, USDA Forest Service, Ketchikan, AK

Peter Dunlevy - Wildlife Biologist, Alaska Maritime National Wildlife Refuge, US Fish and Wildlife Service, Homer, AK

Steve Elbert - Invasive Species Biologist, Alaska Maritime National Wildlife Refuge, US Fish and Wildlife Service, Homer, AK

Nora Foster - Independent Biologist, Fairbanks, AK

Randall H. Hagenstein - Director of Conservation, Alaska Chapter, The Nature Conservancy, Anchorage, AK

Michele Hebert - Land Resources Agent, Cooperative Extension Service, University of Alaska Fairbanks, Fairbanks, AK

Patricia J. Heglund - Regional Refuge Biologist, US Fish and Wildlife Service-Refuges, Anchorage, AK

Ed Holsten - Research Entomologist, Forest Health Protection, USDA Forest Service, Anchorage, AK

Henry P. Huntington - Owner, Huntington Consulting, Eagle River, AK

Randi Jandt - Fire Ecologist, Alaska Fire Service, Bureau of Land Management, Fort Wainwright, AK

Christina Jewett - State Plant Health Director-Alaska, Animal and Plant Health Inspection Service, Plant Protection & Quarantine, US Department of Agriculture, Anchorage, AK

Charles Knight - Agricultural Inspector, Alaska Division of Agriculture, Alaska Department of Natural Resources, Fairbanks, AK

Jack Lorrigan - Biologist, Sitka Tribe of Alaska, Sitka, AK

Rich Lowell - Wildlife Biologist, Division of Wildlife Conservation, Alaska Department of Fish and Game, Petersburg, AK

Marta Mueller - Program Assistant, Invasive Plants Program, and Integrated Pest Management (IPM) Technician, Cooperative Extension Service, University of Alaska Fairbanks, Fairbanks, AK

Cathy A. Needham - Environmental Technical Specialist, POWTEC, llc. Environmental Services, Juneau, AK

Robert S. Otto - Supervisory Fishery Biologist, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Kodiak, AK

Steve Peterson - Wildlife Biologist (retired), Division of Wildlife Conservation, Alaska Department of Fish and Game, Juneau, AK

Bob Piorkowski - Invasive Species Program Coordinator, Commercial Fisheries Division, Alaska Department of Fish and Game, Juneau, AK

Bill Pyle - Supervisory Wildlife Biologist, Kodiak National Wildlife Refuge, US Fish and Wildlife Service, Kodiak, AK

Mary L. Rabe - Nongame Program Coordinator, Division of Wildlife Conservation, Alaska Department of Fish and Game, Juneau, AK

Matt Robus - Director, Division of Wildlife Conservation, Alaska Department of Fish and Game, Juneau, AK

Mike Roy - Habitat Restoration and Partnerships Coordinator, Alaska Regional Office, US Fish and Wildlife Service, Anchorage, AK

Janet Hall Schempf - Habitat Biologist, Sport Fish Division, Alaska Department of Fish and Game, Juneau, AK

Mark Schwan - Research Coordinator, Sport Fish Division, Alaska Department of Fish and Game, Juneau, AK

Michael Shephard - Vegetation Ecologist, Forest Health Protection, State & Private Forestry, USDA Forest Service, Anchorage, AK

Thomas C. Shirley - Invertebrate Biologist, Juneau Center, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Juneau, AK

Gary Sonnevil - Field Supervisor, Kenai Fish and Wildlife Field Office, US Fish and Wildlife Service, Kenai, AK

Page Spencer - Ecologist, National Park Service, Anchorage, AK

© 2003 Union of Concerned Scientists

 Printed on recycled paper



## Union of Concerned Scientists

Citizens and Scientists for Environmental Solutions

### NATIONAL HEADQUARTERS

Two Brattle Square  
Cambridge, MA 02238-9105  
Phone: 617-547-5552  
Toll free: 1-800-666-8276  
Fax: 617-864-9405

### WASHINGTON OFFICE

1707 H Street NW, Suite 600  
Washington, DC 20006-3962  
Phone: 202-223-6133  
Fax: 202-223-6162

### WEST COAST OFFICE

2397 Shattuck Ave., Suite 203  
Berkeley, CA 94704-1567  
Phone: 510-843-1872  
Fax: 510-843-3785

### EMAIL

[ucs@ucsusa.org](mailto:ucs@ucsusa.org)

### WEB

[www.ucsusa.org](http://www.ucsusa.org)