

ENDANGERED SPECIES

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Endangered Species Program, Washington, D.C. 20240

Arctic Peregrine Falcon Reclassified to Threatened

The Service has published a final rule (F.R. 3/20/84) that reclassifies the Arctic peregrine falcon (*Falco peregrinus tundrius*) under the Endangered Species Act from Endangered to Threatened. This reclassification does not significantly change the protection of the subspecies under the Act; it was taken only to ensure that this bird's current biological status is reflected accurately on the U.S. List of Endangered and Threatened Species, as required by law. Another part of the rule clarifies the legal status of peregrines that nest in western Washington. Finally, it gives added protection to all free-flying peregrines in the conterminous 48 States, under the classification of "Endangered due to Similarity of Appearance," in order to facilitate enforcement of conservation rules for the listed forms.

Background

The peregrine falcon (*Falco peregrinus*) is found widely throughout the world, and three subspecies occur in North America: the Arctic, American (*F. p. anatum*), and Peale's (*F. p. pealei*). The Arctic and American subspecies were listed in 1970 as Endangered after contamination of their food supply by DDT and its metabolites. These pesticides interfered with peregrine reproduction and caused severe depletions in population numbers.

With the subsequent decline in DDT usage within the U.S. and Canada, the reproductive rates for Arctic peregrines have shown enough improvement that this subspecies is no longer in imminent danger of extinction. From all available evidence, the Service concludes that

there are no fewer than 3,000 pairs occupying the Arctic and sub-Arctic areas of North America. Blood samples collected from Arctic peregrines trapped during migration indicate that about 90 percent of these birds are now capable of normal reproduction. But although the status of the Arctic peregrine has improved enough for a reclassification from Endangered to Threatened, it is not completely secure. Current populations are almost certainly lower than those known prior to the use of DDT (pre-1945). There also is a continuing threat from the use of DDT (and possibly other environmental contaminants) throughout peregrine wintering grounds in Central and South America. Until that danger is clearly removed, both the Arctic and American *continued on page 3*

Recovery Plans Approved for Hawaiian Wildlife

As part of the BULLETIN's continuing series on recovery plans for Threatened and Endangered wildlife and plants of the U.S., this month's issue looks at three more plans that have been approved within the past year for nine Hawaiian animals:

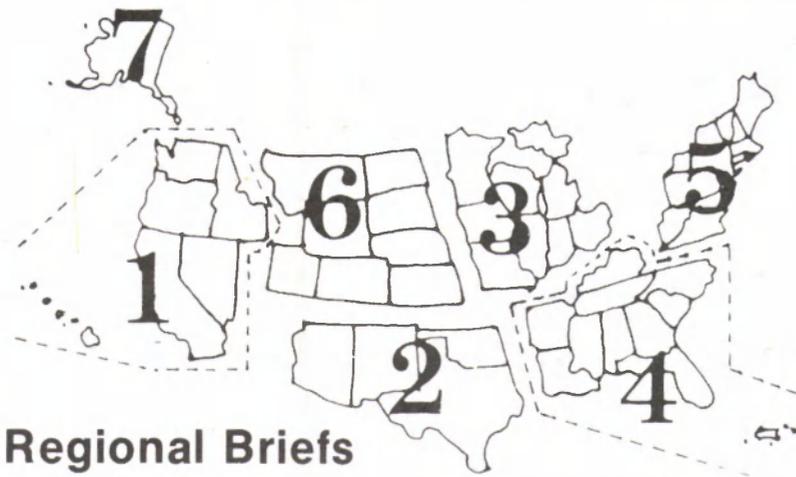
Six Kaua'i Forest Birds

Within historical times, the avifauna of the Hawaiian Islands has suffered a severe decline. Birds in the order Passeriformes (song birds) have been particularly hard hit; of the 57 endemic passerines (species and subspecies), 20 are now extinct and another 22 are on the U.S. List of Endangered and Threatened Wildlife and Plants. The Island of Kaua'i is home to 13 of the surviving native passerines, more than any other island in the archipelago. Unfortunately, six of these birds have become Endangered due to habitat destruction and introductions of exotic plants, animals, and diseases. A recovery plan approved last summer could help in the effort to conserve these taxa:

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puaiohi, or small Kaua'i thrush



Regional Briefs

Endangered Species Program regional staffers have reported the following activities for the month of March:

Region 1—The U.S. Air Force (USAF) had proposed to clear a portion of Andersen Air Force Base on Guam that has been identified by the Guam Division of Aquatic and Wildlife Resources (GDAWR) as one of the few remaining places harboring the Guam rail (*Rallus*

owstoni), which has been proposed for listing as an Endangered species. Under a listing proposal, the USAF would have only been required to informally "confer" on actions that may affect the species; however, on April 11, an emergency listing of the bird as Endangered was published. (A story on the listing will appear in the May BULLETIN.) The USAF will now be required to formally

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consult on any actions that may affect the rail. The USAF has suspended the clearing operation pending consultation on how best to improve base security while conserving the rail; meanwhile, the Defense Department has assured us that it will take no action that would harm the birds.

Endangered species biologists with the FWS Reno Office visited Ash Meadows on two occasions last month in an attempt to remove introduced goldfish (*Crassius auratus*) from pools at the Point of Rocks Springs. Despite the use of a variety of techniques, the efforts were unsuccessful. Unless removed soon, the goldfish will invade other habitats occupied by the Endangered Ash Meadows Amargosa pupfish (*Cyprinodon nevadensis mionectes*) and Ash Meadows speckled dace (*Rhinichthys osculus nevadensis*). Goldfish have been present in the Point of Rocks Springs since autumn 1983. This introduction is further evidence that public access into the Ash Meadows area must be managed.

Biologists from the Great Basin Complex met with refuge and regional office personnel to discuss stream habitat improvements on the Moapa National Wildlife Refuge. This southern Nevada refuge was established in 1979 for the conservation of Moapa dace (*Moapa coriacea*) and consisted of 12 acres with three primary spring heads discharging into a single stream. The stream was renovated and stocked with Moapa dace in 1981. In November 1983, an additional 20 acres with four spring heads were purchased. The more recently acquired stream will need thinning of its riparian canopy and addition of gravel substrate in order to renovate the habitat. These activities will enhance production of insects, the dace's primary food source. It was also agreed that additional habitat should be created at the northeastern refuge boundary where water temperatures are lowest and dissolved oxygen is highest. Closer to the spring heads, temperatures are warm (31.4°C) and dissolved oxygen extremely low (2.5-4.0 mg/l), conditions that limit successful recruitment.

Special Agents (SA) of the FWS Law Enforcement Office in Klamath Falls, Oregon, have investigated the deaths or injuries of 15 bald eagles (*Haliaeetus leucocephalus*). All dead birds were submitted to the FWS National Wildlife Health Laboratory in Madison, Wisconsin, for necropsy. Reports on the first 10 showed the causes of death or injury as follows: electrocution, four dead and

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Peregrine

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Peregrines will remain on the List of Endangered and Threatened Species.

