APRIL 2001

AVIAN PREDATION ON JUVENILE SALMONIDS IN THE LOWER COLUMBIA RIVER RESEARCH PROJECT

Final Environmental Assessment and Finding of No Significant Impact

DOE/EA-1374

Double-crested Cormorants

BONNEVILLE POWER ADMINISTRATION

AVIAN PREDATION ON JUVENILE SALMONIDS IN THE LOWER COLUMBIA RIVER RESEARCH PROJECT

Finding of No Significant Impact (FONSI)

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Department of Energy

BONNEVILLE POWER ADMINISTRATION

Avian Predation on Juvenile Salmonids in the Lower Columbia River Research Project

Finding of No Significant Impact (FONSI)

Summary: Bonneville Power Administration (BPA) is proposing to fund the Avian Predation on Juvenile Salmonids in the Lower Columbia River Research Project. This project proposes to continue the research on Caspian terns, double-crested cormorants, and glaucous-winged gulls begun in 1996. BPA has prepared an Environmental Assessment (EA) (DOE/EA-1374) evaluating the proposed project. Based on the analysis in the EA, BPA has determined that the proposed action is not a major Federal action significantly affecting the quality of the human environment, within the meaning of the National Environmental Policy Act (NEPA) of 1969. Therefore, the preparation of an Environmental Impact Statement (EIS) is not required, and BPA is issuing this FONSI.

Copies: For copies of this FONSI or the EA, please call BPA's toll-free document request line: 800-622-4520. It is also available on our website at www.efw.bpa.gov.

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Public Availability: This FONSI will be distributed to all persons and agencies known to be interested in or affected by the proposed action or alternatives.

Supplementary Information: BPA proposes to continue funding the Avian Predation on Juvenile Salmonids in the Lower Columbia River Research Project which began in 1996 as a requirement of the incidental take statement that the National Marine Fisheries Service (NMFS) issued to agencies that operate the Federal Columbia River Power System (FCRPS). This project involves the following activities: (1) Survey the managed Caspian tern colonies in the Columbia River estuary and along the Washington coast, (2) study the food habits, energy requirements, and smolt consumption rates of managed adult and pre-fledgling Caspian terns nesting in colonies in the Columbia River estuary, (3) determine foraging distribution, foraging range, and habitat use of managed Caspian terns in the Columbia River estuary and along the Washington coast, (4) survey unmanaged double-crested cormorants and glaucous-winged/western gull nesting colonies in the Columbia River estuary and unmanaged Caspian terns nesting on the lower Columbia River above John Day Dam, (5) study the food habits, energy requirements, and smolt consumption rates of unmanaged double-crested cormorants

nesting in the Columbia River estuary and unmanaged Caspian terns nesting on the lower Columbia River above John Day Dam, (6) determine foraging distribution, foraging range, and habitat use of unmanaged double-crested cormorants nesting in the Columbia River estuary and unmanaged Caspian terns nesting on the lower Columbia River above John Day Dam, (7) study the food habits of double-crested cormorants nesting in Grays Harbor, (8) monitor effects of this research on endangered California brown pelicans roosting on East Sand Island, (9) ensure tern colony restoration by removing predatory birds from the East Sand Island Caspian tern colony under the direction of the Interagency Caspian Tern Working Group, and (10) provide technical assistance to the Interagency Caspian Tern Working Group.

Published research suggests that avian predation can, under some conditions, be a substantial source of mortality for juvenile salmonids. In 1995, 11.3% of radio-tagged yearlings (11 of 97) and 4.1% of subyearlings (4 of 71) fell prey to gulls below The Dalles Dam. In 1996 and 1997, between 10% and 30% of radio-tagged chinook yearlings in the Columbia River estuary were consumed by terns or cormorants nesting in that area. Researchers estimate that the Caspian terns nesting on Rice Island in 1998 consumed 7.4 million - 13.2 million smolts. In 1999, an estimated 8.3 million - 15.9 million smolts were consumed by Caspian terns in the Columbia River estuary.

