MANAGEMENT OF AMERICAN WHITE PELICANS IN IDAHO

A five-year plan (2009–2013) to balance American white pelican and native cutthroat trout conservation needs and manage impacts to recreational fisheries in southeast Idaho

August 17, 2009

EXECUTIVE SUMMARY

Numbers of American white pelicans (*Pelecanus erythrorhynchos*), including adult nesting birds, have increased dramatically in southern Idaho since 2002. These increases have been well documented at Idaho's two nesting colonies located on islands in Blackfoot Reservoir and Lake Walcott (Minidoka National Wildlife Refuge). Numbers at Lake Walcott increased from approximately 400 breeding birds in 2002 to more than 4,000 breeding birds in 2008. The Blackfoot Reservoir colony has increased from approximately 1,400 breeding birds in 2002 to 2,400 breeding birds in 2008. Pelican distribution and abundance has increased at other water bodies throughout southeastern Idaho.

Increases in pelican populations are generally considered as positive contributions to pelican conservation goals in the Western population segment, but the increased number of pelicans has also resulted in documented predation impacts on native cutthroat trout subspecies and other important recreational fisheries. The primary concern is for native Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*; henceforth YCT) and predation by pelicans in the Blackfoot Reservoir-Blackfoot River complex. Idaho Department of Fish and Game (IDFG) believes there is a need to develop an approach to manage impacts of pelicans on trout in Idaho that balance conservation and recreation interests for both birds and fish.

IDFG has conducted numerous management actions in recent years in an attempt to reduce impacts of pelicans on trout in the Blackfoot Reservoir-Blackfoot River complex. Trout stocking practices were modified to reduce opportunistic predation by pelicans. Significant hazing actions, including noise making and bird wires, have been conducted in an attempt to reduce pelican predation on migrating YCT. These efforts have been expensive and have had limited success. Limited lethal control was authorized by the U.S. Fish and Wildlife Service in an attempt to increase the effectiveness of hazing. Hazing, supplemented with limited lethal control, did not result in measurably fewer foraging pelicans.

This document represents the IDFG-proposed five-year management plan (2009–2013) for reducing pelican predation on fish in areas where current management conflicts exist. The plan identifies both statewide and regional pelican population and management objectives. In southeast Idaho (IDFG Southeast Region), where impacts of birds on fish are greatest, the regional population objective is to maintain a five-year average of 700 breeding pelicans at Blackfoot Reservoir. Management objectives in this region are to achieve the desired numbers of breeding pelicans by 2013, to reduce pelican predation on migrating YCT, and to reduce pelican predation on sport fish in key recreational fisheries.

The overall goal of this plan is to maintain viable breeding populations of pelicans while reducing impacts to key recreational fisheries and special status fish. Emphasis is on reducing predation pressure on spawning YCT in the Blackfoot River through a combination of management actions that could include non-lethal and lethal hazing of foraging birds, manipulation of nesting habitat, and/or directly limiting pelican production and recruitment. Comprehensive monitoring of both bird and fish populations will facilitate an adaptive management approach throughout the life of this plan.

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INTRODUCTION

Pelicans

American white pelicans (*Pelecanus erythrorhynchos*) breed at two nesting colonies in Idaho and numbers have increased significantly at both since the turn of the Century. The pelican colony on Blackfoot Reservoir has increased from approximately 200 breeding birds in 1993 to almost 2,400 in 2008. The colony at Minidoka National Wildlife Refuge (NWR) has encountered similar growth and exceeded 4,300 breeding birds in 2008. When the young birds from these colonies fledged, the 2008 Idaho pelican population attributed to these colonies potentially reached an estimated annual peak of almost 9,000 birds (6,698 adults).

Increases in pelican distribution and abundance have also been documented throughout southern Idaho, generally coinciding with documented population increases at the nesting colonies. This growing pelican population has resulted in increased impacts to fish populations. In some areas, pelicans predominately forage on abundant populations of nongame fish resulting in non-consequential or acceptable impacts. However, in some areas pelican predation is measurably impacting native trout populations and recreational fisheries resulting in resource conflicts.

Pelican Adaptability to an Artificial Environment in Southern Idaho

Pelicans likely inhabited parts of Idaho before European settlement. However, the environments in southern Idaho where pelicans are currently nesting are entirely artificial ones created by reservoir construction. Large water projects such as Blackfoot Reservoir and Lake Walcott (Minidoka NWR), constructed in the early 1900s, have provided substantial open water habitats with abundant forage. The islands produced by reservoir development are largely free of terrestrial predators making them safe havens for pelicans and other ground-nesting birds.

These large, open water environments have resulted in burgeoning populations of nongame fishes such as carp (*Cyprinus carpio*) and Utah chub (*Gila atraria*). While these species largely comprise the bulk of the diet of feeding pelicans, hatchery rainbow trout that are stocked in Blackfoot Reservoir and other locations to provide recreational fisheries can be significantly impacted. Low flows in the Blackfoot River increase vulnerability of Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*; YCT) to predation by pelicans. Pelicans have proven highly adaptable to these artificial environments with both nesting colonies increasing in size due to the availability of safe nesting habitat and abundant prey.

Cutthroat Trout

Opportunistic and directed foraging on YCT spawners by pelicans is impacting fish stocks that migrate out of Blackfoot Reservoir into the Blackfoot River to spawn. Opportunistic foraging behavior by pelicans is becoming more common on other native cutthroat trout populations, such as Bonneville cutthroat trout (*O. clarkii utah*; BCT), elsewhere in southeastern Idaho. Foraging by pelicans at St. Charles Creek (tributary to Bear Lake; BCT) and McCoy Creek (tributary to Palisades Reservoir; YCT) has been noted where native cutthroat trout concentrate while

migrating upstream to spawn. While IDFG lacks empirical evidence of bird impacts on fish in these river systems as they do for the Blackfoot River, observations by professional staff suggest they could be significant. As a result, IDFG fishery managers will continue to assess both pelican presence and numbers at these key spawning tributaries during the life of this plan and beyond.

Previous Efforts to Reduce Impacts of Birds on Fish at Blackfoot Reservoir

Past actions to reduce impacts of foraging pelicans on native YCT in Blackfoot Reservoir include hazing with zon guns, cracker shells, airboat, and putting flagged lines across the river to exclude pelican foraging activity. These activities require significant resources including staff time. Most of these hazing actions met with limited success, perhaps in part because of constraints on the time and duration for which they were conducted. Monofilament lines were effective in reducing pelican impact on spawning YCT in the Blackfoot River (D. Teuscher, *pers. comm.*), but water levels strongly influenced that effectiveness (Wackenhut and Farnsworth 2006).

In 2005, IDFG obtained a scientific collecting permit from the U.S. Fish and Wildlife Service (USFWS) authorizing take of up to 50 pelicans. IDFG requested this permit in order to evaluate the effectiveness of using lethal control, in addition to hazing, to reduce the impacts of pelicans on YCT as they move from the Blackfoot Reservoir upstream to spawn in the Blackfoot River.

Lethal control in conjunction with hazing resulted in taking 13 pelicans over a two-day period in May 2006 at the mouth of the Blackfoot River. As recommended by USDA/APHIS Wildlife Service personnel, pelican carcasses were left on site to further deter pelicans from using the area. There is little indication that this was effective and in fact the pelican carcasses may have attracted other birds to the area. Counts indicate that pelican numbers decreased slightly at the mouth of the river following these control actions but the number of birds present was still high.

In 2008, a volunteer crew hazed pelicans on the Blackfoot River from the fish trap to the mouth of the Reservoir from mid-May through mid-June. Hazing using pyrotechnics was conducted at least twice daily. Lethal control was also implemented and resulted in the take of 10 pelicans. Although pelicans left the immediate area during hazing events, hazing activity did not appear to reduce pelican use in the long term. However, even short-term reduction in pelican foraging may have benefits for migrating trout. Control efforts employed elsewhere to reduce impacts from pelicans and double-crested cormorants are reviewed in Appendix I.

Plan Goals and Objectives

The overall goal of this plan is to maintain viable breeding populations of pelicans while reducing impacts to key recreational fisheries and special status fish. Emphasis is on reducing predation pressure on spawning YCT in the Blackfoot River through a combination of management actions that could include non-lethal and lethal hazing of foraging birds, manipulation of nesting habitat, and/or directly limiting pelican production and recruitment. Comprehensive monitoring of both bird and fish populations will facilitate an adaptive management approach throughout the life of this plan.

AMERICAN WHITE PELICAN

Ecology

The American white pelican is the second largest bird in North America, next to the California condor (*Gymnogyps californianus*). There are currently 134,000 breeding pelicans in North America (King and Anderson 2005) and an unknown number of non-breeding pelicans. Pelicans are divided into two separate populations (eastern and western) based on their breeding and wintering distributions, and as a reflection of the contrasting ecological conditions they inhabit. Pelicans from the western population (including Idaho's birds) breed west of the Rocky Mountains in 13–15 nesting colonies totaling an estimated 46,000 breeding birds (Fig. 1).

Distribution and Migration—Breeding range for the pelican is from Canada through Minnesota, the Dakotas, Montana, Wyoming, Colorado, Utah, Nevada, California, Oregon, and Idaho. Winter range includes the Pacific coast from central California south to Mexico and the Yucatan Peninsula. Pelicans migrate annually, traveling to northern breeding grounds during the spring, and returning to winter range during the fall. Winter range includes southern and western coastal marine habitats, including shallow coastal bays, inlets, and estuaries (Chapman 1988). Birds usually winter where minimum January temperature stays above 40° Fahrenheit (Root 1988).

Breeding—Pelicans breed colonially on isolated islands in lakes of the inland northern U.S. and Canada, and require minimal disturbance at the nesting colony for successful nesting and rearing of young. When disturbance is significant, pelicans may abandon their nests or young (Knopf and Evans 2004). Breeding begins at age 3 (Sloan 1982), and individuals likely breed each year thereafter (Knopf and Evans 2004). Although pelicans lay two eggs per clutch, it is rare for more than one chick to fledge. Young are capable of flight at 9–10 weeks and typically begin leaving the colony in late August to early September (O'Malley and Evans 1982).

Reproductive Success and Survival—Nest success averaged 0.86 chicks / nest (n = 1,343) at Gunnison Island, Great Salt Lake (Knopf and Evans 2004). At Chase Lake NWR, North Dakota, reproductive success ranged from 0.34 (n = 5,268) to 0.68 (n = 6,142) chicks / nest (Sidle et al. 1984). Considered collectively, these studies suggest pelican production approximates 0.63 chicks / nest on average. After fledging, mortality has been estimated at 41% through the first year, 16% in the second year, and a mean of 21.3% for the third through thirteenth year (Strait and Sloan 1974). The average lifespan of a pelican is 12–14 years, although the maximum reported lifespan is 26.4 years (Clapp et al. 1982).

Feeding Habits—Pelicans require shallow water (typically 1–2 ft; Ivey and Herziger 2006), or fish that can be reached within 4.1 ft of the surface of deep water. In most circumstances, this leads to a diet predominantly comprised of nongame fish such as chubs, suckers (*Castostomus* sp.), and carp (Knopf and Evans 2004, Teuscher 2004). However, pelicans are opportunistic foragers, selecting sites and prey that are most readily available (Hall 1925; Knopf and Kennedy 1980, 1981; Lingle and Sloan 1980; Flannery 1988; Findholt and Anderson 1995). They are cooperative feeders that will push schools of fish to shore (or toward a culvert/weir) by forming a

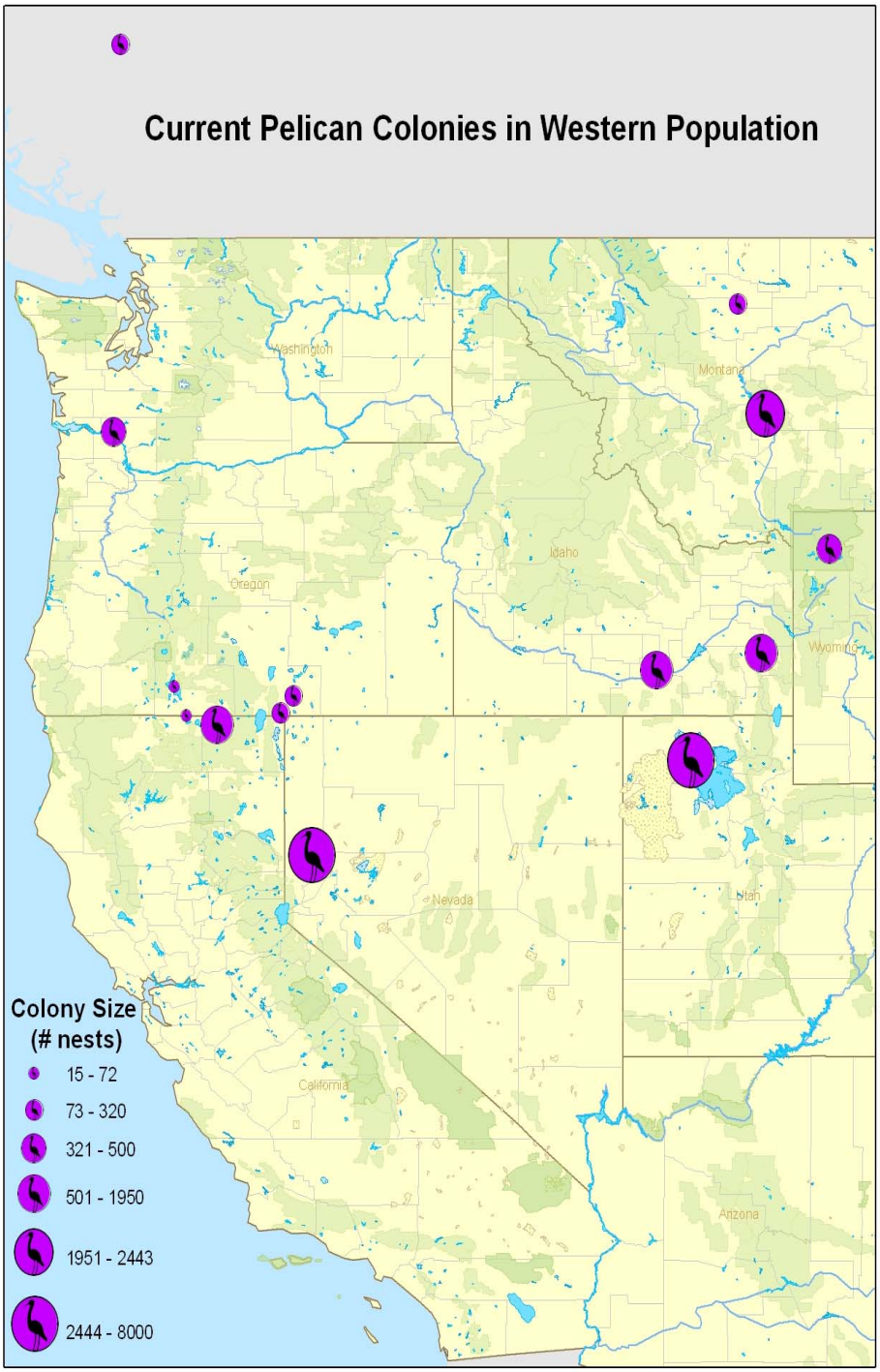

Figure 1. Current locations and relative sizes of western pelican colonies. Compilation of recent data from: Hendricks and Johnson 2002; Ivey and Herziger 2006; McEneaney 2006; J. Beckstrand, pers. comm.; J. Luft, pers. comm.; E. Roberts, pers. comm.; D. Roby, pers. comm.; and D. Withers, pers. comm. The range in number of colonies is a result of two colonies (Malheur NWR and Lower Klamath) being inactive or unproductive in recent years.

herding wing. Foraging groups are generally less than 10 birds in size, but can be as large as 300 birds. Pelicans are capable of successfully foraging at night. Nestlings close to fledging are fed approximately 2.4 lbs of fish once a day (Knopf and Evans 2004). Breeding adult foraging requirements have been estimated at 4.0 lbs per day (20–40% of body mass). Total food to rear one young to fledging was estimated to be 150 lbs (Hall 1925). During the breeding season, foraging sites generally need to be within 50 miles of the nest colony, but it is not uncommon for pelicans to regularly travel up to 80 miles to find food (Findholt and Anderson 1995, D. Withers, *pers. comm.*). Idaho likely provides a substantial amount of foraging habitat for nesting birds from Utah's colony at the Great Salt Lake (~25% of the western population), and migrating birds from Utah, Montana, and Wyoming (~38% of the western population).

Population Trends

Rangewide—The continental population of pelicans experienced long-term historical declines until the 1960s (Knopf and Evans 2004). The population has subsequently experienced a steady increase since the 1980s, likely due to the decrease in the use of organochlorine pesticides, increased federal and state protection, and the adaptability of pelicans (Keith 2005).