The Peale's peregrine falcon, which nests from the Aleutian Islands east and south to Vancouver Island, was not seriously affected by DDT contamination and therefore was never listed under the Endangered Species Act. A few peregrines nest on Washington's Olympic Peninsula, just to the south of Vancouver Island, and there has been some disagreement among ornithologists over whether these birds are actually Peale's or American peregrine falcons. Therefore, the second part of the March 20, 1984, rule was a determination by the Service that these birds are indeed members of the Endangered American subspecies and are covered by the conservation provisions of the Act. If they had been found to be Peale's peregrines, they would not have had legal protection under the Act. The State of Washington already lists all peregrine falcons within its borders as endangered, and prohibits any taking except under strict permit.

Because different peregrine subspecies are difficult to distinguish and sometimes intergrade at the boundaries of their ranges, the March 20, 1984, rule also reclassified all free-flying peregrines in the 48 conterminous States as Endangered under the Similarity of Appearance clause [Section 4(e)] of the Endangered Species Act. This classification conveys the full protection authorized by the Act. By removing doubts about which birds are covered by the Act and by making enforcement more efficient, all peregrines should benefit, including those birds released into the wild under the peregrine restoration program.

The reclassification rule was proposed by the Service in the March 1, 1983, *Federal Register* (see BULLETIN, Vol. VIII No 4.). Some 71 comments were received, two-thirds of them supporting the action. These comments, along with the Service's responses, are summarized in the March 20, 1984, final rule.

Effects of the Rule

Under the Threatened classification, the Arctic peregrine falcon has virtually the same protection it received under its former Endangered status. (There is a minor change in applications for take of peregrines on the Alaskan North Slope for scientific or conservation purposes, in accordance with 50 CFR 17.32.) Except where authorized by permit, taking, possessing, transporting, and trading in listed peregrines remains prohibited. Federal agencies will still be

required to ensure that any actions they fund, authorize, or carry out are not likely to jeopardize the survival of the listed peregrines or adversely modify their habitat. Except for the permit change mentioned above, all of these conservation measures also apply to any free-flying peregrine in the conterminous 48 states.

The Service does not intend to allow the take of wild American or Arctic peregrines for the purposes of falconry until these subspecies have recovered and are removed from the List of Endangered and Threatened Species. No changes have been made in existing Federal falconry regulations, and rules implementing the Migratory Bird Treaty Act will not be affected. Further, all peregrine falcons remain on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, and are subject to the treaty's permit procedures.

Owens Tui Chub Proposed as Endangered

The Owens tui chub (*Gila bicolor snyderi*), a small California fish that is jeopardized by habitat degradation and introductions of exotic fishes, has been proposed by the Service for listing as Endangered (F.R. 3/28/84). During the 1930s, ichthyologist Carl Hubbs and his coworkers conducted the first major survey of fishes in the arid Owens Basin (Inyo and Mono Counties, California). Owens tui chubs were found to be common in a wide range of aquatic habitats. Unfortunately, this vulnerable subspecies has suffered a serious decline, and pure populations can be found at only two locations.

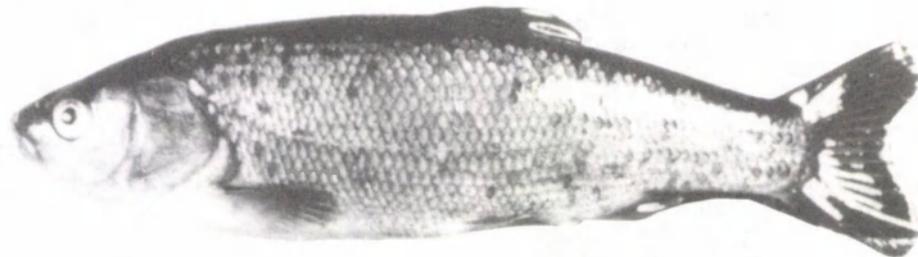
Demand for the limited water resources of the Owens Basin is high, and they are used extensively for irriga-

tion and municipal purposes. The largest consumer of Owens Basin water is the city of Los Angeles, approximately 260 miles away, which takes in the water through an extensive system of diversion structures and aqueducts. Physical habitat alterations associated with impoundments and stream diversions have reduced the chub's available habitat.

Exotic fishes currently are the main threat to the remaining two populations of this subspecies. The Owens tui chub is one of only four fishes native to the Owens River, but 18 exotic fishes have been introduced into the ecosystem. Predation by exotic brown trout (*Salmo trutta*) is a problem for the Owens tui chubs below Long Valley Dam, one of the two remaining populations. Another threat is hybridization with the Lahontan tui chub (*G. b. obesa*), a related but non-native fish that has been illegally introduced into many waters of the Owens Basin for use as a bait fish.

The status of the Owens tui chub is recognized by California under its own endangered species legislation, although the State lacks authority to protect habitat. U.S. Fish and Wildlife Service interest in this subspecies was first expressed in the December 30, 1982, *Review of Vertebrate Wildlife for Listing as Endangered or Threatened*. On April 12, 1983, the Service was petitioned by the Desert Fishes Council to list the Owens tui chub, and the Service subsequently published an announcement that the petitioned action was warranted (F.R. 6/14/83).

If the listing proposal is approved, the Owens tui chub will receive all of the protection authorized under the Endangered Species Act, which includes general prohibitions against taking, possessing, transporting, and trading in listed species. Permits to conduct otherwise prohibited activities are available for certain scientific and conservation purposes. Under Section 7 of the Act, Federal agencies will be required to ensure that any actions they fund, authorize, or carry out are not likely to jeopardize the survival of the fish or adversely modify its Critical Habitat. continued on page 12



An Owens tui chub can reach up to 5 inches in length. Its coloration is olive above and whitish below, with lateral blue and gold reflections; the sides of the head also display a noticeable gold tinge.

From a photo by E. Philip Pister

Hawaiian Recovery Plans

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• **pualohi**, or **small Kaua'i thrush** (*Phaeornis palmeri*)—The *puaiohi* is about 7 inches long, dark brown above, gray below, and with a white eye ring. It forages for insects along fern and sedge-covered stream banks in 'ohi'a forests. This species was relatively numerous around the turn of the century, but it is now extremely rare. The 1968-1973 estimate was 250 or fewer birds.

• **kama'o**, or **large Kaua'i thrush** (*Phaeornis obscurus myadestina*)—This thrush reaches a body length of up to 8 inches, and is colored a dull brown above, light gray below. Nests were just recently discovered and were constructed in cavities of 'ohi'a (*Metrosideros collina*) trees. Its diet consists primarily of fruit and berries. In 1891, the *kama'o* was the most common forest bird on Kaua'i, but the forest bird surveys conducted during 1968-1973 resulted in an estimate of only about 300 or fewer remaining.

• **Kaua'i 'o'o** (*Moho braccatus*)—This bird is a bit larger (up to 8.5 inches) and darker in coloration than the other Kaua'i forest birds. The black upper body and brown abdomen contrast with bright yellow thigh feathers. In behavior, the 'o'o is continually on the move and defending its feeding territory from other birds. It feeds on the nectar of 'ohi'a and lobelia flowers, and hunts spiders, moths, and crickets. The most recent nest known (1973) was in an 'ohi'a cavity. Although common in 1891, the 1968-1973 estimate was that fewer than 100 were left. During a 1981 survey, only two 'o'o were sighted.

• **Kaua'i 'akialoa** (*Hemignathus procerus*)—This bird might already be extinct; none were seen during the 1968-1973 surveys. Recorded sizes for the 'akialoa average almost 8 inches. Male birds are bright olive-yellow above and yellow below, with a distinctive eye stripe, and they have a downward curving bill reaching up to 2.5 inches long. Females are somewhat duller in color with shorter bills. The 'akialoa feeds primarily on 'ohi'a and lobelia nectar, although some insects are taken.

