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Review: Bird Predation of Juvenile Salmonids and Management of Birds Near 14 Columbia Basin Dams

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ABSTRACT

Bird predation of juvenile salmonids and/or bird predation control are reviewed for 14 of the 18 mainstem dams on the Columbia and Snake Rivers, but there was little information for some of these dams.

California gulls, ring-billed gulls, Caspian terns, double-crested cormorants, American white pelicans, and several other bird species have been reported as predators of juvenile salmon and steelhead at these dams. Most estimates of the amount of this predation have been 2% or less of salmonids passing a dam. This is less than the percentage of juvenile salmonids killed during dam passage, and it has not been determined what proportion of salmonids taken by birds were already dead or mortally injured from dam passage. Thus, it is not clear what portion of bird predation is of viable salmonids that would have otherwise survived. Further, it appears that most juvenile salmonids in the Columbia Basin are not federally listed as threatened or endangered, so it is not known what impact bird predation at dams may have on listed salmonids. Nevertheless, predation may significantly affect certain salmon stocks, so it cannot be dismissed as unimportant.

Bird management includes installing wires above the water at dam tailraces. Closely spaced wires are effective in keeping out flying birds. However, not all areas where birds feed on fish below dams can be covered with wires, the wires have sometimes been placed too far apart to keep out flying birds, and nonflying birds can go under wires. Consequently, Wildlife Services (which was known as Animal Damage Control prior to 1998) of the U.S. Department of Agriculture has also nonlethally harassed and lethally taken birds at dams after it has been requested to do so. Studies by staff of the U.S. Army Corps of Engineers have shown that nonlethal and lethal control by Washington Wildlife Services at The Dalles and John Day Dams needed to be repeated because birds would return. During 1997-1998, Wildlife Services dispersed at least 20,682 birds (mostly gulls) and lethally took at least 3,143 birds at these two dams.

Most juvenile salmonids migrate past dams from April through early June, although many subyearling chinook migrate during July and August. Thus, bird control to protect juvenile salmonids would be most effective during April-July and perhaps through August for subyearling chinook. Beginning in August, many juvenile American shad are also migrating over lower Columbia dams and then can be more abundant than migrating salmonids; however, few shad pass Snake River dams and at least one mid-Columbia dam. Washington Wildlife Services' bird control has been during April-September at mid-Columbia dams and apparently during spring through winter at lower Columbia dams, so its control may sometimes occur when few juvenile salmonids are migrating.

Although bird management at some dams has occurred since at least 1992, it has not yet been determined if this control is cost effective (i.e., the costs of bird control are less than the costs of predation). Washington Wildlife Services asserts that the cost of bird predation can be estimated by the cost of controlling predation. With this circular logic, Wildlife Services could spend a considerable amount of taxpayer or electric ratepayer money controlling predators that may be taking an insignificant number of viable juvenile salmonids and justify doing so because it has spent so much money. Consequently, it is important for there to be realistic evidence for the need or benefits of predator control, so that control is cost effective.

Washington Wildlife Services has not been forthcoming in answering general questions about its activities at Columbia Basin dams and asserts that a federal Texas court case precludes disclosure of information. However, it seems that Wildlife Services may be using that court case to avoid scrutiny because the court ruled that Wildlife Services not provide information that could identify cooperators with Wildlife Services, not that it withhold all information about its activities. Further, Wildlife Services appears to have violated this court decision by providing other agencies with reports of its predator control activities that identifies specific cooperators, so Washington Wildlife Services seems to have selectively chosen when

to use the court ruling as an excuse to not give out general information.

Fish-eating bird control has proceeded very differently in the Columbia Estuary than at Columbia Basin dams. In the Estuary, bird predation was quantified in 1997 to establish a need for bird control; agency, tribal, and public consultations about a management plan were conducted, management actions began to be implemented in 1999, and predation reduction began to be quantified in 2000. At dams, Washington Wildlife Services assumed bird predation to be significant, initiated bird management before the amount of predation was measured, appears to have done less consultation with the public, other agencies, or tribes about its management actions; and assumed that its predator control actions have significantly reduced predation.

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ACKNOWLEDGMENTS

I thank Roger Woodruff (Washington/Alaska Wildlife Services' Director of the Animal and Plant Health Inspection Service [APHIS] of the U.S. Department of Agriculture) for his letters. His critical comments about the previous draft of this report are reprinted in Appendix III and helped improve the final draft of this paper.

I am grateful to Gretchen Starke and Sallie Jones of the Fisheries Field Unit of U.S. Army Corps of Engineers for providing copies of Jones et al. (1996-1999), to Darryl York of the U.S. Department of Agriculture National Wildlife Research Center for providing a copy of York et al. (2000) and promptly responding to my email request for information, and to Gerald Winegrad of American Bird Conservancy for providing an unpublished report. I thank Ken Collis of Real Time Research for unpublished data, answers to questions, and permission to use unpublished reports (i.e., Collis et al. 2001b, Columbia Bird Research 2000a,b; 2001) on the Columbia Bird Research web site (http://www.ColumbiaBirdResearch.org).

I thank Janet Webster, Susan Gilmont, and Judy Mullen of the Guin Library at the Oregon State University Hatfield Marine Science Center for providing some hard to obtain papers. I am also grateful to their library for having high-speed Internet connections, which were necessary to view some of the very large files that some government agencies provide on their Internet sites.

I appreciate the Chelan County Public Utility District for providing information about its activities on the Internet (http://www.chelanpud.org)--it would be great for citizens if other public agencies were as public. I also thank those U.S. Department of Agriculture Wildlife Services' staff who have provided information about some Wildlife Services' activities on the Internet (http://www.aphis.usda.gov/ws).

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PREFACE

HISTORY OF THIS REVIEW. I have written this report because I have not found a previous review about bird predation and control at Columbia Basin dams. I started it in 2000 and submitted 40 pages of it as comments on 10 April 2002 in response to the "Invitation for Public Involvement" by Washington Wildlife Services (Wildlife Services 2002a) about its bird management at mid-Columbia River dams.

When I started this review, I had no opinion about Washington Wildlife Services. However, during the course of researching and writing this report, I realized that this review had become critical of Washington Wildlife Services, so I felt it was fair to give them a chance to respond. Accordingly, on 8 September 2002, I sent a draft to Roger Woodruff (Washington/Alaska Wildlife Services' Director) for Wildlife Services' comments by October 26. On September 8, I also emailed Darryl York, Patricia

Pochop, and John Cummings of the U.S. Department of Agriculture National Wildlife Research Center/Wildlife Services and asked if they would be willing to review this paper. I contacted them because they have been involved in Wildlife Services' actions to control fish-eating birds in the Columbia Basin (e.g., Pochop et al. 1998, 2001; York et al. 2000), but they did not respond. On September 20, Roger Woodruff wrote a letter with critical comments that is reprinted in Appendix III; he indicated that Dr. Mark Tobin, head of the bird research section at the Wildlife Services' National Wildlife Research Center had received a copy of my draft and would be providing additional comments. But I have not received any additional comments or a request for a delay. My October 26 deadline is 48 days after September 8, which is sufficiently long for comments by Wildlife Services. In contrast, Washington Wildlife Services only allowed a 18 day public comment period for Wildlife Services (2002a) and a 30 day public comment period for Wildlife Services (2001c).

In his September 20 letter, Woodruff said: "Overall, we identified many sections of your report pertaining to WS' activities which are unfounded, inaccurate, or misleading" (Appendix III). That is his opinion, but I have checked my statements several times for accuracy, though I realize that I may have inadvertently included some errors. I gave staff of Wildlife Services the opportunity to point out errors or unfounded or misleading statements, but they chose not to do so.

MY BACKGROUND. I have a background in predation issues and experience in biological research and publishing. I started working with the issue of predation of juvenile salmonids in 1972 as a graduate student and received a nonthesis Master of Science degree in Zoology in 1976 from Oregon State University. I have had many biological papers published in peer-reviewed journals as well as in other biological journals; some of my papers are listed in the Yaquina Bay bibliography by J. Webster and H. Hiveley of Guin Library at the Oregon State University Hatfield Marine Science Center (see http://osulibrary.orst.edu/guin/yaqbib.htm). I have also reviewed many papers for biological journals.

In working on this and other reports about predation of juvenile salmonids in the Columbia Basin, I have often been asked for whom I am working. After reading reports of some agency staff, researchers, or consultants that sometimes seem to have been written to suit their employer or grantor, I understand that questioners may really be asking for which special interest group my reports are written because that may affect my objectivity (also see Baker 1998). During 1976-1984, I worked seasonally at a private Oregon coast salmon release/return site, and I worked as a part-time consultant during 1986-1987. Since 1987, I have been an unpaid, independent biologist; have not been a consultant, have not been employed nor a volunteer to do this report for a governmental agency, educational institution, or nongovernmental group; and have not applied for nor received grants. I earn a living by working full-time in a job that does not use my training in biology. This report is independently published and will be made available in 2003 for free on the Internet, so it is also not written to make money.

MY VIEWPOINT ABOUT ANIMAL DAMAGE CONTROL. I believe there are situations where animal damage control is justified and that predator control should be carried out in accordance with guidelines established by many wildlife management professionals as outlined in Appendix II-D-1. In researching this report, I found that Washington Wildlife Services appears to have an extreme view of predator control in which it undertakes predator control without determining if it is biologically justified or cost effective.

MY STANDING TO COMMENT ABOUT SALMON RECOVERY ISSUES. All citizens of the Pacific Northwest have standing (i.e., the right to participate) in Pacific Northwest salmon recovery issues. I am one of those citizens. We have standing because salmon recovery is directed by governmental agencies and often occurs on public waters and lands. We have standing because salmon recovery activities of governmental agencies are publicly financed through electric bills and taxes (e.g., section 4-B-3). As

citizens, we have a right to question governmental agencies and staff about their activities and to receive timely, honest answers. We have a right to be part of the decision-making process.

Unfortunately, Washington Wildlife Services has refused to disclose information about its bird management at Columbia Basin dams (sections 4-B-1 and 4-B-2). Wildlife Services justifies its refusal because of its interpretation of a federal court case, but it also violated a stipulation of that case when it chose to do so (section 4-B-2). In my opinion, Wildlife Services seems to be using the court case as an excuse to not answer questions, which allows it to evade accountability (sections 4-B-2 and 4-B-3). In my opinion, Washington Wildlife Services' lack of candor allows citizens and watchdog groups concerned with governmental inefficiency as well as animal rights' groups to imagine the worst.

READER BE AWARE! I have tried to present more than one side about bird predation and management issues at Columbia Basin dams. However, Washington Wildlife Services is critical of this report (Appendix III). I urge the reader to explore these controversial issues and to keep an open, skeptical mind. Bird predation and control issues are more complex than they may seem at first.

Range (Richard) D. Bayer 15 February 2003

TABLE OF CONTENTS

(Table of Contents continued on next page)

(Table of Contents continued)

List of Figures

List of Tables

CHAPTER 1. INTRODUCTION

1-A. INTRODUCTION

There is an ongoing effort to improve survival of juvenile salmonids at Columbia Basin dams because an average of 6-14% yearling chinook salmon and 8-12% steelhead died during passage through each project in recent years (National Marine Fisheries Service 2000a:72). Since birds conspicuously feed at dams while juvenile salmonids are migrating, birds may be one factor in this mortality. Consequently, bird control has been implemented at dams to improve salmonid survival. This control was requested by operators of dams and was conducted by Wildlife Services of the U.S. Department of Agriculture. Wildlife Services was known as Animal Damage Control prior to August 1997 (Appendix II-B).

The purpose of this paper is to review bird predation of juvenile salmonids and control of fish-eating birds at or near Columbia Basin dams. I have found predation or control information for 14 of the 18 mainstem dams on the Columbia and Snake Rivers (Fig. 1.1) and include what I have found in this report, though the information is meager for some dams.

In the rest of this introductory chapter, background information about the location of mainstem dams, listing of salmonids under the federal Endangered Species Act, timing of juvenile salmonid migration, and the presence of nesting and nonnesting birds near dams are examined.

Common and scientific names given in this report are in Appendix I. Some of the history and background of predator control by Wildlife Services is in Appendix II.

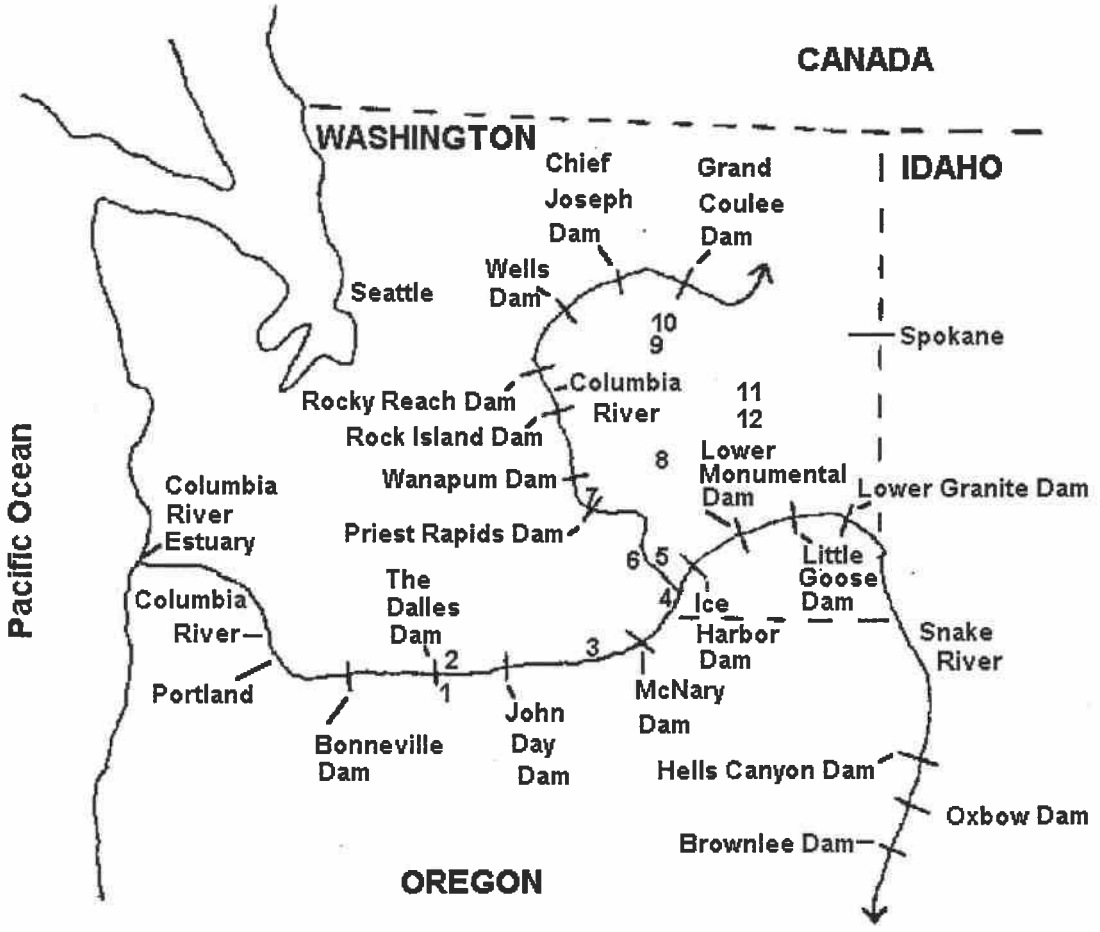
FIGURE 1.1. Locations of known gull or tern colonies and of 18 mainstem dams along the Columbia River from the Columbia River Estuary to Grand Coulee Dam and from the mouth of the Snake River to Brownlee Dam. There are additional dams further upstream (see the U.S. Army Corps of Engineers' map at http://www.nwd.usace.army.mil/ps/colbsnmap.htm). **The lower Columbia River is from Bonneville Dam to McNary Dam, and the mid-Columbia extends from above McNary Dam to Chief Joseph Dam** (Fish Passage Center 1999:88, 90).

The U.S. Army Corps of Engineers operates Bonneville, The Dalles, John Day, McNary, Chief Joseph, Ice Harbor, Lower Monumental, Little Goose, and Lower Granite Dams; the U. S. Bureau of Reclamation operates Grand Coulee Dam, Grant County Public Utility District operates Priest Rapids and Wanapum Dams, Chelan County Public Utility District operates Rock Island and Rocky Reach Dams, Douglas County Public Utility District operates Wells Dam, and Idaho Power Company operates Hells Canyon, Oxbow, and Brownlee Dams (Kaczynski and Palmisano 1993:276).

Bird colonies, with River Kilometer distances, if available, are from Collis et al. (2002:539):

1=Little Memaloose Island (River Kilometer 315)
2=Miller Rocks (River Kilometer 333)
3=Three Mile Canyon Island (River Kilometer 414)
4=Crescent Island (River Kilometer 510)
5=Richland Island (which is also known as Island 20)(River Kilometer 547)
6=Island 18 (River Kilometer 553)
7=Cabin Island (Conover et al. 1979:34, York et al. 2000:216)
8=Solstice Island in Potholes Reservoir (Collis et al. 2001b:8)
9=Goose Island in Banks Lake (Collis et al. 2001b:8)
10=south end of Banks Lake (Conover et al. 1979:34)
11=Harper Island in Sprague Lake (Collis et al. 2001b:8)
12=west end of Sprague Lake (Conover et al. 1979:34).

Little Memaloose Island, Miller Rocks, and Three Mile Canyon Island were formed by dam impoundment, and Crescent Island was created by dredged materials (Collis et al. 2000:33, National Marine Fisheries Service 2000b:42). I do not know if the other islands are natural.



1-B. DAMS IN THE COLUMBIA BASIN INCLUDED IN THIS REPORT

The Columbia Basin is the fourth largest in North America and is in parts of Washington, Oregon, Idaho, Montana, Nevada, and British Columbia (see the U.S. Army Corps of Engineers' map at http://www.nwd.usace.army.mil/ps/colbsnmap.htm). There are 18 mainstem dams on the Columbia and Snake Rivers, and their locations are shown in Fig. 1.1. Mainstem dams in Washington and Oregon are operated by public entities: the Corps (nine dams), public utility districts (five dams), and U.S. Bureau of Reclamation (one dam)(Fig. 1.1). The three mainstem Snake River dams in Idaho are operated by the Idaho Power Company (Fig. 1.1).

Information about bird predation or control was found for 14 of these dams, but not for Chief Joseph and Grand Coulee dams on the Columbia nor for Hells Canyon and Oxbow dams on the Snake.

1-C. FEDERAL LISTINGS OF JUVENILE SALMONIDS IN THE COLUMBIA BASIN

Twelve Evolutionarily Significant Units (ESU) of Columbia Basin salmonids are listed in December 2002 by National Marine Fisheries Service under the federal Endangered Species Act (U.S. Army Corps of Engineers 2001:5, Espenson 2001a). Current listings are at: http://www.nwr.noaa.gov/1salmon/salmesa. The vast majority of juvenile salmonids in the Columbia Basin are not listed as Threatened or Endangered, since the percentage of listed smolts predicted to arrive in the Columbia Estuary were 2% in 1998, 7-9% in 1999, and 17% in 2000 (U.S. Army Corps of Engineers 2000:18-19, 2001:20).

On 10 September 2001, U.S. District Judge Michael Hogan ruled that the National Marine Fisheries Service's federal listing of Oregon coastal coho under the Endangered Species Act was unlawful because hatchery coho were not included (Espenson 2001a). In response to this decision and to subsequent petitions to delist all listed Columbia Basin salmonids as well as other salmonids in the Pacific Northwest, the National Marine Fisheries Service decided to not appeal the decision, to delist Oregon coastal coho, and to review other Pacific Northwest salmonid listings (Espenson 2001a,b; McClure 2001). Seven environmental groups and fishing groups have appealed Hogan's decision (Espenson 2001b), and time will tell whether his decision will be upheld or if the National Marine Fisheries Service will change its listings.

Although federal listings of Columbia Basin salmonids are under review, listings under state Endangered Species Acts are not affected and are currently still in place (Anonymous 2001). But state laws may also be legally challenged.

1-D. TIMING OF DOWNSTREAM MIGRATION OF JUVENILE SALMONIDS

Juvenile salmonid migration does not occur throughout the year. Most of the migration for coho, yearling chinook, steelhead, and sockeye at Columbia Basin dams occurs during April through early June (Table 1.1). Subyearling chinook begin migrating later, but 90% of their migration is usually complete by August 1 at mid- and lower Columbia dams (Table 1.1).

TABLE 1.1. Timing of 10%, 50%, and 90% of juvenile salmonid migration in 1998 and 1991-1997 median 10% and 90% migration times at several Columbia Basin Dams. These data are from Fish Passage Center (1999:49); graphs of the timing of passage are in Fish Passage Center (1999:D-2 through D-25) and Martinson et al. (1999:17, 54-55). Age 0=subyearlings, Age 1=yearlings.

	Salmonid Species	Rearing Type	1998 Passage 10%	50%	90%	Historic Median * 10%	90%
SNAKE RIVER							
Lower Granite Dam	Chinook Age 0	Wild	6/12	7/14	8/25	6/24	8/26
	Chinook Age 1	Wild	4/12	5/2	5/18	4/16b	5/20b
	Chinook Age 1	Hatchery	4/21	5/1	5/10	4/23	5/17
	Coho	All	5/6	5/15	5/29	-	-
	Steelhead	Wild	4/26	5/5	5/24	4/23	5/22
	Steelhead	Hatchery	4/27	5/5	5/22	4/28	5/22
	Sockeye	Wild	5/11	5/15	5/26	-	-
	Sockeye	Hatchery	5/9	5/14	5/26	6/15c	7/13c
MID-COLUMBIA RIVER							
Rock Island Dam	Chinook Age 0	All	4/15	7/4	7/31	6/9	8/1
	Chinook Age 1	All	4/27	5/16	6/2	4/26	6/6
	Coho	All	5/25	6/1	6/8	-	-
	Steelhead	Wild	4/28	5/9	6/3	5/2	6/2
	Steelhead	Hatchery	4/30	5/10	5/22	5/2	5/22
	Sockeye	Wild	4/20	5/4	5/18	4/25f	5/24f
	Sockeye	Hatchery	5/3	5/27	6/7	4/25f	5/24f
LOWER COLUMBIA RIVER							
McNary Dam	Chinook Age 0	All	6/18	7/4	7/19	6/20	7/31d
	Chinook Age 1	All	4/20	5/7	5/27	4/24	5/30
	Coho	All	5/3	5/18	6/3	5/7	6/1
	Steelhead	Wild	4/25	5/8	5/30	4/29	5/27
	Steelhead	Hatchery	4/21	5/10	5/29	5/1	5/26
	Sockeye	Wild	5/4	5/12	5/24	5/5f	5/29f
	Sockeye	Hatchery	5/5	5/12	6/3	5/5f	5/29f
John Day Dam	Chinook Age 0	All	6/11	6/30	7/29	6/12	8/15
	Chinook Age 1	All	4/28	5/16	6/2	4/29	6/1
	Coho	All	5/10	5/22	6/2	5/8	5/29
	Steelhead	Wild	4/27	5/9	5/29	4/27	5/25
	Steelhead	Hatchery	5/4	5/15	6/1	5/7	5/27
	Sockeye	Wild	5/8	5/16	5/30	5/10f	6/1f
	Sockeye	Hatchery	5/8	5/17	6/4	5/10f	6/1f
Bonneville Dam (Power House 1)	Chinook Age 0	"brights"	-e	6/16	7/20	-e	7/29
	Chinook Age 1	All	4/23	5/5	5/23	4/20	5/27
	Coho	All	5/3	5/20	6/4	4/29	6/1
	Steelhead	Wild	4/27	5/12	5/31	4/28	5/27
	Steelhead	Hatchery	5/2	5/15	6/1	5/3	5/29
	Sockeye	Wild	5/10	5/15	5/28	5/11f	5/31f
	Sockeye	Hatchery	5/8	5/16	7/6	5/11f	5/31f

* Historic middle 80% passage period based on median date of 10% of passage and median date of 90% passage during 1991-1997, except where specifically footnoted.

b Historic middle 80% is computed using 1993-1997.

c Historic middle 80% is computed using 1995-1997.

d Historic middle 80% is computed using 1991-1993, 1995, 1997.

e June 1 is assigned as the start of the upriver "bright" fall chinook migration in order to exclude the Spring Creek hatchery tule fall chinook released throughout the springtime. Because this threshold date is fixed, the computation of a median date of 10% passage for "brights" is inappropriate.

f Historic middle 80% is computed for combination of Wild and Hatchery fish.

1-E. NUMBER OF NESTING, FISH-EATING BIRDS NEAR COLUMBIA BASIN DAMS

1-E-1. INTRODUCTION

Most downstream migration of juvenile salmonids occurs during the nesting season of fish-eating birds. For California and ring-billed gulls, eggs were first laid in mid- to late April and young were present through mid-July or mid-August; for Caspian terns, eggs or young were present from late April through mid- to late July; and for Forster's terns, eggs or young were present from early May through mid-August (Thompson and Tabor 1981:213, Roby et al. 1998:24).

The number of nesting gulls and terns is an index of the number of birds present that potentially may prey on juvenile salmonids. But nonbreeders or failed breeders are not included, and it is possible that not all nesting colonies of fish-eating birds have been reported. Thus, counts of nesting birds are only estimates of the number of birds present.

1-E-2. NUMBER OF NESTING CALIFORNIA AND RING-BILLED GULLS

The location of known California and ring-billed gull colonies along the Columbia from Bonneville Dam to Priest Rapids Dam is shown in Fig. 1.1. Although counts of California and ring-billed gulls were sometimes differentiated in Conover et al. (1979:34) and Thompson and Tabor (1981:212), they were not during 1996-1998 (Collis et al. 2000:53, 2002:541), so they are not separated in Table 1.2.

Differences between 1977-1978 and more recent counts in Table 1.2 may result from differences in counting methods rather than changes in the number of nesting gulls. For Colonies 1-6, the number of nesting ring-billed and California gulls may have increased from 29-32 thousand in 1977-1978 to 49-57 thousand in 1996-1998 (Table 1.2). At Colony 7 (Cabin Island) there appears to have been a large increase from 250 ring-billed and four California gulls in 1977 (Conover et al. 1979:34) to York et al.'s (2000:216) report of 7,000 ring-billed and 200 California gulls in 1995, but Wildlife Services oiled all ring-billed gull eggs at this colony during at least 1995-1997 (section 5-H-2), so the number of gulls nesting there may have subsequently decreased.

There was considerable variation in gull numbers at some colonies, especially during 1996-1998 (Table 1.2). When these counts were by the same researchers, this variation appears to be real and not an artifact of research methods.

Other aspects of California and ring-billed gull breeding biology at some of these colonies are in Conover et al. (1979), Thompson and Tabor (1981), Roby et al. (1998), Collis et al. (2000), and Columbia Bird Research (2000a,b; 2001).

TABLE 1.2. Number of nesting California and ring-billed gulls along or near the Columbia River upstream of the Columbia River Estuary. 1977-1978 data for colonies 1-6 are from Thompson and Tabor (1981:212); 1977 data for other colonies are from Conover et al. (1979:34); 1995 data are from York et al. (2000:216); 1996 data are from Collis et al. (2000:53); and 1997-1998 data are from Collis et al. (2002:541). Differences between 1977-1978 and more recent counts may result from differences in counting methods. California and ring-billed gulls were sometimes differentiated by Conover et al. (1979:34) and Thompson and Tabor (1981:212) but not by Collis et al. (2000:53). Crescent Island was formed by dredged materials (Collis et al. 2000:33) and may not have existed in 1977-1978.