Western Population—In the early 1900s, there were approximately 24 breeding pelican colonies in the western population segment, and 60,000 breeding birds (compilation of data from: Schaller 1964; Shuford 2005; Keith 2005; D. Withers, *pers. comm.*; Luft, *pers. comm.*). According to the USFWS (USFWS 1984), this included four colonies in Idaho but two were unproductive. By the late 1970s, the western population declined to eight productive colonies and 16,000 breeding birds, none of which were in Idaho.

Following the decline in pelican abundance in the western population, the USFWS drafted the "Guidelines for the Management of the American White Pelican, Western Population" in 1984, in hopes of establishing/reestablishing colonies in the West to avoid potential ESA listing of the western pelican population. Breeding Bird Survey data for pelicans show a positive short-term trend of 2.8%/yr ($P = 0.05$) for the western population during 1980-2007 (Sauer et al. 2008). Three new colonies were established in the early 1990s and include Arod Lake (MT), Canyon Ferry Reservoir (MT), and Badger Island on the Columbia River (WA). Current information indicates the western population has increased to 13–15 productive colonies and approximately 46,000 breeding birds (compilation of recent data from Hendricks and Johnson 2002; Ivey and Herziger 2006; McEneaney 2006; J. Beckstrand, *pers. comm.*; J. Luft, *pers. comm.*; E. Roberts, *pers. comm.*; D. Roby, *pers. comm.*; and D. Withers, *pers. comm.*). Idaho currently supports approximately 16% of the western pelican breeding population and is the third largest relative contributor to this nesting population (Fig. 2).

Idaho Population—The two documented nesting colonies in Idaho are located at Blackfoot Reservoir and Minidoka NWR. The Blackfoot Reservoir colony (Gull Island) originated shortly after the construction of Blackfoot Reservoir in 1910. In 1962, approximately 200 nests were destroyed by local anglers (Burleigh 1972). Surveys conducted in the mid-1980s documented adult birds but no evidence of nesting (Trost 1985). In 1991 and 1992, IDFG contracted with USDA Wildlife Services to remove native predators (badgers) from Gull Island. The following

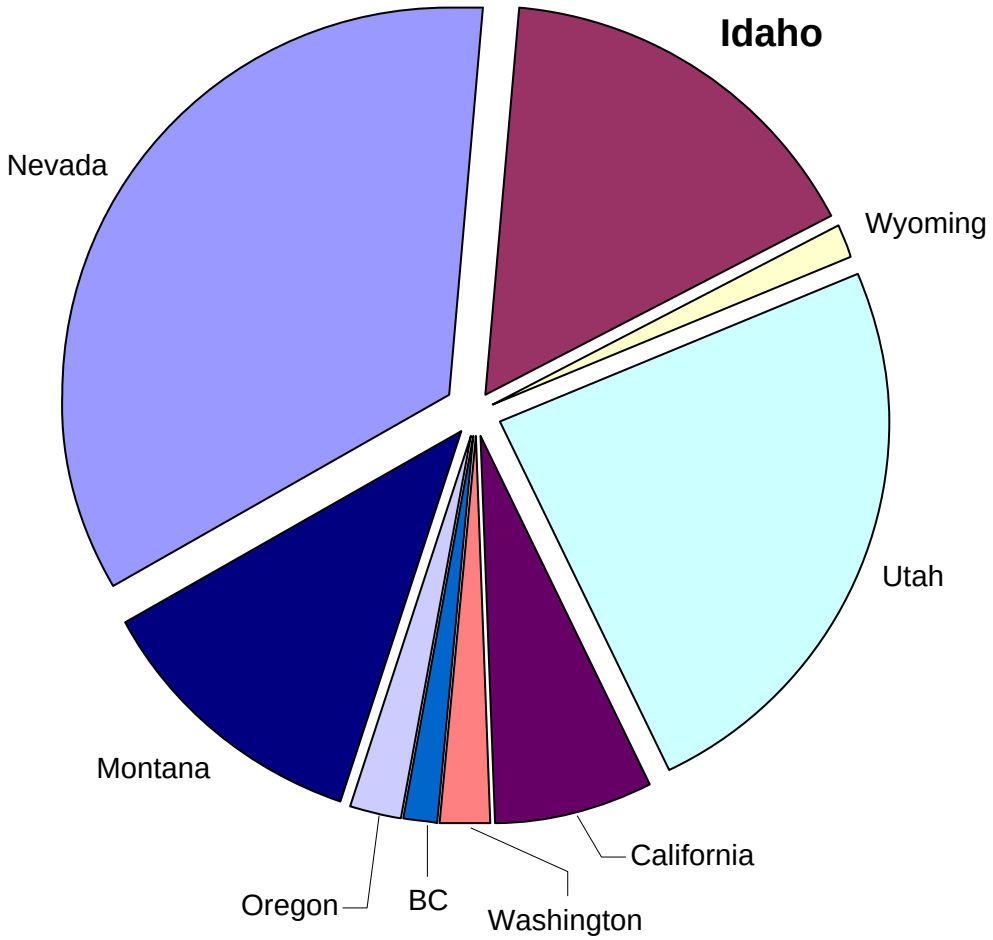

Figure 2. Relative contribution by state and province of breeding adult American white pelicans in the western population (these data represent the best available population estimates as of 2007).

year (1993) was the next record of pelican production at Blackfoot Reservoir when 80–100 nearly-fledged young were observed (Trost and Gerstell 1994). IDFG began surveying the colony in 2002 and counted 1,352 breeding birds. Since 2002, the colony increased to 3,418 breeding birds in 2007 but declined to 2,390 breeding birds in 2008 (Fig. 3).

The Minidoka NWR colony in Lake Walcott was active in the early 1910s, but became inactive in the late 1950s, likely as a result of disturbance from recreational boating near the nesting islands (USFWS 1984). Pelicans were successful at reestablishing this colony in the 1980s. Since this time, overall abundance has increased to the most recent estimate of 4,308 breeding birds (Fig. 4).

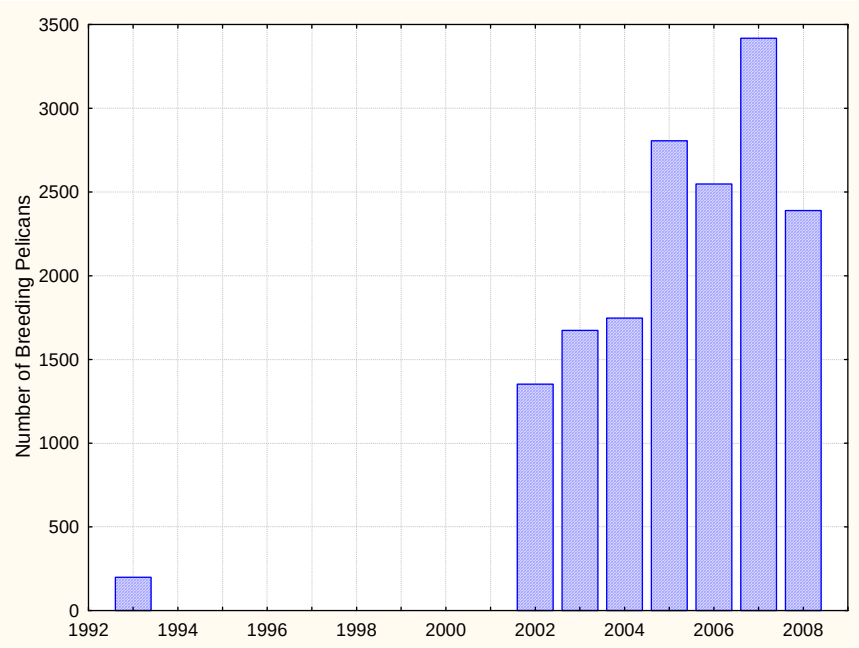

Figure 3. Number of breeding pelicans at Blackfoot Reservoir, 1993 and 2002–2008.

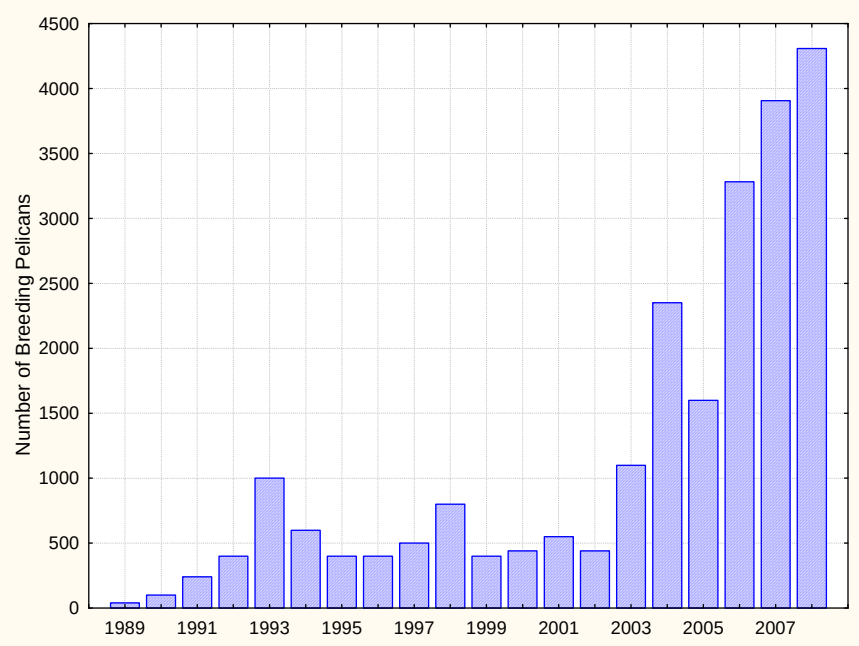

Figure 4. Number of breeding pelicans at Minidoka National Wildlife Refuge, 1989–2008. A change in survey technique likely accounts, in part, for the increased number of birds in 2006–2008 (counts prior to 2006 were conducted from the reservoir shoreline using optics rather than by entering the colony on foot and counting nests).

Conservation status—Standard natural heritage methodology developed by NatureServe (a nonprofit organization) is used to verify species populations and to assess their current conservation condition across their range and within individual states and provinces (http://www.natureserve.org/aboutUs/network.jsp). In 1993, NatureServe ranked pelicans rangewide as G3, or "vulnerable." The primary reason cited for the ranking was that only about 70 breeding colonies existed and many appeared to be threatened by habitat loss and water level problems (NatureServe 2008). Current threats to the western population include relatively few colonies, large fluctuations in colony size and productivity, disease pandemics, and possibly West Nile virus.

The same methodology was used by IDFG (a member program of NatureServe) in 2004 to calculate a state conservation rank of S1B, or "critically imperiled." This rank is used to describe extreme rarity, often due to five or fewer occurrences (one nesting colony = one occurrence), making pelicans especially vulnerable to extirpation from the state or province. Following four years of population growth, the calculation was repeated by IDFG and yielded the same ranking in 2008. Relative rarity based on natural heritage methodology has not changed in light of the recent population growth of pelicans in Idaho. Ultimately, the number of nesting colonies (five or fewer) and population size (2,500–10,000 individuals) have a major influence on the state conservation status based on natural heritage methodology.

Other efforts to assess the conservation status of the pelican include Audubon's watchlist (status is "green" for the pelican indicating no current conservation concerns) and the International Union for Conservation of Nature's (IUCN) Red List (the pelican is categorized as being of "least concern" – the lowest rank for species with adequate data to make an assessment).

State classification—State fish and wildlife agencies have different classification systems, but pelicans are generally classified as a species of concern in all eight western states in which they breed. In Idaho, pelicans are classified as "priority species" under the Idaho Administrative Procedures Act (IDAPA) and as "protected nongame" by IDFG. The Idaho Comprehensive Wildlife Conservation Strategy (CWCS) identifies the pelican as one of 229 "species of greatest conservation need" due to (1) low breeding and disjunct populations in Idaho, and (2) a vulnerable rangewide conservation status (IDFG 2005). The Idaho CWCS recommended the following actions to benefit pelicans in Idaho:

- protect wetlands and water levels
- monitor breeding colonies
- protect colonies from disturbances and educate the public about this concern
- educate the public about foraging habits and food preference

IDFG will consider these recommendations when visiting breeding colonies for management needs.

CUTTHROAT TROUT

Ecology

YCT and BCT are both species of concern in the state of Idaho and are listed as species of greatest conservation need in the Idaho CWCS. According to IDAPA, cutthroat trout are classified as “game fish.”

Cutthroat trout are spring spawners. The timing of spawning activities is dependent on latitude, altitude, water temperature, and spring water flows (Varley and Gresswell 1988). In the Upper Snake River Basin, YCT are known to spawn from approximately April through June (Thurow et al. 1988). Bear Lake BCT also complete spawning activities during this period (Neilson and Lentsch 1988). Cutthroat fry emergence begins as early as July and continues into early fall (Thurow et al. 1988). The timing of juvenile emigration varies among populations, but may occur shortly after emergence or up to several years following (Neilson and Lentsch 1988, Thurow et al. 1988).

YCT and BCT exhibit multiple migratory spawning patterns across their native range including fluvial, adfluvial, lacustrine, and allacustrine patterns (Thurow et al. 1988, Varley and Gresswell 1988). Multiple migratory spawning patterns may also exist within drainages. YCT within the Blackfoot River drainage maintain a combination of both fluvial and lacustrine migratory patterns (Thurow et al. 1988). Migratory adults typically remain in spawning tributaries for only a short period (Thurow et al. 1988).

Maturation of adult cutthroat is inconsistent between subspecies and populations. Maturity of YCT occurs from three to seven years of age (Thurow et al. 1988). Maturation of Bear Lake BCT is notably delayed from other BCT, occurring at five to 10 years of age (Nielson and Lentsch 1988). A small proportion of mature YCT and Bear Lake BCT repeat spawn (Neilson and Lentsch 1988, Thurow et al. 1988).

Genetics

YCT and BCT are native to southeastern Idaho (Behnke 1992). YCT inhabit the Upper Snake River Basin and are currently distributed in up to 45 populations within 11 geographic management units (GMUs) (Cegelski et al. 2006, IDFG 2007). Cegelski et al. (2006) evaluated YCT genetics in the Upper Snake River Basin. Their analysis suggests that genetic diversity is strongly partitioned among drainages.

Drainage-specific GMUs for YCT defined in the Upper Snake River Basin include the Blackfoot River, Dry Creek, Goose Creek, Henry’s Lake, Palisades/Salt River, Portneuf River, Raft River, Sinks drainages, South Fork Snake River, Teton River, and Willow Creek. Five ecologically-based GMUs have been defined for BCT. Defined GMUs include Bear Lake, Bear River, Northern Bonneville, West Desert, and Southern Bonneville (Lentsch et al. 2000). Defined ecological boundaries within Idaho include only portions of the Bear Lake and Bear River GMUs.

The Blackfoot River GMU designation is supported by microsatellite DNA analyses that show low levels of genetic differentiation among populations within the Blackfoot River (three sites), but relatively high levels of genetic differentiation in comparisons of populations within the Blackfoot River to other YCT populations outside the drainage (Cegelski et al. 2006). The Blackfoot River's GMU designation is also supported by mitochondrial DNA analyses that indicate that the most frequent haplotype found in samples from the Blackfoot River drainage has not been observed in any sample collected outside the drainage (IDFG, unpublished data).

Fish Populations

The number of fluvial YCT residing in the upper Blackfoot River and tributaries appears to be stable on the six-mile river reach within the IDFG Blackfoot River Wildlife Management Area where estimates of 4,092 and 3,564 YCT at least one year old have been made in 2005 and 2006, respectively. YCT exhibiting fluvial life history can sustain the overall YCT population through low water years and low carryover storage in Blackfoot Reservoir (IDFG 2007).

Several factors have historically contributed to the variation observed in the adfluvial YCT population, including water storage levels in the reservoir, river discharge during spring spawning migrations, mining activities, livestock grazing, angler overfishing, and predation by pelicans. Both phosphate mining and livestock grazing have been ongoing in upriver tributaries for decades. However, overall, grazing has declined along riparian corridors in the basin due to several large conservation-related land acquisitions. Low water storage levels in Blackfoot Reservoir could theoretically impact YCT abundance, but the population has increased even during prolonged drought periods such as the 1990s (IDFG, unpublished data). Adfluvial YCT in the upper Blackfoot River declined markedly during the period from 1980–1988. This decline was believed to be the result of angler overexploitation. In 1990, angling regulations for YCT were changed to no harvest in the reservoir and two trout over 18 inches on the river with a bait restriction. By 2000, YCT numbers in the river had increased dramatically compared to 1988 levels (IDFG 2000). In 1998, angler harvest on the river was also completely prohibited. Thus it has been unlawful for anglers to harvest YCT from the reservoir or river for over a decade.