• **Kaua'i nuku-pu'u** (*H. lucidus hanapepe*)—This bird was already very rare by 1889, and there have been very few sightings in recent years. It is slightly smaller than the other Endangered Kaua'i forest birds, about 5.5 inches in length. The male birds have a bright yellow head, throat, and breast, and females are olive-gray above. They glean caterpillars and other insects from tree bark, and might also feed on nectar.



Kaua'i 'o'o



Kaua'i nuku-pu'u

Illustration by H. Douglas Pratt

Illustration by H. Douglas Pratt



'o'u

• **'o'u (*Psittirostra psittacea*)**—The 'o'u is the only bird covered in this recovery plan that still occurs on Kaua'i and one other island. Historically, it was distributed throughout six of the main Hawaiian Islands, and was considered extremely common. Today, however, only remnant populations are found on Kaua'i (Alaka'i Swamp) and the windward slopes of the island of Hawai'i. Males have a bright yellow head that contrasts sharply with their green and brown body; females are more olive in color and lack the distinctive yellow head feathers. Their diet includes 'ie'ie (*Freycinetia arborea*) fruits and flowers, 'ohi'a buds and flowers, and caterpillars.

Alteration and destruction of the original lower elevation forests, which were important habitat for these Endangered birds, occurred quickly and extensively. The process began when early Polynesians discovered and settled the islands about 1,200 years ago, and it accelerated rapidly following the arrival of Captain Cook in 1778. As new settlers arrived, large areas of forest land were cleared for pastures and crop plants. Overgrazing by feral livestock, particularly cattle and goats, caused widespread erosion and heavily disturbed the native forest ecosystems. Many species of aggressive exotic plants also have been introduced, competing with natural vegetation upon which the endemic birds depend for food and nesting. Although Kaua'i is the fourth largest of

the Hawaiian Islands, totalling 553 square miles, only 40,000 acres of native forest in the higher elevations and remote interior valleys have so far escaped heavy modification.

Predation by introduced rats and cats on Kaua'i probably had, and continues to have, significance in the decline of native birds. The black rat (*Rattus rattus*), for example, can be found on almost every forested mountain on the island, and is fully capable of climbing trees in search of eggs and young birds. A destructive predator on other Hawaiian islands, the mongoose (*Herpestes auropunctatus*), possibly has become established on Kaua'i; if not, it is probably only a matter of time before an accidental introduction. Kaua'i, the only one of the major Hawaiian Islands to have avoided infestation by the mongoose for this long, is also the only one that has not lost one of its native birds to extinction (assuming that the Kaua'i 'akialoa survives).

Competition with exotic birds for food and living space has been another problem. There were major introductions of various songbirds from around the world from 1865 through at least the first three decades of this century, and it was during 1900-1930 that the heaviest decline in Kaua'i's native forest birds was recorded.

It is likely that imported songbirds, game birds, and even poultry introduced new diseases and parasites that infected native Hawaiian birds. Two other diseases, avian pox (*Poxvirus avium*) and

avian malaria (*Plasmodium* spp.), might have been present already in the islands, but later transmitted more widely by introduced birds and mosquitos. Threats to the Endangered forest birds in their high retreats could intensify if the temperate-zone subspecies of the night mosquito (*Culex pipiens pipiens*), a major disease vector, becomes established in upper elevations.

The best remaining habitat for Kaua'i's Endangered forest birds is the Alaka'i Swamp, a montane rain forest on a deeply dissected plateau about 4,000 feet in elevation. At the southeast corner of the swamp is Mt. Wai'ale'ale, which receives an average annual rainfall of 486 inches and is often cited as the rainiest spot on earth. Within the Alaka'i Swamp, the heaviest rainfall is 150-200 inches per year on the east side, dropping to 50 inches on the west side next to Waimea Canyon. Most recent observations of the Endangered forest birds were within the area of heavier rainfall in relatively pristine habitat.

In 1964, the State of Hawai'i established the 9,939-acre Alaka'i Wilderness Preserve to conserve the swamp's native fauna and flora. This preserve includes the primary habitat of the Endangered forest birds, and is the focus of research on how to conserve these species. Attempts by the State to control the spread of exotic pest plants into the Alaka'i Swamp have been made at certain trail heads. The U.S. Forest Service (USFS) has initiated studies looking into the possible use of biological control of undesirable introduced plants. From 1978-1982, the USFS also studied sections of the Alaka'i Swamp to determine avian food supplies, phenology, and relationships to native bird populations. During 1968-1973, the U.S. Fish and Wildlife Service (FWS) conducted single-person surveys of the status and distribution of Kaua'i's forest birds. In 1981, an intensive multiple-person follow-up survey of the Kaua'i forest birds was carried out by the FWS, USFS, and Hawai'i Department of Land and Natural Resources. Activities included in the various surveys have been bird banding, collection of blood samples, habitat evaluation and mapping, and testing of artificial nesting structures.

Recovery Actions

The *Kaua'i Forest Birds Recovery Plan*, prepared by the FWS in cooperation with the Hawai'i Division of Forestry and Wildlife, was approved in July 1983. Its first objective is, necessarily, to halt the trend toward extinction of the six Endangered birds; the next step is to increase the population of each species to 1,000 birds in secure habitat, whereupon they can be considered for reclassification to Threatened. A population of 1,000 birds would represent up to a 10-

fold increase, depending on the species, over current levels and indicate that management is becoming effective.

The plan identifies an area of approximately 19,500 acres in the Alaka'i Swamp that is essential to the survival and ultimate recovery of the forest birds. Most of this land is already under the control of the Hawai'i Division of Forestry and Wildlife, including the 9,939 acres protected by the special regulations governing the Alaka'i Wilderness Preserve. Broadscale efforts to reduce rat populations and eliminate any feral cats in the swamp, especially around bird nesting sites as they are discovered, could help to control the predation problem. Every effort should be made to prevent the mongoose and any other predators from becoming established on the island. Although existing hunting regulations appear adequate to contain habitat degradation caused by feral livestock animals in much of the swamp, goats seem to be increasing in the important Wainiha Pali section. The plan advocates periodic control efforts or increased hunting of the animals to conserve this vital habitat. Biological and/or mechanical methods to control exotic pest plants in the Alaka'i Swamp could be used, if feasible and without risk to native species.

Due to the flourishing aviary trade in Hawai'i, importation of exotic birds continues, and some could prove to be new predators, competitors, or disease vectors. The plan calls for stricter quarantine laws and better enforcement of laws against smuggling exotics. More complete screening and spraying of incoming aircraft and ships could help prevent the introduction of new mosquito species. As research identifies specific hosts of avian diseases, control methods should be evaluated and applied where possible.