Colony No.=colony number and location of colony in Fig. 1.1. ?=no data.

Colony No.		Number of Breeding California & Ring-billed Gulls 1977	1978	Number of On-Colony California & Ring-billed Gulls 1995	1996	1997	1998
1	Little Memaloose Is.	856	954	?	542	939	357
2	Miller Rocks	1,042	1,836	?	1,559	3,783	2,179
3	Three Mile Canyon	8,554	8,920	?	8,828	13,305	11,102
4	Crescent Island	0	0	?	3,334	5,769	4,597
5	Richland Is. (Is. 20)	8,310	9,210	?	17,793	18,820	22,348
6	Island 18	10,402	11,558	?	17,096	14,495	12,669
	SUM OF BREEDING GULLS	29,164	32,478	-	-	-	-
	SUM OF ON-COLONY GULLS	-	-	?	49,152	57,111	53,252
7	Cabin Island	254a	?	7,200b	?	?	?
8?	near Solstice Island*	2,728a	?	?	?	?	?
11	Sprague Lake	2,130a	?	?	?	?	?
12	Banks Lake	7,126a	?	?	?	?	?

* In Potholes Reservoir, which includes Solstice Island.

a These data are from Conover et al. (1979:34). Thompson and Tabor (1981:Table 1, footnote e) noted that there were some errors in the number of breeding birds in Conover et al. (1979), and Thompson and Tabor provided corrected data for colonies 1-6, but not for the other colonies, so the estimates for colonies 7, 8?, 11 and 12 may be in error.

b York et al. (2000:216) indicate that the 1995 estimate is of the breeding population, but they do not give their methods for determining this estimate. During at least 1995-1997, Wildlife Services oiled all ring-billed gull eggs at this colony (section 5-H-2).

1-E-3. NUMBER OF NESTING CASPIAN TERNS

Upstream of the Columbia Estuary, there were six colonies of Caspian terns in 2000 with a total of at least 1,662 terns (Table 1.3). The number of nesting terns along the Columbia River downstream of the Snake River appears to have increased by a factor of about four between 1977-1978 and 2000-2001 (Table 1.3), and the number of nesting terns in the Potholes Reservoir that includes Solstice Island area also increased from 160 in 1976 to about 400-600 in 2001 (Table 1.3, Penland 1976:74-75). In the 1930's, Caspian terns nested on an island upstream of the junction of the Snake and Columbia Rivers near Pasco, Washington, but no terns were found in that area in 1975 (Penland 1976:64, 78).

Other aspects of tern breeding biology at some of these colonies are in Penland (1976:48-49,

74-78), Thompson and Tabor (1981), Roby et al. (1998), Collis et al. (2000, 2001b), Columbia Bird Research (2000a,b; 2001, 2002), Antolos et al. (2002), and Shuford and Craig (2002).

TABLE 1.3. Estimated number of nesting Caspian terns in the Columbia Basin upstream of the Columbia River Estuary. 1977-1978 data are calculated by multiplying the number of nests in Thompson and Tabor (1981:212) by two. Nesting in 1996 was reported by Roby et al. (1998:26); 1997-1998 data are from Collis et al. (2002:541); 1999 data are from U. S. Army Corps of Engineers (2001:28); 2000 data are from Columbia Bird Research (2000a); and 2001 data are from Collis et al. (2001b:5-6, 8). Sources of other counts are in the footnotes. Differences between 1977-1978 and more recent counts may result from differences in research methods. Crescent Island was formed by dredged materials (Collis et al. 2000:33) and may not have existed in 1977-1978.

Colony No.=colony number and location of colony in Fig. 1.1. X=breeding pairs were observed, but an accurate estimate is not yet available. ?=unknown.

Col-ony No.		Estimated Number of Breeding Caspian Terns						
		1977	1978	1996	1997	1998	1999	2000	2001
COLUMBIA RIVER BELOW THE SNAKE RIVER									
2	Miller Rocks	0	0	0	0	0	?	0	<40a
3	Three Mile Canyon	368	420	X	571	339	384	520	0a
4	Crescent Island	0	0	X	990	575	890	1,142	1,440
	SUM	368	420	X	1,561	914	1,274	1,662	<1,480
7	Cabin Island	?c	?	?	0c	0c	0c	0c	0c
OFF COLUMBIA RIVER									
8	Solstice Island	?d	?d	?	0b	0b	0	Xe	400-600
-	near Solstice Island	?d	?d	?	Xd	?	?	0d	?
9	Goose Island	?	?	?	?	?	?	Xf	Xf
10	Harper Island	?	?	?	?	?	X	Xf	Xf

a In 2000, no chicks fledged at Three Mile Canyon because of mink predation on tern eggs and young chicks (Columbia Bird Research 2000a). In 2001, this colony was abandoned early in the nesting season because of mink predation; afterwards, some terns, perhaps from Three Mile Island, nested on Miller Rocks (Collis et al. 2001b:6).

b Data are from U.S. Army Corps of Engineers (2001:28). If terns were reported, the counts may not be as accurate as those in 2000-2001, so they are not included here.

c At Cabin Island, Penland (1976:76-77, 1982:76) found 10 nesting Caspian terns in June 1975; it does not appear that this colony was checked in 1976-1977 (see map in Thompson and Tabor 1981:210). No terns are listed at Cabin Island more recently (York et al. 2000, U.S. Army Corps of Engineers 2001:28), but it is not clear that Cabin Island has been recently checked for nesting terns.

d At least one colony was in the Potholes Reservoir area (which includes Solstice Island) in the late 1950's and 1970's, with about 160 breeding terns in 1975 (Penland 1982:77) or 1976 (Penland 1976:74-76). This area was not included within Thompson and Tabor's (1981:210) study area during 1976-1977. For 1997, U.S. Army Corps of Engineers (2001:28) reports that there were a total of 259 terns at "multiple islands" at Potholes Reservoir.

e During a few visits in 2000, as many as 210 adult terns were counted at Solstice Island (U.S. Army Corps of Engineers 2001:28; Columbia Bird Research 2000a).

f An undetermined number of terns nested. These islands were not included within Thompson and Tabor's (1981:210) study area during 1976-1977. Fewer than 50 adult terns were counted during one or more visits to each colony during 2000 and 2001 (Columbia Bird Research 2000a, Collis et al. 2001b:8).

1-E-4. NUMBER OF OTHER NESTING FISH-EATING BIRDS

At dams, gulls and terns are the fish-eating birds of most concern (see below). But double-crested cormorants, great blue herons, western grebes, common mergansers, osprey, eared grebes, pied-billed grebes, and American crows were also noted at Bonneville, The Dalles, or John Day Dams (Jones et al. 1996:7-11, 1998:6), and these species nest in eastern Washington (Alcorn 1978).

Prior to 2001, the only reported double-crested cormorant colony upstream of the Columbia River Estuary in the Columbia Basin was of 850 cormorants at Potholes Reservoir in 1991 (see colony 8 in Fig. 1.1)(Carter et al. 1995:214). In 2001, "hundreds of pairs" of double-crested cormorants nested at Foundation Island, just below the confluence of the Snake and Columbia Rivers (Bonneville Power Administration 2002:3). Perhaps there are additional colonies.

Thompson and Tabor (1981:212) reported 316 great blue heron nests (632 birds) in 1978 along the Columbia River.

Nesting American white pelicans (which are listed by Washington State as Endangered, National Marine Fisheries Service 2002:3-142, 3-146) are also of concern for juvenile salmonid predation (section 5-G-4). Their colony on "Badger Island" was to be monitored in 2002 (Bonneville Power Administration 2002:3), and tagged juvenile salmonids were found at an unspecified Columbia Basin pelican nesting colony (Ryan et al. 2002).

I have not found any information about the number of breeding grebes, mergansers, and osprey in the Columbia Basin.

Forster's terns have not been documented as predators of juvenile salmonids (Fresh 1997:250, National Marine Fisheries Service 2000b:39). However, Merrell (1959) implies that a Forster's tern was with gulls feeding below McNary Dam, so it is possible that they may sometimes be predators of juvenile salmonids. In 1977-1978, counts of breeding Forster's terns included 52-74 near Miller Rocks, 252 at Richland Island, and 556 near or at Island 18 (Thompson and Tabor 1981:212). I have not found more recent counts.

1-F. NUMBER OF NONNESTING, FISH-EATING BIRDS NEAR COLUMBIA BASIN DAMS

Most concern about fish-eating birds has been for nesting birds, but some nonnesting, migrating birds may be present in April-May when many juvenile salmonids are passing dams (section 1-D). For example, Jones et al. (1996:7, 1997:1, 1998:11, 1999:6) noted that western, glaucous-winged, herring, and Bonaparte's gulls were sometimes observed near Bonneville, The Dalles, or John Day Dams; these gulls do not nest in eastern Washington (Alcorn 1978:39-40).

In fall and winter, some fish-eating birds are also present. Jones et al. (1997:15) noted that about 50-100 unidentified gulls were feeding (perhaps on juvenile shad, see section 2-B) in tailwaters of John Day Dam in November, and some remained into December. In 1997 and 1998, Bonaparte's gulls were present in late October-November at Bonneville Dam and may have fed on juvenile shad (Jones et al. 1998:11, 1999:6). There was a concern about fish-eating birds outside the nesting season, since they were apparently hazed in September at mid-Columbia dams and in winter at lower Columbia dams (section 4-D-4).

It is unclear if many nonnesting birds feed on juvenile salmonids because counts or diet studies have not been reported.

CHAPTER 2. ASSUMPTIONS ABOUT BIRD PREDATION AND MANAGEMENT NEAR COLUMBIA BASIN DAMS

2-A. INTRODUCTION

At dams, birds often appear to be feeding on fish-like prey that have been assumed to be juvenile salmonids. It has also often been assumed that these prey would survive if saved from birds. In the following sections, I examine these assumptions. Whether stated or not, these assumptions need to be recalled when reviewing reports of bird predation at dams.

2-B. ASSUMPTION: ALL FISH PASSING DAMS ARE JUVENILE SALMONIDS

Fish have been collected and identified at three lower Columbia River and three lower Snake River dams during most of the year (Table 2.1). At lower Columbia River Dams, 61-68% of the fish at Bonneville Dam, 41-74% of the fish at John Day Dam, and 79-86% of the fish at McNary Dam were juvenile salmonids (Table 2.1A). At three Snake River dams, 97-100% of the fish were juvenile salmonids (Table 2.1B).

At lower Columbia River Dams, juvenile American shad were also very abundant, since 32-51% of fish at Bonneville Dam were shad (Table 2.1A). At John Day Dam, juvenile shad began to be collected in early August and were often abundant from about August 12 through mid-September (Martinson et al. 1997:23, 1998:26, 1999:27, 2000:26, 2001:32). At Bonneville Dam, shad began to be collected in mid-August and were generally abundant from late August through October (Martinson et al. 1997:29, 1998:36, 1999:34, 2000:30, 2001:36). The only juvenile salmonids passing Bonneville Dam in late August and September were subyearling chinook (Table 1.1), and then it appears that more juvenile shad than subyearling chinook were migrating (e.g., compare Fish Passage Center 2000:D-24 with Martinson et al. 2000:30). I have not found the status of shad in the Columbia River upstream of McNary Dam, but they are probably less abundant than at McNary Dam or absent, since shad are not listed as occurring in the Rocky Reach project (BioAnalysts 2000:5-7, 16-17).

At each dam, 3% or less of the fish were juvenile Pacific lamprey (Table 2.1). Lamprey were found during March-June and occasionally July at John Day and Bonneville Dams, but they may have been migrating earlier (Close et al. 1995:16, Martinson et al. 1997:23, 29; 1998:26, 36; 1999:27, 34; 2000:26, 30; 2001:32, 36; Kostow 2002:12).

Thus, nearly all fish passing dams from April through early or mid-August appear to be juvenile salmonids at lower Columbia and Snake River dams. Outside of this period, many juvenile shad are also passing lower Columbia dams, but not the lower Snake dams.

TABLE 2.1. Percentage of fish collected at various lower Columbia River dams (A) and lower Snake River dams (B) during part of 1996-1997 or 1996-1998 that were juvenile salmonids or other fish. The starting and ending times of collection are at the bottom of the Table. See Fig. 1.1 for locations of dams.

Collection data for Bonneville Power House 1 (PH1) and John Day Dam Unit 3B are from Martinson et al. (1999:52-53, 67-68). The timing of migration of juvenile shad and juvenile lamprey for these dams is in Martinson et al. (1997:23, 29; 1998:26, 36; 1999:27, 34).

Fish collection data during 1996-1997 for McNary and the Snake River Dams are from the U.S. Army Corps of Engineers (1997, 1998). I requested data for 1998 from the U.S. Army Corps of Engineers in March 2001 but have not received the 1998 report as of 31 December 2002.

A. LOWER COLUMBIA RIVER DAMS

	Relative Proportions of Fish Collected at Bonneville Dam			John Day Dam			McNary Dam	
	1996 (%)	1997 (%)	1998 (%)	1996 (%)	1997 (%)	1998 (%)	1996 (%)	1997 (%)
juv salmonids	68	61	49	74	41	71	86	79
juv American shad	32	39	51	25	59	24	13	18
juv Pacific lamprey	<1	<1	<1	<1	<1	3	<1	2
other fish	<1	<1	<1	<1	<1	1	1	1
Collection Start	3/11	3/17	3/9	4/8	4/8	4/9	4/19	4/5
Collection End	10/31	10/30	10/31	9/9	9/8	10/31	12/15	12/14

B. LOWER SNAKE RIVER DAMS

	Relative Proportions of Fish Collected at Lower Granite Dam		Little Goose Dam		Lower Monumental Dam	
	1996 (%)	1997 (%)	1996 (%)	1997 (%)	1996 (%)	1997 (%)
juv salmonids	100	99	100	98	99	97
juv American shad	<1	<1	<1	<1	<1	<1
juv Pacific lamprey	<1	<1	<1	<1	<1	<1
other fish	<1	1	<1	2	1	3
Collection Start	3/28	3/27	4/2	4/2	4/2	4/2
Collection End	10/31	11/1	10/28	11/1	10/28	11/1

2-C. ASSUMPTION: ONLY JUVENILE SALMONIDS ARE AVAILABLE TO BIRDS AT COLUMBIA BASIN DAMS

I have not found any studies that have determined if all fish present below dams during April to mid-August are only juvenile salmonids. Nonsalmonids that are not then migrating may also occur; for example, juvenile shad would be present downstream of lower Columbia dams before they begin migrating in early to mid-August (section 2-B). Because the fork length of subyearling and yearling shad averages 7.0 cm and 10.5 cm, respectively (Dawley et al. 1986:195) and is similar to the length of some juvenile salmonids, an observer may glimpse a fish in a bird's bill and assume that it is a juvenile salmonid, but it may be a juvenile shad.

There has not been enough recent research of bird diets at dams to determine if they are only catching juvenile salmonids. Gulls collected below McNary Dam in May 1955 that were thought to be feeding only on juvenile salmonids were feeding mostly on lampreys (section 5-G-2). Since then, the only fish identified in gulls collected during 4 April-12 May 1997 at The Dalles and John Day Dams were juvenile salmonids (section 5-E-5). But there have not been any studies of birds collected below dams during mid-May through August to determine if the only fish they are feeding on then are juvenile salmonids.

2-D. ASSUMPTION: FISH-EATING BIRDS NEAR COLUMBIA BASIN DAMS FEED ONLY ON JUVENILE SALMONIDS

Gulls or terns collected at or below dams or at nesting colonies did not feed only on juvenile salmonids. Other important items included nonsalmonid fish or food other than fish (sections 5-E-5, 5-E-6, 5-G-2, 5-G-3, 5-H-1, 5-L-1, and 5-O). Some birds may have specialized on salmonid foraging at dams because the percentage of juvenile salmonids in the diet of gulls collected at nesting areas was lower than for gulls collected at dams (sections 5-E-5 and 5-H-1).

2-E. ASSUMPTION: FISH-EATING BIRDS AT COLUMBIA BASIN DAMS FEED ONLY ON LISTED JUVENILE SALMONIDS

Most juvenile salmonids in the Columbia Basin are not federally listed as Threatened or Endangered (section 1-C). In the Columbia Estuary, Collis et al. (2001a:391) found that listed and unlisted juvenile salmonids were equally vulnerable to predation by Caspian terns and double-crested cormorants, except listed sockeye salmon smolts were taken significantly more and listed chinook salmon were taken significantly less by nesting terns than unlisted sockeye and chinook. Thus, it does not appear that birds selectively take or only take listed salmonids.

2-F. ASSUMPTION: BIRDS ARE ONLY FEEDING ON VIABLE JUVENILE SALMONIDS AT DAMS

2-F-1. INTRODUCTION

The hope in reducing bird predation of juvenile salmonids at Columbia Basin Dams is the assumption that salmonids taken by birds are viable and would survive if not eaten by birds. However, this assumption is unproven.

2-F-2. FISH INJURED FROM DAM PASSAGE

As pointed out by Haas (1965:50), Ruggerone (1986:741), and Animal Damage Control staff Steuber et al. (1995:Discussion), birds may be taking fish below dams that were killed or injured during dam passage. The mortality rate for juvenile salmonids passing through dam turbines recently averaged about 7-13% per dam, through bypasses around dams ranged from 1-7%, and over spillways at dams was generally 0-2% (National Marine Fisheries Service 2000a:67-71). The overall direct dam passage mortality rates at three mid-Columbia dams were estimated to be 3-4% for Wells Dam, 6-9% for Rocky Reach Dam, and 5-9% for Rock Island Dam (National Marine Fisheries Service 2002:2-15).

Estimates of direct dam mortality such as for the three mid-Columbia dams are incomplete because not all mortality from dam passage is immediate (e.g., Cramer and Oligher 1964:254, Gloss and Wahl 1983:199, Mathur et al. 1996:Table 7, National Marine Fisheries Service 2002:2-51). For instance, National Marine Fisheries Service (2002:2-14) note that mortality immediately after passing through turbines averaged 5.5% but in studies with longer times between turbine passage and recovery mortality averaged 10.9%. Thus, some fish may appear to be alive in dam tailraces but be mortally injured.

Because dead or mortally injured fish would be much easier to catch than healthy fish, birds may take proportionately more dead or mortally injured fish than their frequency of occurrence. For example, northern pikeminnows, a fish predator in dam tailraces, took 2.2 times as many dead juvenile salmonids as their frequency of occurrence relative to live salmonids (Petersen et al. 1994:1201).

Estimates of bird predation at Columbia Basin dams or bypasses of 2% or less (section 6-C-2) are less than the mortality from dam passage. Consequently, a portion (perhaps a significant portion) of the juvenile salmonids that birds catch below dams may already be dead or mortally injured.

2-F-3. DISEASED FISH

Some juvenile salmonids in the Columbia Basin are diseased (section 2-G). Fish infected by disease or parasites are more vulnerable to predation (Van Dobben 1952, Mesa et al. 1994, 1998) because they behave abnormally, are more visible to predators, and may be less able to escape predators (Sindermann 1990:360). For example, at the Columbia Estuary, Caspian terns took relatively more juvenile salmonids with high levels of infection of Bacterial Kidney Disease than nontransported juveniles, but this was based on a small sample size of only 8 juvenile salmonids (Schreck and Stahl 2000:24, 46, 58). In any case, diseased fish that are saved from birds at one dam may later die directly from the disease or be weakened sufficiently to die from other causes.

2-G. ASSUMPTION: THERE IS NO COMPENSATORY MORTALITY FOR FISH SAVED FROM BIRDS; JUVENILE AND ADULT SALMONID NUMBERS ARE DIRECTLY LINKED

Although egg to smolt survival for juvenile salmonids is considerably higher for hatchery fish than wild salmonids, the culling process that would have occurred during this stage for hatchery fish is delayed until after they are released as smolts (Waples 1991:128). Evidence of culling of hatchery smolts after release is that the smolt to adult survival of hatchery fish is generally less than for wild salmonids in the Columbia Basin (Raymond 1988:Fig. 4, Waples 1991:128, Hilborn and Coronado 1997:16) and elsewhere (Nickelson 1986:531-532, Ward and Slaney 1990:497). Most of the culling in the Columbia Basin may be of poor-quality juvenile salmonids after release (Waples 1991:128, Muir et al. 2001:280); for instance, juvenile chinook in the Columbia Basin that were of high quality or that were more developed had better survival than those that were not (Zaug 1989, Zaug and Mahnken 1991, Dickhoff et al. 1995:298). The National Marine Fisheries Service (2000c:27) acknowledges the culling of some post-release Columbia Basin juvenile salmonids:

> "It is not surprising that survival of transported fish in the post-Bonneville phase is generally not as high as that of in-river [nontransported] fish. First, passage through reservoirs and dams likely culls weaker downstream migrants, with only the stronger fish surviving to below Bonneville Dam. Transported fish face no physical obstacles and are generally released below Bonneville Dam within 36 to 48 hours after collection. The culling process for them likely continues after release. Moreover, some fish arriving at the hydropower system are certain to die (i.e., fish with active or advanced bacterial kidney disease infections) during the ensuing 3-week period whether they migrate through the hydropower system or are transported. These fish would die even if the hydropower system were not in place."

When evaluating the need for predator control in the Columbia Basin, it has sometimes been assumed that juvenile salmonids saved from predators will not die from other causes, so that if x% of juveniles are saved, then x% more adult salmonids will generally return (e.g., Beamesderfer 2000:20, U.S. Army Corps of Engineers 2001:8). However, this assumption does not appear valid for salmonids in the Columbia Basin (Whitney et al. 1993:4-5, Independent Scientific Group 1996:xxii-xxiii, Bayer in prep.) for two reasons. First, reducing bird predation may have little effect on adult returns because many juvenile salmonids taken by birds below dams may already have died or have been mortally injured before being caught by birds (section 2-F-2).

Second, the assumed increase in juvenile numbers by reducing bird predation at one dam may be compensated by other sources of mortality. These compensatory mortality factors include:

1) **PHYSICAL INJURY FROM PASSAGE AT DAMS.** Juvenile salmonids may also die during passage through turbines or bypasses or over spillways of dams downstream from the dam where bird control occurs (section 2-F-2).

2) **DISEASE AND PARASITES.** Disease can kill juvenile salmonids directly or indirectly because infected fish are more vulnerable to predation (Mesa et al. 1994:85, 1998). Columbia Basin hatchery fish are sometimes infected (Bley and Moring 1988:15, Raymond 1988:18, Steward and Bjornn 1990:61-63, Independent Scientific Group 1996:407, VanderKooi and Maule 1999). One disease of particular relevance is Bacterial Kidney Disease (BKD), which is caused by *Renibacterium salmoninarum* (RS). RS occurs in many Columbia Basin juvenile salmonids, with 75% or more testing positive using the ELISA diagnostic test, 4 to 18% having moderate to high infections, and 1-11% showing lesions (Schreck et al. 1997:22, 48; Elliott et al. 1997). BKD can cause substantial post-release mortality (Raymond 1988:18, Fryer and Lannan 1993:22,

Washington and Koziol 1993:111-112, Olson et al. 1999). But BKD is not the only disease that juvenile salmonids in the Columbia Basin may have (Independent Scientific Group 1996:407-408). Some of these other diseases or parasites may also be important in post-release mortality, since 11% of the juvenile chinook that were collected in the lower Columbia River later died from ceratomyxosis, which is caused by the parasite *Ceratomyxa shasta* (Bartholomew et al. 1992:39).

Disease problems have not been solved. For example, in 2002, millions of juvenile fall chinook had an uncontrollable protozoan infection and were released early at Spring Creek National Hatchery in the Columbia Basin so that they would not die at the hatchery (Bernton 2002). It can be expected that many of these infected fish died after being released.

3) **OTHER PREDATORS.** If saved from birds at one dam, juvenile salmonids may be taken by northern pikeminnows or other freshwater predatory fish (Beamesderfer et al. 1996, Friesen and Ward 1999, National Marine Fisheries Service 2000b:2-38) or by predatory birds in the Columbia River Estuary (e.g., Roby et al. 1998, Collis et al. 2000, 2001a,b; 2002).

4) **OCEAN CONDITIONS.** Juvenile salmonids saved from bird predation at dams would still be vulnerable to ocean conditions unfavorable for their survival. Many researchers regard ocean conditions as being a very important factor in the survival of juvenile salmonids (Nickelson 1986, Pearcy 1992, 1997; National Research Council 1996:39-45, Beamish et al. 1997, 1999; Emmett and Schiewe 1997, Bisbal and McConnaha 1998, Coronado and Hilborn 1998, Mahnken et al. 1998, Ward 2000).

In summary, some (many ?) juvenile salmonids saved from bird predation at dams may die from other causes that would compensate for a reduction in bird predation. The relevance of compensatory mortality is also expressed in an Oregon Department of Fish and Wildlife report by Schaeffer (1991:8):

> "Of the juvenile salmonids consumed by predators, the proportion that would have died of other causes cannot be accurately estimated. Estimates of consumption probably include dead or moribund juvenile salmonids that were injured while passing dams or were not robust or healthy enough to survive. Predators often select weaker or disoriented prey. Sublethal stresses from transport, handling at collection facilities or hatcheries, and disease make juvenile salmonids more vulnerable to predation. Because we cannot isolate the ultimate causes of mortality, the absolute importance of predation is uncertain. Although predation is a cause of mortality of healthy juvenile salmonids, reductions in predation will not necessarily result in equivalent reductions in total mortality."

CHAPTER 3. METHODS OF CONTROLLING FISH-EATING BIRDS

3-A. INTRODUCTION

Birds can be controlled by nonlethal or lethal methods, and these are discussed in general in the following sections.

3-B. NONLETHAL METHODS OF FISH-EATING BIRD CONTROL

3-B-1. EXCLUSION OF BIRDS

An often recommended method of minimizing bird predation at aquaculture facilities or sites where fish-eating birds concentrate is to cover or surround ponds or areas with screens, wires, or fences (e.g., Schaeffer 1991:8-9; 1992:7, 11-12). Exclosures have been recommended for over 60 years in publications available to fisheries and wildlife managers (e.g., Cottam and Uhler 1936, 1945; Lucas 1936:10, McAtee and Piper 1936, Lagler 1939, Pough 1941, Salyer and Lagler 1946:108), even though exclosures may not eliminate predation (e.g., Parkhurst et al. 1987:392, Steuber et al. 1995, Pitt and Conover 1996:620). However, hatcheries and other sites have been designed and built without exclusionary devices, and after they are built it may be too expensive or impractical to do so if ponds or other areas are very large (Draulans 1987:226-227, Parkhurst et al. 1987:391, Schaeffer 1992:7, 11-12; Gorenzel et al. 1994:12-15, Mott and Boyd 1995:178, Pitt and Conover 1996:623, Glahn 1997:10-13, Littauer et al. 1997, Glahn et al. 2000).

Overhead wires have been frequently used at Columbia Basin dams, but it is not always practical to cover all areas where birds forage (Chap. 5). Their use is discussed in section 6-F.