The adfluvial spawning run of YCT in the Blackfoot River declined from 4,747 fish in 2001 to about 100 in 2007 (Table 1). In 2008, the run increased five-fold (540) from the number observed in 2007, but the run remains well below those at the start of the decade. IDFG believes that in below-normal water years, predation by pelicans is the single most limiting factor to survival of adult adfluvial YCT in the Blackfoot River. In above normal water years, however, based on both YCT run data and photographic records of river use by pelicans, avian predation likely represents a less significant limiting factor to overall adult adfluvial YCT survival.

Table 1. Blackfoot River YCT spawning escapement, number of breeding pelicans, percent YCT bird scars, reservoir storage of Blackfoot Reservoir, and Blackfoot River discharge, 2001–2008.

Year	Weir Type	YCT Count	Pelican population	% Bird Scars on YCT	Reservoir Storage (acre-feet)	Mean May River Discharge (cfs)
2001	Floating	4,747	No data	No data	230,322	74
2002	Floating	902	1,352	0	142,775	132
2003	Electric	427	1,674	No data	97,620	151
2004	Electric	125	1,748	70	58,370	127
2005	Electric	16	2,806	6	130,150	388
2006	Electric	19	2,548	38	218,000	453
2007	Electric	98	3,418	15	210,000	115
2008	Electric	540	2,390	9	141,715	409

PELICAN IMPACTS ON FISH

Pelican Predation on YCT

Beginning in 2003, concentrations of 50–100 pelicans began foraging at the mouth of the Blackfoot River. Since then, the frequency and abundance of pelicans foraging on migrating fish has increased commensurate with the pelican nest count trends monitored on Gull Island in Blackfoot Reservoir. Table 1 shows trends in YCT spawning escapement, pelican population, and water storage.

Low water storage in Blackfoot Reservoir also contributed to increased predation by pelicans on fluvial YCT. During the past seven years, water storage in Blackfoot Reservoir has been drawn down to meet irrigation demands. When reservoir levels are significantly below full pool, the migration corridor used by fluvial cutthroat trout is shallow, longer in length, and subjects migrating fish to a greater risk of predation.

Direct predation by pelicans on migrating YCT was documented in 2004 and again in 2007. The predation rates were measured by implanting radio telemetry tags in migrating fish and recovering those tags from pelican nests on Gull Island. In the 2004 telemetry study, four of 28 (14%) tags were recovered from pelican nests on Gull Island. In 2007, the predation estimate increased to 33% (nine of 27 tags recovered on Gull Island). The predation estimates are conservative because they do not take into account any predation that occurs prior to migrating

cutthroat reaching the weir, and predation rates are calculated using only tags that were deposited by pelicans on Gull Island. Pelicans likely defecate fish telemetry tags in other areas and are not recovered. These tags were classified as mortalities from unknown predators. For example, in the 2004 study, 10 fish tags were recovered on land in areas other than Gull Island.

In addition to the tagging studies, to estimate pelican use and predation, cameras have been deployed along the Blackfoot River where pelicans concentrate to feed. The cameras were installed in 2007 and were placed in the same locations in 2008. The cameras record hourly abundance of pelicans using key reaches of the Blackfoot River. To date, the photograph files have provided documentation of peak use during fish spawning migrations, diet foraging patterns that include nighttime feeding activity, and the ability to compare pelican concentrations between 2007 and 2008.

For example, the five-fold increase in YCT abundance measured at the IDFG fish trap in 2008 was similar in magnitude to the reduction in pelicans foraging downstream of the weir. Overlapping photograph records for an identical reach of river were available from May 26 through June 13 (Fig. 5). During that period, the mean hourly peak in pelican abundance at the photographed reach was 10 birds in 2008 compared to 59 in 2007 (nearly a six-fold decrease in pelican use). The decline in foraging pelicans may be related to the reduction in the pelican breeding population observed in 2008, enhanced hazing effort in 2008 (daily patrols completed morning and night), or higher river flows that impede pelican foraging. All of those factors may have contributed to the reduction in pelican use of the Blackfoot River and presumably pelican predation on the YCT spawning run.

Pelicans have been observed foraging on other cutthroat trout runs in southeast Idaho. Since 2002, pelicans have been observed foraging at the mouth of St. Charles Creek, which is the most important spawning tributary for BCT in Bear Lake (IDFG and USFS 2007). Pelicans have also been observed foraging at the mouth of Swan Creek, a Utah tributary to Bear Lake. In 2005, pelicans concentrated at the mouth of Swan Creek below the Utah Department of Natural Resources (UDNR) spawning and egg take trap. To reduce predation losses, UDNR installed bird lines, set up a human effigy, and regularly shot cracker shells at the birds (S. Tolentino, UDNR, *pers. comm.*). In 2007, another flock of more than 250 pelicans was observed near the mouth of McCoy Creek (Palisades Reservoir) during the cutthroat trout spawning run.

Pelican Predation on Sport Fisheries

Resource, economic, and social impacts of pelican predation on recreational fisheries are an additional concern. Studies conducted at Blackfoot Reservoir in 2002 and 2003 indicated that pelican diet consists of fish species generally represented in proportion to their abundance in the foraging area. The fish community in Blackfoot Reservoir is dominated by abundant populations of nongame fish, and 90% of pelican diets were composed of suckers, carp, and chubs (Teuscher 2004). However, the study estimated that the small proportion of the pelican and double-crested cormorant (*Phalacrocorax auritus*; henceforth cormorant) diet that was composed of rainbow trout amounted to a total weight of 7.6 tons, which was similar to the total weight of trout stocked (Teuscher 2004). In 2002, the IDFG stocked only catchable size (>6 inches long)

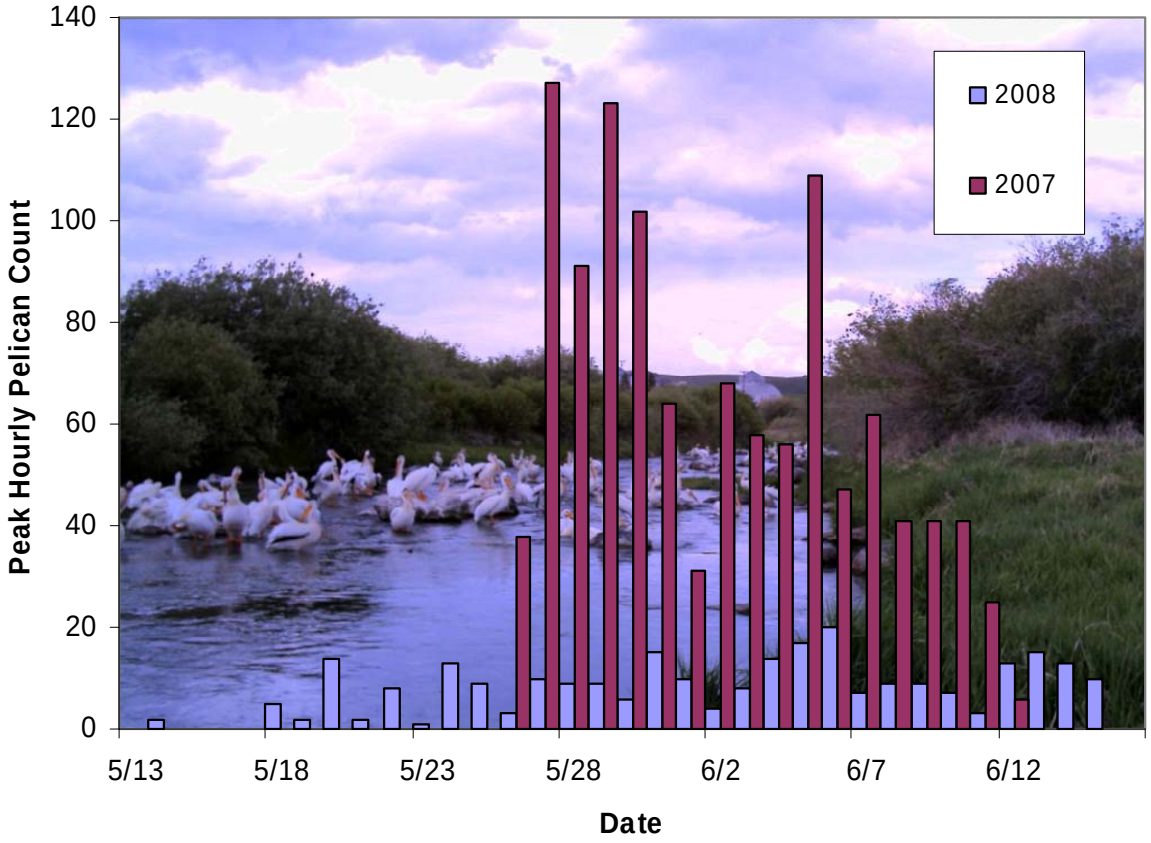

Figure 5. Pelican counts from photographs taken at a fixed location on the Blackfoot River. The inset photograph shows the reach of river recorded by the remote camera at 5:00 p.m. MDT on June 5, 2007. The camera was deployed on May 26 in 2007 and May 13 in 2008.

rainbow trout in Blackfoot Reservoir in the spring while a combination of fingerlings (<6 inches long) and catchables were stocked in the spring of 2003. Although pelicans and cormorants opportunistically forage on trout throughout their seasonal occupation of Blackfoot Reservoir, predation was significantly higher immediately following stocking of rainbow trout. This understanding prompted a change in stocking timing so that it currently occurs during times of low pelican abundance.

In 2003, a bird predation study was completed on Blackfoot Reservoir (Teuscher et al. 2005). The objective of that research was to document the impact that pelicans and cormorants had on newly-stocked hatchery rainbow trout (fingerlings and catchables stocked in May 2003). Methodologies used to complete the study were based on examples published in peer-reviewed journals. A predation model was developed by IDFG using estimates of predator abundance, diet analysis, and daily consumption demand. In 2003, the total adult bird population nesting on Gull Island was 1,672 pelicans and 694 cormorants. Literature values were used to estimate

consumption demand for pelicans (2.4 lbs per day as per Shmueli et al. 2000 and Brown and Urban 1969) and cormorants (1.0 lbs per day as per VanDeValk et al. 2002). Daily consumption demand was expanded for the total bird population and summed over the 90-day nesting period. Diet information from both species of birds was collected by examining chick regurgitations.

During the nesting period from May 1 through July 31, 2003, adult birds and their young consumed an estimated 215 tons of fish. Utah chub made up the largest proportion of prey consumption (65.5%), followed by Utah sucker (11.1%), common carp (7.5%), yellow perch (5.5%), dace spp. (5.1%), and rainbow trout (3.6%). Although rainbow trout made up a relatively small overall portion of total fish consumption during the model period, pelicans and cormorants altered their foraging behavior to take advantage of newly stocked hatchery rainbow trout (fingerlings and catchables). Pelican counts near the hatchery-trout stocking site increased from 21 birds the day prior to stocking fish to 150 birds the day after. Similarly, rainbow trout comprised 66% of cormorant diets immediately after stocking. During the first week after stocking, an estimated 27% (150,000) of the newly-stocked hatchery rainbow trout were lost to bird predation. This is out of a total of over 560,000 rainbow trout stocked. Over the 90-day model period, total rainbow trout consumption by pelicans and cormorants was an estimated 7.7 tons, which was 102% of the total weight of hatchery trout stocked in 2003 (7.5 tons).

Based on the predation study results, fisheries managers concluded that the nesting bird colonies significantly reduced the survival of hatchery rainbow trout stocked in Blackfoot Reservoir and that stocking rainbow trout will be delayed until pelicans and cormorants fly south for the winter. Anecdotal fishing reports suggest an improvement in the fishery following this adjustment to fish stocking, but a creel survey and diet work will be considered to determine the efficacy of the new stocking strategy.

As the adult pelican population nesting on Blackfoot Reservoir grew, their foraging areas expanded to other popular sport fisheries in southeast Idaho. Thus, pelican use of reservoirs supporting popular sport fisheries has increased markedly over the past several years and now includes key reservoirs such as Treasureton, Daniels, Twin Lakes, and Chesterfield. These sport fisheries generally occur in artificial reservoirs and the fisheries are supported largely by hatchery trout stocked by IDFG to meet public angling demand. Pelican diets at these reservoirs are almost exclusively comprised of game fish as there are few nongame fish present.

To monitor the increase in pelican use of other irrigation reservoirs (separate from Blackfoot Reservoir), a comprehensive survey program was initiated in 2006. A random survey design, identical to that used to quantify angler use, was used to quantify the frequency and abundance of pelicans foraging on several lake and reservoir fisheries in the IDFG Southeast Region. Sample dates were stratified into four equal daily time periods (starting at 0600 through 2200) in 2006–2008. Strata were assigned equal probabilities of being sampled (25%) during 2006. Pelican use was found to be higher during the early (0600–1000) and late (1800–2200) time periods in 2006. As a result, sample probabilities were adjusted in 2007 and 2008 to 30% in the early/late time periods and 20% during the two mid-day periods (1000–1400, 1400–1800) to better estimate peak abundance. Basic data collected was the number of pelicans observed per

count (subsequently converted to mean counts for the season). Large lakes and reservoirs (American Falls, Blackfoot Reservoir, and Bear Lake) were excluded from the surveys because they would have required aerial counts by plane, which was prohibitively expensive.

To date, the pelican use data on reservoirs in southeast Idaho mirror changes observed in the adult pelican population nesting on Blackfoot Reservoir. In 2007, there was a marked increase in both the adult pelican population nesting on Blackfoot Reservoir and the mean counts of pelicans foraging on southeast Idaho irrigation reservoirs. Similarly, a 30% decline in the 2008 adult pelican nesting colony resulted in an overall reduction in pelican use at 11 of 14 reservoirs frequented by pelicans (Table 2). These observations support a key assumption made in this plan; that reducing the number of pelicans nesting on Blackfoot Reservoir will result in a commensurate reduction in pelican foraging impacts on the Blackfoot River and the surrounding reservoir fisheries in southeast Idaho.

Table 2. Numbers of pelicans observed foraging on southeast Idaho reservoirs, 2006–2008.

	Mean Pelican Count Data		
Location	**2006**	**2007**	**2008**
24 Mile	0.4	1.5	2.1
Alexander	6	28.5	19.5
Chesterfield	8.6	30.5	45
Condie	0.7	5.8	0.1
Daniels Reservoir	NA	15.1	17.5
Deep Creek Reservoir	0	2.8	1
Devil Creek Reservoir	2.7	3.4	0.8
Fosters	0.1	0	0
Glendale	0	0	0
Johnson	0	0	0
Lamont	0	0	0
Oneida Narrows	0.2	0.6	0.5
Oneida Reservoir	0.8	3.5	1.2
Oxford	0.2	7.6	0.03
Strong Arm	1.7	1.5	NA
Treasureton	3.8	13	6.8
Twin Lakes	0.4	11.6	1.9
Upper Deep Creek	0	0	0
Weston	0	3.1	0.4
Winder	1	0.3	0

In addition to monitoring use trends, the pelican survey data can be used to model predation impacts on some smaller reservoirs. For example, the mean number of pelicans using Daniels Reservoir in 2008 was 17.5 (Table 2). Those birds consumed an estimated 42 lbs of fish per day (17.5 birds x 2.4 lbs of fish per day = 42 lbs of fish / day). Pelicans begin using the reservoirs in May and start leaving the area in late September or early October, for a total predation period of about 150 days. Total consumption by pelicans for that period is an estimated 3.2 tons of trout. It is reasonable to assume the predation by pelicans is all trout because nongame fish species are not present in Daniels Reservoir.

Based on the use data above, we estimated the cost of replacing the hatchery trout consumed by pelicans using the average production cost for fingerling rainbow trout at IDFG facilities ($3.30 per pound). The estimate was derived from average production costs to raise 3.5–6 in fingerling trout (IDFG hatchery management reports; Tom Frew, IDFG, *pers. comm.*). Based on production costs, it would cost IDFG about $20,000 to replace the 3.2 tons of trout consumed by pelicans from Daniels Reservoir in 2008. Table 3 shows other waters with trout-dominated communities that currently support pelican populations.

Table 3. Estimated trout consumption by pelicans and estimated replacement costs of hatchery fish for select southeast Idaho Reservoirs. Recreational fisheries in these reservoirs are supported solely by hatchery rainbow trout. These reservoirs are devoid of other fish species and sampled every 1-2 years.