As the plan points out, some or all of the six Endangered birds could easily become extinct before studies to better determine the importance of various limiting factors are complete, or before corrective management actions are developed and applied. To ensure their survival, the recovery plan recommends immediate initiation of a captive propagation and sperm bank program. The Honolulu Zoo has expressed interest in a propagation program, and the FWS Patuxent Wildlife Research Center might be able to provide support. If this approach is approved, techniques will first be attempted on related, but less jeopardized, surrogate species. For the rarest birds, artificial manipulation of nesting biology to increase production, using such methods as building artificial nesting structures or double-clutching the eggs, might initially be less hazardous than captive propagation. The ultimate goal is to build up large enough flocks in captivity so that offspring can

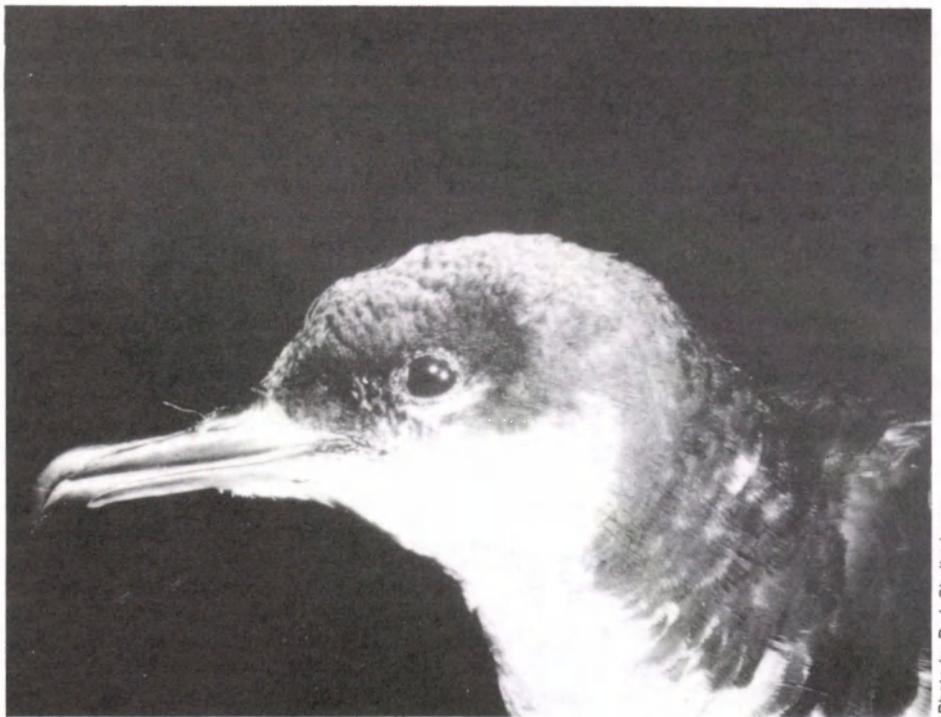


Photo by R. J. Shallenberger

'a'o, or Newell's Townsend's shearwater

be released into secure natural habitat to supplement any remaining wild populations.

Two Hawaiian Seabirds

Another recovery plan approved last year addresses two of Hawai'i's native seabirds. Both have been seriously reduced in range and numbers, primarily due to predation by exotic animals. Avian diseases, habitat alteration, and even artificial lighting are noted in the plan as limiting factors for one or both of these birds:

- **'ua'u, or Hawaiian dark-rumped petrel (*Pterodroma phaeopygia sandwichensis*)**—This subspecies of petrel is typically about 16 inches in length, with a wingspan of almost 36 inches. Its flight is characterized by high, steeply banked arcs and glides. The colonial, burrow nesting 'ua'u historically bred on most of the main Hawaiian Islands, but confirmed populations currently are known only on Maui (Haleakala Crater) and upper elevations on the island of Hawai'i. There is some evidence to indicate the existence of remnant populations on several other islands. The 'ua'u is listed as Endangered.

- **'a'o, or Newell's Townsend's (formerly Manx) shearwater (*Puffinus auricularis* (formerly *puffinus*) newelli)**—This subspecies averages about 13 inches in length, with a wingspan of 30-35 inches. It is glossy black above, white below. The 'a'o is another burrow nester, and has well-developed claws for excavating and climbing. Burrows for both birds are generally 3 to 6 feet deep, but occasion-

ally some 15 feet long are found. Nesting colonies are restricted to steep, forested mountain areas on Kaua'i and possibly remote sections of several other islands. The 'a'o is listed as Threatened.

The single greatest limiting factor for both the 'ua'u and 'a'o, and for many other Hawaiian birds, is predation by exotic animals. Early settlers from Polynesia themselves may have consumed some birds and eggs, and they brought with them such predators as rats and feral pigs. Later settlers helped establish other species of rats, the mongoose, feral cats and dogs, and more livestock, with a devastating effect on the ground nesting birds. For example, early descriptions of 'ua'u nesting areas indicated that burrows typically were found between 1,500-5,000 feet in elevation; known sites today, however, are restricted to levels above 7,200 feet, which is probably the upper limit of most dense populations of predators.

Another serious limiting factor to the 'a'o, and potentially for the 'ua'u, is urbanization and the accompanying increase in artificial lighting. Street lights, resort security lights, and athletic field lights have resulted in substantial problems for 'a'o fledglings during their first flights from their nesting grounds to the ocean. Both the 'a'o and 'ua'u normally fly to and from their ocean feeding areas only at night. The young have an apparently natural attraction to light, possibly related to the bioluminescence of their pelagic food supply or a tendency to use reflected moonlight on the water's surface to find the ocean. When attracted to artificial light, fledglings

become confused and often strike various obstructions on land. ('A'o adults, being more experienced, are less attracted to artificial light sources.) Most fallen birds at first are only stunned, but while on the ground they can be hit by automobiles, killed by dogs and cats, and simply unable to become airborne again. The fall-out problem is greatest during poor weather when there is little or no visible moonlight. From 1978 to 1981, 5,528 fallen 'a'o were found on Kaua'i. An annual, publicly supported salvage effort to pick up and release fallen birds has been successful; without it, much of the annual recruitment would be lost.

Damage to nesting habitat could be limiting the remaining populations of both birds. Most of their remaining habitat is on steep slopes at high altitudes, and has so far escaped urbanization. However, military and civilian communication installations, commonly located

on mountainous ridgetops, could directly affect the habitat, increase artificial light, and add to fire hazards.

'A'o nesting colonies are associated with dense stands of *uluhe* (*Dicranopteris linearis*) and similar ferns. This vegetation provides some cover from predators and helps to stabilize the slopes, but it also makes nesting sites particularly susceptible to damage by forest fires. The 'ua'u historically might have nested in denser vegetation at lower elevations, but now it is restricted to higher areas with only sparse plant cover.

Pelagic habitat is where the 'a'o and 'ua'u spend more of their lives, but very little is known about it. Breeding adults apparently stay near the main Hawaiian Islands during nesting season, but they could be ranging far at other times. Their diet includes small fishes, crustaceans, and squid. Concerns have been raised about potential future threats to the food supply from toxic waste dumping and other sources of pollution.

Early Conservation Efforts

Predator control around 'ua'u nesting colonies within Haleakala National Park began in 1966, with noticeable results, and trapping has continued since then. A number of studies have been conducted on 'ua'u at the park since the 1960s to locate and map nesting sites, determine population status, assess the effects of predation, and investigate breeding biology.

During the 1960s, the impact of artificial lighting on 'a'o fledglings on Kaua'i became apparent, and efforts to salvage fallen birds were initiated. In 1978, the 'a'o "aid station" program began on Kaua'i. Local agencies, organizations, and citizens participated in gathering fallen birds, which were taken to stations operated by State and Federal wildlife personnel. Each healthy bird was measured, banded, and released. In 1979, two aid stations were set up on Maui, but only a few 'a'o and 'ua'u have been recovered. The actual survival rate of salvaged birds is not known, but it is almost certainly higher than if they were left where fallen.