3-B-2. HAZING OF BIRDS FROM FEEDING AREAS

There are many devices to harass birds such as cracker or screamer shells fired from a gun to create a loud noise, propane cannons that emit loud explosions at adjustable intervals, water spray devices, harassment patrols, recordings of bird alarm or distress calls, flashing lights, scarecrows, predator models, ultrasonic devices, guard dogs, kites, trained raptors used by falconers, balloons, shouting, rock throwing, and ultralight aircraft (Draulans 1987:223-225, Parkhurst et al. 1987:392, Bayer 1989:11-13, Bomford and O'Brien 1990:419, Schaeffer 1992:6-7, Gorenzel et al. 1994:15-17, Mott and Boyd 1995, Dolbeer et al. 1996:479-480, Pitt and Conover 1996:620, Glahn 1997:13-15, Littauer et al. 1997, Reinhold and Sloan 1999:101, Bayer 2000:8-11, 51-53). These references indicate that hazing methods generally do not eliminate all predation, that some of these methods (e.g., flashing lights or shouting) are not very effective or may be effective for only a short time or for small areas, and that other methods such as pyrotechnic devices (i.e., cracker shells or propane cannons) may often significantly reduce predation, but need to be moved or used in combination with other methods (e.g., patrols) to continue their effectiveness. These references also report that some methods may not be cost effective unless predation losses are great (i.e., the costs of using the method may be greater than the cost of predation; also see section 4-E and Appendix II-D-1). The benefits of hazing birds may be reduced by the inadvertent harassment of nontarget species or the shifting of predation from the site of harassment to other areas (Schaeffer 1991:11-12).

The use of hazing techniques to reduce bird predation of juvenile salmonids at Columbia Basin dams is summarized in section 6-F.

3-B-3. CHANGES IN REARING PRACTICES OF HATCHERY SALMONIDS TO REDUCE THEIR VULNERABILITY TO BIRD PREDATION

Most juvenile salmonids in the Columbia Basin are reared in hatcheries. 1997-1998 estimates of the total annual number of hatchery and wild juvenile salmonids in the Columbia Basin are about 200 million (John Palensky of National Marine Fisheries Service in Espenson 1998; G. Bisbal of Northwest Power Planning Council in Espenson 1999b) or 200-250 million (U.S. Army Corps of Engineers 2000:3). During 1997-1999, 145-147 million hatchery juveniles were released into the Columbia Basin (Columbia River Data Access in Real Time [DART], http://www.cbr.washington.edu/dart/hatch.html). Subtracting the estimated number of hatchery fish from the estimated number of total fish gives a rough estimate of 55-105 million wild juveniles during 1998-1999. The U.S. Army Corps of Engineers (2001:19) also reports that the majority of out-migrating smolts are from hatcheries.

Juvenile hatchery-reared Pacific salmonids (*Oncorhynchus* sp.) often attract predatory birds after they are released (Mace 1983:33, Bayer 1986, Macdonald et al. 1988:1370-1371, Jones et al. 1996:12, Scheel and Hough 1997, Stahl et al. 2000). They can be impaired after release for several reasons, so that they are vulnerable to predation (Maynard et al. 1995, 2001). First, hatchery juvenile salmonids are easily detectable to predators because some behave inappropriately after they are released. Since they are fed at hatcheries on pellets spread on the water surface, many hatchery fish come to the surface to feed shortly after release and in so doing are easily seen by potential predators; they also often jump out of the water or roll, exposing their highly conspicuous silver sides, which makes it very easy for predators to find them (Bayer 1986). Their presence near the surface makes them particularly vulnerable to aerial predators such as Caspian terns (Roby et al. 1998:64, Collis et al. 2000:37). Second, hatchery fish are vulnerable to predation because they are not wary of predators (e.g., Bayer 1989:61-63; Suboski and Templeton 1989, Olla et al. 1994, 1998, Maynard et al. 1995, 2001). Third, hatchery fish in the Columbia Basin have sometimes been released that are diseased or of poor quality (section 2-G) or

were released because of management concerns rather than when they were physiologically or behaviorally prepared to migrate (Muir et al. 1994:388, Bernton 2002), so it is not surprising that they may attract predators. Because it has been recognized that hatchery fish are vulnerable to predators, changing rearing practices to reduce post-release predation has been proposed or is being attempted (Olla et al. 1994, Maynard et al. 1995, 2001; Oregon Dept. of Fish and Wildlife 1998:27-28, 2000:section B, #5; Hansen 2000). However, it remains to be seen if these techniques will be practical at hatchery production levels.

3-B-4. FACILITY DESIGN TO REDUCE VULNERABILITY OF SALMONIDS

Changing the design of hatchery ponds and raceways has been recommended to reduce bird predation (e.g., Lagler 1939:174-75, Salmon and Conte 1981:10, Gorenzel et al. 1994:14-15, Glahn 1997:9). Because dams are already constructed, this is not feasible, but some Columbia Basin bypasses have been designed and built to reduce predation (section 5-C-2).

3-C. LETHAL METHODS OF FISH-EATING BIRD CONTROL

3-C-1. CONTROVERSIES ABOUT LETHAL CONTROL

Lethal control of predators is controversial for several reasons. First, lethal control may be practical or effective only if there are a few individuals to be removed (Dolbeer et al. 1996:481, Glahn 1997:15). At fish hatcheries, shooting or other lethal control measures did not eliminate predation, and some hatchery managers rated lethal control as being of limited success (Parkhurst et al. 1987:392, Pitt and Conover 1996:620). Second, animals that are not the targets of control may also be killed (Oregon Department of Fish and Wildlife 1998:29-30). Third, some groups and individuals believe that nonlethal methods of control should be tried first, and lethal methods should only be used as a last resort (e.g., Humane Society of the United States in Wildlife Services 1998a:section 3.3.5); the Washington Department of Wildlife policy at its fish hatcheries is to use nonlethal methods where possible (Appendix Table II.1:#1). The Associated Press (2002) quoted a Washington hatchery manager about lethal control at salmon hatcheries: "Bird kills typically are unpopular with the public and have been a subject of debate among government agencies for years." When lethal control of a public resource (birds) occurs on public lands or waters such as the Columbia or Snake Rivers or at dams operated by governmental entities and is funded by the public through taxes or electric rates (see section 4-B-3), the general public has standing to comment about the advisability or priority of lethal control.

Because of concerns about lethal control, the International Association of Fish and Wildlife Agencies:

> "encourages control methods that are as efficient, safe, economical, humane, and selective as possible, with minimum lethal control" (Belanger 1988:200).

Some Animal Damage Control/Wildlife Services' staff also believe that the use of lethal control needs to be carefully considered; for example, Glahn (1997:15) of Animal Damage Control/Wildlife Services writes:

> "Although most wildlife-damage-management professionals consider lethal control appropriate and necessary as a last resort in certain situations, its use remains controversial. ... Lethal control seems to be practical only when there are a limited number of individuals that need to be removed. Typically, lethal control is recommended only to reinforce or supplement nonlethal techniques by removing a few individuals."

Further, the U.S. General Accounting Office (2002b:38) reported:

> "A [Wildlife Services'] National Wildlife Research Center program manager noted that scientists feel considerable pressure to research and quickly develop nonlethal control methods. The manager noted that the pressure comes not only from animal advocacy groups and personal preferences, but also from a changing environment where experts in the field see the loss or diminishing acceptance of traditional control tools like guns, traps, and poisons."

Some of the issues about lethal control are included in comments by the Oregon Department of Fish and Wildlife (1998:29-30) about using lethal control for control of bird predators of juvenile salmonids in the Columbia River Estuary:

> "The shooting of Caspian terns, double-crested cormorants, and/or gulls is the option that would likely be the most controversial with the public. The overall benefits of this option would be limited, at best, and at worst, might result in the disturbance or 'take' of nesting bald eagles or other non-target species. In order to be very effective, large numbers of birds would have to be killed. Even if that could be accomplished, it is likely that these individuals would be replaced over time with birds migrating into the area into 'vacated' territories. To be effective, this activity would have to take place on a continual basis. It is highly unlikely that this would be either cost-effective or publicly acceptable. Furthermore, this would be in violation of international, federal and state laws. Lethal shooting has been used to a limited extent to discourage birds from foraging in the tailrace of some mainstem dams. It has been an effective method for reducing avian predation at specific sites where smolts are particularly vulnerable, but would not be effective in eliminating or reducing breeding colonies of terns, cormorants or gulls."

An overview of lethal control of birds at Columbia Basin dams is in section 6-G.

3-C-2. THE U.S. MIGRATORY BIRD TREATY ACT (MBTA) AND WILDLIFE SERVICES' BIRD CONTROL

The Migratory Bird Treaty Act (MBTA; 16 U.S.C. 703-711; 40 Stat. 755) gives the U.S. Fish and Wildlife Service authority to protect migratory birds (see http://migratorybirds.pacific.fws.gov/mbta.htm or http://migratorybirds.pacific.fws.gov/permits.htm). Permits are required to "take" migratory birds (e.g., kill or cause disruption of nesting or feeding of young)(Oregon Department of Fish and Wildlife 1998:13-14, Wildlife Services 2000b:15). There has been some confusion as to whether federal agencies need a permit from the U.S. Fish and Wildlife Service to conduct lethal control, but a permit is required as Wildlife Services (2000b:15) summarizes:

> "A litigation position issued in 1997 by the U.S. Justice Department (DOJ) is that federal agencies are not subject to the MBTA procedural requirements for permits. The Department of Interior Solicitor's Office interpreted this position to mean the USFWS is no longer authorized to issue permits to federal agencies for the take of migratory birds. WS' [Wildlife Services] interim guidance subsequently has been to allow the conduct of actions that were previously covered by USFWS permits and to notify the USFWS when conducting RCGDM [Resident Canada Goose Damage Management] actions that involve species for which permits were formerly required to assure their concerns are considered. A more recent ruling by the U.S. District Court of Columbia conflicts with the DOJ position, and the USDA Office of General Council has advised WS to once again apply for and obtain MBTA permits."

3-C-3. METHODS OF LETHAL CONTROL

Methods of lethal control include shooting and trapping as well as reducing reproduction success. Destroying nests or eggs may reduce a bird population by attrition because the number of recruits to the breeding population is reduced. If nests or eggs are mechanically destroyed, birds may renest, although their nesting success may decrease. If eggs were sprayed so that they would not hatch, parents may remain and not renest, so that nesting success is greatly reduced (e.g., Bedard et al. 1995:81, Pochop et al. 1998, Korfanty et al. 1999:133, 141). Egg-spraying has been employed in Quebec to help control cormorant populations (Bedard et al. 1995, 1999), but egg-spraying in Maine was not an effective means of cormorant population control and was discontinued (Krohn et al. 1995:102). In the Columbia Basin, egg-spraying of gull eggs has also been used to control gull populations (section 5-H-2).

CHAPTER 4. INTRODUCTION TO WASHINGTON WILDLIFE SERVICES' CONTROL OF FISH-EATING BIRDS IN THE COLUMBIA BASIN

4-A. INTRODUCTION

The authority and history of Wildlife Services are examined in Appendix II. Although dams are also at Idaho and Oregon borders (Fig. 1.1), it appears that Washington Wildlife Services has been doing most, if not all, bird control at dams that are in or which border Washington. This is based on several lines of evidence. First, Jones et al. (1999:5, 17) cite a Washington Wildlife Services' report for Wildlife Services' bird control at The Dalles and John Day Dams (which are on the Washington/Oregon border, Fig. 1.1). Second, Wildlife Services (2001a) reports that Washington Wildlife Services had installed overhead wires to exclude birds at all dams on the Columbia/Snake River in Washington, but Wildlife Services (2001b) does not mention any control of birds at dams by Oregon Wildlife Services. Third, Wildlife Services (2002a) reports that the Washington Wildlife Services had controlled fish-eating birds at "mid-Columbia" dams. Fourth, the Washington Wildlife Services' program has lethally controlled more than 10 times the number of fish-eating birds in the Idaho and Oregon programs combined (Table 4.1). Thus, even if the Idaho and Oregon programs have done some control at dams, they have not often used lethal control (Table 4.1), which is much more controversial than nonlethal methods (section 3-C-1).

In the rest of this Chapter, I discuss my experience with the nonresponsiveness of Wildlife Services and examine known activities of Washington Wildlife Services in controlling fish-eating birds at Columbia Basin Dams.

TABLE 4.1. Number of fish-eating birds taken by lethal control in Idaho (ID), Oregon (OR), and Washington (WA) by Wildlife Services' programs in each state. 1998-2000 Fiscal Year data are calculated and/or compiled from the Wildlife Services' Annual Table "Number of Animals Taken and Control Methods Used" for each fiscal year (which starts on October 1 and ends on September 30, R. A. Woodruff, Washington Wildlife Services' Director, pers. com.); these tables are available at http://www.aphis.usda.gov/ws/tblfrontpage.html; however, birds caught in cages or live traps are excluded. Gull eggs were oiled by Wildlife Services in Washington during at least 1995-1997 and perhaps later (section 5-H-2), but the number of eggs oiled were not included in Wildlife Services' tables of animals "taken," so the Washington Wildlife Services' take may be more than given here for 1998-2000.

Wildlife Services has not been forthcoming in making its information understandable as it does not indicate the meaning of some of the abbreviations or codes in its tables; I happened to find the meaning for some of these tables at https://foia.aphis.usda.gov/wl_mgmt/defmis.html (all lower case letters--no numbers).

These data are for each entire state, so not all of these birds may have been taken to reduce predation on juvenile salmonids along the Columbia or Snake Rivers. For example, an unknown portion may have been taken at airports to reduce the risk of strikes with airplanes, at structures such as bridges to reduce property damage, or at fish hatcheries.

To simplify this Table, I have pooled data for species into larger taxonomic categories (e.g., gulls).

See Table 4.3 for Washington data for 1996-2001 that are separated for species, when possible.

	Fish-eating Birds Taken by Wildlife Services in Fiscal Year								
	1998			1999			2000		
	ID	OR	WA	ID	OR	WA	ID	OR	WA
cormorants	0	0	671	0	0	867	0	0	497
grebes	0	0	48	0	0	85	0	0	28
gulls	1*	433*	18,715	12*	1,065*	13,470	10*	704*	8,297
herons	34	0	384	18	0	467	4	0	190
kingfishers	0	0	31	0	0	15	0	0	21
mergansers	0	0	400	0	0	340	0	0	195
terns	0	0	84	0	0	136	0	0	327
TOTAL	35	433	20,333	30	1,065	15,380	14	704	9,555

* All gulls were ring-billed gulls.

4-B. WILDLIFE SERVICES' NONRESPONSIVENESS TO QUESTIONS

4-B-1. WILDLIFE SERVICES' DELAY AND LACK OF RESPONSE IN 2000

Although I have found some information about Washington Wildlife Services' bird control at some mainstem Columbia and Snake River dams, I have found few details (section 4-D). Accordingly, I have requested some specific information from them. On 17 July 2000, I sent an email request to the Wildlife Services' web site for information about Washington Wildlife Services' activities at Bonneville,

The Dalles, and John Day Dams that were cited in Jones et al. (1999:5, 17). On 2 August 2000, I was informed by Jessica Dewey, Wildlife Services' Staff Officer, that in order to release the information that I had requested that Wildlife Services had to process my request under the Freedom of Information Act (FOIA), and she referred my email to its FOIA office. On 10 August 2000, Kimberly Pacheco, FOIA officer for the Animal and Plant Health Inspection Service of the U.S. Department of Agriculture, said that my request was being processed and provided a sheet with charges for FOIA requests that may be waived or reduced if they felt that "disclosure of the information is deemed to be in the public interest." On 4 March 2001 (7.5 months after my initial inquiry), I withdrew my request because I had not received a response and I thought then that I would be able to soon finish this paper.

Unfortunately, my experience is not unique, for it appears that Wildlife Services often does not respond to questions and that lawsuits result (Appendix II-E-3).

4-B-2. WILDLIFE SERVICES' REFUSAL TO ANSWER QUESTIONS IN 2002

In 2002, after discovering some Wildlife Services' information on the Internet (e.g., Tables 4.1-4.3), I decided to try once more to get some information about Washington Wildlife Services' predator control program at dams. On March 4, I wrote the Washington State Director of Wildlife Services and asked:

1) how many of the fish-eating birds taken in Washington (see Table 4.3) were taken along the Columbia and Snake Rivers to reduce bird predation of juvenile salmon and steelhead?
2) were these birds taken throughout the year?
3) had Wildlife Services dispersed gulls or terns at their nesting colonies or oiled their eggs to prevent them from hatching (see section 5-H-2)?

In his letter of 12 March 2002, Roger Woodruff, Wildlife Services' State Director for Washington and Alaska replied that my requests were for information that is protected under a court injunction against Wildlife Services that was issued by the Western District of Texas U.S. District Court (Civil Action No. W99CA335, filed 9 February 2000). Woodruff included a copy of the injunction, which stated, in part, on p. 5:

> "Pursuant to FED. R. CIV. P. 65, Daniel Glickman, the United States Department of Agriculture, Wildlife Services, and Animal & Plant Health Inspection Service, including their officers, agents, servants, employees, and attorneys, are ENJOINED, RESTRAINED, and PROHIBITED from releasing to any third parties, individuals, groups, or agencies, including but not limited to animal rights groups such as API [Animal Protection Institute] or FG [Forest Guardians], or their agents or lawyers, directly or indirectly, any Private Information, which is any such information that allows the recipient of it to obtain or deduce the specific identity or personal identifying information of the farmers, ranchers, and other individuals and entities who have requested, executed Cooperative Agreements with, or otherwise allowed Wildlife Services to enter their property for any purpose (hereinafter "Cooperators"). Specific examples of Private Information are names, telephone numbers, street addresses, towns or cities, counties, acreage, map coordinates of Wildlife Services traps, or other unique identifying characteristics of the Cooperators that allow the recipient to ascertain the specific identity of Cooperators."

Wildlife Services' concern about providing identifying information about cooperators, such as counties where control occurred, is also illustrated in Wildlife Services' Environmental Assessments available online (http://www.aphis.usda.gov/ws/eafrontpage.html). For example, in Wildlife Services (1998a), the names and locations of Arizona cooperators, including federal cooperators, have been blacked out.

Nevertheless, this injunction does not prohibit Washington Wildlife Services from all questions. My questions could be answered without divulging information that could identify cooperators because

the Columbia Basin is larger than one county, and there are many dams (section 1-B). Thus, a cooperator would not be revealed by Washington Wildlife Services reporting if it took fish-eating birds throughout the year, if it dispersed nesting gulls or terns, or how many fish-eating birds were taken by Wildlife Services to reduce salmonid predation along the Columbia or Snake Rivers.

On 8 September 2002, I mailed a draft this paper with the above comments to Roger Woodruff for review by him or others in Wildlife Services (see Preface). In his 20 September 2002 letter of response that is given in Appendix III, Woodruff wrote:

> "We empathize with your obvious frustration at the limited information we are able to provide due to the Texas Farm Bureau injunction. We can only ask that you put yourself in our shoes and understand the frustration that we also feel as a public agency which has been directed to withhold some of the most basic information from both the general public and management agencies. This recent predicament is not unique to only the Washington State WS Program, but applies to our program nationwide. We are directed to comply with the courts and to follow the council of our attorneys, who in turn interpret court decisions such as the Texas Farm Bureau injunction."

However, Wildlife Services (a part of Animal & Plant Health Inspection Service [APHIS] and the United States Department of Agriculture) appears to have violated the court injunction about Wildlife Services' activities in Washington State at least three times:

1) APHIS is cited as the source of unpublished information about cooperative agreements for bird predator control between the Chelan and Douglas County Public Utility Districts and APHIS at Wells, Rock Island, and Rocky Reach Dams as well as the number of gulls hazed and killed at Rock Island Dam "between 1996 and 2001" (sections 5-J-3 and 5-K) in National Marine Fisheries Service (2002:3-148, 3-140). Unfortunately, "between 1996 and 2001" is ambiguous and could refer to 1997-2000, 1996-2001, 1997-2000, or 1997-2001. Nevertheless, after the February 2000 court injunction, APHIS, Wildlife Services, and the Department of Agriculture were all prohibited from providing information that identifies individual cooperators (see top of this section). Thus, APHIS' providing of data about these cooperators after February 2000 or for activities after February 2000 (e.g., data for 2000) to National Marine Fisheries Service (2002) violates this injunction.

2) Woodruff sent a Wildlife Services' "Annual Report for Migratory Birds Taken by Our Program in Washington and Alaska during Calendar Year 2001 under Permit Number MB69298-0" to Tami Tate Hall of the U.S. Fish and Wildlife Service (911 NE 11th Avenue, Portland, OR 97232)(also see Table 4.3). His report is dated 17 January 2002 and includes the number of birds of each species taken in each county in Washington. Since five dams are operated by the Chelan County, Douglas County, and Grant County Public Utility Districts, identifying takes of birds in each of these counties implicates these Public Utility Districts as cooperators with Wildlife Services. Woodruff's report clearly violates the Texas injunction because it gives data for each county (see quote above from the injunction).

3) In March 2002, Washington Wildlife Services sent out an "Invitation for Public Involvement" for a future Environmental Assessment about "Piscivorous Bird Damage Management for the Protection of Salmonids in the Mid-Columbia River Basin" (Wildlife Services 2002a). This "Invitation" listed some control measures, including lethal control (see quotation in section 4-D-2) at "mid-Columbia" dams and hatcheries. Thus, this invitation identifies all mid-Columbia dam owners as cooperators with Wildlife Services. Further, Woodruff (2002) wrote in his letter in Appendix III that no U.S. Army Corps of Engineers dams were included in "mid-Columbia" dams in Wildlife Services (2002a), and in text on his page 2 and in a footnote, he identified three mid-Columbia dams as the Wells, Rocky Reach, and Rock Island dams. He thereby identified the owners of these dams as cooperators with Wildlife Services.

My requests for information were for general information that would not identify a site as much as giving information for a county or for "mid-Columbia" dams. Thus, Washington Wildlife Services appears to have selectively used the Texas court case as an excuse to not answer general questions about its activities. Prior to the Texas court decision, Wildlife Services was also sometimes not forthcoming (see Appendix II-E-3).

4-B-3. WILDLIFE SERVICES: LACK OF ACCOUNTABILITY OF A GOVERNMENT AGENCY

It seems to be a breach of governmental accountability if Wildlife Services does not report its activities. Washington Wildlife Services has contracted for bird control at dams with public entities: the U.S. Corps of Engineers (nine dams), U. S. Bureau of Reclamation (one dam), and Chelan, Douglas, and Grant County Public Utility Districts (five dams)(sections 4-D-1 and 4-D-2). General information about Wildlife Services' operations at these dams should be available to the public because:

1) public waters are dammed
2) public entities are operating these 15 dams
3) public resources (salmon) are being protected
4) public resources (birds) are being controlled
5) the public (taxpayers and electric ratepayers) funds salmon recovery activities at these dams (e.g., section 5-J-2, Berry and Rettig 1994:5, Anonymous 1999, Barnett 1999:A8, Wildlife Services 2001a, U. S. General Accounting Office 2002a:16-17, 28, 80),
6) the public through federal funds provided 28% of Washington Wildlife Services' budget in 2000 (U. S. General Accounting Office 2002b:53).

If Wildlife Services does not provide information, the public may wonder what Wildlife Services is trying to hide or if public monies are being wisely spent. Since the U.S. Army Corps of Engineers has reported Wildlife Services' activities at three dams operated by the Corps (Jones et al. 1996-1999), Chelan County Public Utility District has discussed its contract with Washington Wildlife Services for predator control at its two dams (section 5-J-2), and Steuber et al. (1995) report using wires to reduce predation at 12 dams in Washington and, specifically, Wells Dam operated by the Douglas County Public Utility District (section 5-K); it would seem that Washington Wildlife Services could report its activities at dams operated by the Corps and these Public Utility Districts.

4-C. WASHINGTON WILDLIFE SERVICES' GENERAL ACTIVITIES

4-C-1. WILDLIFE SERVICES' PRESENTATION OF DATA ABOUT ITS ACTIVITIES

TABLES 4.1-4.3. Wildlife Services has provided data about the number of each species of animal that its programs in each state have dispersed or taken (lethally controlled) on the Internet (see Tables 4.1-4.3). Unfortunately, Wildlife Services has not been forthcoming in making this information understandable as it does not indicate the meaning of some of the abbreviations or codes in these tables; I happened to find the meaning for some of the tables at https://foia.aphis.usda.gov/wl_mgmt/defmis.html (all lower case letters--no numbers); some of Wildlife Services' control methods are also discussed in Wildlife Services (2000a:Appendix B).

The data in Tables 4.1-4.3 are for the whole state; not all of these birds may have been dispersed or taken to reduce predation on juvenile salmonids along the Columbia or Snake Rivers. For example, an unknown portion may have been taken at airports to reduce the risk of strikes with airplanes, at structures such as bridges to reduce property damage, or at fish hatcheries; and some may have been taken in western Washington. I wrote the Washington Director of Wildlife Services to find out how many of these birds were taken along the Columbia or Snake Rivers, but the Director declined to release such information (see section 4-B-2).

TABLE 4.2. Number of fish-eating birds dispersed in Washington State by Wildlife Services. These data are calculated and/or compiled from the Wildlife Services' Annual Table "Number of Animals Dispersed and Methods Used" for each fiscal year (which starts on October 1 and ends on September 30, R. A. Woodruff, Washington Wildlife Services' Director, pers. com.); these tables are available at http://www.aphis.usda.gov/ws/tblfrontpage.html.

See section 4-C-1 for a discussion of these data; this hazing is not just at dams but also at hatcheries, airports, farms, bridges, and elsewhere (Wildlife Services 2001a).

Bird taxa are arranged in alphabetical order.

Taxon of Fish-eating Bird	Number of Fish-eating Birds Dispersed by Wildlife Services in Washington State, Fiscal Year 1996	1997	1998	1999	2000	Total
cormorant, double-crested	2,532	17,351	3,712	6,511	3,274	33,380
cormorant (other)	0	0	276	383	195	854
grebes	240	911	465	810	378	2,804
gull, California	787	7,173	27,594	20,851	14,396	70,801
gull, ring-billed	204,127	77,407	88,672	95,579	128,633	594,418
gull (other) *	57,356	86,648	300,368	203,473	97,125	744,970
heron, black-crowned night-	217	577	125	65	17	1,001
heron, great blue	382	858	913	2,343	2,665	7,161
heron, green	0	0	12	425	36	473
kingfisher	51	44	33	1,110	1,480	2,718
mergansers	42	368	6,668	4,244	1,166	12,488
pelican, Am. white	0	2	6	0	0	8
tern, Caspian	?a	1,341	25	500	799	2,665a
tern (other)	1,129a	2	317	123b	13	1,584a
Washington Total	266,863	192,682	429,186	336,417	250,177	1,475,325

* Includes Franklin's, herring, glaucous-winged, and western gulls in addition to the "Other Gull" category in the Wildlife Services' Tables, but does not include great black-backed, Heermann's, and laughing gulls that were listed only as being dispersed in other states.
a In 1996, some of "Other Terns" may have been Caspian terns.
b All were Forster's terns.

TABLE 4.3. Number of fish-eating birds taken by lethal control in Washington State by Wildlife Services, and percentage of the Wildlife Services' total take of these birds in the United States that were taken just in Washington State. 1996-2000 Fiscal Year data are calculated and/or compiled from the Wildlife Services' Annual Table "Number of Animals Taken and Control Methods Used" for each fiscal year (which starts on October 1 and ends on September 30, R. A. Woodruff, Washington Wildlife Services' Director, pers. com.); these tables are available at http://www.aphis.usda.gov/ws/tblfrontpage.html; however, birds caught in cages or live traps are excluded. Many ring-billed gull eggs were oiled by Wildlife Services at Cabin Island during 1995-1997 and perhaps later (section 5-H-2), but the Wildlife Services' "take" of ring-billed gulls for Washington does not include the number of oiled eggs, so the total number of ring-billed gulls that were lethally controlled is more than given here for at least 1996-1997. I do not know if Wildlife Services also oiled eggs of other fish-eating birds. See Table 4.1 for 1998-2000 comparisons of Washington Wildlife Services' lethal control with Wildlife Services' programs in Idaho and Oregon.