Water	**Year**	**# Pelicans**	**Total Estimated Trout Consumption (lbs)**	**Replacement Costs $**
Treasureton	2006	3.8	1,368	$4,500
Treasureton	2007	13.0	4,680	$15,400
Treasureton	2008	6.8	2,448	$8,100
Daniels	2007	15.7	5,652	$18,700
Daniels	2008	17.5	6,300	$20,800
24-mile	2006	0.4	144	$500
24-mile	2007	1.5	540	$1,800
24-mile	2008	2.1	756	$2,500
Deep Creek	2007	2.8	1,008	$3,300
Deep Creek	2008	1	360	$1,200

Using pelican count data, IDFG developed an index of potential predation impacts for reservoir fisheries that support more diverse fish communities (Table 4). The index combined the following variables: reservoir size, economic benefit of the sport fishery (fishery value), fish community structure, and average pelican abundance. This index is not intended to estimate losses caused by pelican predation. Instead the index can be used to compare potential impacts among waters or prioritize future research and management activities. Variables and impact rankings are defined in Table 4.

An example of how the Impact Index can be used follows: Oneida Reservoir has a high economic index ($529,000), a fish index (1) indicative of diverse prey options for pelicans, and a relatively low predator index (0.01). In relative terms, pelican potential to impact sport fishing on Oneida Reservoir is low. Conversely, potential impacts of pelicans to the sport fishing opportunity of Daniels Reservoir are high because only hatchery-stocked rainbow trout are available as forage, the predator index is moderately high, and the economic index is high.

Economic Importance of Watchable Wildlife

The economic value of watchable wildlife, including bird watching, has been well documented both nationally and in Idaho. In 2006, 746,000 people participated in wildlife watching in Idaho, spending $265 million and generating $443 million in economic output; these figures compare well to the fishing community where $315 million were spent by anglers resulting in $492 million in economic output (USDI and USDC 2006). Wildlife watching generated 5,903 jobs and $35,000 and $31,000 in state and federal tax revenues, respectively.

Twenty-eight percent of Idaho residents (16 years of age and older) participated in bird watching in 2006; the national average is 21%, and Idaho ranked eleventh in the country for participation (Carver 2009). Nonresident bird watching is significant in Idaho – of 557 million birders in the state in 2006, 56% and 44% were residents and nonresidents, respectively. Data addressing the potential economic importance of individual taxonomic bird groups such as pelicans *per se* are lacking.

CONNECTING MANAGEMENT OBJECTIVES FOR BIRDS AND FISH

IDFG Management Plan for Yellowstone Cutthroat Trout

IDFG completed a management plan for YCT that was approved by the Idaho Fish and Game Commission in 2007 (IDFG 2007). As per this plan, the IDFG management goal for YCT in the Blackfoot River is to attain a spawning run of 10,000–15,000 adfluvial fish to provide the public with the highly prized recreational fishery resembling that which occurred in the 1950s. IDFG fishery managers do not believe it is possible to attain this management goal without a concurrent effort to manage numbers of pelicans. As demonstrated by the recent 2001 YCT spawning run of approximately 4,800 spawners, this population demonstrated resiliency following the river fishery closure instituted by IDFG in 1998, in addition to the absence of heavy predation pressure by foraging pelicans. Yellowstone cutthroat trout exhibiting the fluvial

Table 4. Pelican impact index for sport fisheries in southeast Idaho.

Reservoir	Acres[a]	Fishery Value[b] ($1,000)	Fish Index[c]	Bird Count[d]	Predation Index[e]	Impact Index[f]
Daniels	375	$442	3	15	0.04	53
Twin Lakes	446	$861	2	12	0.03	45
Chesterfield[g]	1600	$1,022	2	31	0.02	39
Treasureton	143	$114	3	13	0.09	31
Devil Creek	142	$501	2	3	0.02	24
24 Mile	44	$127	3	2	0.03	13
Deep Creek	183	$166	3	3	0.02	8
Crowthers	33	$38	2	2	0.05	4
Oneida	515	$529	1	3	0.01	4
Weston	112	$63	2	3	0.03	3
Condie	89	$21	2	6	0.06	3
Alexander	1000	$44	1	29	0.03	1
Winder	94	$62	2	0	0.00	0
Pleasantview	47	$4	1	0	0.01	0
Oxford	29	$0	1	8	0.26	0
Foster	145	$114	2	0	0.00	0
Glendale	230	$338	2	0	0.00	0
Lamont	92	$165	2	0	0.00	0
Johnson	50	$35	2	0	0.00	0
Hawkins	54	$403	3	0	0.00	0

[a] Acres = reservoir surface acres.
[b] Fishery Value = results from IDFG fisheries economic survey completed in 2003 (values represent total angler expenditures to fish the listed water in 2003).
[c] Fish Index = a rating system base on the complexity of the fish community, where (1) is a fishery dominated by nongame species with limited sport fish abundance, (2) is a water with a complex fish community dominated by sport fish either produced naturally or through IDFG hatchery supplementation, and (3) is a fishery containing only hatchery rainbow trout produced by IDFG for sport fish enhancement. There are no other fish species present in these water bodies.
[d] Bird Count = average pelican abundance observed in 2007.
[e] Predation Index = Bird Count / Acres.
[f] Impact Index = Predation Index x Fish Index x Economic Index.
[g] The economic index was estimated differently than the general economic survey. Chesterfield Reservoir was drained prior to the 2003 economic survey and had no recreation or economic value. However, since then, the reservoir refilled and has become a productive fishery. Therefore, the reported value is based on angler trips estimated by a comprehensive creel survey completed in 2006. The estimate of angler trips was multiplied by the average fishing trip expense estimated in the 2003 economic survey for Caribou County fisheries (Grunder et al. 2008).

life history can sustain the overall YCT population through low water years and low carryover storage in Blackfoot Reservoir. If pelican numbers are appropriately managed, thus relieving the YCT population from significant predation, the adfluvial YCT population in the Blackfoot River can likely recover.

McCoy Creek, an upstream tributary to Palisades Reservoir, also supports a spawning run of YCT. IDFG fishing rules for McCoy Creek include a July 1 opener which prevents harvest of adfluvial spawners since most of these fish return to Palisades Reservoir by early July. As witnessed during the 2007 spawning run, a flock of foraging pelicans numbering approximately 250 birds could significantly impact the McCoy Creek YCT population, and thus compromise its recovery.

IDFG Management Plan for Bonneville Cutthroat Trout

The Bear Lake population of BCT is the only natural adfluvial stock existing in Idaho. The majority of tributary spawning habitat occurs in Fish Haven Creek and St. Charles Creek. Unfortunately, due primarily to unscreened irrigation diversions and migration barriers, natural production of BCT is very low. As a result, the Bear Lake population of BCT has become increasingly dependent on hatchery supplementation. According to the IDFG management plan for BCT (IDFG and USFS 2007), reestablishing natural production in St. Charles Creek and Fish Haven Creek is one of the highest restoration priorities in Idaho. As stated previously, since 2002, pelicans have been observed foraging at the mouth of St. Charles Creek, presumably on spawning BCT. IDFG, along with conservation partners, intends to spend considerable effort restoring and reconnecting stream habitats in both of these tributaries. In order to be successful in building spawning runs to viable levels in both tributary systems, pelican numbers must be appropriately managed.

ADAPTIVE MANAGEMENT

Pelicans of the western population are an example of a “boom-and-bust” species (Anderson and King 2005), with colonies fluctuating in size and productivity from year to year. In less than a five-year period, these colonies can, and often do, vary by 50–100% or more. As such, the management of pelican impacts on fish in Idaho will be adaptive to changing biological and social conditions.

The goals, objectives, and management actions outlined below will be implemented within an adaptive management framework. The response of fish and/or pelicans will be monitored as management actions are implemented. In some cases, multiple management actions will be implemented simultaneously and monitored to determine effectiveness.

Throughout the duration of the plan, management actions and the relative response of the management actions on pelican and fish populations will be assessed through ongoing monitoring efforts. Adjustments in management actions will consider monitoring results, the

overall priority of management actions, cost, and an integrated approach to managing and monitoring.

A brief summary of management actions considered by IDFG is provided below (for more details see Appendix II).

Increase Reservoir Water Levels—Maintain reservoir water at levels that provide adequate refuge for fish at times and/or locations necessary to avoid predation by birds. *This action was deemed infeasible due to state water law, existing federal water contracts, and expense.*

- Requires cooperation with water users and associated water management agencies.

Modify Prey Composition—Stock game and/or nongame fish species to diversify pelican prey base in order to buffer valuable native fish species. *Although feasible, this action was deemed impractical due to cost and uncertainty of success.*

- Divided public if fishery quality is compromised.
- IDFG has a seven-step process for new species introductions.

Modify Fish Stocking Strategies—Distribute stocking location(s) in time (seasonal/daily) and space. *This action was deemed feasible on a case-by-case basis.*

- Alter time of stocking from spring to fall (after pelicans have migrated south for winter).
- Increase the number of stocking locations to reduce predation risk.
- Change stocking time from day to dusk.
- Reduce fish stocking at some locations.
- May be applicable in some cases, either temporarily or permanently.

Provide Refugia for Fish—Create physical barriers to separate pelicans and fish. *This action was deemed feasible in specific circumstances.*

- Floating rope.
- Anchored wood or plastic platforms.

Install Bird Lines—Install lines across waterways where birds concentrate to forage. *This action was deemed feasible in specific circumstances.*

- Use flagging for increased visibility, with line spaced at 20 yd intervals.
- String lines 2–3 ft above the water.

Haze Birds—Haze only foraging or loafing birds (no hazing on nesting islands). *This action was deemed feasible.*

- Harassment by air boat, motor boat, or aircraft.
- Harassment by human presence and/or dogs.
- Harassment by crackers shells, zon guns, or pyrotechnics.
- Disturbance by lasers or strobe lights.
- Disturbance by human presence or effigies.

Translocations (Establish New Nesting Colonies)—Translocate adult birds to alternate nesting locations to reduce bird numbers at original colony while establishing new colonies or supplementing bird numbers at existing colonies. *This action was deemed infeasible due to site fidelity exhibited by nesting birds and uncertainty of success.*

- Capture adult birds on nesting islands.
- May require wing clipping of translocated adults to prevent their return to the capture site.
- Could require use of wing-clipped decoy birds at new site.

Manipulate Nesting Habitat—Reduce nesting habitat available for pelicans. *This action was deemed feasible.*

- Manipulate habitat (i.e., add vegetation or large rock).
- Remove habitat (i.e., blasting).
- Erect fence, bird wire, or physical barriers to break up island surface area.

Introduce Predators to Nesting Islands—Translocate native mammalian predators to nesting islands (i.e., badgers, raccoons, foxes, coyotes). *This action was deemed feasible but there is a high risk to non-targeted species (e.g., other nesting colonial waterbirds) as well as a general lack of control in terms of impacts to pelicans.*

- Badgers were historically present on Gull Island in the early 1990s; following their removal in 1991 and 1992 by IDFG, the current Blackfoot Reservoir pelican colony immediately established itself with approximately 200 breeding birds.
- Would require cooperation with the Bureau of Land Management who manages the nesting islands on Blackfoot Reservoir.
- May require authorization from the USFWS because it is still considered take.

Harvest Season on Birds (By the Public)—Lethal take of birds in problem areas through an IDFG-regulated harvest season. *This action was deemed infeasible and impractical at this time.*

- Controlled hunt or quota hunt.

Oil Eggs to Limit Pelican Productivity and/or Recruitment—Spray vegetable oil on incubating eggs (suffocates embryos). *This action was deemed feasible.*

- May require multiple applications of vegetable oil.
- Requires authorization from the USFWS because pelicans are protected under the Migratory Bird Treaty Act (MBTA).

Pelican Population Management (Shoot Adult Birds)—Shoot adult birds in high impact areas to reduce predation pressure on spawning fish, enhance non-lethal hazing efforts, and/or directly manage the pelican population. *This action was deemed feasible.*

- Requires authorization from the USFWS because pelicans are protected under the MBTA.

PELICAN MANAGEMENT GOALS, OBJECTIVES, AND MANAGEMENT ACTIONS

This section describes statewide goals and objectives that are further refined into regional objectives tied to near-term and long-term actions. This plan is primarily driven by the need to relieve predation pressure by foraging pelicans on spawning YCT in the Blackfoot River. As such, a pelican population objective was first established for the Blackfoot Reservoir colony consistent with the number of birds thought to be present in the late 1990s when impacts to fish were considered manageable and prior to the crash of spawning YCT in 2002. Using an exponential growth equation fit to the pelican population trend data for Blackfoot Reservoir, we predicted the number of breeding birds that would have been present in 1998 (582 birds), 1999 (701 birds), and 2000 (843 birds). An average of these estimates (709 birds) was then used to yield the pelican population objective for this colony (700 breeding birds, rounded to the nearest 100; Fig. 6). This objective is intended to be a five-year average, not necessarily a minimum.

Recognizing that the Intermountain West Waterbird Conservation Plan established a statewide minimum pelican population objective of 2,770 breeding birds (2,800 birds, rounded to the nearest 100; Ivey and Herziger 2006), we simply subtracted the established objective for Blackfoot Reservoir from this number to derive the population objective for Minidoka NWR (2,800 – 700 = 2,100 breeding birds; Fig. 7). This objective reflects a colony size that is approximately 50% of that recorded in 2008 and, like that for Blackfoot Reservoir, is intended to be a five-year average rather than a minimum *per se*.

Since 2003, efforts have been directed at reducing impacts to spawning YCT and documenting dispersal and foraging patterns of pelicans in southern Idaho. The management objectives and associated actions presented in this plan build upon our previous efforts and step up the tempo of management to achieve the following statewide and regional goals.

Statewide Management Goal – Maintain a viable population of pelicans while reducing impacts of pelicans on public resources throughout Idaho. See region-specific goals for more details on the following statewide objectives.

Objective 1 – By 2013, maintain a five-year average of 2,800 breeding pelicans at existing nesting colonies in Idaho.

- Managing the size of existing nesting colonies will likely reduce the number of foraging pelicans elsewhere in the state as dispersal away from breeding sites becomes more limited. Actions intended to protect local fish populations will therefore have additional benefits elsewhere in the state, thereby relieving concerns away from nesting colonies where evidence of bird impacts on fish are currently lacking (e.g., IDFG Clearwater and Upper Snake regions).

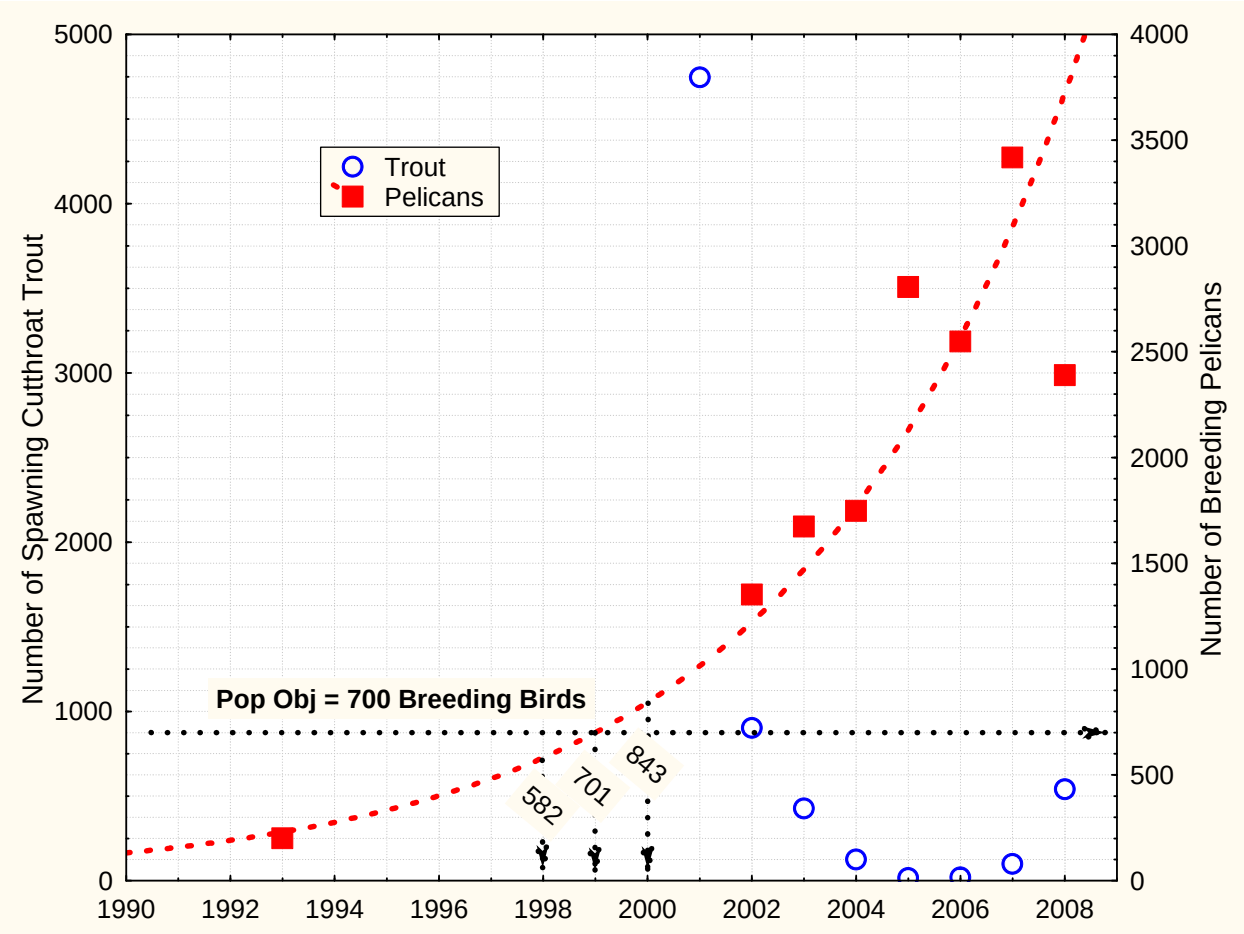

Figure 6. Number of breeding pelicans (solid squares) at Blackfoot Reservoir, 1993 and 2002–2008, and number of spawning cutthroat trout (open circles) in the Blackfoot River above the Reservoir, 2001–2008. An exponential curve was fit to the pelican data in order to estimate the number of breeding birds prior to 2002 when fish runs crashed. We chose to use extrapolated bird numbers for the years 1998 (582 birds), 1999 (701 birds), and 2000 (843 birds) to establish the pelican population objective for this nesting colony; averaging these numbers yielded an estimate of 709 breeding pelicans resulting in a population objective of 700 birds when rounded to the nearest 100.