Due to concern about the impacts of avian predators on ESA-listed salmonids, regional fish and wildlife managers who are members of the Interagency Caspian Tern Working Group (Working Group) sought to relocate the Rice Island tern colony in 2000 to a new site on East Sand Island, 21 kilometers (km) closer to the ocean, where it was hoped terns would consume significantly fewer juvenile salmonids. Over 94 percent of the terns shifted to East Sand Island, where nesting success was nearly four times higher than at the Rice Island colony. The relocation of nearly all the nesting terns from Rice Island to East Sand Island resulted in a sharp drop in consumption of juvenile salmonids as compared to the previous year: juvenile salmonids comprised 44 percent of the prey items of terns nesting at East Sand Island, compared to 91 percent of prey items at Rice Island.

Although management actions implemented by the Working Group in 2000 resulted in a substantial reduction in the numbers of salmonid smolts being consumed by Caspian terns in the estuary (Collis et al. 2000), the Working Group needs to continue to monitor current management activities to determine if they are meeting their objectives to reduce predation on ESA-listed species. Furthermore, decisions regarding future management of currently unmanaged bird populations depend upon results from the research activities proposed as part of this study.

This project was recommended for funding by BPA under the Northwest Power Planning Council's Fish and Wildlife Program and is to be jointly conducted by the U.S.

Geological Survey-Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University; Columbia River Inter-Tribal Fish Commission; and Real Time Research (RTR) Consultants.

Two possible alternative plans have been identified and are addressed in the EA (Chapter 2). Briefly, they are as follows:

Avian Predation Research: BPA would fund the efforts to continue the research on Caspian terns, double-crested cormorants, and glaucous-winged/western gulls begun in 1996. Much of the focus would be to measure the salmonid smolt consumption rate of managed Caspian terns in the Columbia River estuary; of unmanaged tern, cormorant, and gull populations located in the estuary; and of unmanaged upriver tern populations. In addition, BPA proposes to fund a study of the impacts of this research on the population of brown pelicans roosting on East Sand Island in the Columbia River estuary and to study the potential impact of re-establishing a tern colony in Grays Harbor, Washington.

No Action Alternative: BPA would not fund the Avian Predation on Juvenile Salmonids in the Lower Columbia River Research Project. As a result, it most likely would not be implemented. This alternative would not allow evaluation and refinement of management actions previously implemented by the Working Group to reduce the consumption of juvenile salmonids by piscivorous waterbirds in the Columbia River estuary.

Table 1 in the EA summarizes the impacts of these two alternatives. The negative impact of the no action alternative is not acceptable because it would not be consistent with the Northwest Power Planning Council's Fish and Wildlife Program, and it would not complement the activities of fish and wildlife agencies and appropriate Tribes. Additionally the no action alternative would not provide needed data to evaluate existing management actions to reduce the impact of fish-eating birds on salmonids, which could result in higher impacts to juvenile salmonid populations if populations of birds are not managed. The no action alternative would also not aid implementation of actions called for in NMFS FCRPS biological opinions from 1995, 1998, and 2000.

Appendix C of the Final EA further describes how the potential disturbance of brown pelicans will be monitored and mitigated. The U.S. Fish and Wildlife Service (USFWS) may suggest additional measures after their review of the Biological Assessment submitted to them by the U.S. Army Corps of Engineers (Corps) and BPA. The parties responsible for the mitigation are the research group members—the Oregon Cooperative Fish and Wildlife Research Unit at Oregon State University; the Columbia River Intertribal Fish Commission; and RTR, a private research firm.

BPA has determined, based on the context and intensity of the impacts identified for the preferred alternative (funding the avian predation research), that they are not significant, using the definition of this concept in Section 1508.27 of the *Council on Environmental Quality Regulations for Implementing the National Environmental Policy Act*. This determination is based on the following discussion of the points in section 1508.27.

1) The project aims to assess previous management actions taken to reduce bird predation on depressed stocks of ESA-listed fish in the lower Columbia River. The research itself will not have any significant beneficial impacts to the depressed stocks; however, the information from the research will be available to guide wildlife management agencies (the Working Group) in their management decisions regarding bird predation on these stocks.

2) Implementation of the proposed action would not affect the health or safety of the people of the project area. Shooting birds with shotguns will be done only when there is a safe distance between the shooters and any other people in the vicinity.