See section 4-C-1 for a discussion of these data; these takes are not just at dams but also at hatcheries, airports, farms, bridges, and elsewhere (Wildlife Services 2001a).

East. Wash. Cal. Year 2001=only eastern Washington counties (i.e., counties east of approximately 121-121.5 West Longitude) during Calendar Year 2001 (i.e., from January 1 through December 31). Calendar Year 2001 data are calculated from a 17 January 2002 Wildlife Services' Annual Report for each County in Washington by R.A. Woodruff (Washington Wildlife Services' Director) to Tami Tate Hall of the U.S. Fish and Wildlife Service (911 NE 11th Avenue, Portland, OR 97232). A Texas Court Case (section 4-B-2) precludes giving information specific to sites or to a County, but does not preclude giving information for areas larger than a County, such as eastern Washington. Fiscal Year 2000 data includes part of Calendar Year 2001, so the 2001 Calendar Year data can not be added to Fiscal Year 2000 data for a total of birds taken. Further, 1996-2000 data are for all of Washington, 2001 data are only for eastern Washington counties.

Bird taxa are arranged in alphabetical order; dc cormorant=double-crested cormorant and bc night-heron=black-crowned night-heron.

% of U.S. Total=sum of these birds taken by Wildlife Services in Washington State divided by the total number of these birds that were taken in all of the United States by Wildlife Services; the result was multiplied by 100 to convert it to a percentage. Percentages are not calculated for 1996-1997 because the take then was sorted only by state and the total for the U.S. was not given.

	Number of Fish-eating Birds Taken in All of Washington State						East. Wash. Cal. Year
	Fiscal Year						
Taxon of Fish-eating Bird	1996	1997	1998	1999	2000	Total	2001
cormorant, dc	191	1,256	666	826	491	3,430	242
cormorant (other)	0	0	5	41	6	52	0
grebes	70	78	48	85	28	309	36
gull, California	34	1,073	1,884	2,697	1,967	7,655	2,845
gull, ring-billed	6,018	3,192	11,564	9,488	5,539	35,801	5,360
gull (other) *	82	4,179	5,267	1,285	791	11,604	220
heron, bc night-	0	249	218	175	82	724	98
heron, great blue	42	137	166	292	108	745	121
kingfisher	16	15	31	15	21	98	7
mergansers	21	241	400	340	195	1,197	91
tern, Caspian	0	0	7	5	313	325	938
tern (other)	0	0	77	131**	14	222	0
Washington Total	6,474	10,420	20,333	15,380	9,555	62,162	9,958
% of U.S. Total	-	-	90.3	82.1	72.0		

(Table 4.3 footnotes are on next page)

(Table 4.3 continued)

* Includes herring, glaucous-winged, and western gulls in addition to the "Other Gull" category in the Wildlife Services' Tables, but does not include Franklin's, great black-backed, Heermann's, and laughing gulls that were listed only as being taken in other states.
** All were Forster's terns.

ENVIRONMENTAL ASSESSMENT. In Wildlife Services (2001c), Washington Wildlife Services provided a final Environmental Assessment and Finding of No Significant Impact for its management of migratory birds in Washington. On p. 24 of the report, Wildlife Services gives its "5-year WS activity report in the State of Washington" with the number of birds of each species that were hazed or killed in Washington during fiscal years 1996-2000. These numbers are much lower than those given by Wildlife Services that were used in Tables 4.1-4.3; for example, in fiscal year 2000, 128,633 ring-billed gulls were dispersed in Table 4.2 versus 96,794 in Wildlife Services (2001c:24) and 5,539 ring-billed gulls were taken in Table 4.3 versus 3,055 in Wildlife Services (2001c:24). The data in Wildlife Services (2001c:24) are misleading because Washington Wildlife Services did not explain in its table that it did not include all birds dispersed or killed in Washington but only those controlled for nonfederal cooperators; Wildlife Services mentioned this out only in its final Environmental Assessment (Wildlife Services 2001c: Appendix A, Comment 8).

Washington Wildlife Services presents data for the average and range in yearly take of birds "relevant to this EA" for fiscal years 1996-2000 on p. 26 of Wildlife Services (2001c) that are similar to values in Table 4.3. But Wildlife Services does not explain the differences between its data on its pages 24 and 26, so a reader can be confused as to which data are valid.

4-C-2. WILDLIFE SERVICES' DATA ABOUT ITS ACTIVITIES

Washington Wildlife Services has been very active in dispersing or taking fish-eating birds (Tables 4.1-4.3); however, its control activities reported in these tables are not just at dams but also includes its control activities at hatcheries, airports, bridges, farms, and elsewhere (Wildlife Services 2001a). During 1996-2000, Washington Wildlife Services dispersed 193-429 thousand fish-eating birds per year, and almost all were gulls (Table 4.2). During these years, it also took (lethally controlled) 6-20 thousand birds each year, and most were gulls (Table 4.3). Its take of Caspian terns has increased from seven or less during 1996-1999 to 313 in Fiscal Year 2000 and 938 during Calendar Year 2001 (Table 4.3).

In its final Environmental Assessment, Wildlife Services (2001c:26) minimizes its take of birds by asserting that "The USFWS reported this take as extremely low." The accuracy of this statement is questionable. During fiscal years 1998-2000, 72-90% of the take of the fish-eating birds listed in Table 4.3 for the entire United States was just in Washington (Table 4.3) and Washington Wildlife Services took considerably more fish-eating birds than the Idaho and Oregon Wildlife Services' programs combined (Table 4.1).

4-D. WASHINGTON WILDLIFE SERVICES' BIRD MANAGEMENT NEAR COLUMBIA BASIN DAMS

4-D-1. SOURCES OF INFORMATION ABOUT WILDLIFE SERVICES' ACTIVITIES AT COLUMBIA BASIN MAINSTEM DAMS IN GENERAL

The Washington unit of Animal Damage Control/Wildlife Services has been active in fish-eating bird management at Columbia Basin dams. Steuber et al. (1995) of Animal Damage Control report that they were contacted by operators of 12 dams in Washington during 1988-1992 to reduce gull predation and that they had installed overhead wires at these dams, but they only name one dam, Wells Dam (section 5-K). Jones et al. (1996-1999) of the Fisheries Field Unit of U.S. Army Corps of Engineers reported about Washington Wildlife Services' activities at three of the nine dams operated by the Corps: Bonneville, The Dalles, and John Day Dams (see sections 5-D-3 and 5-F). Finally, in a 27 July 2000 email, Darryl York of the Wildlife Services' National Wildlife Research Center wrote:

> "On the Columbia River, USDA/Wildlife Services is conducting gull control work on Bonneville, Dalles, John Day, Priest Rapids, Wanapum, Rock Island, Rocky Reach, and McNary Dams. On the Snake River, WS [Wildlife Services] is doing gull control work on Ice Harbor, Lower Monumental, Little Goose, and Lower Granite Dams. This gull control work includes exclusion with wire grids, hazing with pyrotechnics and propane cannons, and lethal control with shooting."

The Wells Dam mentioned by Steuber et al. (1995) and the 12 dams cited by York are operated by the U.S. Army Corps of Engineers (eight dams), the Grant County Public Utility District (two dams), the Chelan County Public Utility District (two dams), or the Douglas County Public Utility District (one dam)(see Fig. 1.1 legend). Further, the Wildlife Services' state report for Washington indicates that Wildlife Services, in cooperation with federal and state agencies, has installed overhead wire grids at all dams on the Columbia and Snake Rivers in Washington to protect downstream migrating juvenile salmonids from bird predation (Wildlife Services 2001a:2), so Wildlife Services may also have acted at Chief Joseph Dam operated by the U.S. Army Corps of Engineers, and Grand Coulee Dam operated by the U.S. Bureau of Reclamation (see Fig. 1.1 legend).

4-D-2. SOURCES OF INFORMATION ABOUT WILDLIFE SERVICES' ACTIVITIES SPECIFICALLY AT MID-COLUMBIA DAMS

The mid-Columbia extends from above McNary Dam to Chief Joseph Dam (Fish Passage Center 1999:90). Control at some of these dams were mentioned in the preceding section, but there are additional sources of information. For example, York et al. (2000), whose authors are from the U.S. Dept. of Agriculture National Wildlife Research Center (which is now a part of Wildlife Services, http://www.aphis.usda.gov/ws/nwrc), mentioned Wildlife Services' actions at Priest Rapids Dam operated by Grant County Public Utility District (section 5-H-2). Minutes of meetings of the Chelan County Public Utility District discuss some of Wildlife Services' program at the two dams operated by this Public Utility District (see section 5-J-2). Further, Wildlife Services (2002a) wrote about bird control at mid-Columbia River dams:

> "WS [Wildlife Services] has constructed and actively maintains vast overhead wiring systems which stretch across the tailrace areas of each dam. Strands of reflective tape (mylar) are tied at spaced intervals to the wire for easier visibility. Propane cannons, pyrotechnics, effigies, and various other harassment methods are used with varied success in deterring birds. Similar methods are used at hatcheries where fish are raised to supplement runs of T&E [Threatened and

Endangered] salmonids. Non-lethal methods are supplemented with limited lethal control where necessary, to provide aversive conditioning to flocks and persistent individual birds. Lethal methods used by Wildlife Services for reducing bird damage may include shooting, egg addling/destruction, or euthanasia following live capture."

Roger Woodruff (2002), Washington Wildlife Services' Director, wrote (see Appendix III) about Wildlife Services' bird control at mid-Columbia dams:

"On the mid-Columbia River, vast overhead wiring exclusion systems over the tailrace at each dam have been constructed and are actively maintained. These wiring systems consist of 3/64"[inch] stainless steel cable stretched from one bank of the river to the other or from the shore to the dam, depending on the availability of suitable anchor points. The average exclusion system at hydroelectric dams is comprised of 21 to 30 wires spaced at 25 to 50 foot intervals, with wires stretching anywhere from 500 to 1,800 feet. In general, wire grids have been one of the most effective deterrents available, particularly for gulls, when used in combination with hazing and limited lethal reinforcement. Wire exclusionary systems alone are not 100% effective, however, and gulls are capable of learning to fish beneath the wires."

However, Wildlife Service personnel at Columbia Basin dams found that wires spaced at 15 m (49.2 ft) intervals were not as effective in keeping gulls out as those placed at 7.5 m (24.6 ft) intervals (Steuber et al. 1995). The decreasing effectiveness of wires as they are spaced farther apart has also been found elsewhere (e.g., Gorenzel et al. 1994:E-12, Mott and Boyd 1995:178-179, Littauer et al. 1997). Accordingly, Wildlife Services' wire grids at Columbia Basin dams may not be as effective as they could be because Wildlife Services has placed some of the wires too far apart or there may not be enough of them to cover the area. But installing more wires or covering some areas may not be practical (section 3-B-1).

Another source of information about some mid-Columbia dams is National Marine Fisheries Service (2002:3-138, 3-140), in which the Animal and Plant Health Inspection Service (of which Wildlife Services is a part) is cited as having given site-specific information about bird control at Wells, Rocky Reach, and Rock Island Dams (section 4-B-2).

4-D-3. SPECIES OF BIRDS CONTROLLED BY WILDLIFE SERVICES AT COLUMBIA BASIN DAMS

At Columbia Basin dams, ring-billed gulls, California gulls, and Caspian terns are mentioned as being predators of smolts (Steuber et al. 1995, Wildlife Services 2002a), and D. York (27 July 2000, pers. comm.) noted that gulls were being controlled by Wildlife Services at these dams (section 4-D-1). But Washington Wildlife Services has also dispersed or taken other fish-eating birds (section 4-C), though it is unknown if it did so at dams.

4-D-4. TIMING OF BIRD CONTROL BY WILDLIFE SERVICES AT COLUMBIA BASIN DAMS

Washington Wildlife Services' bird control at mid-Columbia River dams was said to be during April-September (Wildlife Services 2002a); however, its control at lower Columbia dams was apparently throughout the year, since Jones et al. (1999:14) recommended that Wildlife Services' efforts at Bonneville, The Dalles, and John Day dams:

> "could be concentrated during the month of May to protect salmonids and relaxed or even discontinued during the winter months when gulls, overwintering nonresident grebes and other avian piscivorous species are likely feeding upon juvenile shad."

Juvenile shad began abundantly arriving at Bonneville and John Day Dams in mid- to late August (section 2-B), and few juvenile salmonids were passing after mid-August (section 1-D), so it is questionable how effective Wildlife Services' control of birds outside of the April through mid-August period is in protecting juvenile salmonids at dams.

4-E. WASHINGTON WILDLIFE SERVICES HAS NOT DETERMINED IF BIRD CONTROL NEAR COLUMBIA BASIN DAMS IS COST EFFECTIVE

Many wildlife professionals and government agencies have recommended that animal damage control be conducted only if the economic loss or impact on the resource by predation is greater than the economic, biological, aesthetic, and social costs of conducting control (Appendix II-D-1). Otherwise, a control program may cost more than its benefits. Wildlife Services has established theoretical guidelines that are supposed to consider costs (Appendix II-E-1), although, in practice, Wildlife Services also states that its projects do not have to be cost effective (Appendix II-D-2).

Washington Wildlife Services has apparently not determined if its bird control at Columbia Basin dams is cost effective. This information is not included in its final Environmental Assessment for migratory bird control (Wildlife Services 2001c) or in its invitation for public comment about fish-eating bird control at mid-Columbia dams in 2002 (Wildlife Services 2002a). Further, it asked the Chelan County Public Utility District in 2002 to help prepare such an analysis for that Public Utility District's two dams, although Wildlife Services had a control program at these dams since at least 1996 (section 5-J-3).

To determine if bird control is cost effective, it is important for bird predation damages to be accurately estimated. In its final Environmental Assessment for migratory bird control in Washington, Wildlife Services states that migratory bird damage reported and verified by Wildlife Services during fiscal years 1996-2000 totaled $400 for natural resources (which includes salmonids)(Wildlife Services 2001c:5, 7). Wildlife Services indicates that damage estimates are probably underestimates because cooperators have nothing to gain by over reporting damages (Wildlife Services 2001a: Appendix A, Comment 13). But that is not true; by overestimating losses, cooperators are more likely to acquire services from Wildlife Services. An example of over reporting predation damages is that hatchery managers estimated losses of 15% at two hatcheries, but researchers found that losses were actually 7.0% at one hatchery and 0.6% at the other (Pitt and Conover 1996:622).

Washington Wildlife Services does not believe that it has to verify predation damage estimates or that its bird control programs need to be cost effective, since it writes (Wildlife Services 2001c:Appendix A, Comments 4 and 13):

> "... the primary justification of the WS program is to resolve conflicts between humans and wildlife. This justification is both different and broader than 'reducing economic losses.' ... WS does not have the resources, responsibility, or authority to verify all damage reports. ... WS has the legal mandate to respond to all requests for wildlife damage management regardless of extent of loss, and it is program policy to assist each requester to minimize losses. ... The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated."

Wildlife Services assumes that bird control at dams does not have to be cost effective because birds may be taking Threatened and Endangered salmon and steelhead. For example, in response to my earlier draft of this paper, Washington Wildlife Services' Director Roger Woodruff (2002; see Appendix III) wrote:

> "Few publications have attempted to put a dollar value on threatened and endangered (T&E) species. There are very few ways to estimate the associated economic cost to mitigate the vulnerability of smolt below hydroelectric dams. One way to estimate monetary damage is to take into account the costs involved to improve smolt survival. The monetary value of Federally-listed juvenile salmonids lost to predation is not presented, because a quantitative value cannot be placed on a smolt listed under the ESA or the information generally is not available. **Instead, the economic costs, or damage, which results from the predation of anadromous fish may be represented by the monetary costs associated with the implementation of mitigation measures which improve the survival of those juvenile salmonids past each hydroelectric dam** [boldface added]."

This is circular reasoning that can lead to unnecessary bureaucratic spending without evidence of need or benefits. If polar bears were claimed to eat salmon at Columbia Basin dams and a million dollars were spent to prevent polar bears from eating salmon at dams, does that mean that polar bears do a million dollars worth of damage to salmon at dams?

It is difficult to determine the value of threatened and endangered species. But it is also important to establish a realistic need for a mitigation process or money from taxpayers and electric ratepayers can be wasted in enhancing a bureaucracy rather than a threatened or endangered species.

While bird predation at Columbia Basin dams can be significant in some cases (see Tables 6.1 and 6.2), a small percentage of passing salmonids have been estimated to have been taken by birds (section 6-C-2), most juvenile salmonids in the Columbia Basin are not federally listed (section 1-C), some (many ?) of those taken by birds may not have survived even if saved from birds (sections 2-F and 2-G), and fish or juvenile salmonids are a small part of the diet of birds at some nesting colonies (Table 6.2). Thus, it would be prudent to determine the need for control and to examine the cost effectiveness of control on a case by case basis to determine situations where control is justified.

Given the lack of information about whether predator control at Columbia Basin dams is cost effective and its expense (e.g., $320,000 for bird and fish predator control in 2002 at just two dams, section 5-J-2) compared to the 1996-2000 reported and verified total loss of $400 from bird damages to natural resources in Washington (Wildlife Services 2001c:5), it is reasonable for the need and cost effectiveness of Wildlife Services' control to be questioned by citizens or taxpayer groups who ultimately pay for the control (section 4-B-3).

CHAPTER 5. FISH-EATING BIRD PREDATION AND MANAGEMENT NEAR COLUMBIA BASIN DAMS

5-A. INTRODUCTION

In this Chapter information about bird predation and management is given, if available, for each dam, starting with Bonneville Dam and going upstream. First, however, the possible effect of weather or turbidity on bird foraging success is discussed.

5-B. EFFECT OF WEATHER, STREAM FLOWS, AND TURBIDITY ON BIRD FEEDING AT DAMS

During studies by the U. S. Army Corps of Engineers at Bonneville, The Dalles, and John Day Dams in 1995, Jones et al. (1996:28) observed that there did not appear to be any difference in the number of gulls present during rainy or dry weather. However, they found that the percentage of gull dives into water in which gulls surfaced with fish or with swallowing movements decreased from 42% on days without rain to 25% on days with rain (Jones et al. 1996:28).

At Wanapum Dam, Ruggerone (1986:737-738) found that gull foraging success significantly declined when the foraging area below the dam was in a shadow.

Differences in turbidity, river flows, and spill discharges may have affected the number of gulls present during the Corps' studies during 1995-1998 (Jones et al. 1998:19, 1999:10, 11, 13). Elsewhere, high turbidity has been reported to reduce predator foraging success or decrease juvenile salmonid survival vulnerability to predators (Cezilly 1992, Gregory and Levings 1998).

5-C. LOWER COLUMBIA RIVER: BIRD PREDATION AND MANAGEMENT WITHIN 5 MILES (8 KM) DOWNSTREAM OF BONNEVILLE DAM

5-C-1. TRANSPORTATION RELEASE SITE DOWNSTREAM OF BONNEVILLE DAM

Bonneville Dam is located at River Mile 145.5, and many juvenile salmonids are transported around dams and released below Bonneville Dam at about River Mile 141-144 (Mundy et al. 1994:2, 15-16; National Marine Fisheries Service 2000c:1). The amount of bird predation at transportation release sites is not known, but, in the summer of 1986, one of the release sites became unusable because of predation by northern pikeminnows and gulls (Koski et al. 1987:14, Athearn 1991:341). In 1990, unspecified "predators" concentrated at a release site when water flows declined and water temperatures increased (Ceballos et al. 1991:12). In 1997, truck drivers used a firehose to keep gulls away while they released transported fish (U.S. Army Corps of Engineers 1998:5).

To try to reduce predation by birds and northern pikeminnows, barge releases are after dark, and the release site is varied, but truck releases are during daylight (Athearn 1991:341, U.S. Army Corps of Engineers 1998:5).

5-C-2. JUVENILE BYPASS DOWNSTREAM OF BONNEVILLE DAM

In early 1999, U.S. Army Corps of Engineers began using a $62 million, 2-mile pipe (flume) for juvenile salmonids to bypass the turbines of the second powerhouse at Bonneville Dam; the goal was to perhaps increase juvenile survival by 6-15% by reducing physical injury to fish from the old bypass and by reducing predation by northern pikeminnows (Brinckman 1999, Espenson 1999a). After it began operation, gulls were attracted to the outfall of the pipe and were estimated to take about 900-1,000 juvenile salmon on some days and as many as 2% of the passing fish (Brinckman 1999, Espenson 1999a). However, the accuracy of these estimates is not clear; for example, on a day when gulls were estimated to have taken 900 fish, about 250,000 were estimated to have gone through this bypass (Espenson 1999a)--900 is 0.4% of the passing fish.

To curb this predation, two water cannons (hydrocannons) that could spray water up to 155 ft (47.2 m) commenced operation at the outfall to disperse gulls on 30 April 1999, and wire lines with plastic flags were also placed at the outfall to discourage gulls (Brinckman 1999, Espenson 1999a). In May 1999, a spokeswoman for the Corps said that there were no longer any gulls present at the outfall (Brinckman 1999).

5-D. LOWER COLUMBIA RIVER: BIRD PREDATION AND MANAGEMENT AT BONNEVILLE DAM

5-D-1. FISH-EATING BIRDS AT BONNEVILLE DAM

At Bonneville Dam during 1995-1998, California gulls were the most numerous bird, but other fish-eating birds included some western, glaucous-winged, herring, and Bonaparte's gulls; double-crested cormorants, great blue herons, common mergansers, osprey, western grebes, eared grebes, pied-billed grebes, American crows, and bald eagles were also noted (Jones et al. 1996:7-9, 1998:11, 1999:6). In 1996, more than 10 cormorants were only seen three times, and there was a maximum of 13 herons, 11 mergansers, five osprey, and a few grebes during April-August; additionally, a few crows sometimes flew over the water and caught fish with their feet (Jones et al. 1996:8-9, 16-17, 20, 26). In 1998, California gulls were the only gull noted during April-July (Jones et al. 1999:6). In 1997 and 1998, Bonaparte's gulls were present in late October-November at Bonneville Dam and may have fed on juvenile shad (Jones et al. 1998:11, 1999:6).

Gull abundance was greatest during April-May when the number of juvenile salmonids passing Bonneville Dam was also greatest and was low after mid-July when the number of salmonids had decreased (Jones et al. 1996:13, 1997:6, 1998:13, 1999:9). Gulls were most numerous at the tailrace of the spillway, though some were also seen at the tailraces of the power houses (Table 5.1).

Gull abundance at the dam increased after nearby hatchery releases. The Spring Creek National Hatchery is about 22 miles (35 km) upstream of Bonneville Dam (Jones et al. 1996:12). In 1995, bird predation at Bonneville Dam increased 2-3 days after two releases from the hatchery (Jones et al. 1996:12-13).

5-D-2. PREDATION OF FISH AT BONNEVILLE DAM

Jones et al. (1996:3-5, 1997:3-5, 1998:4) used the frequency of gulls catching fish to calculate the total number of juvenile salmonids caught by gulls. They did not identify these fish and assumed that they were only juvenile salmonids; however, it is not clear if this assumption is true (sections 2-C and 2-D). In 1996, when the salmonid Passage Index was greatest, about 85,000 fish were estimated to have been caught by gulls, and the number declined in 1997-1998, when the Passage Index was less than half that of 1996 (Table 5.1).

Using the estimates of the number of fish caught by gulls and the number of juvenile salmonids passing Bonneville Power House 1, gulls caught about 1.2% or less of the salmonids that were passing (Table 5.2). However, this may overestimate gull predation because the Passage Index is only for those passing Power House 1, but salmonids also passed by the spillway and by the bypass of Power House 2 (section 5-C-2).

TABLE 5.1. Estimated numbers of gulls and fish caught by gulls at Bonneville Dam tailraces during 1995-1998 from data in Jones et al. (1999:6, 12). There were 54, 41, 28, and 24 observation days, respectively, during 1995-1998, and the observation periods are from Jones et al. (1998:4, 1999:1, 9). Yr=year. Number of Fish Caught=estimated number of fish predated by gulls; Jones et al. assumed that these were all juvenile salmonids; the methods used for these estimates are discussed in Jones et al. (1996:3-5, 1997:4-5). N=number of gulls that Jones et al. (1997:3-4) "equalized" to be comparable because the number of observation days varied among years. Wires=1 mm thick stainless steel array of wires over water to deter flying gulls (Jones et al. 1997:1). PI=Passage Index, which is an estimate of the millions of juvenile salmonids at Bonneville Dam Power House 1; it is a sum of data in Fish Passage Center (1997:66, 1999:48).

		Bonneville Dam								
		Power House 1 Tailrace		Power House 2 Tailrace		Spillway Tailrace		Total	Number	
Yr	Observation Period	Gulls (N)	Wires	Gulls (N)	Wires	Gulls (N)	Wires	Gulls (N)	of Fish Caught	PI
95	4/11-8/3	262	No*	523	No*	713	No*	1,448	?a	5.2
96	4/15-7/31	81	No**	371	No**	1,223	No**	1,676	84,694	7.5
97	4/15-7/30	19	Yes	12	Yes	346	Yes	377	11,114	3.3
98	4/13-7/31	31	Yes	58	Yes	583	Yes	672	35,966	3.0

a The method of estimating the number of fish taken by gulls differed between 1995 and later years (Jones et al. 1997:8), so the 1995 number is not given.

* In 1995, there were a few, sagging dacron fishing lines suspended 25-30 ft (7.6-9.1 m) above the water: four at Power House 1, three at Power House 2 that were 20 ft (6.1 m) apart, and six at the spillway (Jones et al. 1996:5, 1997:8). These lines were ineffective because they were not placed in areas where gulls foraged and because the lines were often broken and were not consistently maintained (Jones et al. 1996:20, 23; 1997:8).

** In 1996, wires were installed on June 25 at Power House 1, on July 23 at Power House 2, and on September 11-12 at the Spillway tailrace (Jones et al. 1997:8-9), so wires would not have deterred gulls during most of the smolt migration season.

TABLE 5.2. Rough estimates of the proportion of juvenile salmonids passing Bonneville and John Day Dams that were estimated to have been taken by birds during daylight. Birds also took fish at night at John Day Dam, but the number was not estimated (section 5-E-3). The numbers of fish estimated to have been taken by birds at Bonneville Dam is from Table 5.1 and at John Day Dam is from Table 5.4. It is assumed in this Table that all fish estimated to be taken by birds were juvenile salmonids, although evidence for this assumption is lacking (see sections 2-C and 2-D).

The Passage Index is only for juvenile salmonids and is a "relative indicator of population magnitude" (Fish Passage Center 1998:52), so it is a crude estimate of the number of fish passing Bonneville Power House 1 or John Day Dam. During the Observation Periods for birds (which are from Tables 5.1 and 5.4), probably all steelhead, coho, sockeye, and yearling chinook passed these dams, but about 10% of the subyearling chinook may have passed after the Observation Period (Table 1.1). Accordingly, the Adjusted Passage Index is calculated by subtracting 10% of the estimated number of subyearling chinook from the Passage Index given for 1996-1998 in Fish Passage Center (1997:66, 1999:48).