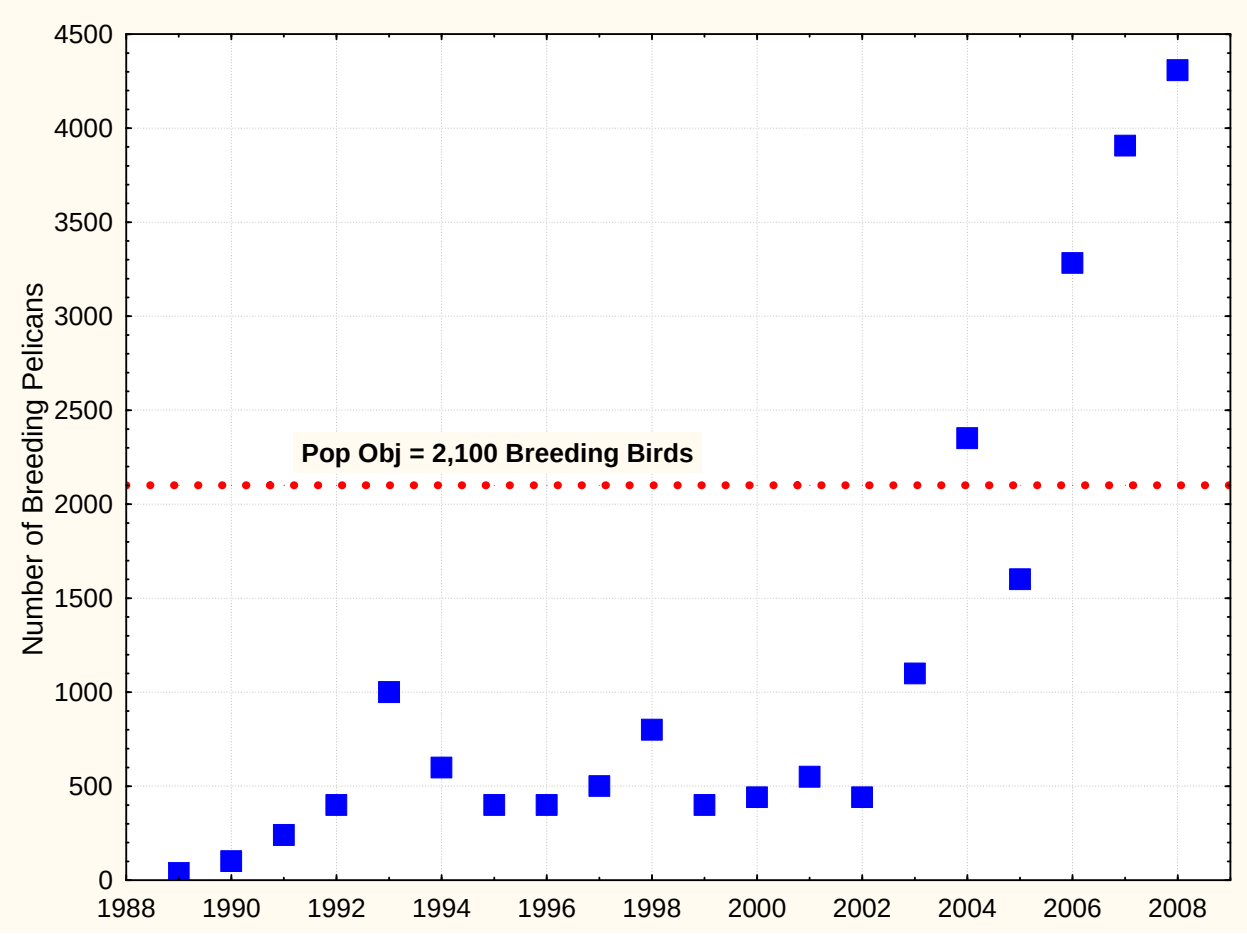

Figure 7. Number of breeding pelicans at Minidoka National Wildlife Refuge, 1989–2008, and the population objective established for this colony (2,100 breeding birds). This population objective was established by subtracting the objective for Blackfoot Reservoir (700 birds) from the statewide objective (2,770 birds, or 2,800 when rounded to the nearest 100) published in Ivey and Herziger (2006); this objective represents approximately one-half (49%) of the current colony size at Minidoka.

Objective 2 – Implement adaptive management actions at pelican foraging areas to reduce predation on spawning cutthroat trout and important sport fisheries throughout Idaho, and at nesting colonies to actively manage pelican populations.

- While this plan focuses on those regions where pelican impacts on fish have been documented or are suspected, it allows for management actions in other areas should conflicts emerge. The adaptive nature of this plan is emphasized throughout.

Objective 3 – Monitor pelican population trends, distribution, and foraging patterns in Idaho.

- This plan emphasizes the need for continued monitoring of pelicans in southern Idaho while recognizing that increased vigilance for expansion of birds, and potential impacts on fish, is needed elsewhere in the state (i.e., IDFG Panhandle, Clearwater, Southwest, and Salmon regions). Should managers become concerned about emerging bird-fish conflicts in other areas, options to limit initiation of new pelican nesting colonies beyond those presently occupied should be considered.

IDFG Southeast Region Management Goal – Manage the foraging patterns and population size of pelicans at Blackfoot Reservoir to reduce impacts of predation on spawning YCT and sport fisheries in southeast Idaho.

Objective 1 – Implement adaptive management actions to reduce predation on spawning YCT in the Blackfoot River.

Management Actions:

1. Install Bird Lines.

    - This action can be implemented to deter pelican foraging in specific stream sections where the following conditions are met: (1) water levels make fish especially vulnerable to concentrated pelican predation; (2) water levels do not fluctuate to a degree which will cause lines to be inundated and wash away; and (3) in areas of stream where the channel width is such that lines can span it without sagging into the stream.

2. Haze Birds.

    - Intensively haze birds from foraging areas in the Blackfoot River.

    - Explore hiring personnel and recruiting volunteers.

3. Provide Refugia for Fish.

    - Providing structures for fish cover to reduce bird predation may be used in specific situations. For example, a floating rope matrix may be effective where streams flow into reservoirs or in areas around dams, diversions, weirs, or fish traps.

4. Lethal Control to Enhance Hazing.

- Use existing permit (50 birds) from the USFWS to lethally remove foraging pelicans in the Blackfoot River.

- Seek additional authority from the USFWS to lethally remove pelicans foraging in the Blackfoot River.

Objective 2 – Reduce predation on important sport fisheries in southeast Idaho.

Management Actions:

1. Haze Birds.

    - Intensively haze birds from foraging areas.

2. Modify Fish Stocking.

    - Alter the timing of fish stocking and the species or size of fish stocked at waters subject to pelican predation where feasible.

3. Limit Pelican Production / Recruitment.

    - By 2013, alter pelican breeding habitat on Blackfoot Reservoir to reduce the breeding population while maintaining a five-year average of 700 breeding birds; will need to acquire necessary federal permits and/or authorization.

4. Lethal Control to Enhance Hazing.

    - Use existing USFWS permit to lethally remove pelicans that are habituated to high-quality, intensively-managed sport fisheries.

    - Seek additional authority from the USFWS to lethally remove pelicans foraging on specific high-quality, intensively-managed sport fisheries.

Objective 3 – By 2013, reduce the pelican breeding population on Blackfoot Reservoir while maintaining a five-year average of 700 breeding birds at the nesting colony.

Management Actions:

1. Manage the Pelican Population.

    - Near-term: Use existing permit (50 birds) from the USFWS to lethally remove foraging pelicans to help manage the breeding population.

Seek additional authority from the USFWS to lethally remove pelicans. IDFG will pursue additional permits and/or authorization required to implement single or multiple actions listed in Appendix II during 2010 through 2013. Breeding population control measures will be adjusted annually to accommodate natural population fluctuations and a population objective of 700 breeding birds by 2013. The population objective is described as a five-year average, not a minimum, to allow for annual variation.

- Long-term: Maintain or modify appropriate near-term actions, or implement additional actions listed in Appendix II, to provide the level of recruitment necessary to maintain the population objective at Blackfoot Reservoir.

2. Limit Pelican Production / Recruitment.

   - Near-term: Acquire necessary permits and/or authorization to implement single or multiple actions listed in Appendix II to achieve the necessary reduction in recruitment when combined with population management actions and naturally occurring mechanisms that result in the population objective of 700 breeding birds by 2013.

   - Long-term: Maintain or modify appropriate near-term actions, or implement additional actions listed in Appendix II, to provide the level of recruitment necessary to maintain the population objective at Blackfoot Reservoir. Based on literature values for pelican annual survival rates (Strait and Sloan 1974, Sidle et al. 1984, Knopf and Evans 2004), we estimate that 250–300 nests are needed to maintain the population objective for this region. Actual recruitment levels necessary to maintain a steady state population will be dynamic and will be determined through an adaptive management approach.

Objective 4 – Monitor pelican population trends, distribution, and foraging patterns in southeast Idaho.

Pelican Monitoring Actions:

1. Breeding Population Estimate.

   - An annual ground-based nest count of each island on Blackfoot Reservoir occupied by nesting pelicans will occur in the late incubation/early nestling stage of most of the nesting birds (typically in late May–early June).

2. Productivity Estimate.

- Productivity estimates track effectiveness of management actions intended to limit pelican recruitment, as well as inform other population control measures, such as lethal take of adult birds.

- Estimate the number of juvenile birds present on each island on Blackfoot Reservoir occupied by nesting pelicans in late July or early August, just prior to fledging.

3. Reservoir Use Index.

    - Conduct an annual aerial survey across southeast Idaho to provide an index of wetland use by adult pelicans during the late incubation/early nestling stage at nesting islands on Blackfoot Reservoir.

    - Conduct a ground-based survey twice/week during the months of May–September at waters of high impact concern in southeast Idaho to assess foraging patterns of adult pelicans and post-breeding dispersal of juveniles.

    - Monitor pelican numbers at selected areas to determine relationship of abundance and distribution of pelicans to fishery monitoring metrics and objectives.

4. Riverine Use Index.

    - Monitor pelican numbers using remote cameras along the Blackfoot River or elsewhere (e.g., St. Charles Creek) to assess the relationship of abundance of pelicans to YCT or BCT monitoring metrics and objectives.

    - Monitor pelican numbers at selected areas to determine relationship of abundance and distribution of pelicans to fishery monitoring metrics and objectives (see Objective 5 below).

        - Remote monitoring cameras.
        - Aerial surveys.
        - Ground surveys.

5. Post-fledging Dispersal and Migration.

    - Juvenile pelicans will be trapped and tagged at all nesting islands on Blackfoot Reservoir to assess post-fledging dispersal, habitat preferences, migration routes, over-wintering habitats, survival rates, age at first reproduction, and fidelity to natal and breeding sites.

- Tag 300 pre-fledging juvenile pelicans with a USFWS metal leg band and a patagial wing tag with an alpha-number code.

Objective 5 – Develop coordinated fish monitoring strategies designed to assess the predation impacts of foraging pelicans on YCT populations and sport fisheries, and determine the effectiveness of management actions intended to reduce pelican predation on fisheries resources.

Fish Monitoring Actions:

1. Annual monitoring of adult YCT escapement to Blackfoot River fish trap.

2. Document evidence of pelican scars on adult YCT at the Blackfoot River fish trap.

3. Determine pelican predation rates on YCT from recovery of radio tags; explore methods to implant radio tags in YCT prior to emigrating from Blackfoot Reservoir in order to improve this estimate.

4. Perform standard creel surveys and fish community structure surveys.

IDFG Magic Valley Region Management Goal – Maintain a viable population of pelicans at the Minidoka NWR colony and monitor potential impacts of bird predation on sport fish at high-impact areas in south-central Idaho.

Objective 1 – Monitor pelican population trends, distribution, and foraging patterns in the IDFG Magic Valley Region.

Pelican Monitoring Actions:

1. Breeding Population Estimate.

   - Subject to continued approval by the USFWS, an annual ground-based nest count on Lake Walcott (Minidoka NWR) will occur in the late incubation/early nestling stage of most of the nesting birds (typically in late May–early June).

   - Evaluate using aerial photograph counts as a less intrusive alternative.

2. Productivity Estimate.

   - Productivity monitoring will help assess mortality concerns such as disturbance and disease, as well as inform population management goals statewide.

- The number of juvenile birds present at the Lake Walcott nesting colony will be estimated in late July or early August, just prior to fledging.

3. Reservoir Use Index.

    - Conduct an annual aerial survey across the IDFG Magic Valley Region to provide an index of wetland use by adult pelicans that will coincide with the late incubation/early nestling stage at the nesting colony on Lake Walcott.

    - Conduct a ground-based survey of waters within the vicinity of Minidoka NWR every two weeks during the months of May–September to assess foraging patterns of adult pelicans and post-breeding dispersal of juveniles.

    - Monitor pelican numbers at selected areas to determine relationship of abundance and distribution of pelicans to fishery monitoring metrics and objectives (see Objective 4 below).

        - Remote monitoring cameras.
        - Aerial surveys.
        - Ground surveys.

4. Post-fledging Dispersal and Migration.

    - Subject to continued approval by the USFWS, juvenile pelicans will be trapped and tagged at the Minidoka NWR to better assess post-fledging dispersal, habitat preferences, migration routes, over-wintering habitats, survival rates, age at first reproduction, and fidelity to natal and breeding sites.

    - Tag 300 pre-fledging juvenile pelicans with a USFWS metal leg band and a patagial wing tag with an alpha-number code.

<u>Objective 2</u> – Reduce pelican predation on sport fisheries at high impact reservoirs by implementing adaptive management actions.

Management Actions:

1. Modify Fish Stocking.

    - The timing of fish stocking and the species or size of fish stocked will be considered at waters subject to pelican predation.

2. Haze Birds.

- Intensively haze birds from foraging areas.

3. Lethal Control to Enhance Hazing.

    - This action may be used to target individual birds which have habituated on specific high-quality, intensively-managed sport fisheries and to enhance the effectiveness of non-lethal hazing.

Objective 3 – By 2013, maintain a five-year average of 2,100 breeding birds at the Minidoka NWR nesting colony.

Management Actions:

- The population objective for Minidoka NWR corresponds to the difference between the statewide objective (2,800 breeding birds) and the IDFG Southeast Region objective (700 breeding birds). Deleterious impacts of pelicans on sport fisheries in the IDFG Magic Valley Region have yet to be clearly documented. The population objective of 2,100 breeding birds for the Minidoka NWR colony is not therefore intended as a specific goal to be obtained during the life of this plan. Rather, we provide it as a guideline for future consideration pending empirical evidence that important recreational fisheries are being impacted by foraging birds. Near-term actions at Minidoka NWR will focus on gathering additional information needed to describe pelican ecology and biology, and determine scope and scale of resource impacts.

Objective 4 – Develop coordinated fish monitoring strategies designed to assess the predation impacts of foraging pelicans on sport fisheries, and determine the effectiveness of management actions intended to reduce pelican predation on fisheries resources.

Fish Monitoring Actions:

1. Perform standard creel surveys and fish community structure surveys.

2. Develop fishery impact assessment for waters in the IDFG Magic Valley Region.

IDFG Upper Snake Region Management Goal – Assess distribution and impact of pelicans on fisheries resources and, where appropriate, manage pelicans to reduce the impacts of pelican predation on spawning YCT and sport fisheries in the Upper Snake.

Objective 1 – There is no pelican population objective for this region due to an absence of nesting colonies at this time.