3) The project would take place in the Columbia River, Grays Harbor, and on various islands in the Columbia River. No ground disturbance is planned; thus no sensitive areas such as historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas would be affected.

4) The impacts of actions proposed under the preferred alternative are not significant due to their controversy. Many of the comments that surfaced during the development and review of the preliminary EA focused on the management actions being undertaken by the Interagency Caspian Tern Working Group. These actions have been addressed in an EA and FONSI prepared by the Corps entitled, "Caspian Tern Relocation FY 2001-2002 Management Plan and Pile Dike Modification to Discourage Cormorant Use, Lower Columbia River, Oregon." Other comments focused on concerns about the disturbance to California brown pelicans roosting and double-crested cormorants nesting near the Caspian tern colony. Further discussion with USFWS staff has resulted in some changes to the research activities to mitigate these concerns and ensure they are not significant. These and other comments on the research activities have been addressed in the final EA and are found to be resolvable within the scope of this project. Overall, given the large numbers of Caspian terns and double-crested cormorants in the study area, the direct or indirect fatalities to individuals resulting from this research project are *de minimus* and will not significantly adversely affect either population.

5) The impacts of the proposed action are not significant due to the degree of highly uncertain, unique, or unknown risks. This is a research project intended to evaluate previous management actions. While staff at the USFWS were concerned about the potential risks to the California brown pelican colony on East Sand Island due to disturbance by researchers, mitigation measures outlined in the Final EA will ensure this disturbance is not significant and will scientifically document the extent and effects of the disturbance. Moreover, these staff concerns were in contrast to

decisions already made by the USFWS. The USFWS submitted a report to Congress, in response to FY2001 Interior and Related Agencies Appropriations Act Committee language in H.R. 106-646 and S.R. 106-312, in which the USFWS said its 2000-2001 management recommendations for terns included support for continued research and monitoring activities to evaluate the effectiveness of tern management actions. The USFWS anticipated issuing scientific collecting permits under the Migratory Bird Treaty Act for this research. The USFWS also made a commitment to "contribute funds to develop tern nesting habitat on East Sand Island." BPA concludes that the USFWS managers who speak for the agency had already determined that this research posed no significant risk to California brown pelicans or other resources.

6) The actions proposed would not establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration.

7) The proposal is not connected (40C.F.R. 1508.25 (a)(1)) to other actions with potentially significant impacts, nor is it related to other proposed actions with cumulatively significant impacts (40 C.F.R. 1508.25 (a)(2)). Although the proposed action is related to actions being addressed under the Corps' EA and FONSI, "Caspian Tern Relocation FY2001-2002," it is not precluded by 40 C.F.R. 1506.1 or 10 C.F.R. 1021.211 because it is research with utility that is independent of the Corps' action. Moreover, as small-scale pure scientific research this is, per se, not a major Federal action and would not significantly affect the quality of the human environment (Department of Energy Regulations for Implementing NEPA, 10 CFR 1021, Subpart D, Appendix B B3.3, and Appendix C C8).

8) As much of this project is located on previously disturbed ground and does not involve additional ground disturbance, this project would not adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or cause loss or destruction of significant scientific, cultural, or historical resources.

9) The following listed threatened or endangered species are found in the vicinity of the proposed actions: California brown pelican, Bald eagle, Western snowy plover, Oregon silverspot butterfly, and Howellia. The Corps has submitted to the USFWS a Biological Assessment that addresses the effects of the proposed research activities on these species. The Corps and BPA have determined that the proposed research activities would have no effect on Western snowy plovers, Oregon silverspot butterflies, or Howellia. We also have determined that the activities may affect, but are not likely to adversely affect, Bald eagles and California brown pelicans. Measures outlined in the Biological Assessment and EA to minimize effects on these two species will be strictly adhered to by the researchers. We have requested concurrence with our determinations from the USFWS.

10) The actions proposed would not threaten to violate Federal, State, or local law or requirements imposed for the protection of the environment. The following permits and consultation will be required and will be obtained: Migratory Bird Treaty Act collection permits and Section 7 consultation on endangered species.