For John Day Dam, only data for 1998 are calculated because the number of fish taken by birds in 1995 was not estimated, the observation period for estimating bird predation in 1996 ended on July 10 so many juvenile salmonids may have passed later (Fish Passage Center 1999:49), and, in 1997, an unknown, significant proportion of subyearling chinook passed after the Observation Period ended on July 30 (Fish Passage Center 1998:C-14).

			Juvenile Salmonids		
Year	Dam	Bird Observation Period	Estimated Number of Fish Caught by Birds	Adjusted Fish Passage Index	Proportion of Adjusted Index Caught by Birds
1996	Bonneville	4/15-7/31	84,694*	7,305,900	<1.2% *
1997	Bonneville	4/15-7/30	11,114*	2,804,398	<0.4% *
1998	Bonneville	4/13-7/31	35,966*	3,154,266	<1.1% *
1998	John Day	4/13-7/31	94,176	5,274,032	1.8%

* The Bonneville data may overestimate the proportion taken by birds because the Passage Index is only for Power House 1, but the estimate for bird predation includes both powerhouses and the spillway (Table 5.1).

5-D-3. BIRD CONTROL METHOD (EXCLUSION) AT BONNEVILLE DAM

In 1995, a few dacron fishing lines hung over part of the tailraces; these lines were ineffective because they did not cover much area and were not maintained (footnote * in Table 5.1). In June-September 1996, stainless steel wire arrays were installed by Wildlife Services (Jones et al. 1997:8-9) and were "virtually 100% effective" in keeping gulls away during 1998-1999 (Jones et al. 1998:20, 1999:13). Consequently, gull abundance and the number of fish estimated to have been caught by gulls declined after the arrays were installed, but some of this decline may also have resulted from fewer juvenile salmonids being present (i.e., a lower Passage Index)(Table 5.1). However, not all areas at tailraces could be covered with wires, so that is why some gulls were still present at Bonneville tailraces and caught fish after wires were installed (Table 5.1).

5-E. LOWER COLUMBIA RIVER: BIRD PREDATION AT THE DALLES AND JOHN DAY DAMS

5-E-1. INTRODUCTION

Where possible, information for bird predation at The Dalles or John Day Dams is separated for each dam in the following sections. Bird management at these dams is discussed in section 5-F.

5-E-2. FISH-EATING BIRDS AT THE DALLES DAM

During 1995-1998, gulls were the most abundant fish-eating bird at The Dalles Dam, and California gulls were the most numerous gull; but some double-crested cormorants, great blue herons, western grebes, and common mergansers were also observed (Jones et al. 1996:7, 9; 1998:14, 1999:6). Only gulls were enumerated, and they were most abundant during late April-early July, with few seen later (Jones et al. 1998:15). Most gulls were recorded at the spillway tailrace, but some were also at the power house and ice/trash sluice tailraces (Table 5.3).

Illumination allowed some gulls to feed at night in the forebay of The Dalles Dam, but the number of fish taken then was not estimated (Jones et al. 1999:14).

TABLE 5.3. Estimated numbers of gulls and fish caught by gulls at The Dalles Dam tailraces during 1995-1998 from data in Jones et al. (1999:10). The observation periods and number of observation days are from Jones et al. (1998:4, 1999:1). Number of Fish Predated=estimated number of fish predated by gulls; Jones et al. assumed that these were all juvenile salmonids; the methods used for these estimates are discussed in Jones et al. (1996:3-5, 1997:4-5). Yr=year. N=number of gulls that Jones et al. (1997:3-4) "equalized" to be comparable because the number of observation days varied among years. Wires=stainless steel array of wires over water to deter flying gulls. No Passage Index for the numbers of juvenile salmonids reaching The Dalles Dam is available (Fish Passage Center 1999:48).

			The Dalles Dam							
			Power House Tailrace		Spillway Tailrace		Ice/Trash Sluice Tailrace		Total	Number
	Observation		Gulls		Gulls		Gulls		Gulls	of Fish
Yr	Period	Days	(N)	Wires	(N)	Wires	(N)	Wires	(N)	Caught
95	4/25-8/30	19	52	No	5,143	No	11	Yes	5,204	64,787a
96	4/16-7/10	29	201	No	2,034	Yes	12	Yes	2,247	?a
97	4/15-7/30	31	17	No	473	Yes	0	Yes	490	?a
98	4/13-7/31	?	37	No	986	Y/N*	6	Yes	1,029	?a

a The number of juvenile salmonids was estimated only in 1995 (Jones et al. 1996:18), but in later years the wire array over the spillway tailrace moved most gulls beyond where their predation success could be studied, so the number of juveniles was not estimated (e.g., Jones et al. 1999:13).

* Wires covering the spillway were installed in 1996 and remained the same in 1997 (Jones et al. 1998:2), but, in 1998, some of the wires covering the spillway were missing and were replaced by June 3 (Jones et al. 1999:2).

5-E-3. FISH-EATING BIRDS AT JOHN DAY DAM AND BYPASS

In 1995, gulls and western grebes were the most abundant fish-eating bird predators, but some double-crested cormorants, common mergansers, ospreys, and Caspian terns were also observed (Jones et al. 1996:7, 11). Western grebes foraged almost exclusively in the forebay of the powerhouse, where an average of 16 grebes was counted during April-May and 6-9 grebes were noted during June-August (Jones et al. 1996:7, 11).

During 1997-1998, most gulls were California gulls, but some ring-billed gulls were also noted (Jones et al. 1998:16, 1999:6). Gull abundance was high from late April to early July when numbers of migrating juvenile salmonids at John Day Dam were also high (Jones et al. 1996:13, 1997:13, 1998:18, 1999:12). Most gulls were seen at the spillway and juvenile bypass tailraces, but some were also at the power house tailrace (Table 5.4). In fall and winter, some gulls were also occasionally present as Jones et al. (1997:15) noted that about 50-100 unidentified gulls were feeding (perhaps on juvenile shad, see section 2-B) in tailwaters of John Day Dam in November 1996, and some remained into December.

Lighting allowed gulls to feed at night in the John Day forebay during 1996-1998 and, in 1997, at the juvenile bypass system outfall (Jones et al. 1997:16, 1998:9, 17, 20; 1999:14).

TABLE 5.4. Estimated numbers of gulls and fish caught by gulls at John Day Dam tailraces during 1995-1998 from data in Jones et al. (1999:11, 13). There were 18, 28, 31, and 22 observation days, respectively, during 1995-1998, and the observation periods are from Jones et al. (1998:4, 1999:1, 12). Yr=year. Number of Fish Caught=estimated number of fish predated by gulls; Jones et al. assumed that these were all juvenile salmonids; the methods used for these estimates are discussed in Jones et al. (1996:3-5, 1997:4-5). N=number of gulls that Jones et al. (1997:3-4) "equalized" to be comparable because the number of observation days varied among years. Wires=stainless steel array of wires over water to deter flying gulls. PI=Passage Index, which is an estimate of the millions of juvenile salmonids passing John Day Dam; it is a sum of data in Fish Passage Center (1997:66, 1999:48).

		John Day Dam								
		Power House Tailrace		Spillway Tailrace		Juvenile Bypass Tailrace		Total Gulls	Number of Fish	
Yr	Observation Period	Gulls (N)	Wires	Gulls (N)	Wires	Gulls (N)	Wires	(N)	Caught	PI
95	4/4-8/30	19	Yes	859	No	120	No*	1,164	?	4.3
96	4/16-7/10	42	Yes	4	Yes	169	No*	215	5,196	3.0
97	4/15-7/30	19	Yes	118	No**	235	No*	372	22,772	1.5
98	4/13-7/31	11	Yes	1,467	No**	265	No*	1,743	94,176	5.5

* A pair of oscillating high-pressure hydrocannons was the only deterrent for the juvenile bypass outfall (section 5-F-2, Jones et al. 1999:11).

** Contractors removed the spillway wire array in 1997, and it was not replaced in 1998 because of a lack of funding (Jones et al. 1999:3, 11).

5-E-4. PREDATION OF RADIOTAGGED SALMON AT THE DALLES AND JOHN DAY DAMS AND JOHN DAY BYPASS

For radiotagged juvenile salmonids, Snelling et al. (1997) report that 1% of 154 yearling and subyearling chinook were taken by birds at the juvenile bypass outfall at John Day Dam in 1994. In 1995, 11% of 100 yearling and 6% of 75 subyearling chinook were taken by gulls at the Dalles Dam tailrace (Snelling et al. 1997). In 1996, 5% of 311 yearling and 3% of 219 subyearling chinook were accounted for by birds, though it is not specified if this was for one or both dams (Snelling et al. 1997).

It is not clear if at least some of these radiotagged fish were killed during dam passage and then were scavenged by gulls or other birds (section 2-F-2). Passage mortality may be greater for tagged than nontagged fish because the process of radiotagging can increase the vulnerability of fish to predation or other mortality (Adams et al. 1998, Hockersmith et al. 1999:45). Consequently, it is unclear if results by Snelling et al. are a good estimate of the amount of predation for nonradiotagged fish. Further, it is not known if control measures employed by Wildlife Services since 1996 (see section 5-F) may have reduced predation since the study by Snelling et al. (1997).

5-E-5. DIET OF GULLS FEEDING AT THE DALLES AND JOHN DAY DAMS

During 4 April-12 May 1997, 25% (N=14) of 56 gulls collected at The Dalles and John Day dams by Wildlife Services during its bird control activities (section 5-F-5) had fish in their stomachs, and all identifiable fish remains were juvenile salmonids; their nonfish diet was mostly mollusks (K. Collis, pers. comm.). Consequently, most (75%) gulls lethally controlled by Wildlife Services at these dams did not contain juvenile salmonids. For 24 California gulls collected during 4 April-12 May 1997, 66% of their diet by weight was salmonids; this was greater than for 25 California gulls collected at nesting colonies during 14 April-15 May 1997 for which salmonids were 43% of their diet (Roby et al. 1998:15, 38), so some gulls may have specialized on salmonid feeding at dams.

5-E-6. DIET OF NESTING GULLS NEAR THE DALLES AND JOHN DAY DAMS

During the 1997 and 1998 nesting seasons, Collis et al. (2002:543) found that juvenile salmonids were 15% of the diet of California gulls at Little Memaloose and 3% of the diet of California gulls at Miller Rocks, but 4% and 7% of gull diet at these colonies, respectively, were of unidentified fish that may have included salmonids (see Colonies 1 and 2, respectively, in Fig. 1.1).

In 1997, Roby et al. (1998:34) did not find any fish in the diet of ring-billed gulls nesting at Miller Rocks, but the sample size was small (N=8).

5-E-7. ESTIMATED NUMBER OF FISH TAKEN BY BIRDS AT THE DALLES AND JOHN DAY DAMS

Jones et al. (1996:3-5, 1997:3-5, 1998:4) used the frequency of gulls catching fish in calculating the number of fish caught by gulls. They did not identify these fish and assumed that they were only juvenile salmonids; however, it is not clear if this assumption is true (sections 2-C and 2-D). At The Dalles Dam, they estimated that 64,787 fish were taken in 1995, and they did not estimate the amount of

predation in other years (Table 5.3 footnote a). Most of this predation was presumably in the spillway tailrace because that is where most gulls were observed rather than at the powerhouse or ice/trash sluice tailraces (Table 5.3). A Passage Index for juvenile salmonids at The Dalles Dam was not estimated (Fish Passage Center 1999:48).

At John Day Dam, 5-94 thousand fish were estimated to have been taken annually during 1996-1998 (Table 5.4). Most gulls were usually at the spillway tailrace, which is where most predation may have occurred (Table 5.4). The greatest number of fish caught by gulls occurred in 1998, which is also when the Passage Index for juvenile salmonids was greatest (Table 5.4). Although it was not possible to estimate the proportion of salmonids taken by gulls during 1995-1997 (see Table 5.2 legend), gulls may have caught about 1.8% of passing juvenile salmonids in 1998 (Table 5.2).

5-F. LOWER COLUMBIA RIVER: BIRD MANAGEMENT AT THE DALLES AND JOHN DAY DAMS

5-F-1. INTRODUCTION

Wildlife Services was contracted (presumably by the U.S. Army Corps of Engineers, who operated these dams) to control birds at The Dalles and John Day Dams (Jones et al. 1998:8, 1999:5). Washington Wildlife Services declined providing any information about its bird control in the Columbia Basin (section 4-B), so the following information is from Jones et al. (1996-1999) of the U.S. Army Corps of Engineers.

5-F-2. BIRD EXCLUSION

Although it is not specified who installed the stainless steel wire arrays at these dams (e.g., see Jones et al. 1997:11, 15), Wildlife Services appeared to be responsible for maintaining these arrays to exclude birds (Jones et al. 1997:17, 1999:2). These wires were effective in keeping gulls away (Jones et al. 1997:16, 1998:20, 1999:13), since gull abundance was low at powerhouse and spillway tailraces with wires and declined at areas after wires were installed (Tables 5.3 and 5.4). But not all areas at tailraces could be covered with wires, so some gulls remained (Tables 5.3 and 5.4).

At the John Day Juvenile Bypass System outfall, an avian hydrocannon was also operating by the middle of February 1997 to keep birds away (Jones et al. 1998:2). The avian hydrocannon was composed of two irrigation type impulse sprinklers that under favorable conditions swept a 135 ft (41.1 m) radius, but prevailing winds often reduced the reach to a 105 ft (32.0 m) radius (Jones et al. 1998:2, 7). It excluded gulls within the reach of its spray, but many gulls fed beyond its reach (Jones et al. 1998:7-8, 1999:11, 13).

5-F-3. HABITAT MANIPULATION

In 1997, Wildlife Services directed a spotlight at night-time feeding birds at John Day Dam (Jones et al. 1998:9), but it apparently was unsuccessful as Jones et al. (1999:14) continued to recommend that lighting in the forebays of The Dalles and John Day Dams be eliminated to limit night feeding.

5-F-4. NONLETHAL HAZING

Wildlife Services also used pyrotechnic devices with disturbing sounds such as cracker and screamer shells or a propane cannon to disperse birds (Jones et al. 1996:20-22, 24; 1998:8-9, 1999:5).

In 1997, Wildlife Services dispersed 2,679 birds at The Dalles Dam--about 97% were gulls; at John Day Dam, it hazed 5,797 birds, of which about 80% were gulls (Table 5.5). In 1998, many more gulls were dispersed at both dams, but the number of birds that were not gulls was not specified (Table 5.5). The number of gulls hazed at these two dams in these two years was a small proportion of the total for Washington during 1997-1998 (see Table 4.2).

Nonlethal hazing did not keep all birds away, though it may have reduced predation. In 1995, some birds quickly became accustomed to the propane cannon and ceased responding to it; for all pyrotechnic devices, birds were absent from an area after hazing an average of 1.6 minutes, and all birds only left the area 17% of the time after hazing (Jones et al. 1996:21-22, 24). In 1997, 32% of birds had returned within 15 minutes of being dispersed by pyrotechnic devices, but hazing appeared to have a longer lasting effect in 1998 as less than 20% had returned within 50 minutes (Table 5.6). Elsewhere, hazing also can reduce but not eliminate predation (section 3-B-2).

The Wildlife Services' hazing was evidently extended throughout the year, as Jones et al. (1999:14) recommended that Wildlife Services' efforts "be concentrated during the month of May to protect salmonids and relaxed or even discontinued during the winter months when gulls, overwintering nonresident grebes and other avian piscivorous species are likely feeding upon juvenile shad."

TABLE 5.5. Number of birds dispersed or taken by Wildlife Services at The Dalles or John Day Dams in 1997-1998. This Table is from Wildlife Service data given in Jones et al. (1998:9, 1999:5); Washington Wildlife Services would not provide any information (section 4-B). Since some birds that were not gulls were dispersed and Washington Wildlife Services lethally controlled fish-eating birds of many species (Table 4.3), some birds that were not gulls may have also been controlled lethally at dams.

+=at least the indicated number of birds. In 1997, the number of gulls or nongulls that were controlled lethally was not differentiated. In 1998, more birds may have been controlled because the number of birds other than gulls that were dispersed or taken was not specified and the number of gulls controlled was only during the 1998 study period (April 13-July 31) of Jones et al. (1999:1, 5), but Wildlife Services may also have controlled birds outside of this time period (section 5-F-4).

		Bird Control by Wildlife Services					
		Dispersed			Removed by Lethal Control		
			Other			Other	
Dam	Year	Gulls	Birds	Total	Gulls	Birds	Total
The Dalles	1997	2,599	80	2,679	?	?	346*
	1998	4,405	?	4,405+	1,277	?	1,277+
John Day	1997	4,638	1,159	5,797	?	?	269*
	1998	7,801	?	7,801+	1,251	?	1,251+
Total		19,443	1,239+	20,682+	2,528+	?	3,143+

* In 1997, the total number of birds taken was reported, but it is not stated if the total only includes gulls or may include other birds (Jones et al. 1998:9).

TABLE 5.6. Average percentage of the initial number of gulls in an area that were present up to 60 minutes after pyrotechnic hazing or lethal control by Wildlife Service personnel at The Dalles and John Day Dams in 1997 and 1998. These data are from Jones et al. (1998:8, 1999:5); Jones et al. (1999:5) also included data at 5 minute intervals after 20 minutes. For 1997, Jones et al. (1998:8) also give data for 20-30 minutes after a disturbance, but these data are not comparable to data for 5-15 minutes because the initial number of gulls during these intervals is not the same, so these data are not included. -=data not available or not comparable.

	Average % of Initial Number of Gulls Present			
	1997		1998	
Interval After Disturbance	Pyrotechnic Hazing Only	Lethal Control	Pyrotechnic Hazing Only	Lethal Control
5 min	22	0	2	<1
10 min	27	2	0	1
15 min	32	11	0	1
20 min	-	-	3	4
30 min	-	-	9	9
40 min	-	-	18	15
50 min	-	-	15	16
60 min	-	-	37	20

5-F-5. LETHAL CONTROL

Wildlife Services was given a permit to lethally control birds at dams by the U.S. Fish and Wildlife Service (Jones et al. 1998:5). A total of at least 3,143 birds was taken at these two dams in 1997 and 1998 (Table 5.5). The Wildlife Service's lethal control of gulls by shooting did not keep gulls away because a third of a flock of 19 gulls returned within 18 minutes of one being shot in 1995 (Jones et al. 1996:21). In 1997, 11% of the original number of gulls were present 15 minutes after one was shot (Table 5.6). In 1998, lethal control effects were longer lasting as only 1% of birds were present after 15 minutes, but 20% of the original number were present an hour after one was shot (Table 5.6). Thus, lethal control did reduce the number of gulls present for a while, but it is unknown if this resulted in a reduction of predation or if gulls foraged more efficiently after they returned. Elsewhere, lethal control of fish-eating birds also did not eliminate predation (section 3-C-1).

Evidence that lethal control may not reduce predation as much as it may be assumed is that 75% of the gulls collected in 1997 by Wildlife Services while conducting bird control at these dams and whose stomach contents were examined had not eaten juvenile salmonids (section 5-E-5).

5-G. LOWER COLUMBIA RIVER: BIRD PREDATION AND MANAGEMENT NEAR MCNARY DAM

5-G-1. FISH-EATING BIRDS AT MCNARY DAM

In 2002, researchers in Columbia Bird Research (2002) noted cursorily reported western grebes in April and gulls, Caspian terns, and pelicans during April-July in the tailrace of McNary Dam. Gulls and terns were observed taking fish that may have been juvenile salmonids. When a final report about this research is completed, then it will be possible to know more about the abundance and foraging of these birds.

5-G-2. DIET OF GULLS COLLECTED NEAR MCNARY DAM IN 1955

Merrell (1959) writes:
"In May 1955 a large concentration of gulls was observed feeding below McNary Dam on the Columbia River. Since a heavy migration of downstream-moving salmon and steelhead occurs during this season, it was assumed that gulls were feeding on these fingerlings."

Merrell reports that 27 California gulls, 11 ring-billed gulls, two immature western gulls, and one Forster's tern were shot during 11-12 May 1955. The gulls' stomach contents indicated that their principal prey were 158 lampreys 2-8 inches long; there were only five recognizable salmonids, which would be about 3% of the identified prey. The lamprey found in gull stomachs included 101 Pacific lamprey ammocoetes and 57 adult western brook lamprey. He suggests that more of the unidentified fish bones in the gull stomachs may have been salmonids or that the gulls may have regurgitated salmonids after they were shot but before they were collected. He did not report the stomach contents of the Forster's tern.

It is not clear how juvenile Pacific lamprey abundance now compares to 1955, though brook lamprey abundance now appears to be reduced (Kostow 2002:36). Adult Pacific lamprey numbers have fluctuated greatly at McNary Dam and were also low during 1954-1957 (Close et al. 1995:9, Kostow 2002:40), but there are no counts of juvenile Pacific lamprey or adult brook lamprey then and now. If lamprey are not as abundant now as in 1955 or if there are many more hatchery salmonids vulnerable to predation now (see section 3-B-3), then the diet of gulls feeding below McNary Dam may now be different than found by Merrell.

5-G-3. DIET OF GULLS AND CASPIAN TERNS NESTING NEAR MCNARY DAM

In 1997 and 1998, juvenile salmonids were not found in the diet of ring-billed and California gulls nesting at Three Mile Canyon (Roby et al. 1998:34, Collis et al. 2000:60; 2002:543), where about 11-13 thousand gulls nested during 1997-1998 (Table 1.2). Only 2% of the diet of these California gulls were nonsalmonid fish (Collis et al. 2002:543).

In 1998 and 2000, juvenile salmonids were about 81-86% of the diet of Caspian terns nesting at Three Mile Canyon (Table 5.7), where 520 nested in 2000 and none nested in 2001 (Table 1.3). Many Passive Integrated Transponders that had been inserted into juvenile salmonids were also found at this colony (Collis et al. 2000:25). Thus, salmonids were an important part of the diet of terns at this colony.

TABLE 5.7. Percentage of juvenile salmonids in the diet of Caspian terns nesting at Three Mile Canyon Island near McNary Dam, Crescent Island near Ice Harbor Dam, and at Solstice Island. Diets were determined by nonlethally observing fish carried by adult terns to their nest. Colony locations are shown in Fig. 1.1. These data are from Collis et al. (2000:56; 2001b:10-11; 2002:542) and Columbia Bird Research (2000a:Diet Composition). N=total number of prey items observed; Juv. Sal.=proportion of total prey items that were juvenile salmonids.

		Caspian Tern Diet					
		1998		2000		2001	
Colony No.	Colony	N	Juv. Sal.	N	Juv. Sal.	N	Juv. Sal.
3	Three Mile Canyon Island	60a	81%a	331	86%	0b	-b
4	Crescent Island	0	-	846	75%	2,189	68%
8	Solstice Island	0	-	0	-	255	30%

a In 1998, 26 adult terns were also lethally collected for their stomach contents; 89% of the 26 prey items and 85% of the prey biomass were juvenile salmonids (Collis et al. 2000:56).
b Three Mile Canyon was abandoned by terns in 2001 (Collis et al. 2001b:6).

5-G-4. POSSIBLE PREDATION BY AMERICAN WHITE PELICANS AT MCNARY DAM

In 2002, Tiller and Welch (2002) and Columbia Bird Research (2002) observed white pelicans (which are listed by Washington State as Endangered, National Marine Fisheries Service 2002:3-142, 3-146) feeding on unknown prey in the McNary Dam tailrace. The Columbia Bird Research (2002) report was preliminary.

Pelicans were first consistently observed in the tailrace on April 21 with a maximum count of 24 in late May; then numbers declined slightly but later peaked again during the first week of July (Tiller and Welch 2002). The first peak of pelicans occurred during the migration of most juvenile salmonid species at McNary Dam, but the second peak occurred only when mostly subyearling chinook were migrating (Table 1.1).

Although neither Tiller and Welch (2002) nor Columbia Bird Research (2002) documented foraging of pelicans on juvenile salmonids at McNary Dam, Ryan et al. (2002) reported that tags for juvenile salmonids marked with Passive Integrated Transponders were found at an unspecified Columbia Basin pelican nesting colony. So it is possible that pelicans may feed on juvenile salmonids at McNary Dam.

5-G-5. BIRD MANAGEMENT AT MCNARY DAM

Wildlife Services has been noted as controlling gulls at McNary Dam (which is operated by the U.S. Army Corps of Engineers, Fig. 1.1), but its specific activities have not been reported (section 4-D-1). In early 2002, the Corps installed a water cannon (a 5/8 inch water nozzle) to discourage fish-eating birds from foraging below McNary Dam (Call 2002).

In 2002, Tiller and Welch (2002) observed that bird deterrent practices ("primarily water cannon and firearms for gulls") initially altered pelican behavior but that pelicans rapidly adapted to them and that the amount of time spent by pelicans in the tailrace was more than for other fish-eating birds. In the preliminary Columbia Bird Research (2002) report, changes in bird numbers with hazing in 2002 are also sketched at McNary Dam, but a final report by these researchers is required before making conclusions.

5-H. MID-COLUMBIA RIVER: BIRD PREDATION AND MANAGEMENT NEAR PRIEST RAPIDS DAM

5-H-1. GULL DIET AT OR NEAR PRIEST RAPIDS DAM

York et al. (2000:216, 219) of Wildlife Services' National Wildlife Research Center (http://www.aphis.usda.gov/ws/nwrc) studied gull predation below Priest Rapids Dam and at Cabin Island (Colony 7 in Fig. 1.1). Cabin Island is where 7,200 ring-billed and California gulls nested in 1995 (Table 1.2) and is 0.9 mile (1.5 km) north of the dam (Pochop et al. 1998:411). They collected gulls to determine stomach contents at both locations (Tables 5.8 and 5.9) and assumed that any fish found in gulls were juvenile salmonids because most fish predation occurred during peak salmon smolt migration in May. They found that ring-billed gulls at the Cabin Island colony had consumed few fish, but that unidentified fish were an important food item for ring-billeds collected below Priest River Dam in May (Table 5.8). In contrast, California gulls collected at the nesting colony took more fish, although fish were only a significant food item on May 25 (Table 5.9). For California gulls collected below the dam, unidentified fish formed 65-85% of their diet during the two days when they were collected in May (Table 5.9).

TABLE 5.8. Diet (percent by volume) of ring-billed gulls at their Cabin Island colony (Colony 7 in Fig. 1.1) or below Priest Rapids Dam. All data are from York et al. (2000:Tables 1 and 2). Gulls Sampled=number of gulls collected to determine their diet, t=trace, Unidentified Fish=fish not identified to taxon, Misc. Debris=unidentifiable or nonfood items.

	Ring-billed Gull Diet (% volume) at Cabin Island Colony in 1995				Below Priest Rapids Dam in 1996	
Prey	4/19	5/5	5/25	6/13	5/7	5/21
Unidentified Fish	0	4	t	0	26	41
Grain	t	t	13	4	26	t
Insect	t	1	15	47	15	2
Mammal	1	49	45	1	t	0
Earthworm	0	6	0	1	0	0
Plant Matter	87	35	25	35	31	55
Misc. Debris	12	5	2	13	3	2
SUM	100	100	100	101	101	100
Gulls Sampled	16	18	22	21	21	22

TABLE 5.9. Diet (percent by volume) of California gulls at their Cabin Island colony (Colony 7 in Fig. 1.1) or below Priest Rapids Dam. All data are from York et al. (2000:Tables 1 and 2). Gulls Sampled=number of gulls collected to determine their diet, t=trace, -=no data, Unidentified Fish=fish not identified to taxon, Misc. Debris=unidentifiable or nonfood items.