Objective 2 – Monitor pelican population trends, distribution, and foraging patterns.

Pelican Monitoring Actions:

- Conduct an annual aerial survey of waters in the IDFG Upper Snake Region to determine the distribution and numbers of pelicans.

- Conduct a ground-based survey of waters in the IDFG Upper Snake Region every two weeks during the months of May–September to assess foraging patterns of adult pelicans and post-breeding dispersal of juveniles.

- Monitor pelican numbers at selected areas to determine relationship of abundance and distribution of pelicans to fishery monitoring metrics and objectives (see Objective 4 below).

    - Remote monitoring cameras.
    - Aerial surveys.
    - Ground surveys.

Objective 3 – Reduce pelican predation on YCT and sport fisheries if and when impacts by pelicans are documented and considered by managers to be significantly harming YCT populations and sport fisheries.

Management Actions:

1. Haze Birds.

    - Perform intense hazing in areas such as McCoy Creek where pelican predation at the mouth is limiting upstream movement of spawning cutthroat trout, in turn reducing productivity and upstream sport fishing success.

    - Hazing in a flowing environment such as McCoy Creek may include the use of motorized vehicles on shore, human presence, effigies, pyrotechnics, and/or dogs.

    - Hazing in areas such as Henrys Lake to reduce predation on congregated trout could include the use of motor boats and pyrotechnics.

2. Install Bird Lines.

    - Bird lines may be used when the area is small and lines could be effectively placed and maintained, such as at McCoy Creek. No recreational opportunity would be limited at McCoy Creek nor are there any human safety hazards from bird lines. Lines would be placed across the stream only during the cutthroat trout spawning season.

3. Lethal Control to Enhance Hazing.

    - Acquire necessary permits and/or authorization required to lethally remove pelicans from identified problem areas; removing birds is intended to enhance the effectiveness of non-lethal hazing, as well as curtail emerging bird impacts on fish.

Objective 4 – Develop coordinated fish monitoring strategies designed to assess the predation impacts of foraging pelicans on YCT populations and sport fisheries, and determine the effectiveness of management actions intended to reduce pelican predation on fisheries resources.

Fish Monitoring Actions:

1. Perform standard creel surveys and fish community structure surveys.

2. Develop a fishery impact assessment for waters in the IDFG Upper Snake Region.

COMPREHENSIVE MONITORING PLAN

Pelicans

IDFG will conduct annual comprehensive monitoring of the pelican population in Idaho, including estimating the number of breeding and non-breeding birds across the state, obtaining an estimate of maximum productivity at breeding colonies, determining the distribution of birds across the state, and marking juvenile birds to increase understanding of life-history characteristics of Idaho's birds (see Table 5 for all cost estimates).

Breeding Population Estimates—Estimates of the state breeding pelican population will be necessary to assess the effects of control actions, direct future control efforts, and monitor statewide population viability. The estimated number of breeding birds will be used each year to reassess a five-year average, predict the current trajectory of the breeding population, and help determine the control actions that need to occur, if any, to reach established population objectives.

Methods: Monitoring of the breeding pelican population will be aligned with protocols outlined by the Western Colonial Waterbird Survey (Seto 2008). This survey entails an annual ground-based nest count of each island used by nesting pelicans and occurs in the late incubation/early nestling stage of most of the nesting birds, typically in late May–early June. This survey has been conducted at the Minidoka colony since 2006, at the Blackfoot colony since 2002, and is expected to be continued indefinitely; however, annual ground-based counts at Minidoka are contingent upon USFWS approval. The use of aerial photograph counts will be evaluated as a less intrusive alternative. Estimated cost: $2,000 (Table 5).

Table 5. Summary of proposed pelican monitoring activities and estimated budget needs.

Project	Detail	Personnel	Time	Salary / Per Diem	Materials	Vehicles	Total
Pelican Population Estimates	Nest Counts	4	2 days	$1,500	–0–	$500	$2,000
	Productivity Estimates	4	2 days	$1,500	–0–	$500	$2,000
	Statewide Aerial Survey	2/region for 4 regions	3 days	$6,000	–0–	–0–	$6,000
Pelican Distribution / Use of Important Fisheries	Ground Counts	1/region	30 hr/wk	$5,000	–0–	$9,000	$14,000
	Statewide Aerial Survey	Assessed above with population estimate	–0–	–0–	–0–	–0–	–0–
Pelican Marking	Juveniles at Colonies	15–20	2 days	$4,000	$1,000	$1,000	$6,000
Total Costs							$30,000

Productivity—An estimate of pelican productivity at Idaho's nesting colonies will be an important population parameter to measure as pelican management actions are implemented. An estimate of productivity can be used to assess effectiveness of some proposed management actions, such as egg oiling. Productivity monitoring can also help assess other mortality concerns, such as disturbance and disease. While true productivity will be difficult to obtain, an estimate of maximum productivity can be obtained by estimating the number of chicks at the colony just prior to fledging.

Methods: The number of juveniles at breeding colonies will be estimated in late July or early August, just prior to fledging. Estimates of juveniles can be made during the late summer banding and tagging activities during years that project is conducted. Estimated cost: $2,000 (Table 5).

Wetland Use Index and Distribution Assessment—Monitoring the waters used by pelicans across the state will provide a better understanding of seasonal distribution and help estimate the impact that pelican predation is having on specific fisheries. The scale of distribution monitoring will depend on the degree of impact concern. A coarse-scale aerial survey will provide an index of wetland use by pelicans, as well as assess the distribution of pelicans, throughout southern Idaho. A mid-scale ground survey will assess the distribution of pelicans in low impact waters. A fine-scale ground survey will be used in areas of high impact concern. Monitoring important fishing waters will also document pelican use of specific fisheries as pelican population changes

occur and/or management actions are implemented and will help quantify the effects of control actions toward alleviating the predation pressure on specific fisheries.

Methods: An aerial survey of potential habitats across southern Idaho (IDFG Southwest, Magic Valley, Southeast, and Upper Snake regions) will be conducted once per year and will coincide with the late incubation/early nestling stage at the breeding colonies. This survey will be conducted over the same area in the same time frame each year to provide an index of the number of pelicans using wetlands in southern Idaho during the breeding season. To the extent possible, surveys around the state will occur simultaneously to minimize the likelihood of counting the same individuals more than once. Estimated cost: $6,000 (Table 5).

A ground-based survey of waters within the vicinity of breeding colonies will be conducted at least every two weeks during the months of August and September (between times of juvenile fledging and migration) to assess post-breeding dispersal of juveniles. This project has been conducted for the last two years and will continue as an annual assessment of post-breeding dispersal and habitat use by pelicans after the breeding season.

A ground-based survey will be conducted twice/week during the months of May–September at waters of high impact concern in southeast Idaho (IDFG Southeast Region) as a continuation of surveys conducted the past three years. Survey schedules will be randomized by date and time of day, using four daily time blocks (0600–1000, 1000–1400, 1400–1800, 1800–2200). Preferential weighting will be assigned to the 0600–1000 and 1800–2200 time periods, because past survey data suggests pelican use of surveyed waters was higher during these time periods. This survey will provide an annual assessment of pelican distribution and habitat use in areas of high impact concern and will provide an assessment of changes in pelican use of area waters in response to management actions taken as implementation of this management plan. This survey may also be implemented on important fishing waters in the IDFG Magic Valley and Upper Snake regions (i.e., Henrys Lake and McCoy Creek). Estimated cost: $14,000 (Table 5).

Marking—The trapping and marking of juvenile birds from Idaho's breeding colonies will provide insight into the post-fledging dispersal, habitat preferences, migration routes, over-wintering habitats, survival rates, age at first reproduction, and fidelity to natal and breeding sites. Understanding these fundamental life-history characteristics will be valuable in assessing the long-term effects of control actions on the pelican population and on reducing the predation pressure imposed by pelicans on Idaho waters.

Methods: For the last two years (2007 and 2008), 600 pre-fledging juvenile pelicans (300 from each breeding colony) have been trapped and marked each year; this project will continue for at least the next three years. In mid-July, pre-fledging juvenile birds are almost full-grown but are still flightless and closely associated with the breeding colony islands. At this time, trapping crews go ashore on the breeding colony islands and surround the juveniles with plastic fencing materials. Individual birds are then removed from the group for marking. Each bird receives a USFWS metal leg band and a unique alpha-number cattle ear-tag placed in the patagial of the

wing. The ear-tag colors are specific to the breeding colony with red tags for Minidoka birds and black tags for Blackfoot birds. Estimated cost: $6,000 (Table 5).

Native Cutthroat Trout

***Adult Cutthroat Trout Escapement Estimate*—**Total escapement estimates are made annually for cutthroat trout migrating out of Blackfoot Reservoir to spawn in the upriver tributaries. The annual escapement estimates began in 2001. The cutthroat trout monitoring results can be correlated with the adult pelican population nesting on islands in the reservoir. In addition to escapement estimates, every cutthroat trout captured in the fish trap is checked for bird scars. The bird scarring rates are qualitative, but add to circumstantial evidence of a predation effect. Estimated cost: $20,000.

***Pelican Predation Estimates*—**Recovery of radio telemetry tags implanted in migrating cutthroat trout have been used to directly estimate predation loss by pelicans. In 2004 and 2007, radio transmitters were implanted in migrating cutthroat trout. Those fish were tracked to their spawning grounds and some were recovered from pelican nests on islands in Blackfoot Reservoir. The proportion of tags recovered from pelican nests provides a direct measure of predation losses. The predation rate information is extremely valuable in quantifying the impacts of pelican predation on the cutthroat trout population and should be replicated every few years. Estimated cost: $30,000.

***Remote Camera Monitoring*—**The last two summers, several cameras have been deployed along the banks of the Blackfoot River. The cameras are set to take pictures every hour. The cameras are set in areas where pelicans concentrate along the Blackfoot River to feed. The pictures provided hourly documentation of the number of pelicans using the Blackfoot River. The camera information is a relatively inexpensive method of collecting foraging behavior and use of the Blackfoot River during the cutthroat trout migration. Estimated costs to purchase equipment, maintain, and analyze the photographs is approximately $5,000 per tributary. This monitoring program should be expanded to other rivers and streams where pelicans have been observed foraging during native cutthroat trout spawning periods (i.e., St. Charles, Fish Haven, Swan, and McCoy creeks). Estimated cost: $15,000–20,000.

Sport Fisheries

***Catch Rates and Return to Creel of Hatchery Trout*—**IDFG will employ standardized creel surveys at important recreational sport fisheries to assess catch composition, catch rates, and return to the creel of hatchery trout. Estimated cost: $10,000.

***Community Composition in Lakes and Reservoirs*—**The composition of fish communities in lakes and reservoirs will be assessed using standardized survey techniques; electrofishing and netting will be used to determine species composition. Estimated cost: $10,000.

INFORMATION NEEDS

Short-term

1. Evaluate the economic impact of bird predation to sport fisheries outside southeast Idaho.

2. Incorporate pelican counts for Blackfoot Reservoir into annual monitoring to assess the potential economic impact to this fishery *per se*.

3. Evaluate egg removal (collection) as an alternative to oiling.

4. Trap and mark problem birds at Treasureton and Daniels reservoirs and IDFG Hagerman Wildlife Management Area to see if these individuals are repeat offenders.

Long-term

1. Quantify nest success and productivity rates at both the Blackfoot Reservoir and Minidoka NWR breeding colonies; this will help to better inform population growth models.

2. Develop a better model for pelican population growth given oiling and pelican removal as management techniques (seek outside expertise).

3. Estimate predation on YCT below the fish migration trap on Blackfoot River.

4. Obtain better information on the biology of Idaho's pelicans with specific emphasis on loafing, foraging behavior, home range size, habitat use, and the percent of the overall population that are adult breeders.

PUBLIC OUTREACH

There are two aspects of public outreach associated with the implementation of this pelican management plan. First, public input on the plan will be sought from a variety of user groups during a formal 30-day public comment period. A second aspect of public outreach associated with this plan includes public education. Information and education materials and programs must represent a balanced approach to the potential impacts to fisheries and to pelican management and conservation. Public education should emphasize pelican ecology and conservation needs as well as potential negative impacts on native fish populations and sport fisheries. Additionally, a greater understanding and appreciation of pelican conservation and the management actions used to address impacts to fisheries may be achieved by seeking public involvement in conservation and management activities, specifically using volunteers to mark birds, conduct surveys, and assist with some control actions (e.g., hazing, bird lines).

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APPENDICES

APPENDIX I

PREVIOUS CONTROL EFFORTS (OUTSIDE OF IDAHO)

Pelicans

Pelican depredations on aquaculture fish stock (Glahn and King 2004, King 2005), sport fish (D. Teuscher, *pers. comm.*), and sensitive fish species (Kaeding 2002, Tiller et al. 2003, Stephenson and Fast 2004) have led to localized lethal and non-lethal control actions. The results of control attempts are similar to those of control attempts for cormorants (Curtis et al. 1996).

Lethal Actions—Lethal control methods (shooting birds) are most often used after non-lethal control efforts have been used and proven ineffective or when a combination of lethal and non-lethal control efforts are hoped to be more effective. Habituated, 'hard to scare' individuals often require lethal control to limit attracting other birds to the depredation site (Gorenzel et al. 1994a).

Other data on the effectiveness of lethal control for pelicans is limited, although lethal take of cormorants at the nest colony or at foraging sites is commonly used to reduce cormorant numbers (Curtis et al. 1996). Lethal control techniques for pelicans and their degree of success are summarized in Table 6.

Non-lethal Actions—Non-lethal devices are most successful for short-term control and when used in combination with human presence. Frequently changing methods of harassment and the combination of multiple harassment devices can also improve success (Gorenzel et al. 1994a). It is important to start harassment before birds become habituated as established feeding patterns are hard to break with standard harassment techniques (Gorenzel et al. 1994a).

Spatial and temporal differences in hazing techniques can significantly influence effectiveness. Harassment at loafing sites can cause abandonment of the site while harassment at feeding sites can fragment flocks making continued hazing more difficult (King 1997, Glahn and King 2004). Diurnal and nocturnal hazing is necessary to deter pelicans as they forage extensively at night (McMahon and Evans 1992, King 1997, Littauer et al. 1997, Glahn and King 2004). King (1997) found spotlights effective in scaring pelicans off nocturnal foraging areas, but reduced vigilance during any period of harassment can lead to damage or depredations (Glahn and King 2004).

Hazing with border collies can reduce bird abundance in small areas; however, birds return soon after hazing has stopped (Carter 2001). Many visual and acoustic scare devices exist but none have demonstrated highly-reliable and long-term success. Water cannons (Tiller et al. 2003) and low-pressure sprinklers (Stephenson and Fast 2004) have both been tested as hazing tools for reducing pelican depredation of juvenile salmonids (*Oncorhynchus* sp.). Both techniques had limited success as pelicans quickly acclimated to the spraying water. Cracker shells and live ammunition (Tiller et al. 2003) have all had short-term effects, but birds simply return to the impact area after some period of acclimation.

Appendix I. Continued.

Other scare devices discussed in the literature and tried with other species include pyrotechnics, bird distress calls, standing or pop-up effigies, eyespot balloons, strobe or flashing lights, and reflective plates. All these devices have limited long-term success but can be more effective when used in combination with each other or increased human presence (Gorenzel et al. 1994a, Brugger 1995). Sound-making devices are more effective when frequently moved to new locations (Gorenzel et al. 1994a).

Habitat modifications such as overhead lines or netting can be effective (Harris and Davis 1998). In natural systems, however, water levels can reduce or eliminate the effectiveness of any habitat modification. Non-lethal control techniques for pelicans and their degree of success are summarized in Table 6.

Table 6. Summary of lethal and non-lethal control techniques, and their degree of success and effectiveness, for American white pelicans and double-crested cormorants.

Hazing Technique	Success and Failures	Habituation to Hazing	Effectiveness	Sources
PELICANS				
Harassment at loafing site	May cause abandonment of the site, thus eliminating predation in localized problem areas.		Long term	King 1997 Glahn and King 2004
Harassment at predation site	Flocks fragment and harassment becomes more difficult.		Short term	King 1997 Glahn and King 2004
Nocturnal harassment	24-hour harassment necessary due to nocturnal foraging.			King 1997 Littauer et al. 1997 Glahn and King 2004
Nocturnal harassment: Bright spotlights	Easily frightens birds.			King 1997
Border collies	Reduced “bird” abundance in an area up to 20 square miles. Particularly effective on large waterfowl. Densities restored shortly after dog harassment stopped.		Short term	Carter 2001
Aircraft	Ultralight aircraft have been used by producers to intercept large flocks of birds and herd them away from commercial facilities. This has been most effective with large		Short term	Gorenzel et al. 1994a

Appendix I. Continued.