Determination: Based on the information in the EA, as summarized here, BPA determines that the proposed action, the Avian Predation on Juvenile Salmonids in the Lower Columbia River Research Project, as described and analyzed in the EA, is not a major Federal action significantly affecting the quality of the human environment within the meaning of NEPA, 42 U.S.C. 4321 et seq. Therefore, an EIS will not be prepared, and BPA is issuing this FONSI.

Issued in Portland, Oregon, on April 5, 2001.

*/s/ Sarah R. McNary for*_____
Alexandra B. Smith
Vice President
Environment, Fish and Wildlife Group

Avian Predation on Juvenile Salmonids in the Lower Columbia River Research Project

Final Environmental Assessment

Bonneville Power Administration

April 2001

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1.0 PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

Development of the hydropower system (dams and generators to make electricity) in the Columbia River Basin has had far-reaching effects on many species of fish and wildlife. The Bonneville Power Administration (BPA), an agency of the United States government, is responsible for protecting, mitigating, and enhancing fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. (See **Pacific Northwest Electric Power Planning and Conservation Act (NW Power Act)** [1], 16 U.S.C. 839 *et seq*., Section 4. (h)(10)(A).) In addition, BPA is responsible for protecting and conserving species listed as Threatened and Endangered under the **Endangered Species Act (ESA)** of 1973, as amended, 16 U.S.C. 1531 *et seq*.

One of the ways in which BPA meets these responsibilities is by funding projects identified through a regional process led by the Northwest Power Planning Council (Council). One of the measures recommended to help mitigate for anadromous fish loss is the "Avian Predation on Juvenile Salmonids in the Lower Columbia River Research Project," a joint proposal by the Oregon Cooperative Fish and Wildlife Research Unit at Oregon State University (OSU), the Columbia River Inter-Tribal Fish Commission (CRITFC), and Real Time Research (RTR), a private research firm. This project falls within the objectives listed in Section 5 “Juvenile Salmon Migration” (5.7B.20, 5.7B.21, 5.7B.22.) in the Council's Columbia River Basin Fish and Wildlife Program (NPPC 1994) and was recommended to BPA by the Council for funding.

The **Interagency Caspian Tern Working Group** (Working Group) is the group of fish and wildlife managers directing the management of the predatory birds. The management actions are the subject of a separate Environmental Assessment and Finding of No Significant Impact prepared by the U.S. Army Corps of Engineers (USCOE 2001), one of the members of the Working Group. BPA has been requested by the Working Group to fund continuing research relating to the management actions through the Columbia River Basin Fish and Wildlife Program.

In the process of meeting its responsibilities, BPA must comply with many other laws, regulations, and policies, including the National Environmental Policy Act (NEPA) and the Migratory Bird Treaty Act, 16 U.S.C. 703-712. (See chapter 4 for a complete list of these regulations and policies and how BPA is meeting their requirements.)

The type of action proposed is not one that normally requires preparation of an EA or an Environmental Impact Statement (EIS), as listed in the Department of Energy Regulations on NEPA.[2] Nevertheless, BPA has prepared this EA following established

[1] Words in **boldface** in the text are defined in the Glossary.
[2] For more information on analysis requirements under NEPA, please see section 1.5.

NEPA regulations and procedures to accommodate other federal agencies that will also benefit from this environmental review. On the basis of the analysis in the EA, BPA will either prepare a Finding of No Significant Impact and may then proceed with the action, or will prepare an EIS if the EA reveals the potential for significant environmental impacts.

1.2 NEED FOR ACTION

BPA's underlying need for action is to ensure that regional fish and wildlife managers (the Working Group) have adequate information to assess the impacts of managed and unmanaged bird populations (i.e., terns, cormorants, and gulls) on the survival of juvenile salmonids from the Columbia River Basin, particularly ESA-listed stocks, to help determine effective future management initiatives that will reduce predation impacts.