	California Gull Diet (% volume) at Cabin Island Colony in 1995				Below Priest Rapids Dam in 1996	
Prey	4/19	5/5	5/25	6/13	5/7	5/21
Unidentified Fish	t	13	54	-	65	85
Grain	1	0	0	-	0	0
Insect	0	0	t	-	2	t
Mammal	0	0	0	-	1	0
Earthworm	0	0	0	-	1	0
Plant Matter	82	41	44	-	21	15
Misc. Debris	17	46	2	-	10	t
SUM	100	100	100	-	100	100
Gulls Sampled	4	5	13	0	17	6

5-H-2. BIRD MANAGEMENT AT OR NEAR PRIEST RAPIDS DAM

Priest Rapids Dam is operated by the Grant County Public Utility District (Fig. 1.1), and gull control by Wildlife Services below Priest Rapids Dam included exclusion with wire grids, hazing, and lethal control (sections 4-D-1 and 4-D-2).

At Cabin Island, staff of the Animal and Plant Health Inspection Service/Wildlife Services and the National Wildlife Research Center (which is now part of Wildlife Services, http://www.aphis.usda.gov/ws/nwrc) used white mineral oil or corn oil to spray eggs at about 3,190 ring-billed gull nests in 1995 "to control the fecundity of ring-billed gulls on the island" and 95% of oiled eggs did not hatch (Pochop et al. 1998:412). In 1996 and 1997, all eggs at this colony were sprayed with corn oil, and 99.3-99.5% of oiled eggs did not hatch (Pochop et al. 1998:412). Egg oiling may have continued since then because Wildlife Services (2002a) notes that it may use egg addling/destruction for controlling bird damage at mid-Columbia dams in Washington (see quotation in section 4-D-2). However, the number of eggs that are oiled are not included in the number of ring-billed gulls taken in Washington in Wildlife Services' tables (see Table 4.3). Pochop et al. (1998) do not state why it was necessary to reduce gull fecundity; perhaps it was because there was a concern that these nesting gulls were eating juvenile salmonids. They also did not indicate who owns Cabin Island or if Wildlife Services was requested to control nesting gulls there by the landowner.

5-I. MID-COLUMBIA RIVER: BIRD PREDATION AND MANAGEMENT NEAR WANAPUM DAM

Ruggerone (1986:736-737) estimated juvenile salmonid mortality by using binoculars to study gulls that were "almost exclusively ring-billed gulls" below Wanapum Dam (which is operated by Grant County Public Utility District, Fig. 1.1) during only 250 minutes (about four hours) of observations from

24 April to 15 May 1982. He did not identify any of the fish taken by gulls but assumed that "most of them probably were salmonids because other juvenile fishes in this area of the Columbia River do not actively migrate downstream in the spring" (Ruggerone 1986:737). He extrapolated his findings to indicate that gulls caught 112,000-119,000 presumed salmonids during his observation period or about 2% of the estimated salmonid migration (Ruggerone 1986:740-741). Ruggerone (1986:741) noted that:

> "Although gulls consume large numbers of salmonids each spring, the total effect of gull foraging on the salmonid population is difficult to estimate because a portion of the salmonids consumed by gulls were likely killed by the turbines prior to being consumed."

Ruggerone (1986:741) suggested using monofilament line strung across the tailrace of Wanapum Dam to reduce gull predation. He also suggested that hatchery managers should release fish at night to reduce predation at release sites, so gulls may have been attracted to daytime hatchery releases.

Recently, Wildlife Services has been noted as managing birds at Wanapum Dam by using overhead wires, hazing, and lethal control (sections 4-D-1 and 4-D-2), but some wires may be too far apart to be effective (section 4-D-2).

5-J. MID-COLUMBIA RIVER: BIRD PREDATION AND MANAGEMENT NEAR ROCKY REACH AND ROCK ISLAND DAMS

5-J-1. INTRODUCTION

The Chelan County [Washington] Public Utility District (PUD) operates and owns both of these dams (Fig. 1.1, National Marine Fisheries Service 2002:3-148, 3-149).

BioAnalysts (2000:19) states that fish and bird predation "probably" results in the bulk of the loss of juvenile salmonids through the Rocky Reach Reservoir, but does not provide evidence for this statement. Fish-eating birds present in the Rocky Reach area include gulls, cormorants, Caspian terns, great blue herons, osprey, common mergansers, belted kingfishers, common loons, western grebes, black-crowned night-herons, and bald eagles (BioAnalysts 2000:15).

5-J-2. INFORMATION FROM CHELAN COUNTY PUD

This PUD has minutes for some of its Board of Commissioners' meetings available on the Internet. These minutes indicate that in 2000, this PUD agreed to pay $160,715 to Wildlife Services to use hazing techniques to scare away gulls and cormorants and to hire fishermen to catch northern pikeminnows at both dams (Gillin 2000). In 2001, the Chelan PUD contracted with Wildlife Services to pay no more than $22,550 to install a wire grid at both dams to deter gulls and terns (Craig 2001a) and $202,900 "to control northern pikeminnow, gulls and cormorants" at both dams (Craig 2001b). In 2002, this PUD agreed to pay $320,295 to Wildlife Services for "animal damage control" at both dams (Gillin 2002). These activities were presumably paid for by this PUD's ratepayers.

In 2002, minutes for the March 11 meeting of this PUD's Board of Commissioners indicated that they would also fund studies of predation (Craig 2002):

> "Commissioners approved agreements with the state Department of Fish and Wildlife and the University of Washington for studies to validate the cost-effectiveness of the District's predator control programs to protect juvenile fish at Rocky Reach and Rock Island dams.
>
> "Last week, HCP Implementation Manager Tracy Yount discussed how the PUD has contracted with the U.S. Department of Agriculture for several years to control fish and birds that prey on juvenile salmon at the dams. Contract crews remove northern pikeminnows downstream of the two projects and use various measures to deter or remove cormorants, gulls and terns.
>
> "Similar actions are taken to protect fish in other areas of the Northwest. Although the actions are designed to help protect an endangered species, animal rights groups have raised questions about possible impacts on migratory birds, mostly terns. While Chelan County PUD's actions have not been questioned, the Department of Agriculture recently asked the PUD for help in preparing an environmental assessment on avian predator control.
>
> "The PUD performed a risk analysis that looked at what might happen if the predator control program were abandoned. Yount said the preliminary conclusion was that the program is very cost-effective. But more detailed studies are needed to confirm that.
>
> "The contract with the state is not to exceed $400,000 and the University of Washington agreement is not to exceed $330,000 in the first year. The studies are expected to take three years."

Although details are not given, the minutes for these PUD meetings indicate that the fish-eating birds of most concern at these dams are gulls, cormorants, and terns and that control measures for them include exclusion with wires, hazing, and lethal control. Although the cost of bird control is not separated from that of northern pikeminnow control, predator control and studies of predator control are expensive. For 2002 alone, expenses may total about $1 million.

The degree that this bird control has reduced predation is acknowledged to be unknown (T. West, Chelan PUD in BioAnalysts 2000:15). Some wire grids that Wildlife Services placed at mid-Columbia dams are spaced far apart that they would not be expected to be as effective as more closely spaced wires (section 4-D-2).

5-J-3. INFORMATION FROM NATIONAL MARINE FISHERIES SERVICE (2002)

The Animal and Plant Health Inspection Service (APHIS; of which Wildlife Services is a part) is cited by National Marine Fisheries Service (2002) as having provided information about bird control at Rocky Reach and Rock Island Dams (section 4-B-2). However, "quantitative data are not available on salmonid mortality by avian predators at the Wells Dam, Rocky Reach Dam, Rock Island Dam, or Wells Hatchery" (National Marine Fisheries Service 2002:3-138). The most numerous predators at dams were reported to be ring-billed gulls, California gulls, and Caspian terns (National Marine Fisheries Service 2002:3-138).

Chelan County PUD is listed as funding bird control, which included wires installed across tailraces, hazing by propane cannons, "other pyrotechnic" methods, and lethal control where deemed necessary (National Marine Fisheries Service 2002:2-29). A diagram of the wire grid at Rocky Reach Dam is included in National Marine Fisheries Service (2002:3-141). At Rock Island Dam "between 1996 and 2001," hazing levels for just ring-billed gulls ranged from 450 to 3,371 per year, and 201-1,075 ring-billed gulls were killed annually (National Marine Fisheries Service 2002:3-140).

5-J-4. INFORMATION FROM WILDLIFE SERVICES

Wildlife Services has acknowledged that it has installed bird wires and conducted nonlethal and lethal control at these and other mid-Columbia dams (sections 4-D-1 and 4-D-2). But some of Wildlife Services' overhead wires may be too far apart to be effective in excluding flying birds (section 4-D-2).

5-K. MID-COLUMBIA RIVER: GULL PREDATION AND MANAGEMENT NEAR WELLS DAM

Wells Dam is operated by the Douglas County PUD (Fig. 1.1, National Marine Fisheries Service 2002:3-147). Wildlife Services conducted bird control at this dam (sections 4-D-1 and 4-D-2), although estimates of bird predation are not available (National Marine Fisheries Service 2002:3-138). The fish-eating predators of most concern were ring-billed gulls, California gulls, and Caspian terns (National Marine Fisheries Service 2002:3-138). In addition, over 100 white pelicans regularly used the Wells reservoir from May to early October (National Marine Fisheries Service 2002:3-146), and white pelicans have been implicated as predators of juvenile salmonids (section 5-G-4).

Douglas County PUD is listed as funding bird control at Wells Dam (National Marine Fisheries Service 2002:2-29, 3-138), and Steuber et al. (1995) report that Wildlife Services was contacted by this PUD in 1992 for "alleviating a historical gull predation problem." In 1993, Wildlife Services and PUD personnel installed an overhead wire exclusion system over much of the area below the dam (Steuber et al. 1995). There was a dramatic decrease in the number of feeding gulls, especially when wires were placed at 7.5 m (24.6 ft) rather than 15 m (49.2 ft) intervals (Steuber et al. 1995); this is also discussed in section 4-D-2. Other bird control methods at Wells Dam included hazing by propane cannons, "other pyrotechnic" methods, and lethal control when considered necessary (National Marine Fisheries Service 2002:2-29).

5-L. SNAKE RIVER: BIRD PREDATION AND MANAGEMENT NEAR ICE HARBOR DAM

5-L-1. DIET OF GULLS AND CASPIAN TERNS NESTING NEAR ICE HARBOR DAM

During 1997-1998, Collis et al. (2002:543) reported that no fish were found in the diet of ring-billed gulls nesting at Island 18 (see Colony 6 in Fig. 1.1) and that only 3% of the diet of California gulls nesting there were fish, with no identifiable salmonids. In 1997, no salmonids were found in the diet of California or ring-billed gulls nesting at Crescent Island (see Colony 4 in Fig. 1.1) and Richland Island (see Colony 5 in Fig. 1.1) (Roby et al. 1998:34).

1,440 Caspian terns nested at Crescent Island in 2001 (Table 1.3). During 2000-2001, juvenile salmonids were about 68-75% of the diet of terns at this colony (Table 5.7). Many Passive Integrated Transponders that had been inserted into juvenile salmonids were found at this colony (Collis et al. 2000:25, 85-86). Thus, salmonids were a significant food item for these nesting terns, although it is not clear if terns caught salmonids at Ice Harbor Dam or in the Columbia or Snake Rivers after hatchery releases (section 6-B-2).

5-L-2. DOUBLE-CRESTED CORMORANTS NESTING NEAR ICE HARBOR DAM

In 2002, as many as 40 nesting adult double-crested cormorants were to be collected to determine their diet at Foundation Island (which is not shown in Fig. 1.1), just below the confluence of the Snake and Columbia Rivers, where "hundreds of pairs" nested in 2001 (Bonneville Power Administration 2002:3). There may also be other cormorant colonies in the Columbia Basin (section 1-E-4).

5-L-3. BIRD MANAGEMENT NEAR ICE HARBOR DAM

Wildlife Services has been noted as controlling gulls at Ice Harbor Dam (which is operated by the U.S. Army Corps of Engineers, Fig. 1.1)(section 4-D-1).

In 1999, Pochop et al. (2001) of Wildlife Services installed silt fencing to discourage ring-billed and California gull nesting at "Upper Nelson Island," where they estimated that there were more than 21,000 gull nests. They found that the zone with fencing had 84% fewer nests than an area without silt fencing. I could not find "Upper Nelson Island" on the topographical map available at http://www.topozone.com, and the TopoZone map indicates that the latitude and longitude Pochop et al. (2001) gave for this island (46 22'50"N, 119 15'05"W) does not match their description that it is 0.3 mile (0.5 km) from the shoreline of Richland, Washington. However, the TopoZone topographical map indicates that Nelson Island is at River Mile 340 (River Kilometer 547), about 0.1 mile (0.2 km) from the Richland shore; an unnamed island just north of Nelson Island is about 0.3 mile (0.5 km) from the Richland shore and could be described as also being at River Mile 340, so maybe it is the island that Pochop et al. refer to as "Upper Nelson Island." Collis et al. (2002:539) searched for nesting gulls to River Mile 343 (River Kilometer 553) during 1997-1998 and did not report any gull nesting on Nelson Island, but they reported that 22,348 gulls nested (which would be 11,174 gull nests) on Richland Island at River Kilometer 547, so Pochop et al.'s "Upper Nelson Island" may be the same as Collis et al.'s Richland Island (see Colony 5 in Fig. 1.1).

5-L-4. BIRD PREDATION AND CONTROL AT ICE HARBOR DAM

Wildlife Services conducted bird control at Ice Harbor Dam (section 4-D-1), but I have not found any specific information about bird predation or control at this dam.

5-M. SNAKE RIVER: BIRD MANAGEMENT AT LOWER MONUMENTAL, LITTLE GOOSE, AND LOWER GRANITE DAMS

These dams are operated by the U.S. Army Corps of Engineers (Fig. 1.1). According to York in section 4-D-1 and Wildlife Services (2001a:2), Wildlife Services conducts gull control at these dams, though the types of control for each dam is not specified. I have not been able to find more information about bird predation or control at these dams, and Wildlife Services has refused to answer general questions about its control programs (section 4-B-2).

5-N. SNAKE RIVER: GULL PREDATION NEAR BROWNLEE DAM

Brownlee Dam is operated by the Idaho Power Company (Fig. 1.1). The only information I have found about bird predation there is for 1959. During large spills in late July-early August and mid-October 1959, "large numbers of seagulls were noted daily" below Brownlee Dam (Haas 1965:47, 50). Haas (1965:50) wrote: "The gulls apparently accumulated below the dam to feed on fish that were killed, injured, or stunned by passing through the turbines or spillway." Idaho Fish and Game staff obtained permits to shoot some of the gulls in 1959 to study their food habits and found that "twenty-seven of 28 gulls shot had at least one identifiable salmon in their stomachs"; no other details are given (Haas 1965:50).

5-O. CASPIAN TERN DIET AT SOLSTICE ISLAND

The Columbia River is over 30 miles (48 km) from the Caspian tern colony at Solstice Island in Potholes Reservoir (see Colony 8 in Fig. 1.1)(Collis et al. 2001b:11). Nevertheless, many juvenile salmonids marked with Passive Integrated Transponder, radio, or acoustic tags in 2000 and 2001 that had been released into the Columbia or Snake Rivers were recovered at this colony (Columbia Bird Research 2000a:Diet Composition, Collis et al. 2001b:11). In 2001, 30% of the prey items for Caspian terns nesting at this colony were juvenile salmonids (Table 5.7). It is unclear if terns caught these marked salmonids at dams or in rivers after they were released (section 6-B-2).

Wildlife Services has controlled birds at dams (section 4-D-1) and some bird colonies (sections 5-H-2 and 5-L-3), but it has not been reported if it has done anything at this colony.

CHAPTER 6. DISCUSSION OF PREDATION AND PREDATOR CONTROL NEAR COLUMBIA BASIN DAMS

6-A. INTRODUCTION

A thorough review of bird predation and control at all Columbia Basin dams is not possible because of a lack of accessible information. But an index to known bird predation at dams is in Table 6.1, an index about fish-eating birds in the Columbia Basin away from dams is in Table 6.2, and an index of bird control is in Table 6.3. In the rest of this Chapter, aspects of bird predation and control are examined.

6-B. SUMMARY OF BIRD PREDATION IN THE COLUMBIA BASIN

6-B-1. PREDATION AT OR NEAR DAMS

Fish-eating birds that are most often identified at dams are gulls, Caspian terns, and cormorants (Table 6.1). Although some predation has been reported in forebays in front of dams, most predation has been noted in tailraces or outfalls of powerhouses, bypasses, and spillways (Table 6.1). Most predation has been observed during daylight, but at some dams where forebays are illuminated, night-time bird predation has also been reported (Table 6.1).

In some collections of birds at dams, juvenile salmonids or other prey were not identified or were identified only as "fish" and assumed to be salmonids (Table 6.1). In a study in 1959, 3% of prey items of gulls shot at McNary Dam were juvenile salmonids (section 5-G-2), but, in 1997, 66% of the diet of California gulls collected at two dams were juvenile salmonids (section 5-E-5).

6-B-2. PREDATION AT HATCHERIES OR IN RIVERS

During the course of my review I found little information about fish-eating bird predation or control elsewhere in the Columbia Basin. However, the State of Washington has a policy about predator control at its hatcheries (Appendix Table II.1), Schaeffer (1992) reports about bird control at Oregon Department of Fish and Wildlife hatcheries, Associated Press (2002) discusses bird predation and control at the Washington Department of Fish and Wildlife's Ringold Springs hatchery (which is about midway between the Priest Rapids and Lower Monumental Dams), and Wildlife Services (2002a) mentions bird control at mid-Columbia hatcheries. Accordingly, bird predation in at least some Columbia Basin hatcheries occurs and may be significant (e.g., see Associated Press 2002).

Bird predation of juvenile salmonids also may regularly take place in the Columbia or Snake Rivers after large hatchery releases. Schaeffer (1992:9) notes that some Oregon Department of Fish and Wildlife hatchery staff observed birds flocking to sites after large releases, and this has also been observed along the Oregon coast (Bayer 1986). At the Spring Creek hatchery about 22 miles (35 km) upstream of Bonneville Dam, gulls were attracted after two releases in 1995, and the hatchery manager "reported that the gulls usually began feeding about 20 minutes after the start of a hatchery release, then follow the fish downstream" (Jones et al. 1996:12). After the 16 March 1995 release, three cracker shells from a shotgun scared the birds away, but they returned within 20 minutes (Jones et al. 1996:12).

6-B-3. DIET OF NESTING GULLS OR TERNS

Nesting birds may have caught juvenile salmonids at dams (section 6-B-1) or at hatcheries or in rivers, especially after hatchery releases (e.g., section 6-B-2). Gulls collected at nesting colonies often had not consumed juvenile salmonids, but juvenile salmonids were a significant prey for nesting Caspian terns at several of their colonies (Table 6.2). At one gull colony, the percentage of unidentified fish in the diet of gulls changed during the nesting season (section 5-H-1).

TABLE 6.1. Index to information about fish-eating bird predation of juvenile salmonids at Columbia Basin dams in Chapters 4-5.

Description	Section(s)
Taxon of Fish-eating Bird at Dams:	
cormorants	5-D-1, 5-E-2, 5-E-3, 5-J-2, 5-J-3, 5-K
gulls	4-D-1, 5-C-2, 5-D-1, 5-D-2, 5-D-3, 5-E-2, 5-E-3, 5-E-5, 5-E-7, 5-F-2, 5-F-4, 5-F-5, 5-G-1, 5-G-2, 5-H-1, 5-H-2, 5-I, 5-J-2, 5-J-3, 5-K, 5-N
Caspian terns	5-E-3, 5-G-1, 5-J-2, 5-J-3, 5-K
American white pelicans	5-G-1, 5-G-4, 5-K
other birds	5-D-1, 5-E-2, 5-E-3, 5-G-1, 5-J-3, 5-K
Site of Bird Predation at Dams:	
Bypass Tailrace/Outfall	5-C-2, 5-D-2, 5-E-3, 5-E-4, 5-F-2, 5-G-4
Forebay in Front of Dam	5-E-2, 5-E-3, 5-F-3
Power House Tailrace	5-D-1, 5-E-2, 5-E-3, 5-E-4, 5-E-7, 5-K
Spillway Tailrace	5-D-1, 5-D-2, 5-E-2, 5-E-3, 5-E-7, 5-F-2, 5-N
Ice/Trash Sluice Tailrace	5-E-2, 5-E-7
Predation Affected by Weather, Stream Flows, and Turbidity:	5-B
Predation After Hatchery Releases:	5-D-1
Night-time Bird Foraging at Dams:	5-E-2, 5-E-3, 5-F-3
Juv. Salmonids as a % of Bird Diet at Dams:	
unknown "fish" *	5-H-1 (gulls), 5-N (gulls)
1-25%	5-G-2 (gulls)
26-50%	
51-75%	5-E-5 (gulls)
>75%	
Estimate of Bird Predation at Dams:	
number of juvenile salmonids	5-C-2, 5-D-2, 5-E-7, 5-I
% of migrating salmonids	5-C-2, 5-D-2, 5-E-4, 5-E-7, 5-I

* "Fish" found in bird stomachs were not identified as juvenile salmonids or not all prey were identified.

TABLE 6.2. Index to information about fish-eating birds away from dams in the Columbia Basin from Chapters 1 and 4-6.

Description	Section(s)
Other Sites of Bird Predation:	
Hatcheries	6-B-2
Hatchery Release Site	6-B-2
Transportation Release Site	5-C-1
Nesting Fish-Eating Bird Taxon:	
double-crested cormorant	1-E-4, 5-L-2
California gull	1-E-2, 5-E-6, 5-G-3, 5-H-1, 5-L-1
ring-billed gull	1-E-2, 5-E-6, 5-G-3, 5-H-1, 5-H-2, 5-L-1
Caspian tern	1-E-3, 5-G-3, 5-L-1, 5-O
American white pelican	1-E-4, 5-G-4
other birds	1-E-4
Juv. Salmonids as a % of Nesting Bird Diet:	
unknown "fish" *	5-H-1 (gulls)
0%	5-E-6 (gulls), 5-G-3 (gulls), 5-L-1 (gulls)
1-25%	5-E-6 (gulls)
26-50%	5-O (terns), 5-E-5 (gulls)
51-75%	5-L-1 (terns)
>75%	5-G-3 (terns)

* "Fish" found in bird stomachs were not identified as juvenile salmonids.

TABLE 6.3. Index to information about fish-eating bird control near Columbia Basin dams in Chapters 4-5.

Description	Section(s)
Cost of Bird Control:	4-E, 5-J-2
Timing of Bird Control:	
April-September	4-D-4
Includes Winter	4-D-4, 5-F-4
Nonlethal Control Methods:	
Effigies	4-D-2
Frightening Devices *	4-D-1, 4-D-2, 5-F-4, 5-G-5, 5-J-3, 5-K
Effectiveness	5-F-4, 5-G-5
Night Transportation Releases	5-C-1
Silt Fencing to Discourage Nesting	5-L-3
Spotlight	5-F-3
Water Cannon/Sprayers	5-C-1, 5-C-2, 5-F-2, 5-G-5
Effectiveness	5-C-2, 5-F-2
Wire Grids	4-D-1, 4-D-2, 5-C-2, 5-D-3, 5-F-2, 5-J-2, 5-J-3, 5-K
Effectiveness	4-D-2, 5-C-2, 5-D-3, 5-F-2, 5-K
Lethal Control Methods:	
Shooting/Unknown	4-D-1, 4-D-2, 5-F-5, 5-J-2, 5-J-3, 5-K
Effectiveness	5-F-5
Egg Oiling	4-D-2, 5-H-2

* Pyrotechnics, including propane cannon, cracker or screamer shells.

6-C. IMPACT OF BIRD PREDATION AT COLUMBIA BASIN DAMS OR BYPASSES

6-C-1. INTRODUCTION

The biological impact of bird predation is difficult to determine, so assumptions are made to estimate the amount of predation. The assumption that all fish passing dams during April through early or mid-August are juvenile salmonids appears to be reasonable for mainstem Columbia and Snake River dams, though many, if not most, fish passing by mid-August at lower Columbia dams may be juvenile shad (section 2-B). It is less clear if birds at dams are taking only salmonids, as is commonly assumed by researchers (e.g., Ruggerone 1986, Steuber et al. 1995, Jones et al. 1996-1999) because other fish may be available (section 2-C) and birds collected at dams may (section 5-G-2) or may not (section 5-E-5) include other fish species.

6-C-2. ESTIMATES OF PROPORTION OF VIABLE JUVENILE SALMONIDS PASSING A DAM OR USING A BYPASS THAT ARE TAKEN BY BIRDS

DAMS. At Bonneville, John Day, and Wanapum Dams; estimates of gull predation were about 2% or less of passing juvenile salmonids (sections 5-D-2, 5-E-7, and 5-I).

At The Dalles and/or John Day Dam, birds took 3-11% of radiotagged chinook, but it is not clear if the process of radiotagging increased predation, so that the predation rate for radiotagged chinook may be much higher than for nonradiotagged fish (section 5-E-4). Further, it is unknown if Wildlife Services' control methods have reduced bird predation at these dams since the study of radiotagged chinook (section 5-E-4).

BYPASSES. At the John Day Bypass, 1% of radiotagged chinook were thought to have been taken by birds (section 5-E-4). At the Bonneville Bypass before water cannons and wires were installed to exclude birds, gulls were estimated to take as many as 2% of passing salmonids, though calculations from published figures suggest 0.4% (section 5-C-2). After the bird control methods were installed, gulls were absent from the Bonneville Bypass outfall (section 5-C-2).

MULTIPLICITY OF PREDATION AT DAMS OR BYPASSES. Although predation levels of 1-2% per dam may not appear significant, there are so many dams that these predation levels may become significant, if viable salmonids are taken at each dam. For example, if there was a 1% predation level of viable salmons at each of the nine dams in the Columbia from Wells Dam downstream, then approximately 9% of salmonids that passed Wells Dam may be taken. But if salmonids only pass one dam (e.g., fish released at Spring Creek Hatchery just above Bonneville Dam, Jones et al. 1996:12), then predation is not multiplicative.

6-C-3. CONCLUSIONS

It is not possible to reasonably estimate the impact of bird predation by just observing birds take fish-like prey at dams and assuming that birds are only taking viable, listed juvenile salmonids and thus have a major negative impact on salmon recovery. With overall direct dam mortality levels of 3-9% at some dams, it is plausible that a portion (perhaps a significant portion) of juvenile salmonids taken by birds below dams may already have been dead or mortally injured (section 2-F-2). Haas (1965:50), Ruggerone (1986:741), and Animal Damage Control staff Steuber et al. (1995:Discussion) acknowledge

this, but National Marine Fisheries Service (2002:2-28, 2-29) and Wildlife Services (2002a) do not. Further, the impact of bird predation at one dam is unclear because fish taken at one dam may have died anyway from other sources of downstream compensatory mortality, so reducing bird predation at one dam may not lead to a proportional increase in survival (section 2-G). Finally, most juvenile salmonids do not appear to be from listed stocks (section 1-C). Nevertheless, the possibility that predation may have a significant effect on certain salmon stocks cannot be disregarded.