Hazing Technique	Success and Failures	Habituation to Hazing	Effectiveness	Sources
	concentrations of pelicans.			
DOUBLE CRESTED CORMORANTS				
Harassment at roost site	Reduced abundance at roost and at nearby feeding areas when harassment was intense.		Short term	Mott et al. 1998
Harassment at predation site	May require constant harassment, and may still not be effective.	X	Short term	Bayer 2000
Harassment at predation site	Limited effectiveness; difficult to implement.[a]	X	Short term	Glahn et al. 2000
Cracker shells, boats, remote airplanes, effigies	Results difficult to measure. Regional differences. Fish returns influenced by many variables.			Bayer 2000
Long wave length lasers	Use of lasers against cormorants at night roosts resulted in the abandonment of roosts by several thousand birds after three nights.		Long term	Blackwell et al. 2002
Dogs/People	Frightened birds only briefly	X	Short term	Brugger 1995
String barriers (“Arkansas technique”)	Effective at reducing predation on aquaculture ponds in Arkansas.		Long term	Radomski et al. 2003
Scarecrows Reflecting tape Pyrotechnics Sound cannons	Limited effectiveness; brief response followed by acclimatization.	X	Short term	Brugger 1995
Autonomous robotic vehicles	Reduced predation in small test facility (flat water, no current)	X		Hall and Price 2003
Breco Bird Scarer©	Ineffective at reducing bird numbers, but slightly effective at modifying behavior (distance from device)	X		Whisson and Takekawa 1998

Appendix I. Continued.

Hazing Technique	Success and Failures	Habituation to Hazing	Effectiveness	Sources
VARIED OR UNSPECIFIED SPECIES				
Lasers (American crow)	Effectively removed crows from roost, but birds came back within 15 minutes.	X	Short term	Gorenzel et al. 1994b
Motion-sensing lasers (Canada geese)	Limited effectiveness; brief response followed by acclimatization.	X	Short term	Werner and Clark 2006
Standing or pop-up effigies	Pop-up models and models with motion and sound somewhat successful. All require frequent relocation.[a]	X		Gorenzel et al. 1994a
Strobe or flashing lights	Strobe lights similar to those used on aircraft are most effective in frightening night-feeding birds. Extremely bright flashing lights have a blinding effect that reduces a bird's ability to catch fish.[a]	X		Gorenzel et al. 1994a
Reflective plates or lines Eyespot balloons Water spray devices Gas-operated exploders Pyrotechnics Electronic noisemakers Bird distress calls	[a]	X		Gorenzel et al. 1994a
Gas cannons Falcon imitator Rotating hunter Phoenix wailer Av-Alarm Bird Gard® 'AVA' and Bird Gard® 'ABC' Predator model Hawk kites Balloons Predator calls Trapping Water sprays	Limited recommendation – techniques can repel or disperse birds but are limited in their effectiveness because of habituation, weak biological basis, limited application, and/or implementation problems	X		Harris and Davis 1998

Appendix I. Continued.

Hazing Technique	Success and Failures	Habituation to Hazing	Effectiveness	Sources
Habitat modification Fencing Netting Overhead wires Overhead lines	Highly recommended: technique can be considered core elements of an effective bird control program. Long-term control, with little habituation if implemented correctly. The active approaches require frequent involvement of skilled, motivated staff.		Long term	Harris and Davis 1998
Lethal control as a form of hazing	Eliminate the habituated 'hard to scare' birds.[b]			Gorenzel et al. 1994a

[a] The value of these devices is usually limited to short-term control. Although bird damage can sometimes be reduced by using only one type of frightening device, better results over longer periods are often achieved by using a combination of devices and/or by changing methods frequently. In addition, scaring equipment, especially sound-making devices, is usually more effective when moved often to prevent birds from becoming accustomed to the device. Birds will eventually ignore any scaring device that is left in the same place or that emits sound in the same regular pattern over a long period of time. It is important to start the frightening regime before the birds establish regular feeding patterns at a site. Once regular habits are established, they are difficult to break using frightening techniques. Although the majority of birds may be scared away initially by frightening methods, some individuals will soon ignore the control methods. These 'hard-to-scare' individuals attract others to the feeding site and require a control method involving real danger from the bird's point of view, such as pyrotechnics or exploders, reinforced by human presence.

[b] The effectiveness of frightening devices can be improved by incorporating the use of rifles or shotguns to remove birds that have habituated.

Cormorants

As with pelicans, cormorants have been subjected to drastic population reductions associated with human persecution and organochlorine contamination (Gress et al. 1973, Wires and Cuthbert 2006). Remediation actions, along with anthropomorphic-related increases in the availability of prey, have led to an overwhelming successful population recovery for cormorants through greater numbers and an increase in the distribution of this species. In turn, this increase in the population of cormorants has led to ecological and economical impacts.

Impacts by cormorant populations can be found on both the breeding and wintering grounds. On the breeding grounds, cormorants can out-compete other colonial nesting birds for nest sites (Shieldcastle and Martin 1999, NYSDEC 2004) and substantially increased numbers of fish-eating birds may have a detrimental impact on local sensitive and/or hatchery fisheries

(Ottenbacher et al. 1994, Lovvorn et al. 1999). As opportunistic foragers, cormorants are commonly found associated with aquaculture farms during the winter months, and the economic loss from fish consumption and from control efforts needed to reduce the impacts has been estimated in the millions of dollars (Sullivan et al. 2006). Also, large numbers of nesting and/or roosting cormorants can also cause detrimental effects to vegetation through either the removal of branches and leaves for nesting material or from an accumulation of high acid guano (Sullivan et al. 2006). Since 2003, a USFWS Final Environmental Impact Statement (USFWS 2003) allows 24 states to lethally control cormorants, although non-lethal techniques and post-control monitoring is encouraged.

Lethal Actions—Lethal control is most effective when it is used in a localized area (small foraging location or nest colony) and with a finite number of birds (Curtis et al. 1996). When large numbers of cormorants are involved, these techniques become less cost efficient because of a constant influx of replacement birds (Curtis et al. 1996). The removal of active cormorant nests can be very effective in reducing local reproductive success but may cause cormorants to re-nest at a nearby location, displacing the problem. Oiling eggs is typically done using food grade corn or mineral oil sprayed from a backpack sprayer. This technique is very effective at reducing annual productivity and has less risk of displacing nesting birds (Bedard et al. 1995, Duerr et al. 2007). The shooting of cormorants can be done with a small caliber rimfire rifle or shotgun. This can be effective in the short term and on a localized area, but the success can diminish quickly as birds learn to stay out of shooting range or are replaced by other birds (Bishop et al. 2003). Lethal control techniques can be labor intensive with the need for repeated treatments within a year as well as on an annual basis (Sullivan et al. 2006). There is a risk that lethal control may have unintended long-term consequences to cormorant populations if younger, more naïve birds are disproportionately killed. Lethal control is most effective when used with other non-lethal scare tactics in an integrated bird management program (Curtis et al. 1996). Lethal control techniques for cormorants and their degree of success are summarized in Table 6.

Non-lethal Actions—The non-lethal control of cormorants can be classified as scare techniques (visual or acoustic) or obstruction tools. Visual scare techniques include human presence, dogs, standing or pop-up effigies, balloons, reflective plates or ribbon, strobe or spot lights, manual or motion-sensing lasers, remote-controlled boats or planes, and water cannons. Acoustic scare techniques include gas-powered noise cannons, electronic noise makers, cracker shells, shooting, pyrotechnics, predator calls, or distress calls. Obstruction tools include string barriers or overhead wires or lines, floating ropes, fencing, or netting. These can be more cost-efficient than lethal control and can be used at feeding or roosting locations; cormorants can, however, become acclimated to a particular scare tactic (Reinhold and Sloan 1999). It is therefore recommended that a suite of techniques (scare, obstruction, and lethal) are used together, started early, and continued consistently to be effective (Curtis et al. 1996). Non-lethal control techniques for cormorants and their degree of success are summarized in Table 6.

Appendix II. Description and analysis of 12 potential management actions considered to address impacts of pelicans on fish in Idaho.

	Action Description	**Biological Impacts – Birds**	**Biological Impacts – Fish**	**Practical / Logistical Considerations**	**Social Impact**	**Cost Analysis**	**Regulatory Constraints**	**Likelihood of success**
Increase Reservoir Water Levels	Maintain reservoir water at levels that provide adequate refugia for fish at times and/or locations needed Would require cooperation with water users and associated water management agencies	Decrease forage opportunity by reducing shallow water foraging habitat Decrease nesting habitat by reducing surface area of island(s) Could displace foraging pelicans to other bodies of water	Increased loss of prey species at other fisheries from displaced pelicans Reduced loss of prey species at treatment waters due to an increase in refugia Potential increase in the survival and/or recruitment of prey species because of stable water levels Fish impacts unknown – depends on timing and duration of flow changes	Not practical because the demand for water resources is too high (i.e., energy, agriculture, commercial, and residential needs) Multiple users and diverse demands for water would make coordination complicated	There would likely be a divided public reaction	Although direct costs of withholding water might be low, the indirect costs to water users and the potential cost of mitigation may be high Currently in-stream flow or in-reservoir use are not currently recognized under water rental rules and further discussion would need to occur with the Idaho Water Resource Board No cost estimate possible at this time	Potential federal, state, and tribal constraints	Unpredictable level of success associated with treatment waters only
Modify Prey Composition	Stock game and/or nongame fish species to diversify pelican prey base	Additional stocked prey species may increase foraging opportunity in treatment waters	Potentially reduce predation impacts to a single species, but could increase impacts	Sources of additional fish species may be difficult to acquire due to state hatchery	Divided public if fishery quality is compromised	The estimated cost of stocking hatchery-reared rainbow trout to feed one adult pelican	IDFG – seven step process for new species introductions	Unpredictable level of success Dependant on current fishery diversity, bird

Appendix II. Continued.

	Action Description	Biological Impacts – Birds	Biological Impacts – Fish	Practical / Logistical Considerations	Social Impact	Cost Analysis	Regulatory Constraints	Likelihood of success
		Potential increase in fecundity / survival of piscivorous birds associated with treatment waters May attract piscivorous birds to treatment waters	if pelicans are drawn to increased foraging opportunities Potential negative effect on other fish species through interspecific competition	limitations Viability of stocked fish uncertain and may require continued supplementation		consuming only rainbow trout would be between $15–50 / day The estimated cost of modifying prey composition by introducing non-native fishes or “rough fish” (i.e., carp) would be approximately $500 / day Initial introduction may require only one day with a delayed response required for natural recruitment to expand the population The delayed cost realized through loss of a quality fishery or treatment to recover a quality fishery (both		behavior, and stocking viability

Appendix II. Continued.

	Action Description	Biological Impacts – Birds	Biological Impacts – Fish	Practical / Logistical Considerations	Social Impact	Cost Analysis	Regulatory Constraints	Likelihood of success
						common scenarios occurring following introduction of non-native / undesired species) could be thousands to millions of dollars		
Modify Fish Stocking Strategies	Distribute stocking location(s) in time (seasonal / daily) and space - Alter time of stocking from spring to fall (after pelicans have migrated) - Increase the number of stocking locations to reduce predation risk - Change stocking time from day to dusk Reduce fish stocking at some locations	May affect short-term foraging opportunities for birds by reducing availability of hatchery fish May change location and/or time of pelican foraging	May reduce predation mortality of hatchery fish May increase mortality of hatchery fish from other causes - Changing stocking time from spring to fall could affect overwinter survival of hatchery fish - Longer retention of hatchery fish in trucks could affect survival - Increased handling	Fall release more difficult due to lower water levels Hatchery constraints due to production timing and needs	Mixed public opinion because this action could change quality of fishery	Expensive due to changes in hatchery production only if species, size, and numbers change Changes in angler use could affect local economies (up or down) No significant change in costs if species, size, and numbers similar	None	Depends on action taken, characteristics of stocking location, and adaptability of pelicans to changes in foraging opportunities - Changing stocking time from spring to fall more likely to be successful than simply changing time of day or number of release sites - Fall stocking more likely to be successful in larger lakes / reservoirs

Appendix II. Continued.

	Action Description	Biological Impacts – Birds	Biological Impacts – Fish	Practical / Logistical Considerations	Social Impact	Cost Analysis	Regulatory Constraints	Likelihood of success
	- May be applicable in some cases, either temporarily or permanently		mortality possible					- More likely to be successful if pelicans slow to adapt foraging behavior in response to release of fish
Provide Refugia for Fish	Create physical barriers to separate pelicans and fish: -Floating rope -Anchored wood or plastic platforms	Little to no physical impact to birds Risk of bird entanglement Platforms could provide perches for birds	Reduced fish loss under barriers Fish resting areas under barriers Could reduce foraging in refugia areas Could concentrate and increase foraging in non-refugia areas Could reduce loss in areas of fish concentration, i.e., spawning streams, mouths of tributaries, etc.	Difficult and labor intensive to maintain Reduced fishing opportunity for anglers, i.e., areas under the barriers would be unavailable to anglers Hindrance to navigation (boating hazard) Potential entanglement liability	May be unpopular with public due to creating areas unavailable to anglers Unsightly	Potentially expensive to install and maintain dependent on method -Floating rope- $1,000 for materials to protect 100 x 50 ft area; $1,400 in manpower to implement through spawning run; $2,400 total cost -Floating platforms $100 in materials; $1,750 in manpower during spawning run; $1,850 total cost	Unknown; Permitting may be required by Corps of Engineers	May prove effective in localized areas (e.g., immediately below weirs or other fish passage barriers) Difficulty of maintenance may limit long-term effectiveness on a large scale Overall likelihood of success low Potentially moderate to high likelihood of success in very localized area depending on physical constraints of site

Appendix II. Continued.

	Action Description	Biological Impacts – Birds	Biological Impacts – Fish	Practical / Logistical Considerations	Social Impact	Cost Analysis	Regulatory Constraints	Likelihood of success
Install Bird Lines	Install lines across waterways where birds concentrate to forage Use flagging for increased visibility, with line spaced at 20 yard intervals String lines 2–3 ft above water	May reduce foraging opportunities May cause mortality by entanglement in lines. Fluctuating water levels can inundate lines and increase risk of entanglement	May reduce bird predation on migrating cutthroat trout and other concentrated fish species	Limited by area covered and water levels. If reservoirs are filling, lines become inundated and require increased maintenance	Socially acceptable	Materials are relatively inexpensive (~$600 / mile) Labor intensive to set up and maintain (daily maintenance) estimated at about $8,600 / mile Estimated total cost about $9,200 / mile	May cause navigable water conflicts if implemented in popular boating areas	Very effective for short-river reaches with high concentrations of birds, but may not work for long river reaches and wide rivers Fluctuating water levels can inundate bird lines making them ineffective
Haze Birds	Haze only foraging or loafing birds (no hazing on nesting islands) Methods could include: -Harassment by air boat, motor boat or aircraft -Harassment by human presence and/or dogs -Harassment by crackers shells, zon guns, or pyrotechnics	Displacement Lost foraging opportunity at hazing site May cause regurgitation of stomach contents, requiring additional predation to meet dietary demands	Reduced predation at hazing site May move birds and predation issues to areas of greater biological significance to native fish populations May move birds and predation issues to areas of greater economic importance (see Table 4)	Labor intensive depending on method and scale Human safety issues if boats or aircraft are used	Divided public	Expensive depending on method, intensity, and scale Volunteers should be considered to implement hazing Labor costs $20 / hour; haze twice per day for 3-hr time periods totaling 6 hrs / day; $120 / day	None – as long as injury or take does not occur	Variable depending on scale High likelihood of success if hazing is intense and at an appropriate scale May be more effective in areas around weirs or tributary mouths

Appendix II. Continued.

	Action Description	Biological Impacts – Birds	Biological Impacts – Fish	Practical / Logistical Considerations	Social Impact	Cost Analysis	Regulatory Constraints	Likelihood of success
	-Disturbance by lasers or strobe lights -Disturbance by human presence or effigies					@ 45 days = $5,400 Costs about $2,700 / mile		
Translocations (Establish New Nesting Colonies)	Capture adult birds on nesting islands Translocate adult birds to alternate nesting locations to reduce bird numbers at original colony while establishing new colonies or supplementing bird numbers at existing colonies Could require wing clipping of translocated adults to prevent their return to the capture site Could require use of wing-clipped decoy birds at new site	May break pair bonds Unknown survival prediction for translocated birds Release sites may have unknown factors such as high levels of predation or human disturbance that limits adult survival Transport may stress birds to the point of reduced survival Reduced chick survival if breeding adults moved during incubation,	Unknown long-term impact Immediate impact on fish if bird capture and removal occurred at targeted problem areas (hazing associated with bird removal, and the actual removal of birds will reduce immediate foraging) Reduction in local pelican population may reduce fish predation but may not improve overall trout numbers if predation is compensatory	Should question why birds have not naturally colonized the areas we would move them to	May give the appearance that we are expanding distribution of the pelicans so we can use more aggressive management alternatives (e.g., oiling eggs, shooting adults) in problem areas such as Blackfoot Reservoir Translocations would demonstrate our dedication to maintaining numbers in Idaho, particularly in light of aggressive management approaches such as oiling eggs	No guarantee of success and no experience to model efforts Costly -Capture is labor intensive -Transport is costly due to transport vehicle and personnel needs Monitoring at release site could be labor intensive, difficult, and potentially very ineffective Scale of removal necessary to make a measurable impact on local populations may	Would require special permit from USFWS	May reduce the numbers of birds at predation site temporarily but it may simply move the problem elsewhere Will not reduce the problem in any given area for very long unless a very large number of birds are moved and do not return No guarantee the birds won't come back

Appendix II. Continued.