An FWS-sponsored light attraction study in 1980 found that installing metal shields around hotel flood lights to eliminate upward glare significantly reduced 'a'o fall-out. In 1982, The Nature Conservancy (TNC) purchased shades for 14 streetlights in an area of heavy fall-out. (TNC is also managing a privately owned 'a'o nesting area of 213 acres on Kaua'i.) John Sincock, of the FWS Lihue (Kaua'i) Field Office, has been involved for some time in discussions with State, county, and utility officials regarding possible streetlight shielding in other critical fall-out areas. Last year, a coop-

erative agreement between the FWS and the Citizens Utilities Company of Kaua'i was developed, under which the power company will purchase, install, and maintain \$21,000 worth of streetlight shades.

In 1978, a cooperative study was initiated by the FWS and the Hawai'i Division of Fish and Game to establish an experimental 'a'o colony at Kilauea Point and the nearby Moku'ae'ae Islet on Kaua'i's north shore. 'A'o eggs were removed from some of their natural burrows in the mountains and transferred to the nearshore burrows of a similar species, the wedge-tailed shearwater (*Puffinus pacificus chlororhynchus*). In most places, the surrogate adults accepted the eggs, and from the 91 'a'o eggs transferred during 1978-1980, 67 chicks fledged. Because of serious predation at Moku'ae'ae by exotic mynah birds (*Acridotheres tristis*) in 1979, all eggs subsequently transferred went only to Kilauea Point, where a mynah control effort was successful in reducing the problem. The intent of the experiment is to see if the cross-fostered 'a'o will return to nest where they fledged. To date, no returning birds have been found at the transplant sites. Depending on the results, a similar program for the 'ua'u might be considered.

Further Recovery Activities

The *Hawaiian Dark-rumped Petrel* ('A'o) and *Newell's Manx Shearwater* ('A'o) *Recovery Plan* was prepared by the FWS and the Hawai'i Division of Forestry and Wildlife, and approved in April 1983. Quantifiable recovery goals were difficult to establish because of the incomplete knowledge of these two birds. However, progress toward recovery will require accomplishing the following interim objectives:

- 1) reducing the current annual fall-out of more than 1,000 'a'o to less than 100 (or near 0); reducing annual 'ua'u fall-out to near 0;
- 2) providing long-term protection for the eight known 'a'o nesting colonies on Kaua'i and the one known 'ua'u nesting colony on Maui; and
- 3) developing efficient predator control methods for use in and around isolated nesting sites.

When these three objectives are met, the 'ua'u could be considered for reclassification to Threatened and the 'a'o for delisting.

The annual 'a'o salvage effort will likely be needed indefinitely, unless very effective light abatement methods can be found, because of increasing urbanization. An effort will be made to inform developers about the fall-out problem during the initial planning phases of new construction so that light shields or other devices can be incorporated into



Illustration by H. Douglas Peritt

'ua'u, or Hawaiian dark-rumped petrel

project designs. The plan also calls for research on other potential methods of controlling the fall-out problem, such as changing the frequency of the light being used to a part of the spectrum less disruptive to the birds.

Existing nesting areas, some of which have not yet been located, should be mapped and essential habitat identified. Better knowledge of the habitat can make the use of conservation zoning regulations more successful. Since most of the known nesting habitat is on government-managed land, the recovery plan does not call for habitat acquisition at this time. It does recommend additional efforts toward establishing new nesting colonies on habitat that is already secure. Maintaining natural vegetation around burrows will be part of the over-all program. None of these recovery activities will be successful over the long term without effective predator control. Such methods as increased hunting of feral livestock, fencing of essential habitat, and the use of toxicants (if it can be done without risk to native species) are mentioned in the plan as possibilities. In the meantime, all possible steps should be taken to prevent the introduction and spread of new predators (as well as the importation of noxious vegetation).

Hawaiian Monk Seal

The Hawaiian monk seal (*Monachus schauinslandi*) is a member of what may be the most primitive living genus of all seals. Its progenitors apparently originated in the North Atlantic, dispersed widely, and eventually became separated in three different regions of the world. Over millions of years, distinct species evolved: the Hawaiian, Mediterranean (*Monachus monachus*), and Caribbean or West Indian (*Monachus tropicalis*) monk seals. Monk seals appear to be far more sensitive to human intrusion into their environment than most other species of seals. As human presence and activities spread into the most isolated parts of their habitat, all three species suffered dramatic population declines. Remnant populations of both the Hawaiian and Mediterranean monk seals are listed as Endangered; the Caribbean monk seal has the same classification, but it probably became extinct several decades ago.

The Hawaiian monk seal currently is found throughout the Northwestern Hawaiian Islands, a chain of coral atolls and small islands, most of which are uninhabited. They make up only about 3,430 acres of emergent habitat. Monk seal breeding groups have been known to occur at eight places in the archipelago: Kure Atoll, at the northwestern end of the chain; the Midway Islands; Pearl and Hermes Reef; Lisianski Island; Laysan Island; French Frigate Shoals;

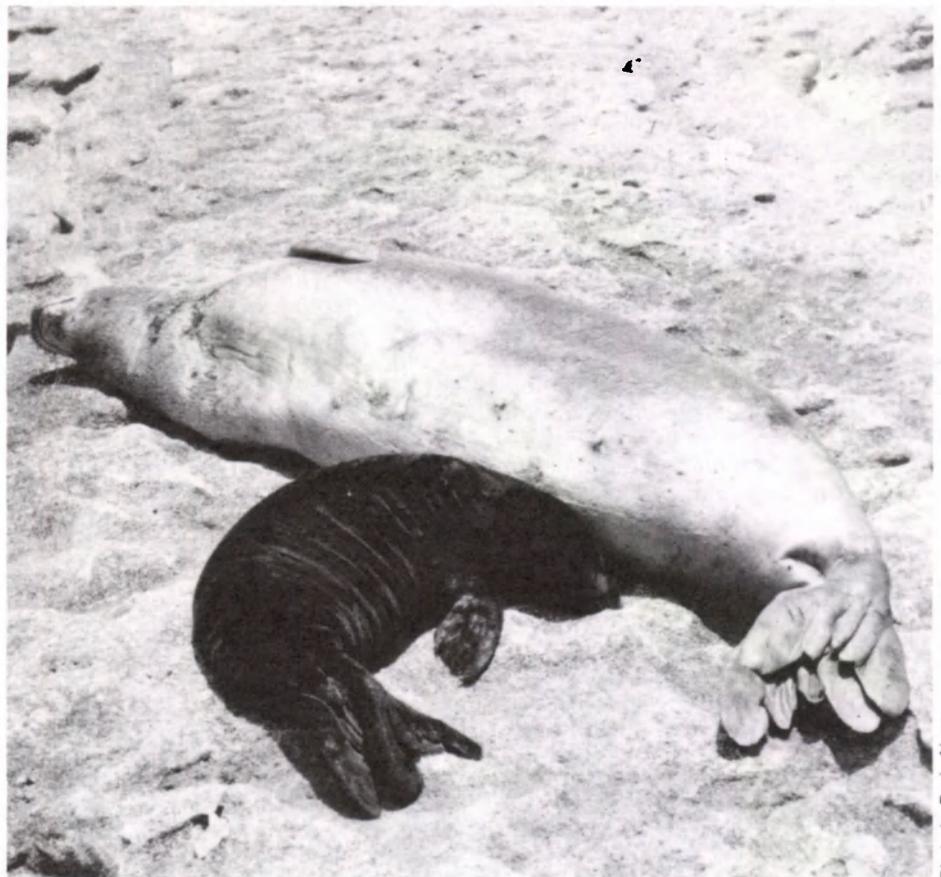


Photo by Doris Alcorn

Until their first molt, Hawaiian monk seal pups have a darker pelage than the older seals.