Published research suggests that avian predation can, under some conditions, be a substantial source of mortality for juvenile salmonids. Aggregations of piscivorous (fish-eating) birds have been observed on the Columbia River near dams, at fish release points near hatcheries and fish transport barges, and in the estuary near the large waterbird breeding colonies at Rice and East Sand islands (Figure 1). Predation by birds on radio-tagged chinook salmon **smolts** has been documented in the tailraces below The Dalles and John Day dams and in the Columbia River estuary. In 1995, 11.3% of radio-tagged yearlings (11 of 97) and 4.1% of subyearlings (4 of 71) fell prey to gulls below The Dalles Dam. In 1996 and 1997, between 10% and 30% of radio-tagged chinook yearlings in the Columbia River estuary were consumed by terns or cormorants nesting in that area. Researchers estimate that 7.4 - 13.2 million smolts were consumed by the Caspian terns nesting on Rice Island in 1998. In 1999, an estimated 8.3 - 15.9 million smolts were consumed by Caspian terns in the Columbia River estuary.

Due to concern about the impacts of avian predators on ESA-listed salmonids, the Working Group sought to relocate the Rice Island tern colony in 2000 to a new site on East Sand Island, 21 kilometers (km) closer to the ocean, where it was hoped terns would consume significantly fewer juvenile salmonids. Over 94% of the terns shifted to East Sand Island, where nesting success was nearly four times higher than at the Rice Island colony. The relocation of nearly all the nesting terns from Rice Island to East Sand Island resulted in a sharp drop in consumption of juvenile salmonids as compared to the previous year: juvenile salmonids comprised 44% of the prey items of terns nesting at East Sand Island, compared to 91% of prey items at Rice Island.

Total smolt consumption by Caspian terns nesting in the Columbia River estuary in 2000 was estimated at 7.3 million (Lyons et al., unpublished data). This represents a reduction of about 4.4 million (38%) compared to the 1999 smolt consumption estimate.[3]

[3] The "best" estimate of smolt consumption by all Caspian terns nesting in the Columbia River estuary in 1999 (both Rice Island and East Sand Island) was 11.7 million. The 95% confidence interval for the 1999 best estimate, was 8.3 to 15.9 million smolts; thus the best estimate of the reduction in smolt consumption in 2000 is 4.4 million (11.7 million minus 7.3 million).

BPA has funded research on avian predation of juvenile salmonids in the Columbia River for four years. The research began in 1996 as a requirement of the incidental take statement that the National Marine Fisheries Service issued to agencies that operate the Federal Columbia River Power System (FCRPS). Since the initial avian predation studies, management actions, such as moving the terns to East Sand Island, have been implemented by the Working Group to reduce avian predation on juvenile salmonids in the Columbia River estuary. Although management actions implemented in 2000 resulted in a substantial reduction in the numbers of salmonid smolts being consumed by Caspian terns in the estuary (Collis et al. 2000), the Working Group needs continued monitoring of current management activities to determine if they are meeting their objectives to reduce predation on ESA-listed species. Furthermore, decisions regarding possible future management of currently unmanaged bird populations depend upon results from the research activities proposed as part of this study.

1.3 PURPOSES

BPA has identified the following purposes for participating in this project. BPA will base its choice among alternatives on these purposes:

- Consistent with the Northwest Power Planning Council's Fish and Wildlife Program
- Administratively efficient and cost-effective
- Avoids or minimizes adverse environmental impacts
- Fulfills monitoring and evaluation goals identified as part of the adaptive management process for the avian predation mitigation
- Complements activities of fish and wildlife agencies and appropriate Tribes
- Consistent with the legal rights of the Tribes in the region
- Implements the National Marine Fisheries Service (NMFS) Biological Opinion on Hydrosystem Operations (2000)
- Compiles research data on the nesting and feeding behavior of piscivorous birds to aid in future Federal Columbia River Power System (FCRPS) predator management.

1.4 RELATED DOCUMENTS AND ACTIONS

- Endangered Species Act Section 7 consultation regarding potential disturbance to endangered California brown pelicans from cormorant research activities, with the U.S. Fish and Wildlife Service (USCOE 2000).
- Columbia River Basin Fish and Wildlife Program (NWPPC 1994).

- United States Army Corps of Engineers (USCOE) Environmental Assessment and Finding of No Significant Impact "Caspian Tern Relocation FY2001-2002 Management Plan and Pile Dike Modification to Discourage Cormorant Use, Lower Columbia River, Oregon." This Environmental Assessment proposes action to maintain relocation of the Caspian tern colony previously nesting at Rice Island to East Sand Island (USCOE 2001).