6-C-4. RECOMMENDATION FOR FUTURE RESEARCH

A significant unanswered question about bird predation at dams is what proportion of juvenile salmonids taken by birds is viable (section 2-F). Studies that only determine if juvenile salmonids have been taken by birds (e.g., see Table 6.1) do not address this question. Research such as Schreck and Stahl (2000:24, 46, 58) that attempted to ascertain if salmonids taken by terns in the Columbia Estuary were smaller, less smolted, or had higher infection levels of disease (e.g., Bacterial Kidney Disease) are essential, but studies should also examine fish taken by birds to determine if they have parasites (e.g., *Ceratomyxa shasta*, see Bartholomew et al. 1992) or show signs of physical injury (e.g., descaling) or gas bubble trauma from passage at dams. Gas bubble trauma is a concern at Columbia Basin dams, especially for fish with high levels of Bacterial Kidney Disease infection, and can make affected fish more vulnerable to predation (Elston et al. 1997, Mesa and Warren 1997, Mesa et al. 1998, Weiland et al. 1999). Unfortunately, juvenile salmonids taken by birds may be partially digested, so it may be difficult to determine if they were viable.

6-D. ESTIMATING AN UNACCEPTABLE LEVEL OF PREDATION AT COLUMBIA BASIN DAMS

6-D-1. UNACCEPTABLE PREDATION: SOCIAL UNACCEPTANCE

The level of predation that is unacceptable depends upon public acceptance, which may change with educational efforts and publicity (Decker and Goff 1987, Decker and Purdy 1988, Wildlife Services 2002c:4). In general, any predation may be too much for some people, moderate predation may be acceptable to many, and all predation may be permissible to others; so wildlife managers may suggest a middle ground of allocating some prey for predators (Thompson et al. 1995:187). Wildlife Services (2001c:21) also describes these differences in perspective:

> "Local residents who are experiencing damage may want effective methods to be employed, whereas unaffected parties may not see any need for action. Aesthetically speaking, a passerby may view a large flock of migratory birds with great delight, whereas the property owner may view the same birds with disdain."

Acceptance of predation in the Pacific Northwest also depends upon the species of predator and prey (e.g., Independent Scientific Group 1996:333-334). For example:

1) Salmonids are themselves predators of other fish (including juvenile salmonids) and Dungeness crab larvae (Heg and Van Hyning 1951, Anonymous 1959, Angstrom and Reimers 1964, Fresh et al. 1981, Stuart and Buckman 1985, Thomas 1985, Brodeur et al. 1987, 1992; Bayer 1989:36-39, 45-46). But this predation is acceptable, although Thomas (1985) pointed out that salmon predation could be important to the Dungeness crab fishery.
2) Striped bass are a predator of juvenile salmonids, but are also popular for sportfishing (e.g., Morgan and Gerlach 1950, Shapovalov and Taft 1954:257, Johnson et al. 1992:104, Temple et al. 1998). In spite of their predation, the Oregon Fish and Wildlife Commission approved a plan in 1990 to

enhance the striped bass population in Coos Bay, Oregon (Johnson et al. 1992, Temple et al. 1998), and the California Department of Fish and Game was also exploring increasing the number of striped bass, although they preyed on an endangered salmonid (Lindley and Mohr 1998).

3) Several species of warmwater gamefish (e.g., walleye and largemouth bass) sometimes prey on juvenile salmonids in the Columbia Basin or along the Oregon Coast but are also popular for sports anglers (Daily 1998, Oregon Department of Fish and Wildlife and National Marine Fisheries Service 1998, Shupp 1998, Temple et al. 1998, Beamesderfer 2000). In 1998, the Oregon Department of Fish and Wildlife proposed reducing this predation of juvenile salmonids by ending fishing restrictions on warmwater gamefish, but the resistance from fishing groups was intense enough for the Oregon Department of Wildlife to quickly withdraw its proposal (Monroe 1998a,b,c).
4) Northern pikeminnows are predators of juvenile salmonids in the Columbia Basin and are controlled in several areas (e.g., Friesen and Ward 1999, Beamesderfer 2000), but they are not popular with anglers. Walleyes also take some juvenile salmonids in the Columbia Basin, but are popular for sports fishing (Temple et al. 1998, Beamesderfer 2000:21). Controlling walleyes appears to be less practical in reducing their predation of salmon (Temple et al. 1998, Beamesderfer 2000:21), and Beamesderfer (2000:21), then of the Oregon Department of Fish and Wildlife, also notes: "A walleye removal program would be less acceptable than the pikeminnow program, especially to an active and vocal group of walleye anglers."

The level of acceptance may also depend upon whether predation is on private or public lands. Some groups have suggested that the unacceptable level of predation be higher on public than private property (e.g., Humane Society of the United States in Wildlife Services 1998a:section 3.3.5). In the case of bird predation at Columbia Basin dams, the damage is not of a private resource on private property. Public opinion about the predator control is relevant because Wildlife Services is a governmental agency that is trying to control a public resource (bird predators) to protect a publicly owned resource (juvenile salmonids) on public waters, and operators of dams are public entities, with predator control publicly funded by taxes or electric rates (section 4-B-3). Wildlife Services' policy is to do predator control only if requested (Appendix Table II.2), so public input to dam operators as well as Wildlife Services may influence decisions about predator control. For the Columbia Basin, Wildlife Services conducted bird control by 1992 (Steuber et al. 1995), but an opportunity for public input to Wildlife Services about this control does not appear to have come until at least 10 years later (Wildlife Services 2002a). However, Wildlife Services (2002a) allowed public input only by letters for 18 days after it was first announced. In contrast, Wildlife Services' (2000a:6-1, 2000b:17) requests for public input in Kentucky and Wisconsin included a 30-40 day comment period, and comments were accepted by fax and letters as well as by e-mail in Wisconsin. Further, the Wildlife Services' (2002a) request for public comments about Wildlife Services' predator control projects at mid-Columbia dams had little information about its control projects, which makes it impossible for the public to provide knowledgeable comments about Wildlife Services' programs.

6-D-2. UNACCEPTABLE PREDATION LEVEL: MORE THAN 5% OF JUVENILE SALMONIDS

[This subsection was revised in April 2003 by deleting the original second sentence.]

One criterion of an unacceptable level of predation is if more than 5% of juvenile salmonids are taken by predators. The Northwest Power Planning Council (1999) stated that its goal was to reduce Caspian tern predation to less than 5% of juvenile salmonids in the Columbia River Estuary. As pointed out in section 6-C-2, the few estimates of predation at Columbia Basin dams is 2% or less per dam and perhaps a significant portion of this predation is of dead or dying salmonids killed while going through

turbines or bypasses or over spillways.

At Wells, Rocky Reach, and Rock Island Dams, the current National Marine Fisheries Service goal for juvenile salmonid mortality is 5% or less during dam passage (i.e., passage through the forebay, dam, and tailraces) and 7% or less for project passage (i.e., forebay, dam, tailraces, and reservoir)(National Marine Fisheries Service 2002:2-51, 2-58). Bird predation is one component of this mortality (which would also include predation by fish), though it is unclear if bird predation is of viable juveniles or of juveniles killed or mortally injured during dam passage (section 2-F-2). In any case, if bird predation is greater than 5% of all juvenile salmonids for dam passage or greater than 7% for project passage, it would be clearly unacceptable for the current National Marine Fisheries Service objective for these dams.

6-D-3. UNACCEPTABLE PREDATION: 4% OR LESS OF GULL DIET IS SALMONIDS

At Cabin Island, fish that were assumed to be juvenile salmonids were found to only be 0-4% of the diet of nesting ring-billed gulls during April 19-June 13 (Table 5.8). Yet all ring-billed gull eggs at this colony were oiled to control gull fecundity during 1995-1997, perhaps because of assumed gull predation of salmonids (section 5-H-2).

At Upper Nelson Island (which is probably Richland Island), Wildlife Services installed silt fences in 1999 to discourage gull nesting and reduce their predation of salmonids (section 5-L-3). However, none of the diet of ring-billed and California gulls nesting at Richland Island in 1997 and nearby Island 18 during 1997-1998 were juvenile salmonids (section 5-L-1).

6-D-4. UNACCEPTABLE PREDATION: WHEN PREDATOR CONTROL IS COST EFFECTIVE

Another criterion of unacceptable predation is if the costs of control are less than the costs of predation. Many wildlife management professionals and government staff, including some Wildlife Services' staff, recommend that the need for predator control be determined before conducting control and that control be cost effective, or the predation may not be significant enough to warrant the costs of predator control (Appendix II-D-1). However, in practice, Wildlife Services states that its control does not have to be cost effective (Appendix II-D-2), and Washington Wildlife Services indicates that it has the legal mandate to respond to all requests for wildlife damage, irregardless of the amount of loss (section 4-E).

When determining the benefits of predation control and in estimating its economic, biological, aesthetic, and social costs, it is important to use realistic estimates rather than unrealistically inflate the benefits and diminish the costs, but this has not always been done (e.g., Cain et al. 1972:12, 24-29; Beasom 1974, Peek 1986:254-261, Dolbeer et al. 1996:476).

At Columbia Basin dams, the costs of predation can be inflated by:

1) assuming that damage reports of predation losses by those requesting predator control are underestimated (section 4-E)
2) assuming all fish taken by birds are listed salmonids, though this is doubtful (sections 2-C, 2-D, and 2-E)
3) assuming birds are feeding only on viable salmonids, but many salmonids taken by birds may have been killed or mortally injured while passing through dam turbines or bypasses or crossing spillways (section 2-F-2)
4) assuming that there is no compensatory mortality of juvenile salmonids saved from birds; however, fish saved from birds can die from other mortality factors such as disease that can directly or indirectly lead to the death of salmonids (section 2-G).

The costs of predator control at Columbia Basin dams has been minimized by:

1) not publicizing the costs, so that the total cost is unknown and consequently less likely to be a controversial issue. The costs of predator control have only been reported for two dams in the Columbia Basin, where contracts with Wildlife Services for bird and fish control have been $160,715-$320,295 each year from 2000-2002, and studies of bird predation were not to exceed $330,000 in 2002 (section 5-J-2).
2) not examining all aspects of predation. For example, all ring-billed gull eggs were oiled at Cabin Island, although a maximum of 4% of the diet of gulls collected at the colony was fish (which were assumed to only be juvenile salmonids), but a much larger part of their diet was of insects and mammals (sections 5-H-1 and 5-H-2). Was the cost of salmonid predation offset by predation of insects and mammals injurious to agriculture? I do not know, and Wildlife Services does not address this issue (e.g., Wildlife Services 2001a, 2002a).
3) assuming that predator control methods have reduced predation rather than determining predation losses before and after control measures were implemented (section 6-G-1).

6-D-5. UNACCEPTABLE PREDATION: ANY PREDATION

Wildlife Services states that predation does not need to be above any particular level nor be cost effective before it conducts control (Appendix II-D-2), so its position about predator control is more extreme than that of many wildlife management professionals (Appendix II-D-1). If Wildlife Services is requested to do predator control, it feels that it is required by law to do so (Appendix II-C).

For mid-Columbia dams, Woodruff (2002:2), which is given in Appendix III, writes that the goal of the National Marine Fisheries Service is to have "100% no net impact" to passing salmon and:

> "The predation of smolt in the tailrace reduces the percent of juvenile fish surviving dam passage, which directly affects the smolt survival standard that each hydroproject must meet. The hydroproject managers have direction from the Federal Energy Regulatory Commission, NMFS, Northwest Power Planning Council, and others to use available mitigative measures to increase anadromous fish survival based upon the best scientific information available, and have identified predator control as a mitigation measure which is likely to increase smolt survival through each hydroproject on the mid-Columbia River."

One interpretation of Woodruff's statement is that a "100% no net impact" goal means a goal of 0% predation. However, this is not what the National Marine Fisheries Service (2002:2-50, 2-51, 2-58) state in its Final Environmental Impact Statement; it (2002:2-50) writes about the "no net impact standard":

> "This term takes into account the fact that 100 percent equivalent survival cannot be achieved at the projects alone, requiring additional mitigation through off-site measures to increase salmonid productivity (e.g., hatchery supplementation programs and tributary habitat improvements."

For three mid-Columbia dams, National Marine Fisheries Service (2002:2-50) notes that its goal is 91% combined adult and juvenile project survival (i.e., forebay, dam, tailraces, and reservoir) with "compensation for the 9 percent unavoidable project mortality" provided by hatchery programs (7%) and tributary habitat programs (2%). Further, its current goal for juvenile salmonid mortality at these three dams is 5% or less during dam passage (i.e., forebay, dam, and tailraces) and 7% or less for project passage (National Marine Fisheries Service 2002:2-51, 2-58). Reducing bird predation may help reach these goals if bird predation is only of viable juveniles, but this has not yet been demonstrated (section 2-F-2).

To conclude, National Marine Fisheries Service (2002:2-58, 2-59, 2-60, 3-138, 3-140) discusses bird control at three mid-Columbia dams but does not state that its goal is 0% predation.

6-E. TIMING OF PREDATOR CONTROL AT COLUMBIA BASIN DAMS

Wildlife Services (2002a) indicates that its control at mid-Columbia River dams is during April-September, but its control at lower Columbia dams continued outside of this time period, since Jones et al. (1999:14) recommended that Wildlife Services' control activities be reduced or discontinued during winter. It seems questionable that control conducted from mid-August through March would be very helpful in protecting juvenile salmonids at lower Columbia dams because mostly juvenile shad, not salmonids, are passing these dams then (sections 1-D and 2-B). At dams further upstream, there appear to be relatively few migrating juvenile shad (section 2-B), but there are also few juvenile salmonids migrating after mid-August (section 1-D). Thus, bird control in September at these dams may also not be useful in protecting juvenile salmonids. Further, it is questionable that controlling wintering birds that leave before juvenile salmonids begin migration would have any effect on reducing bird predation of salmonids.

6-F. METHODS OF NONLETHAL CONTROL AT COLUMBIA BASIN DAMS

6-F-1. INTRODUCTION

Wire grids and frightening devices have been the most extensively employed forms of nonlethal control, although water cannons or sprayers have also been used in certain circumstances (Table 6.3).

6-F-2. OVERHEAD WIRES

Wires may injure a few birds (e.g., possibly two in 1997, Jones et al. 1998:6), so Jones et al. (1997:16, 1998:9) suggested adding mylar streamers to the wires to help make the wires more visible.

Overhead wires can often keep away flying birds, but not swimming birds. At three lower Columbia dams, overhead wires installed by Wildlife Services appeared to be 100% effective in keeping out flying birds when the wires were maintained and were close enough together; however, it was not possible to install them in all areas where flying birds were feeding (sections 5-D-3 and 5-F-2). The effectiveness of wire arrays was also reduced when they were vandalized (Jones et al. 1997:15, 17; 1998:9, 1999:14) or contractors at John Day Dam removed and did not replace an array (see footnote ** in Table 5.4).

At mid-Columbia dams, Wildlife Services reported that wires were not 100% effective because gulls learned to feed under them (Appendix III). However, wires at these dams were spaced up to 50 ft (15.2 m) apart, which is not as effective as more closely spaced wires (section 4-D-2).

Elsewhere, wires have also kept birds away if spaced near each other, but overhead wires can not always be installed (section 3-B-1).

6-F-3. OTHER METHODS OF NONLETHAL CONTROL

Water cannons and frightening devices were two popular ways to keep birds away from dams (Table 6.3). Water cannons or sprinklers could be very effective in keeping fish-eating birds away, if they could be operated and if it was not too windy (sections 5-C-2 and 5-F-2). Frightening devices such as cracker shells or propane cannons reduced the number of birds present when used but kept birds away for a limited period of time (sections 5-F-4, 5-G-5, and 6-B-2). This is similar to results elsewhere (section 3-B-2).

6-G. METHODS OF LETHAL TAKING OF BIRDS FOR CONTROL OR RESEARCH AT COLUMBIA BASIN DAMS

6-G-1. LETHAL CONTROL OF BIRDS AT COLUMBIA BASIN DAMS

The use of lethal control is controversial, especially if many individuals are taken (section 3-C-1, Appendix II-E-2). Washington Wildlife Services uses lethal control of many species of fish-eating birds more than all other states combined (Table 4.1), but it declined to say how much of its lethal control occurred at dams (section 4-B). Nevertheless, there is some information about its lethal control at Columbia Basin dams (sections 4-D-1, 4-D-2, 5-F-5, 5-J-2, and 5-J-3). A research group from the U.S. Army Corps of Engineers observed the effects of Wildlife Services' lethal control at The Dalles and John Day Dams and found that other birds often returned to the area after a bird was shot (section 5-F-5), so lethal control needs to be continued to keep birds away. An indication that lethal control is of uncertain effectiveness in reducing predation of salmonids is that 75% of a sample of gulls shot by Wildlife Services during its control program at The Dalles and John Day Dams in 1997 did not contain juvenile salmonids (section 5-E-5), so it is not clear that shooting these gulls reduced predation, though it may have deterred other gulls that may have fed on salmonids.

Wildlife Services oiled ring-billed gull eggs in at least one Washington colony (section 5-H-2) and refused to answer a question about whether it currently oils eggs at bird colonies (section 4-B-2). The number of eggs oiled was not included in tables of Wildlife Services' "take" of animals (Table 4.3, section 5-H-2).

Washington Wildlife Services does not appear to have measured predation losses before and after using lethal control to see if its lethal control actually reduced predation of juvenile salmonids. It has counted the number of birds taken and assumed that predation was thereby reduced.

6-G-2. LETHAL TAKING OF TERNS FOR RESEARCH AT COLUMBIA BASIN DAMS IN 2002

In 2002, studies of predation at Rocky Reach and Rock Island dams with the Washington Department of Fish and Wildlife and the University of Washington were funded and initiated (section 5-J-2). In 2002, David Wesley of the U.S. Fish and Wildlife Service's Migratory Birds and State Programs emailed Gerald Winegrad that Wildlife Services is not killing terns for damage control at dams in 2002 but is only taking "terns in coordination with Washington Department of Fish and Wildlife and wildlife research."

6-H. POSSIBLE NONCOMPLIANCE OF WASHINGTON WILDLIFE SERVICES WITH SOME WILDLIFE SERVICES' DIRECTIVES

Wildlife Services' Directive 2.201 (Wildlife Services 1993a:section 4b) indicates that Animal Damage Control/Wildlife Services will assess a wildlife damage request; this Directive states:

> "First, a determination should be made as to whether the problem is within the authority of ADC. If it is, damage information should be gathered and analyzed to determine factors such as what species was responsible for the damage; the type, extent, and magnitude of damage; the current economic loss and potential losses; the local history of damage; and what control methods, if any, were used to reduce past damage and the results of those actions."

Washington Wildlife Services does not appear to have complied very well with this Directive since during 1996-2000 a total of only $400 of damage to natural resources in Washington was reported and verified by Wildlife Services (section 4-E). Washington Wildlife Services appears to have assumed that damage was occurring because fish-eating birds were observed.

Directive 2.201 also indicates that Wildlife Services will monitor and evaluate the results of control actions to determine "whether further assistance is required or whether the problem has been resolved" (Wildlife Services 1993a:section 4f). Washington Wildlife Services may not have followed this Directive because it has not released any evidence that it has (section 4-B). Staff of the U.S. Army Corps of Engineers, not Wildlife Services, has monitored and reported on some Washington Wildlife Services' control actions (sections 5-D and 5-F), including a possible reduction in predation of juvenile salmonids as a result of the installation of overhead wires. Wildlife Services' staff have only reported that they have controlled birds at dams or nesting areas (e.g., sections 4-D-1, 4-D-2, 5-H-2, 5-K, and 5-L-3), not that there has been a reduction in the predation of juvenile salmonids. Thus, it appears that the original salmon recovery goal of increasing juvenile salmonid survival by reducing predation may have been changed to the Washington Wildlife Services' goal of decreasing numbers of fish-eating birds, with measures of success being the number of birds hazed or taken or the number of eggs that are oiled.

6-I. CONTRAST IN CONTROL BETWEEN THE COLUMBIA ESTUARY AND COLUMBIA BASIN DAMS

Bird (especially Caspian tern) predation of juvenile salmonids in the Columbia River Estuary has received considerable research and publicity (e.g., Roby et al. 1998, 2002; U. S. Army Corps of Engineers 1999-2002; Collis et al. 2000, 2001a,b; 2002). Bird control in the Estuary has proceeded differently than at Columbia Basin dams. In the Estuary, many of the guidelines for justifying control in

Appendix II-D-1 have been followed. For example, research was conducted in 1997 to determine if control was needed (Roby et al. 1998) and as a result of this research, possible management options were proposed that incorporated public comments as well as the input of many federal, state, and tribal agencies (U.S. Army Corps of Engineers 1999-2002). After a need was established, predator control was initiated in 1999, using nonlethal methods of habitat manipulation of nesting areas and putting bird excluders on pilings to discourage bird perching (e.g., U.S. Army Corps of Engineers 2001:3, Roby et al. 2002).

At lower Columbia Basin dams, bird predation has been studied at The Dalles and John Day Dams during 1995-1998 (section 5-E), but bird hazing and lethal control occurred at these two dams in 1995 (Jones et al. 1996:3) and perhaps earlier (Steuber et al. 1995). Thus, control began before predation studies were complete and before a need for control was established. Control also appears to have commenced before public comment was solicited for an Environmental Assessment, since I have found no record of an Environmental Assessment being proposed or done for these dams. At mid-Columbia dams, control began as early as 1993 (Steuber et al. 1995), but I have found no evidence of a predation study other than by Ruggerone (1986) and public comments were not requested until 2002 (Wildlife Services 2002a). At Columbia Basin dams, it also does not appear that Washington Wildlife Services has involved or consulted other government agencies as much as the U. S. Army Corps of Engineers and National Marine Fisheries Service has about proposed bird control measures in the Columbia Estuary (e.g., U. S. Army Corps of Engineers 1999-2002).

Because of the deliberate process in the Columbia Estuary, there are estimates of how much predation has been reduced after management actions (Collis et al. 2001b:13, U.S. Army Corps of Engineers 2001:7, 2002:23; Roby et al. 2002:669). In contrast, Wildlife Services has only assumed that its bird control projects at dams have reduced predation.

6-J. CONCLUDING REMARKS

Salmon recovery in the Columbia Basin is important, and predator control may sometimes be appropriate to improve adult returns of salmonids. However, predator control, especially lethal control, needs to be based on a realistic consideration of costs and benefits as has been suggested in Appendix II-D-1. Because predators and prey are public resources and predator control occurs at Columbia Basin dams that are operated by public entities on public waters and predator control is publicly financed (section 4-B-3), the public should be part of the decision-making process. To do so, accurate and complete information about the biological value and the cost effectiveness of nonlethal and of lethal control needs to be publicly available. Although a court case precludes Wildlife Services from giving information that would identify individual dam owners, Washington Wildlife Services could release more information than it has (section 4-B-2).

In my opinion, Washington Wildlife Services' refusal to answer general questions (section 4-B) and decision that its predator control programs do not have to be cost effective (sections 4-E and 6-D-4) can make conducting appropriate wildlife control measures more difficult because of public distrust (see Appendix II-F). In addition, its lack of candor seems unacceptable for a government agency (section 4-B-3).

APPENDIX I. Common and Scientific Names of Animals Cited in This Report.

Common Name	Scientific Name
bass, largemouth	*Micropterus salmoides*
bass, striped	*Morone saxatilis*
cormorant, double-crested	*Phalacrocorax auritus*
crab, Dungeness	*Cancer magister*
crow, American	*Corvus brachyrhynchos*
eagle, bald	*Haliaeetus leucocephalus*
goose, Canada	*Branta canadensis*
grebe, eared	*Podiceps nigricollis*
grebe, pied-billed	*Podilymbus podiceps*
grebe, western	*Aechmophorus occidentalis*
gull, Bonaparte's	*Larus philadelphia*
gull, California	*Larus californicus*
gull, Franklin's	*Larus pipixcan*
gull, glaucous-winged	*Larus glaucescens*
gull, great black-backed	*Larus marinus*
gull, Heermann's	*Larus heermanni*
gull, herring	*Larus argentatus*
gull, laughing	*Larus atricilla*
gull, ring-billed	*Larus delawarensis*
gull, western	*Larus occidentalis*
heron, black-crowned night-	*Nycticorax nycticorax*
heron, green	*Butorides virescens*
heron, great blue	*Ardea herodias*
kingfisher, belted	*Ceryle alcyon*
lamprey, Pacific	*Lampetra tridentata*
lamprey, western brook	*Lampetra richardsoni*
loon, common	*Gavia immer*
merganser, common	*Mergus merganser*
merganser, hooded	*Lophodytes cucullatus*
merganser, red-breasted	*Mergus serrator*
osprey	*Pandion haliaetus*
pelican, American white	*Pelecanus erythrorhynchos*
pikeminnow, northern	*Ptychocheilus oregonensis*
salmon, chinook	*Oncorhynchus tshawytscha*
salmon, coho	*Oncorhynchus kisutch*
salmon, sockeye	*Oncorhynchus nerka*
shad, American	*Alosa sapidissima*
steelhead	*Oncorhynchus mykiss*
tern, Caspian	*Sterna caspia*
tern, Forster's	*Sterna forsteri*
walleye	*Stizostedion vitreum*

APPENDIX II. Background of Animal Damage Control/Wildlife Services.

II-A. INTRODUCTION

There has been public controversy about some Animal Damage Control/Wildlife Services' programs (e.g., search the Internet for "animal damage control" or "predator control"). This has resulted in investigative reports by the U.S. General Accounting Office (1990, 1995, 2002b) and attempts to cut funding of Wildlife Services during 1998-2000 in the U.S. House (Swanson 1998, Eilperin 1999, Taugher 1999, DeFazio 2000). It is beyond the scope of this review to examine all these controversies, but it is relevant to examine some of the background of Wildlife Services that is relevant to bird predation at dams in the Columbia Basin. Thus, complaints that some Wildlife Services' projects are a subsidy to private businesses (e.g., U.S. General Accounting Office 1990:15, Deeble and Stadler 1993, O'Toole 1994, Eilperin 1999, Taugher 1999, DeFazio 2000) are not examined because private businesses do not operate most Columbia Basin dams (see Fig. 1.1 legend). Also complaints about Wildlife Services' programs in suburban areas (Portland Audubon Society 2000) are not discussed because Columbia Basin dams are not in suburban areas.

II-B. HISTORY OF ANIMAL DAMAGE CONTROL AND WILDLIFE SERVICES

The history of Wildlife Services is examined in Deeble and Stadler (1993:6), O'Toole (1994:4-5), and U.S. General Accounting Office (2002b:47-52). Here, I only discuss some of the name changes that are relevant to this paper.

In 1939, federal predator control was moved from the U.S. Department of Agriculture to the U.S. Department of Interior and renamed Predator and Rodent Control (PARC)(U.S. General Accounting Office 2002b:48). The name of PARC was later changed to Animal Damage Control, and, in 1986, Animal Damage Control was transferred back to the Department of Agriculture, Animal and Plant Health

Inspection Service (Deeble and Stadler 1993:6). In August 1997, the name of Animal Damage Control was changed to Wildlife Services (Wildlife Services 1999:1-1).