Photo by Doris Alcorn

Adult male seal approaching an unreceptive female

Necker Island; and Nihoa Island, a small remnant volcanic peak about 1,840 km from Kure and the last point of land before meeting the much larger island of Kaua'i. (Infrequent monk seal sightings also have been reported from waters surrounding the main Hawaiian Islands.)

On land, monk seals seek out undisturbed sites where they can haul out to rest, give birth, and nurse their young. These areas are usually undisturbed sandy beaches that are protected by shallow reefs, although basaltic intertidal benches are sometimes used. Monk seals also make use of vegetation behind the beaches, when available, for

resting at night and for shelter from wind and rain. Shallow inner reef waters adjacent to the islands are critical to weaned pups learning to feed. Mature seals also feed in these shallows, as well as in deeper waters away from the islands. They consume spiny lobsters, octopi, eels, and various reef fishes.

Significant human impacts on Hawaiian monk seals were felt early. Beginning in 1837, a series of shipwrecks on Kure Atoll's reefs stranded crews that came to rely on monk seals as a major food source. Shipwrecks also occurred on other islands in the northwestern chain, with similar results. A number of expeditions were sent to the

Northwestern Hawaiian Islands during the 19th and early 20th centuries for commercial exploitation of monk seal fur and oil, green sea turtles (*Chelonia mydas*), sharks and other fish, beche-de-mer, and guano. The huge seabird populations present on many of the islands also faced intensive pressure from traders in down, feathers, and bird skins. In 1909, President Theodore Roosevelt moved to conserve the birds by creating the Hawaiian Islands Reservation (since 1940, the Hawaiian Islands National Wildlife Refuge). By restricting human access to most of the islands, this action gave some protection to monk seals as well as sea birds. Nevertheless, the closure was difficult to enforce, and Japanese feather poachers continued to raid the islands until at least 1915, killing large numbers of birds and undoubtedly disturbing seals.

Several of the Northwestern Hawaiian Islands have been modified and developed for human occupation, a presence that has resulted in further disturbance of seals and other wildlife. For example, since their discovery in 1859, the Midway Islands have been used for various purposes that have significantly altered the physical environment. A communications station was constructed in 1902, and an airport was built in 1935. Midway's role a few years later during World War II is well known. A post-war peak of 2,500 military personnel at the Midway facilities has been reduced to about 300 civilian and military personnel in recent years.

Impacts were felt in other parts of the island chain as well. On Kure Atoll, a U.S. Coast Guard navigation station established in 1960 resulted in significant disturbance of the resident seal population. (The Coast Guard has taken steps to moderate the disturbance.) Kure, like the Midway Islands, is not part of the Hawaiian Islands NWR, although it is designated as a State seabird sanctuary. At French Frigate Shoals, an air base and navigation station were constructed during World War II on separate islands. These facilities, which were later consolidated on Tern Island and turned over to the Coast Guard, were deactivated in 1979. Since that time, the Fish and Wildlife Service has occupied the facility with a small research staff. During Coast Guard occupation, seals were only occasionally encountered on Tern Island beaches; since their departure, however, counts have reached over 100 seals.

Population Trends

Monk seal population data for the 18th and early 19th centuries are sporadic at best, but it is reasonable to assume that there has been a considerable drop in numbers, beginning shortly after the discovery of the various Northwestern

Hawaiian Islands. Counts of hauled out seals at the eight island areas where seals have been known to breed indicate that they declined particularly sharply over the past two and one-half decades. Since the late 1950s, counts of seals hauled out on the beaches have been made almost every year. The highest count for all islands in 1982 was about 50 percent of the high recorded counts for 1956-58. Researchers point out, however, that these figures do not reflect the entire population since it is known that there are at least two seals for every one sighted during the beach counts.

What the counts do show is a continuing downward trend. Of the six areas known to have been used consistently by monk seals during the late 1950s, only islands at the east end of the Hawaiian Islands National Wildlife Refuge—French Frigate Shoals, Necker, and Nihoa—have shown an apparent increase since that time; counts have decreased at the others. The greatest declines have been at Midway and Pearl and Hermes Reef, where recent counts have decreased about 90 percent from 1957-58. Significant decreases at other areas include Kure (80 percent), Lisianski (60 percent), and Laysan (about 65 percent).

During some monk seal counts, data are gathered on the age and sex composition of the population ashore, information useful in predicting future trends. The imbalance in adult sex ratios (many more males than females) detected in seals at some of the islands apparently is a serious limiting factor. It is contributing to behavior that is counterproductive to successful breeding and pup survival. Without corrective measures, it is reasonable to expect that the total number of monk seals will continue to decline.

Natural factors affecting the monk seal population include predation and disease. Sharks probably contribute significantly to monk seal mortality. The disappearance of most pups at Kure at some point between weaning age (about 35 days) and the age of one year may be due in part to shark predation. The impact of disease is not clearly known, but the deaths of at least 50 monk seals at Laysan Island in 1978 are thought to have resulted from eating fish that harbored a naturally occurring toxin. High levels of ciguatoxin were found in monk seal tissues, and it is thought that a "bloom" of the dinoflagellate *Gambierdiscus toxicus* was the source.

Recovery Actions

The *Recovery Plan for the Hawaiian Monk Seal, *Monachus schauinslandi**, was written by William G. Gilmartin, of the National Marine Fisheries Service (NMFS), in cooperation with the Hawaiian Monk Seal Recovery Team,

and was approved on April 1, 1983. NMFS has primary management jurisdiction over most marine mammals, including the monk seal, and is taking the lead in recovery of this species. The Fish and Wildlife Service, which manages the monk seal's beach and near-shore habitat in the Hawaiian Islands National Wildlife Refuge (NWR), provides assistance in the recovery effort.

Because there is not yet enough information to reliably estimate the optimum monk seal population numbers for the Northwestern Hawaiian Islands ecosystem, a quantitative definition of "recovery" is not stated in the plan. However, four intermediate goals are identified: (1) halting the population decline in the central and western parts of the species' range; (2) taking management action that would encourage population growth; (3) identifying and preventing human activities that could degrade the habitat; and (4) determining the population level that would result in maximum net productivity.

Identifying and, where possible, mitigating natural factors that contribute to low monk seal productivity is a major recovery task. In addition, investigations into the behavioral problems resulting from the imbalanced sex ratios among adult seals at various islands will address the possibility and advisability of management attempts to adjust the sex composition by relocating some of the surplus males to another island. This imbalance is a significant limiting factor at several of the islands. Various other problems affecting such subjects as pup survival, which appears to vary greatly among islands, also will be examined.