	Action Description	Biological Impacts – Birds	Biological Impacts – Fish	Practical / Logistical Considerations	Social Impact	Cost Analysis	Regulatory Constraints	Likelihood of success
		nestling or fledgling period Capture of adults without a nest or young could not be guaranteed unless capture and translocation was conducted prior to nesting If colony is space-limited, removal of adult birds at a colony may open up space for new birds that come in from outside areas (e.g., Great Salt Lake) in effect increasing statewide numbers May establish new breeding colonies, thereby increasing abundance in the future			Anglers at release sites may see pelican translocations as simply a distribution of the problem	be prohibitive Estimated total cost per day @ $7,440 includes boats, horse trailers, vehicles, manpower, and fencing supplies Handling 75 birds / day would amount to $100 / bird		

Appendix II. Continued.

	Action Description	Biological Impacts – Birds	Biological Impacts – Fish	Practical / Logistical Considerations	Social Impact	Cost Analysis	Regulatory Constraints	Likelihood of success
Manipulate Nesting Habitat	Reduce nesting habitat available for pelicans Techniques include: -Manipulate habitat (i.e., add vegetation or large rock) -Remove habitat (i.e., blasting) -Erect fence, physical barriers to break-up island surface area	Potential displacement of nesting birds Potential reduced productivity if the available nesting substrate is a limiting factor Potential negative effects on other island nesters (cormorants, herons, egrets, etc.)	May reduce the loss of fish to pelicans on short-term (less chicks to be fed) and/or long-term (reduced pelican numbers) if fewer young pelicans result from treatment	Logistically feasible and highly practical dependant on technique (e.g., planting vegetation may be easily accomplished; however, deposition of rock or the use of heavy machinery may be economically and logistically difficult)	Divided public -A reduced productivity and/or population size of pelicans would likely be acceptable to public with fish concerns but may not be for public with bird concerns	Planting willow cuttings at 1 shrub / yd^2 would cost an estimated $4,000 / acre An excavator would cost an estimated $1,200 / week to modify or remove suitable habitat or add rock Blasting costs range from $2–6 / ft^2 depending on accessibility The nesting islands range in size from 13,000–200,000 ft^2	Would likely require approval and permitting by federal, and/or state entities Depends on island ownership	Moderate short-term dependent on the effects of productivity of pelicans (fewer chicks to be fed) and behavior of displaced pelicans Potentially high long-term dependant on pelican population impacts Unpredictable level of success
Introduce Predators to Nesting Islands	Translocate native mammalian predators to islands used for nesting (i.e., badgers, raccoons, foxes, coyotes)	May reduce pelican population May reduce reproductive success May reduce	Chick mortality may reduce predation demand for fish May reduce local pelican population and associated	Feasible Predators may leave and need to be reintroduced annually Predators can be removed if	Mixed public opinion	Relatively inexpensive Unknown effectiveness Trapping costs about $120 / predator	Needs to be investigated with USFWS IDFG has authority to capture and release predators	Unknown and high probability of impacting the other colonial nesting birds

Appendix II. Continued.

	Action Description	Biological Impacts – Birds	Biological Impacts – Fish	Practical / Logistical Considerations	Social Impact	Cost Analysis	Regulatory Constraints	Likelihood of success
		cohort contribution to future production Pelicans may abandon nesting colony May cause disturbance and predation on other colonial nesting bird species	foraging demand If other colony nesters decline, fish predation may also be reduced A portion or the entire colony may relocate to an area with similar fish predation concerns	necessary A predator may select smaller colonial nesting species rather than pelican May lose control of ability to manage pelican colony size		Transport and release about $280 / predator Total cost about $400 / predator Assuming no more than 10 predators released / year the approximate annual cost would be ~$5,000 / year		
Harvest Season on Birds (By the Public)	Lethal take of birds in problem areas through IDFG-regulated harvest season -Controlled hunt or quota hunt	Potential disturbance to other species May break pair bonds if breeding adult is harvested in turn reducing overall productivity Reduced chick survival if breeding adult harvested during incubation, nestling or fledgling period	Immediate reduction on predation of fish if harvest was targeted at problem areas Reduction in local pelican population may reduce fish predation but may not improve overall trout numbers if predation was compensatory	Harvest season to reduce predation during cutthroat trout spawning would be outside legal harvest dates of other avian game species (with possible exception of sandhill cranes) Potential conflicts between anglers and hunters if harvest season coincides with open fishing	Possible conflict between anglers and hunters Conflict between consumptive and non-consumptive user groups Potentially disruptive to other user groups in immediate area	A portion of the costs related to pelican management could be supported by pelican tag sales: public could support management program Enforcement of harvest regulations and land use restrictions could be costly (time and money) to	IDFG reclassification from protected nongame species to unprotected nongame or game species or predatory species? Federal approval required IDFG commission approval required	High in the short term depending on effectiveness of harvest and number of birds removed Potentially successful long term depending on public acceptance of program and effectiveness of harvest Harvested birds could simply be replaced by new

Appendix II. Continued.

	Action Description	Biological Impacts – Birds	Biological Impacts – Fish	Practical / Logistical Considerations	Social Impact	Cost Analysis	Regulatory Constraints	Likelihood of success
		Immediate reduction in pelican abundance if harvest is effective		season Firearm hunt may be disruptive to other user groups in immediate hunt area Season would need to be implemented annually for any long-term hazing effect or population reduction Hazing effects associated with a harvest season or "hunt" would aid in deterring pelicans from foraging in localized areas		the IDFG enforcement bureau Less expensive relative to other management alternatives to reduce pelican numbers (i.e., Wildlife Services shooting adults, oiling eggs, translocations) Highly effective in localized areas if harvest success was high enough to reduce pelican numbers and if new birds did not quickly fill the vacancies Development of harvest protocol ~ $2,000; tag fees ~ $10.50@ 400 tags generates $4,200; law enforcement personnel time @30 days		birds either in the short term or long term Harvest would act as a form of disturbance / hazing that could contribute *more* to problem resolution than lethal removal Could be an effective method to achieve specific population / site objectives through area-specific quotas or tag sales

Appendix II. Continued.

	Action Description	Biological Impacts – Birds	Biological Impacts – Fish	Practical / Logistical Considerations	Social Impact	Cost Analysis	Regulatory Constraints	Likelihood of success
						~$5,250; net costs $3,050 Depends on public participation and number of tags sold		
Oil Eggs to Limit Pelican Productivity and/or Recruitment	Spray vegetable oil on incubating eggs, which suffocates the embryo May require multiple application of vegetable oil	May reduce pelican population May reduce reproductive success May reduce cohort contribution to future production Potential disturbance to other colonial nesting species Pelicans will continue to incubate eggs rather than renest May increase the incubation period, which could reduce	May reduce predation on fish, because adult pelicans are not feeding young Predation impacts by nesting adults may be maintained until adults abandon nests Oiling eggs may impact the length of time adults will tend nests and how adults will disperse after nest abandonment	Relatively easy to implement Can be selective for pelican nests and specific treatment goals can be identified	Mixed public opinion	Relatively inexpensive Very effective at reducing production May require several years of treatment to detect a population impact Materials $460; labor and transportation $900; total costs ~$1,360 / year	Consider IDFG policy regarding fertility and predator control Federal permit required	High expectation of reducing impacts of pelicans on fish

Appendix II. Continued.

	Action Description	Biological Impacts – Birds	Biological Impacts – Fish	Practical / Logistical Considerations	Social Impact	Cost Analysis	Regulatory Constraints	Likelihood of success
		adult fitness						
Pelican Population Management (Shoot Adult Birds)	Use Wildlife Services to shoot adult birds at high impact areas to actively manage the pelican population, enhance hazing, and/or to target individuals that have habituated to specific sites	May reduce pelican reproductive success if control occurs during the nesting season	May reduce fish predation	Feasible Very species-specific and locations of concern can be targeted	Mixed public opinion	Given a specific population objective, this method can be an effective management tool Materials (ammunition) $1,000 / 200 birds; labor and transportation $3,600 for 30 days; NEPA work $500 Total cost ~$5,100 to remove 200 birds / month or $25.50 / bird	USFWS approval required	High if financial resources are committed

APPENDIX III

Policy-related Public Comments on Draft Pelican Plan (with Department Responses)

1. **The Department is emphasizing the value of cutthroat trout and recreational fishing at the expense of pelicans.** The Department believes the population goals proposed for the nesting colonies at Blackfoot Reservoir and the Minidoka National Wildlife Refuge strike a reasonable balance between conservation of pelicans and cutthroat trout/sport fisheries. The Plan strives to balance benefits from all the species we manage. In our estimation, we provide strong empirical data documenting pelican impacts on cutthroat trout and sport fisheries to justify the management actions proposed in the Plan.

2. **Rainbow trout and other recreational fishing opportunities should not be considered in this plan.** The Department disagrees with this statement. While rainbow trout are not native to the Snake River Basin above Shoshone Falls, they provide significant recreational opportunity in lowland lakes and reservoirs and are much desired by anglers. We stock rainbow trout in lowland lakes and reservoirs where other sport fish opportunities are generally lacking. These sport fisheries can provide significant economic impacts to local communities.

3. **Be specific on which management actions will be emphasized; uncertainty of actual management actions to be taken makes the plan difficult to interpret and assess.** The Department proposed a range of management actions to be considered on a case-by-case basis. In most instances, we expect that several actions will be required to reduce pelican impacts. Federal authorization to remove pelicans or oil eggs is critical in determining scope and scale of available options. The Plan also emphasizes adaptive management to deal with unanticipated changes or provide the Department with enough latitude to respond accordingly.

4. **The Department has not provided enough empirical data to justify lethal control.** In our estimation, we provide sufficient empirical data documenting pelican impacts on cutthroat trout and sport fisheries to justify the management actions proposed in the Plan.

5. **The pelican population goals are set too high.** The Department believes the population goals proposed for the nesting colonies at Blackfoot Reservoir and the Minidoka National Wildlife Refuge strike a reasonable balance between conservation of pelicans and cutthroat trout/sport fisheries. In our estimation, we provide sufficient empirical data documenting pelican impacts on cutthroat trout and sport fisheries to justify the management actions proposed in the Plan. The population goal for the Blackfoot nesting colony is clearly spelled out on page 22 of the Plan and again in legends for Figures 6 (page 23) and 7 (page 24). The Minidoka National Wildlife Refuge nesting colony goal is clearly provided as a reference for future consideration and not something we intend to achieve in the short term (five years).

Appendix III. Continued.

Technical-related Public Comments on Draft Pelican Plan (with Department Responses)

1. **Economic values of pelicans were overlooked.** The Department acknowledges the economic value of bird watching in Idaho and has included language to that effect in the final document (page 17). Ultimately, the Plan population objectives will ensure a sustainable pelican population and abundant pelican viewing opportunities.

2. **There is a contradiction between pelican status (critically imperiled) and proposing a population reduction.** The Department does not agree with this statement. The "critically imperiled" (S1B) rank is primarily an artifact of the NatureServe methodology (less than 6 occurrences = less than 6 colonies for pelicans). The number of nesting colonies (5 or fewer) and population size (2,500–10,000 individuals) have a major influence on the state conservation status based on the NatureServe methodology. See page 8 of the Plan for more details. Anything less than 10,000 pelicans would still yield the same critically imperiled rank because there are few colonies.

3. **Pelicans benefit trout and other sport fish by reducing populations of competing nongame species.** Pelicans do not significantly contribute to reducing populations of nongame fish species. Pelicans remove only a very small portion by number and weight of the total nongame fish community. We regularly collect standardized fish population data for Blackfoot Reservoir. During the period of large, rapid increases in pelican numbers in the Blackfoot Reservoir nesting colony, we documented no effect on the abundance of nongame fish populations in the reservoir.

4. **Restock predators on the nesting island to restore a natural balance.** The Department addresses this potential management action on pages 21 and 59–60 of the Plan. Although considered feasible, this is not a preferred option because of potential impacts to other island-nesting colonial waterbirds (non-target species) and lack of control in terms of impacts to nesting pelicans.

5. **Have all hazing methods been adequately considered and attempted (i.e., floating ropes, enhanced human presence, etc.)?** The Department has been hazing pelicans for several years now and believes we have employed the appropriate methods; however, hazing by itself is not very useful at significantly reducing impacts and it is not cost effective. We have generally observed short-term benefits from hazing methods and none of them appear to be viable options for significantly reducing the threat of a burgeoning pelican population to native cutthroat trout.

Appendix III. Continued.

6. **Control pelican numbers using hunting seasons.** The Department addresses this potential management action on pages 21 and 60–62 of the Plan. We deemed it infeasible/impractical at this time. The Migratory Bird Treaty Act grants the Secretary of the Interior the authority to establish hunting seasons for any of the migratory game bird species. The Fish and Wildlife Service has determined that hunting is appropriate only for those species for which there is a long tradition of hunting, and for which hunting is consistent with their population status and their long-term conservation. Alternatively, the Service may authorize removal or control through a depredation permit.

7. **The Department has not adequately considered or addressed all other factors other than pelicans that potentially impact YCT populations.** The Department fully recognizes other factors contribute to trends in YCT populations such as water quality and water management, selenium, livestock grazing, and angling. Our staff is often involved in discussions pertaining to issues affecting YCT. In the final Plan, we will provide a discussion regarding the relative impact of factors affecting cutthroat trout populations. For instance, during the 1990s, harvest by anglers was considered a major limiting factor to the cutthroat trout population. To help restore YCT, harvest by anglers was eliminated by the Department.

8. **Need to separate pelican foraging impacts on fluvial versus adfluvial life stages**. We have made the appropriate adjustments to the Plan.

9. **Extrapolating Blackfoot Reservoir data to surrounding waters is inappropriate.** No data from the Blackfoot was extrapolated to other waters. Reviewers who made this comment may be referring to the peer-reviewed literature value of 2.4 pounds of daily consumption demand found on page 14 of the Plan. This value was used in Table 3 to derive estimated trout consumption by pelicans in southeastern Idaho reservoirs. This is the same literature value used for the Blackfoot Reservoir consumption estimate found on page 14.

10. **It is unclear that the regional reservoir counts were separate from the Blackfoot studies.** The Department could include a more detailed summary of the weekly pelican surveys that were completed on 20 southeastern Idaho waters.

11. **Nongame species should be introduced to enhance forage base for pelicans.** Introducing nongame fish species for pelican forage would reduce production of game species, lower angling success, and be counter to the Department's mission to enhance fishing opportunities. Currently, there is no shortage of nongame fish in Blackfoot Reservoir or other selected lowland reservoirs to provide forage opportunities for pelicans.

12. **Hatchery trout stocking has contributed to the increase in pelican populations.** The Department disagrees with this statement. The total pounds of trout stocked in southern Idaho are insignificant compared to the availability of nongame species.

Appendix III. Continued.

13. **Ensure that pelicans nesting in surrounding states are not shot in Idaho.** The Department cannot differentiate between pelicans arriving from adjacent states or those nesting in Idaho. However, in our opinion this is irrelevant if birds originating from other states are actively foraging on spawning cutthroat trout or hatchery trout providing important sport fisheries. The impact is the same regardless of where the birds are from.

14. **Need to include species composition data from other reservoirs. The lack of alternate forage (nongame species) in many of the reservoirs was questioned.** On pages 17–18 of the Plan, we introduce the Pelican Impact Index which included a variable for fish community structure or complexity termed the Fish Index. Table 4 on page 18 lists the Fish Index for 20 southeastern Idaho reservoirs. The rating system for each reservoir ranged from 1–3 and is dependent on the variety of fish species present. We will provide clarity to this section and add that we regularly monitor the fish populations in each of those reservoirs. The fish community descriptions in the Plan are based on reliable information.

15. **Explain how these colonies contribute to the viability of the western regional population**. We are unaware of any viability analysis for the western population at this time. This population has experienced a steady increase over the past 25 years and Idaho's contribution in terms of numbers to the western population is described explicitly on pages 5–6 of the Plan. The Department recognizes the significance of Idaho's colonies and has every intention of maintaining a minimum of two viable breeding colonies.