II-C. MISSION OF ANIMAL DAMAGE CONTROL/WILDLIFE SERVICES

The authority and mission of Wildlife Services come from the U.S. Animal Damage Control Act of 1931 (7 U.S.C. 426-426c; 46 Stat. 1468), which states (Wildlife Services 1998a:section 1.5.1):

> "The Secretary of Agriculture is authorized and directed to conduct such investigations, experiments, and tests as he may deem necessary in order to determine, demonstrate, and promulgate the best methods of eradication, suppression, or bringing under control on national forests and other areas of the public domain as well as on State, Territory or privately owned lands of mountain lions, wolves, coyotes, bobcats, prairie dogs, gophers, ground squirrels, jackrabbits, brown tree snakes and other animals injurious to agriculture, horticulture, forestry, animal husbandry, wild game animals, furbearing animals, and birds, and for the protection of stock and other domestic animals through the suppression of rabies and tularemia in predatory or other wild animals; and to conduct campaigns for the destruction or control of such animals. Provided that in carrying out the provisions of this Section, the Secretary of Agriculture may cooperate with States, individuals, and public and private agencies, organizations, and institutions."

Wildlife Services (2000a:section 1.7.1.1) writes about its changing philosophy:

> "Since 1931, with the changes in societal values, Wildlife Services policies and its programs place greater emphasis on the part of the Act discussing 'bringing (damage) under control,' rather than 'eradication' and 'suppression' of wildlife populations."

In 2001, the Animal Damage Control Act of 1931 was amended in the Agriculture Appropriations Bill and states (Wildlife Services 2002c:19):

> "The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program."

Wildlife Services' major constituencies are those citizens and businesses requesting wildlife control. For example, Wildlife Services (2002c:19) states:

> "The USDA is directed by law to protect American agriculture and other resources from damage associated with wildlife."

II-D. COST EFFECTIVENESS OF PREDATOR CONTROL

II-D-1. INTRODUCTION

Many wildlife management professionals have recommended that animal damage control be conducted only if the economic loss or impact on the resource by predation is greater than the economic, biological, aesthetic, and/or social costs of conducting control (e.g., Berryman 1972:397, 399; McCabe and Kozicky 1972:393, Dolbeer et al. 1996:474). Some Animal Damage Control/Wildlife Services' staff have also recommended that before predator control is initiated an environmental as well as an economic cost effective analysis be conducted (Slate et al. 1992:57-59) and that wildlife management actions be used that are cost effective "not only with respect to economics, but to biological, physical, social, and

legal parameters, as well" (Owens and Slate 1991:26). Further, the International Association of Fish and Wildlife Agencies' promotes:

> "thorough planning of control programs with justification, implementation, and evaluation on the basis of total social benefits" (Belanger 1988:200).

At fish hatcheries, it has also been recommended that predator control be economically cost effective (i.e., the costs of control are not greater than the costs of predation). For example, predation losses at Oregon Department of Fish and Wildlife hatcheries have been estimated, so that it can be determined if the magnitude of loss justifies the cost of covering ponds or other control measures (Schaeffer 1992:10-12). Washington Department of Wildlife policy is also that the cost of a predator control system not exceed the value of the fish taken by predators (Table II.1#5). Animal Damage Control/Wildlife Services' staff have also recommended that predator control at aquaculture facilities only be done only if it is economically justifiable (e.g., Glahn 1997:16-17, Littauer et al. 1997:1). Finally, in a review of predation at Pennsylvania trout hatcheries, Parkhurst et al. (1992:415) write:

> "Clearly, an inaccurate assessment of the extent of depredation or a misidentification of what predator is responsible could lead to improper management of predation losses and a potential waste of capital on needless or ineffective control methods."

Nevertheless, predator control programs have sometimes been initiated on the basis of assumed benefits and unrealistic predator consumption estimates rather than on a real proof of need (section 6-D-4). For example, at two hatcheries, managers estimated losses of 15%, but researchers found that losses were 7.0% at one and 0.6% at the other (Pitt and Conover 1996:622). As a result, the economic or biological costs of some predator control programs have been greater than the resulting benefits (e.g., Cain et al. 1972:24-29, Beasom 1974, Peek 1986:254-261). Further, many fish control programs were found to be unsuccessful (Meronek et al. 1996), and the benefits of the cormorant hazing program in Tillamook County (Oregon) are questionable (Bayer 2000:3), so the costs of some control programs may exceed their economic benefits.

TABLE II.1. Washington Department of Wildlife policy POL-5510 for predator control at its fish hatcheries. This is verbatim from PDF file p. 23 in Shelldrake et al. (1993).

POL-5510 Predator Control at Hatcheries.

This policy applies whenever the need exists to reduce or prevent predation by birds or animals at hatcheries.

1. Nonlethal Methods Should Be Used Where Possible. Predator control will be conducted only by nonlethal methods except licensed trappers or hunters may take predators during an open season if local ordinance permit the activity.
2. The Engineering/Lands Division Designs All Major Predator Control Systems. Hatchery Managers will consult with Engineering for a preliminary design and cost estimate when need for a major control system such as netting and cyclone fencing arises.
3. Predator Control Systems Should Target The Most Effective Predators. Hatcheries should use systems that target the predator creating the major loss. Suggested nonlethal, low-cost predator control systems for the following species are:
   a. Herons: strobe lights, pulsating electric fence AV alarm, cracker shells
   b. Gulls: cracker shells, AV alarm, polyrope
   c. Mergansers: polyrope. cracker shells
   d. Otter: underwater sonic devices, pulsating electric fence
4. Public and Employee Safety Must Be Considered. The use of nonpulsating or direct current electric fences is prohibited. Safety must be considered when installing or operating all control systems.
5. Cost-Effective Systems Should Be Used. The annualized cost of the predator control system should not exceed the value of the annual fish loss.
6. Wildlife Control Agents Should Remove Animals. Hatchery personnel should refer predator control problems involving otter, mink, or other mammals to a Wildlife Control Agent.

II-D-2. WILDLIFE SERVICES' POLICY: CONTROL PROGRAMS DO NOT HAVE TO BE COST EFFECTIVE

Some PARC/Animal Damage Control/Wildlife Services' predator projects have been criticized by governmental advisory committees because they were not cost effective or did not include realistic calculations of costs and benefits to determine if a project was justified before it was conducted (Leopold et al. 1964:31-34, Cain et al. 1972:12, 24-29). In a recent review, the U.S. General Accounting Office (2002b:27) reported that it found no independent studies of the costs and benefits of Wildlife Services' programs; the only studies doing so were conducted by or in collaboration with Wildlife Services.

At Columbia Basin dams, the benefits of Wildlife Services' bird control have been assumed (section 4-E), and the costs may have been minimized (section 6-D-4). Thus, it is unclear if Wildlife Services' control programs at dams are cost effective economically (section 6-D-4) or are biologically or socially warranted. Further, Washington Wildlife Services has stated that its programs do not have to be cost effective (see quote in section 4-E). Wildlife Services in other states has also stated in Environmental Assessments that predator control can be implemented even if there is only a threat of predation, that a threshold level of resource loss is not needed to conduct control, and that control does

not have to be cost effective (see 2.4.2 and 2.4.3 in Table II.2). For instance, Wildlife Services (2000b:25) states:

> "WS [Wildlife Services] is charged by law and directed by Congress to protect American agricultural and natural resources, property, and human health and safety, despite the cost of the action. Further, in the Southern Utah Wilderness Alliance et al. v. Hugh Thompson et al. U.S. Forest Service (United States District Court 1993) the court clearly stated that, 'The agency need not show that a certain level of damage is occurring before it implements an ADC [Animal Damage Control] program . . . Hence, to establish need for an ADC, the . . . supervisors need only show that damage . . . is threatened.' In other words, it is not necessary to establish threshold of loss criterion, use only non-lethal methods, establish independent panels before implementing an action, or restriction management strategies, etc. to justify or establish a damage management program."

In another Environmental Assessment, Wildlife Services (2000a:section 2.3.5) writes:

> "WS is aware that some people feel Federal wildlife damage management should not be allowed until economic losses reach some arbitrary predetermined threshold level. Such policy, however, would be difficult or inappropriate to apply to human health and safety situations. Although some damage can be tolerated by most resource owners, WS has the legal direction to respond to requests for assistance, and it is program policy to aid each requester to minimize losses."

In the same Environmental Assessment, Wildlife Services (2000a:section 2.3.10) states:

> "Cost effectiveness is not, nor should it be, the primary goal of the APHIS WS program. Additional constraints, such as environmental protection, land management goals, and others, are considered whenever a request for assistance is received. These constraints increase the cost of the program while not necessarily increasing its effectiveness, yet they are a vital part of the APHIS WS program."

And, in a Finding of No Significant Impact for another Environmental Assessment, Wildlife Services (1998a:3) notes:

> "Some resources protected, such as human health and safety, T&E [Threatened and Endangered] species, and other wildlife populations, are difficult to value monetarily, which can make cost-benefit analysis next to impossible. Thus, in the case of this EA [Environmental Assessment], and, for that matter, most WS EAs, cost-effectiveness is not necessary to a reasoned choice among alternatives."

Wildlife Services has a point that some programs involving human health and safety or the protection of Threatened and Endangered Species should not be considered only on a cost effective basis. The problem, in my opinion, is that Wildlife Services can abuse this excuse to justify any control measures, no matter how costly or how small the benefits, and also use this excuse to avoid any scrutiny of its practices (see sections 4-E and 6-D-4). Although Wildlife Services feels that it is not legally required by the Council on Environmental Quality regulations to show the cost effectiveness of its programs in its Environmental Assessments (Wildlife Services 2000a:section 2.3.10), it would be prudent if it did so to reduce criticism from citizens or groups wondering if their money is being wisely spent.

II-D-3. WILDLIFE SERVICES' POLICY: CONTROL METHODS MAY BE CHOSEN BY COST EFFECTIVENESS

Although Wildlife Services' control programs do not have to be cost effective, Wildlife Services may use economic, social, legal, and biological considerations in choosing which method of control to use (see 2.3 and in 2.4.1 in Table II.2). Use of the most cost-effective control method, however, does not

mean that the control program as a whole is cost-effective; it just means that the selected control method may be the most cost effective choice of the methods available.

II-E. ANIMAL DAMAGE CONTROL/WILDLIFE SERVICES' PREDATOR CONTROL GUIDELINES

II-E-1. INTRODUCTION

Animal Damage Control/Wildlife Services has guidelines for conducting damage control (Table II.2), but it has apparently not always followed its own guidelines (e.g., Appendix II-E-2 and II-E-3).

TABLE II.2. Animal Damage Control's/Wildlife Services' guidelines for animal damage control programs. These are from publications by its staff (i.e., Owens and Slate 1991, Slate et al. 1992), its Directives (http://www.aphis.usda.gov/ws/wsdirectives.html), or its Environmental Assessments (http://www.aphis.usda.gov/ws/eafrontpage.html) that were available on 5 May 2002. Wildlife Services (1995a:1) uses the word "guidelines" for these. Sources for these guidelines are in parentheses, with a section or page number, if appropriate. Note that much of the language and the ordering of sections among Environmental Assessments is similar or identical (e.g., see 2.4.2 and 2.4.3 below).

WILDLIFE SERVICES' GUIDELINES FOR ANIMAL DAMAGE CONTROL (references in parentheses)

1) Wildlife Services is directed to protect agriculture, horticulture, forestry, animal husbandry, natural resources, and human health from predatory animals (Appendix II-C).

2) Use the Wildlife Services' Decision Model in deciding what action to take (Owens and Slate 1991, Slate et al. 1992, Wildlife Services 1993a; 2000a:section 4.2.3; 2002c:30-31).
   - 2.1) receive request for damage control assistance. Wildlife Services assists only when requested (e.g., Wildlife Services 1993a).
   - 2.2) assess damage control problem, including determining the type, extent, and magnitude of the damage; the current economic loss and potential losses; the local history of damage; and what control methods were used previously (Slate et al. 1992:53, Wildlife Services 1993a:section 4b).
   - 2.3) evaluate wildlife damage control methods. "Methods should be evaluated in the context of their legal and administrative availability and their acceptability based on biological, environmental, social, and cultural factors" (Wildlife Services 1993a:section 4c); also see Slate et al. (1992:53-59).
   - 2.4) formulate wildlife damage control strategy using the Wildlife Services' Integrated Wildlife Damage Management (IWDM) approach, which encourages the use of several control techniques rather than relying on a single method (Wildlife Services 1993a:section 4d).
     - 2.4.1) Wildlife Services (1998b) states: "The selection of wildlife damage methods and their application must consider the species causing the damage and the magnitude, geographic extent, duration, frequency, and likelihood of recurring damage. In addition, consideration is given to nontarget species, environmental conditions and impacts, social and legal factors, and relative costs of management options." Similar concepts for choosing control methods are also given in Slate et al. (1992:53-58) and Wildlife Services (1995a:section 5).

(Table II.2 continued on next page)

(Table II.2 continued)

2.4.2) Damage need not be currently occurring for Wildlife Services to provide assistance and damage estimates do not have to be verified. Wildlife Services' control can be undertaken if there is a threat of wildlife damage or if there is a history of damage as well as if damage is currently occurring (see quotes in section 4-E and Appendix II-D-2; Wildlife Services 1995a:section 4; 1995b; 1998a:section 3.3.5; 1999:section 2.3.5; 2000a:section 2.3.5; 2000b:section 3.2.2; 2001c:Appendix A, Comments 4 and 13; 2002c:30).

2.4.3) Wildlife Services does not need to establish a threshold of resource loss to justify control; control can be initiated with any loss; control does not need to be cost effective (Appendix II-D-2, Wildlife Services 1998a:sections 2.3.10, 3.3.5; 1999:sections 2.3.5 and 2.3.10; 2000a:sections 2.3.5 and 2.3.10; 2000b:section 3.2.2; 2001c:Appendix A, Comments 4 and 13 [see quote in section 4-E]).

2.5) provide assistance. Technical assistance includes giving advice, information, equipment, and instructions for others to use; direct control assistance (i.e., assistance conducted or supervised by Wildlife Services' personnel) requires written authorization by the landowner, cooperator, or other authorized official (Wildlife Services 1995a:section 4; 2000b:22-23; 2002c:31).

2.6) monitor and evaluate results of control actions to determine if further assistance is required (Wildlife Services 1993a:section 4f).

II-E-2. CONTRAST BETWEEN WILDLIFE SERVICES' GUIDELINES AND PRACTICE: NONLETHAL/LETHAL CONTROL

Lethal control of predators is controversial (section 3-C-1), and the effectiveness of Washington Wildlife Services' lethal control of birds at Columbia Basin dams is unknown (section 6-G).

In response to questions about Animal Damage Control policies, the U.S. General Accounting Office (1990:16) investigative report about Animal Damage Control's control of livestock predators found:

> "... although the ADC [Animal Damage Control] policy manual states that nonlethal methods will be given first consideration when practical as a predator damage control technique, little evidence exists of state ADC program personnel employing such methods."

The U.S. General Accounting Office (1995:4, 17) also found the same discrepancy between Animal Damage Control written policy and actual field practices about using nonlethal or lethal control of livestock predators.

The use of lethal methods also appears to differ widely among state programs of Wildlife Services. Washington Wildlife Services evidently chooses to use lethal control methods significantly more than other states, since 72-90% of many species of fish-eating birds killed annually in the entire United States during 1998-2000 were killed just in Washington (section 4-C).

II-E-3. CONTRAST BETWEEN WILDLIFE SERVICES' DIRECTIVE AND PRACTICE: PUBLIC INPUT

Animal Damage Control/Wildlife Services' (1993b) Directive 1.201 states:
"In the U.S., wildlife is a publicly owned resource held in trust and managed by State and Federal agencies. Government agencies, including ADC [Animal Damage Control], have mandates to provide for the welfare and perpetuation of wildlife and must be responsive to the desires of various groups while considering potential socioeconomic conflicts."

And a Wildlife Services' fact sheet (Wildlife Services 2002b) reports:
"WS works with cooperators as well as critics to resolve wildlife damage in the most effective and socially acceptable ways possible. WS considers the opinions of all stakeholders and affected parties before implementing wildlife damage management initiatives."

This directive and fact sheet suggest that Wildlife Services is responsive to the public. But in practice Animal Damage Control/Wildlife Services' staff are often not responsive. In 1988, I corresponded with the Oregon Animal Damage Control Director, who answered my questions promptly, completely, and forthrightly (see Bayer 1989:10-12). My request information in 2000 was turned by Wildlife Services into a Freedom of Information Act (FOIA) request that it did not respond to within 7.5 months (section 4-B-1). In my 2002 request for general information, Washington Wildlife Services refused to answer and used a court case as an excuse, though Wildlife Services could have replied to my request without violating the court case (section 4-B-2). Wildlife Services has also not been forthcoming with other citizens or groups; in a 1997 lawsuit, it was claimed that the Animal Damage Control had received 667 FOIA requests but had responded only to 48 (Navarro 1997). Other individuals have also filed lawsuits to try to get information about Animal Damage Control activities (Swanson 1998).

Wildlife Services has worked at improving public communication by providing a web site with much information (http://www.aphis.usda.gov/ws). But some of this information is not very understandable; for example, on 7 March 2002, Wildlife Services used abbreviations in some of its tables (http://www.aphis.usda.gov/ws/tblfrontpage.html), but it did not explain what these abbreviations mean; by chance, I found the meaning for some of these abbreviations at https://foia.aphis.usda.gov/wl_mgmt/defmis.html (all lower case letters--no numbers). Further, some of the files on its web site are not accessible because of large file sizes that citizens without broadband Internet connections can not readily access.

Another way that Wildlife Services has given the appearance of seeking public input is to prepare Environmental Assessments for public comment. Wildlife Services (1998a:1-1, 2000a:1-1) indicates that the National Environmental Policy Act does not require Wildlife Services to prepare Environmental Assessments about its projects, but that Wildlife Services chose to do so, in part, "to clearly communicate with the public." However, in my opinion, Wildlife Services' responses in its Environmental Assessments seem more combative than receptive to public comments that disagree with Wildlife Services' beliefs and requests for Wildlife Services' programs to be cost effective, for thresholds of predation loss before there is predator control, or for use of lethal control methods as a last resort.

Wildlife Services views its mission as protecting resources from wildlife damage (Appendix II-C), and it appears that Wildlife Services has been mostly responsive to those requesting predator control.

II-F. CONCLUSIONS

Some Animal Damage Control/Wildlife Services' staff have recommended communication about its activities to the general public; for example, Owens and Slate (1991:24) write about wildlife damage management professionals:

> "Our credibility, and consequently our effectiveness, are dependent upon public understanding."

and on their p. 26, they state:

> "... we, as a wildlife management profession, are not adequately informing our publics of what we do and why we do it. Through lack of action we are nurturing public misperceptions regarding wildlife-human conflicts and ways to address them."

I agree with their recommendations. It is unfortunate that Washington Wildlife Services has been so unresponsive because doing so nurtures public distrust.

Perhaps the only way for the public to influence Wildlife Services' programs is through the public agencies that request Wildlife Services' programs. Wildlife Services is not supposed to initiate programs on its own (2.1 in Table II.2), although Wildlife Services staff sometimes publicize the need for its proposed programs (Portland Audubon Society 2000). If public agencies do not request Wildlife Services assistance or if they limit Wildlife Services' programs, then all of the general public may be more involved in predator control management. Another advantage to public agencies not requesting Wildlife Services' assistance is that predation losses may be reduced more with less cost. For example, it has been reported that Kansas has not participated in Animal Damage Control livestock protection programs but has an extension agent deal with predation problems; Kansas has spent less money with fewer livestock losses than neighboring states that have participated in the Animal Damage Control program (O'Toole 1994: The Kansas Alternative).

APPENDIX III. Copy of Woodruff (2002).

Roger A. Woodruff is Washington/Alaska Director of Wildlife Services. In his letter of 20 September 2002 to me, which is copied on the following two pages, Woodruff gives his opinions about my 8 September 2002 draft of this paper. His letter is copied here to fairly give his viewpoints.

My notations along the right hand margin give the section where Woodruff's comments are addressed in this paper. In addition, two points in his letter that are not discussed elsewhere are discussed below.

III-1. WOODRUFF STATES THAT MY PAPER IS NOT RELEVANT TO MID-COLUMBIA RIVER DAMS

In the third paragraph of Woodruff's letter, he notes that information that I used for U.S. Army Corps of Engineers dams "is not necessarily relevant or correct in regard to our work on the mid-Columbia River." In Wildlife Services (2002a) or in Woodruff's letter, Washington Wildlife Services did not identify which dams it considered to be in the "mid-Columbia," but the Fish Passage Center (1999:90) identifies the mid-Columbia as being from above McNary Dam "to" Chief Joseph Dam; it is not clear if Chief Joseph Dam is part of the mid-Columbia, but it is operated by the Corps (Fig. 1.1). Nevertheless, the subject of this paper and the draft that I sent to Woodruff is bird predation and control at mainstem Columbia and Snake River dams, not just mid-Columbia dams. Wildlife Services has refused to release general information about its control programs at dams (section 4-B-2), so, of course, Woodruff can claim that I do not know enough details about its control programs at mid-Columbia dams. I include the information that I could find or was given.

Further, while some specific details of Wildlife Services' control at mid-Columbia dams may differ from that at Corps' dams in the lower Columbia, bird control issues as discussed in Chapter 6 can be expected to be similar, if not the same, for dams on the mid-Columbia, lower Columbia, and lower Snake Rivers.

III-2. WILDLIFE SERVICES' ENVIRONMENTAL ASSESSMENTS ARE OFFICIAL

In the next to last paragraph, Woodruff writes that Wildlife Services will soon be releasing a Predecisional Environmental Assessment that "will provide a more factual source of information and will provide an official forum for input and discussion." As of 14 February 2003, I have not received a copy of it, though I had commented on its pre-Environmental Assessment request for public input (Wildlife Services 2002a) and had also requested a copy in my letter to Woodruff on 16 December 2002.

While an Environmental Assessment by Wildlife Services is "official" because it is conducted by a federal agency and it is a "forum" because public and agency input is solicited, it is written, revised, and published by Wildlife Services, not an impartial entity. Accordingly, it is questionable how independent of an assessment it truly is. The mission of Wildlife Services is to conduct animal damage control (Appendix II-C), so it can be expected that Wildlife Services' Environmental Assessments will reflect its mission and not provide a truly impartial forum for free discussion nor that all sides of issues will be equally considered.

Wildlife Services (2001c) by Washington Wildlife Services is also an Environmental Assessment. Although it may be factual, it does not provide details about actual programs that are being conducted--it gives generalities summarized for the entire state, not details that would allow a reader to evaluate facts about individual programs. Some of the data in Wildlife Services (2001c) are misleading (section 4-C-1: Environmental Assessment), so the factuality of Washington Wildlife Services' Environmental Assessments may not be as certain as Woodruff asserts.

While my report is not "official" because I do not represent a governmental agency, I have tried to make it a more comprehensive discussion of these issues than Wildlife Services (2001c, 2002a).

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September 20, 2002

Range Bayer
P.O. Box 1467
Newport, OR 97365

RE: Review: Bird Predation of Juvenile Salmonids and Management of Birds Near Columbia Basin Dams

Dear Mr. Bayer;

Thank you for inviting USDA-APHIS-Wildlife Services (WS) to review your report. We empathize with your obvious frustration at the limited information we are able to provide due to the Texas Farm Bureau injunction. We can only ask that you put yourself in our shoes and understand the frustration that we also feel as a public agency which has been directed to withhold some of the most basic information from both the general public and management agencies. This recent predicament is not unique to only the Washington State WS Program, but applies to our program nationwide. We are directed to comply with the courts and to follow the council of our attorneys, who in turn interpret court decisions such as the Texas Farm Bureau injunction. (4-B-2)

Below, we have addressed some of the basic concerns stated in the abstract of your report. WS' National Wildlife Research Center (NWRC) will provide a scientific review of the report. Dr. Mark Tobin, head of the bird research section at the NWRC, has received a copy of your report. (Preface)

We received your response to our Invitation for Public Involvement on piscivorous bird damage management in the mid-Columbia River Basin, dated April 10, 2002. Both in your comment letter and in this report, many of your sources come from the U.S. Army Corps of Engineers (COE), the internet, or newspaper. None of the COE hydroelectric dams are on the mid-Columbia River; therefore the information you used for COE projects is not necessarily relevant or correct in regard to our work on the mid-Columbia River. (Appendix III-1)

On the mid-Columbia River, vast overhead wiring exclusion systems over the tailrace at each dam have been constructed and are actively maintained. These wiring systems consist of 3/64" stainless steel cable stretched from one bank of the river to the other or from the shore to the dam, depending on the availability of suitable anchor points. The average exclusion system at hydroelectric dams is comprised of 21 to 30 wires spaced at 25 to 50 foot intervals, with wires stretching anywhere from 500 to 1,800 feet. In general, wire grids have been one of the most effective deterrents available, particularly for gulls, when used in combination with hazing and limited lethal reinforcement. Wire exclusionary systems alone are not 100% effective, however, and gulls are capable of learning to fish beneath the wires. (4-D-2)

Few publications have attempted to put a dollar value on threatened and endangered (T&E) species. There are very few ways to estimate the associated economic cost to mitigate the vulnerability of smolt below hydroelectric dams. One way to estimate monetary damage is to take into account the costs involved to improve smolt survival. The monetary value of Federally-listed juvenile salmonids lost to predation is not presented, because a quantitative value cannot be placed on a smolt listed under the ESA or the information generally is not (4-E)

available. Instead, the economic costs, or damage, which results from the predation of anadromous fish may be represented by the monetary costs associated with the implementation of mitigation measures which improve the survival of those juvenile salmonids past each hydroelectric dam. Engeman et al. (In press) reviewed various methods for applying monetary valuations for T&E species so that economic analyses of management actions could be used to help guide and evaluate management decisions, however, this process was neither straightforward nor precise. (4-E)

The United States Department of Commerce / National Oceanic and Atmospheric Administration / National Marine Fisheries Service (USDC-NOAA-NMFS) prepared a Draft Environmental Impact Statement (EIS) for Anadromous Fish Agreements and Habitat Conservation Plan (HCP). A Final EIS is scheduled for completion by October 2002. The HCP developed a set of specific performance standards to achieve "100% no net impact" to anadromous species through the hydroprojects operated on the mid-Columbia River (NMFS 2000). The predation of smolt in the tailrace reduces the percent of juvenile fish surviving dam passage, which directly affects the smolt survival standard that each hydroproject must meet. The hydroproject managers have direction from the Federal Energy Regulatory Commission, NMFS, Northwest Power Planning Council, and others to use available mitigative measures to increase anadromous fish survival based upon the best scientific information available, and have identified predator control as a mitigation measure which is likely to increase smolt survival through each hydroproject on the mid-Columbia River. (6-D-5)

Overall, we identified many sections of your report pertaining to WS' activities which are unfounded, inaccurate, or misleading. Therefore, we do not feel your report in its present state is of sufficient factual integrity to be published in a journal. We will soon be releasing our Predecisional Environmental Assessment (EA) of Piscivorous Bird Damage Management for the Protection of Juvenile Salmonids on the Mid-Columbia River. The EA will provide a more factual source of information and will provide an official forum for input and discussion. We hope that you will use this opportunity to learn more about our program and provide input regarding our program's activities on the mid-Columbia River. (Appendix III-2) (Preface)

Thank you again for allowing us to review your paper. You should be hearing from Dr. Tobin in the near future. (Preface)

Sincerely,

Roger A. Woodruff

Roger A. Woodruff,
State Director WA/AK
USDA-APHIS-Wildlife Services
(360) 753-9884

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