The need to better identify the monk seal's habitat requirements is a vital part of the recovery plan. In addition to documenting the emergent pupping and haul out sites, researchers collect scat and spew samples to study monk seal food preferences. Quantifying seal predation on commercially important fishes and invertebrates will be necessary to conserve the monk seal in the face of an expanding fishery. Seal consumption of the spiny lobster (*Panulirus penicillatus*), a prized commercial species, is of particular concern. Competition for food is not the only potential fishery related problem for the monk seal; some have been found entangled in discarded fishing nets and line, and this is becoming more of a factor as the fishery develops.

Habitat use studies should include a comparison of the two major habitat types for monk seals in the Northwestern Hawaiian Islands: islands fringed by extensive shallow reef waters and those surrounded by deeper waters. Instruments such as depth-of-dive recorders, radio transmitters, and sonic tags may be used. Tests reveal that there is little effect on the behavior of adult male seals

that have been instrumented. On shore, studies are planned to correlate the available haul out and pupping habitat with current patterns of use by the seals. When this information is combined with data on the availability of preferred prey species, a clearer picture of the habitat's carrying capacity should emerge. The recovery plan recommends a designation of Critical Habitat to help promote the conservation of the Hawaiian monk seal.

A method of following individual seals from time of weaning through their adult life is necessary to develop information for improved management. In 1982, a pilot tagging project was initiated using weaned pups. Many of the older seals have distinctive scars from shark and adult male seal attacks, and these natural marks also have been useful in tracking some individuals to evaluate population composition, haul out patterns, and inter-island movements. A program to record and evaluate monk seal responses to disturbance, including any impacts from the field research itself, has been initiated.

An essential part of the recovery effort will be strict enforcement of the access restrictions covering the Hawaiian Islands NWR. Kure Atoll, which is not part of the national wildlife refuge, has seen its seal population plummet because of disturbance at most of its beaches. The solution recommended in the recovery plan is to move the Coast Guard navigation station to the already developed island at Midway or, at least, to reduce the number of personnel on the atoll. Negotiations are being conducted with the Coast Guard to expand the current "off-limits" area of Kure to include beaches preferred by adult female seals. Experience at Tern Island in the French Frigate Shoals indicates that the benefits could be dramatic if beach disturbance is reduced. Further, overlay protection for currently unused islands in the Midway group as part of the Hawaiian Islands NWR could give additional protection to these once important haul out and pupping sites.

Since low survival rates for seal pups has been identified as a major factor in the species' decline, a trial "headstart" project was conducted at Kure during 1981-82. Monk seal pups were collected and maintained in captivity briefly to increase the probability of their survival upon release. Of eight female pups held in the enclosure during that time, seven were regularly resighted at Kure in 1983 after their release. The headstart project will continue, but pup production at Kure is still well below historical levels. An application has been made for permits to take abandoned seal pups from several small, locally overpopulated monk seal breeding sites at French Frigate Shoals to Kure for headstarting and subsequent release.

Shark control efforts around critical breeding areas also may be appropriate under certain conditions as a means of increasing monk seal survival, especially for pups, but potential impacts on the overall shark population and its ecosystem must first be considered.

Copies of the two recovery plans for Hawaiian forest and sea birds, as well as all other recovery plans approved by the Fish and Wildlife Service, are available for purchase from the Fish and Wildlife Reference Service (FWRS), 1776 E. Jefferson Street, 4th Floor, Rockville, Maryland 20852. (The FWRS can be reached toll-free at 800/582-3421.)

Requests for copies of the Hawaiian Monk Seal Recovery Plan should be addressed to the National Marine Fisheries Service, Southwest Region, 300 South Ferry Street, Room 2016, Terminal Island, California 90731.

Regional Briefs

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one injured; vehicle collisions, two dead, two injured; unknown, one injured. Of the four injured eagles, two were rehabilitated and released.

Winter surveillance of the Bear Valley, Oregon, bald eagle roost site in early February showed about 400 bald eagles present. Although roads into the area are closed during the winter by the Oregon State Police, evidence of snowmobile and three-wheeler all-terrain vehicle intrusion was found. SAs will continue to monitor the site for trespass and disturbance of the eagles.

On January 18, volunteers from the FWS Ecological Service Office in Laguna Niguel, California, and refuge personnel conducted a light-footed clapper rail (*Rallus longirostris levipes*) census at Seal Beach National Wildlife Refuge. A total of 23 were counted. The following day, 13 were counted by two refuge employees. An adequate technique for censusing parts of the rehabilitation area has not been devised, and some birds might go undetected under the current system.

Region 2—This year's bald eagle nesting season in Arizona might be the most productive since studies began in the early 1970s. Of the 14 active nests, the most ever, two are believed to be new. As of April 29, eagles at seven nests had hatched 14 young; at three nests, the eggs failed to hatch, and incubation had not been completed at the remaining four nests. The unhatched eggs will be collected and shipped to the FWS Patuxent Wildlife Research Center for analysis.

The most productive bald eagle nest in Arizona was recently jeopardized by a land-clearing project on the Fort McDowell Indian reservation. After repeated discussions with the Bureau of Indian Affairs, it was necessary for FWS Special Agents to seize the two bulldozers that were clearing mesquite trees within 50 yards of the nest. There are three young reported to be in the nest. Whether or not the disturbance will prevent the adults from tending to them has yet to be determined.

A field survey for nesting bald eagles in the Magdalena Bay region along the west coast of Baja, Mexico, was initiated in early March, cooperatively funded by the FWS and the National Audubon Society. Eugene Knoder and Erv Boeker found one fledged eagle at one site, a pair of unhatched eggs at a second site, and an abandoned (possibly inactive) nest at a third site. All nests are on islands in stands of red mangroves. The nests were discovered in 1977 by C. J. Henny and D. W. Anderson, but had not been checked again until earlier this year when FWS waterfowl biologist Jim Voelzer observed incubating eagles on two nests.

The Wood Buffalo/Aransas whooping crane (*Grus americana*) population is being radio-tracked again this year during spring migration. Migration began in late March, with the whoopers leaving Aransas National Wildlife Refuge in Texas on their long flight to Wood Buffalo National Park in Canada. This is the fourth year of the radio tracking effort.

The razorback sucker (*Xyrauchen texanus*) program is in full swing again in Arizona this year, with 1.6 million fry already produced at Dexter National Fish Hatchery (NFH) and stocked into the Salt River. Another 2 million fry were scheduled for release into the same river in April 1984, and 100,000 fingerlings are being reared at Dexter NFH for stocking into the Gila and Verde Rivers later this year. A similar stocking program was scheduled for the San Juan River in New Mexico, but was withdrawn at the request of the State. This is the fourth year of the program in Arizona.

Region 3—Region 3 Endangered Species personnel participated in a U.S. Forest Service (USFS) Timber/Wildlife Workshop, which was set up to determine ways of conserving wildlife while meeting USFS timber management goals.

The staff also has been meeting with the U.S. Army Corps of Engineers (COE), the State of Wisconsin, and an applicant for a COE permit with regard to a pro-



Photo by Mike Amara

Region 7 biologist Skip Ambrose collecting prey remains at a peregrine falcon nest along the Charley River, Alaska

posed barge-fleeting project on the Mississippi River near Prairie du Chien, Wisconsin. According to the developer's plans, the project would be constructed near habitat that has been determined essential to the conservation of the Endangered Higgins' eye pearly mussel (*Lampsilis higginsii*).

Region 5—Based on preliminary surveys, the Region 5 Endangered Species office is anticipating big improvements this year in bald eagle and peregrine falcon (*Falco peregrinus*) populations throughout the region. As of early April, there were reports indicating that 16 pairs of peregrines in the eastern U.S. have established territories.

Observers with the Maine bald eagle winter feeding study have recorded 120

different bald eagles, which suggests that eagle survival in this population might be greater than once thought.

The Region 5 Office has initiated population biology studies on the Furbish lousewort (*Pedicularis furbishiae*), small whorled pogonia (*Isotria medeoloides*), and Robbin's cinquefoil (*Potentilla robbinsiana*).

Region 7—The Alaska region's endangered species program received considerable media attention in March. In recognition of the 10th anniversary of the Endangered Species act, an Anchorage television station featured a 30-minute program on FWS endangered species work in Alaska. Jon Nelson, Assistant Regional Director, and Dennis Money, Endangered Species Coordina-

tor, explained the goals, objectives, and accomplishments of the program. Film of recovery activities for the Aleutian Canada goose (*Branta canadensis leucopareia*) and peregrine falcon also was shown. A recent *National Geographic* publication, *Alaska's National Parks*, has an article and several excellent photographs of FWS Fairbanks field station biologist Skip Ambrose while he was conducting peregrine falcon recovery activities in the Yukon-Charley National Park and Preserve. Also, the current issue of *Alaska Magazine* has a photograph and short article on the Aleutian Canada geese loaned to the Alaska Zoo last fall.

BULLETIN Available by Subscription

The *Endangered Species Technical Bulletin* is now available by paid subscription to persons not eligible to receive this publication regularly without charge. In partnership with the World Wildlife Fund-U.S., the Wildland Management Center at the University of Michigan's School of Natural Resources will be reprinting and distributing the BULLETIN (at cost) each month, along with a clearly distinguishable insert summarizing their activities. For each subscription of 12 monthly issues, send \$12.00 by check or money order (payable to the University of Michigan) to Endangered Species Technical Bulletin, Wildland Management Center, School of Natural Resources, University of Michigan, Ann Arbor, Michigan 48109.

Due to budgetary constraints, the Fish and Wildlife Service has to limit its free distribution of the BULLETIN to Federal employees and official contacts of the Endangered Species Program. Those who have already been receiving the BULLETIN will continue to do so at no charge.

CITES News

The Endangered Species Act of 1973, as amended in 1979, designates the Secretary of the Interior as both the Management Authority and the Scientific Authority of the United States, for the purposes of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Management Authority responsibilities are delegated to the Associate Director—Federal Assistance; Scientific Authority responsibilities are delegated to the Associate Director—Research.

The Service's Wildlife Permit Office (WPO) functions as staff to the U.S.

Management Authority for CITES, ensuring that wildlife and plants are exported or imported in compliance with laws for their protection and issuing permits for legal trade of these species. The Service's Office of the Scientific Authority (OSA) functions as staff to the U.S. Scientific Authority for CITES. OSA reviews applications to export and import species protected under CITES, reviews the status of wild animals and plants impacted by trade, makes certain findings concerning housing and care of protected specimens, and advises on trade controls.

Illinois Ginseng Export Approved

The Service published a notice in the March 19, 1984, *Federal Register* adding Illinois to the list of States receiving export approval for ginseng legally harvested during the 1982-1984 seasons. This notice amends the Service's October 7, 1983, notice of export findings for States that had their own requirements for current information about ginseng population status, management, harvest, and State controls. Ginseng (*Panax quinquefolius*) is on CITES Appendix II, which requires the approval of the U.S. CITES Scientific and Management Authorities for export to another country.

Owens Tui Chub

continued from page 3

Although no Federal involvement is anticipated in these areas, the economic effects of a Critical Habitat designation will be considered.

The areas of Critical Habitat included in the listing proposal include the entire current range of the Owens tui chub, which consists of only two locations. One segment of the Critical Habitat is on the Owens River, from Long Valley Dam downstream for eight miles. This location continues to support a small but viable population of the Owens tui chub despite heavy predation by exotic brown trout. The only other location where a pure population of the Owens tui chub remains is in the headwater springs and outflow of Hot Creek. Since maintenance of the aquatic ecosystems depends in part on the conservation of nearby riparian habitat, a zone of 50 feet along the streams and around the springs is included as part of the Critical Habitat proposal.

Other benefits to the Owens tui chub of a listing under the Endangered Species Act include possible Federal funding of State conservation programs for this fish and development of a plan to help bring about its recovery. Efforts are now underway to establish a population of the Owens tui chub in Fish Slough, north of Bishop, California. Fish Slough currently provides habitat for another Endangered fish, the Owens River pupfish (*Cyprinodon radiosus*), and historically was habitat also for the Owens tui chub.

Back Issues of BULLETIN Available

Back issues of the *Endangered Species Technical Bulletin* are available from the Fish and Wildlife Reference

BOX SCORE OF LISTINGS/RECOVERY PLANS

Category	ENDANGERED			THREATENED			SPECIES* TOTAL	SPECIES HAVING PLANS
	U.S. Only	U.S. & Foreign	Foreign Only	U.S. Only	U.S. & Foreign	Foreign Only		
Mammals	15	18	223	3	0	22	283	19
Birds	51	14	144	3	0	0	212	40
Reptiles	8	6	55	8	4	12	98	6
Amphibians	5	0	8	3	0	0	16	3
Fishes	29	2	11	12	0	0	56	23
Snails	3	0	1	5	0	0	9	5
Clams	23	0	2	0	0	0	25	1
Crustaceans	3	0	0	1	0	0	4	1
Insects	7	0	0	4	2	0	13	3
Plants	55	2	0	9	1	2	69	9
TOTAL	199	44	444	48	7	36	785	113**

* Separate populations of a species, listed both as Endangered and Threatened, are tallied twice. Species which are thus accounted for are the gray wolf, bald eagle, American alligator, green sea turtle, and Olive ridley sea turtle.

** More than one species may be covered by some plans.

Number of Recovery Plans approved: 110

Number of species currently proposed for listing: 23 animals
23 plants

Number of Species with Critical Habitats determined: 59

Number of Cooperative Agreements signed with States: 38 fish & wildlife
12 plants

March 31, 1984

Service (FWRS), a private entity that disseminates publications for a number of U.S. Fish and Wildlife Service programs under government contract.

Available "hard copy" issues will be sent free of charge upon request for as long as the supply lasts. A set of back issues (July 1976-June 1982) is available on microfiche for \$3.00. For those who already have the earlier microfiche compilation (July 1976-November/December 1980), a supplement (through June 1982) is available for \$1.00. Please state clearly which "hard copy" issues (month and year) you wish to receive and/or send money for microfiche copy.

The FWRS information retrieval system also selectively covers other pub-

lished and unpublished research reports resulting from the Endangered Species Program (including recovery plans), Cooperative Fish and Wildlife Research Units, Federal Aid in Fish and Wildlife Restoration Program (Pittman-Robertson and Dingell-Johnson Acts), and Anadromous Sport Fishing Conservation program.

Orders should be addressed to the Fish and Wildlife Reference Service, 1776 E. Jefferson Street, 4th Floor, Rockville, Maryland 20852, or call toll-free at 800/582-3421. Information on which other documents are available and on fees will be included in a quarterly FWRS newsletter that will be sent free to those requesting it.

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