- "Investigation to determine feasibility of attracting Caspian Terns to an experimental barge nesting platform, Commencement Bay, Tacoma, Washington" is a proposal by the Oregon Cooperative Fish and Wildlife Research Unit at Oregon State University, the Washington Department of Fish and Wildlife (WDFW), and RTR Consultants to study the feasibility of using barges as alternative colony sites for Caspian terns and for using these populations to assess diet composition of Caspian terns. This research is being funded by the U.S. Fish and Wildlife Service (USFWS), USCOE, and NMFS, not by BPA. While this research is related to the research addressed in this EA, the funding agencies have determined that this research can be independently categorically excluded under NEPA, so it is not being included in this EA.

- NMFS Biological Opinion on Hydrosystem Operations (NMFS 2000). Action 102 of the 2000 NMFS Biological Opinion (Section 9.6.1.5.3 page 9-108) directs the Action Agencies, in coordination with the Caspian Tern Working Group, to continue to conduct studies to evaluate avian predation of juvenile salmonids in the FCRPS reservoirs above Bonneville Dam. This effort is to be coordinated with ongoing avian management activities in the Columbia River estuary and with USDA Wildlife Services and USFWS.

- Roby, D.D., D.P. Craig, K. Collis, and S.L. Adamany. 1998. Avian predation on juvenile salmonids in the lower Columbia River. 1997 Annual Report. Oregon State University, Corvallis, Oregon, and Columbia River Inter-Tribal Fish Commission, Portland, Oregon, September 1998. (available at the website: www.columbiabirdresearch.org)

- Collis, K., S.L. Adamany, D.D. Roby, D.P. Craig, and D.E. Lyons. 1999. Avian predation on juvenile salmonids in the lower Columbia River. 1998 Annual Report. Oregon State University, Corvallis, Oregon, and Columbia River Inter-Tribal Fish Commission, Portland, Oregon, September 1999. (available at the website: www.columbiabirdresearch.org)

- Roby, D.D., D.P. Craig, D.E. Lyons, K. Collis, and J. Adkins. 1999. Avian predation on juvenile salmonids in the lower Columbia River. 1999 Interim Report. Oregon State University, Corvallis, Oregon, and Columbia River Inter-Tribal Fish Commission, Portland, Oregon, September 1999. (available at the website: www.columbiabirdresearch.org)

Avian Predation Research in the Columbia River System

Figure 1

- Collis, K., D.D. Roby, D.E. Lyons, and D.P. Craig. 2000. Draft 2000 Season Summary: Columbia Bird Research Update. (available at the website: www.columbiabirdresearch.org)

- Collis, K., D.D. Roby, D.P. Craig, B.A. Ryan, and R.D. Ledgerwood. In press. Colonial waterbird predation on PIT-tagged juvenile salmonids in the Columbia River estuary: Vulnerability of different salmonid species, stocks, and rearing types. Trans. Amer. Fisheries Soc.

1.5 DECISIONS TO BE MADE

BPA must decide whether to continue funding the study entitled "Avian Predation on Juvenile Salmonids in the Lower Columbia River Research Project." BPA is required under NEPA to examine the environmental effects of projects it proposes to fund and to determine whether effects are significant. If they are found not to be significant, a Finding of No Significant Impact (FONSI) will be issued and work may proceed. If they are found to be significant, an Environmental Impact Statement (EIS) must be prepared before making a decision.

2.0 ALTERNATIVES

2.1 BACKGROUND

Beginning in 1997, the Bonneville Power Administration funded a study of the population size, breeding ecology, and food habits of piscivorous birds in the lower Columbia River (from the confluence of the Snake and Columbia rivers to the mouth of the Columbia River). The primary objective of this research was to determine the magnitude of avian predation on juvenile salmonids.

During the first two years of this study (1997 and 1998), research focused on:

- Caspian terns nesting on Rice Island in the Columbia River estuary and at two smaller colonies (Three Mile Canyon Island and Crescent Island) in eastern Oregon/Washington;

- Double-crested cormorants nesting on East Sand Island and Rice Island in the Columbia River estuary;

- Glaucous-winged/western gulls nesting on East Sand Island, Rice Island, and Miller Sands Spit in the Columbia River estuary; and

- California and ring-billed gulls nesting at a number of upriver colonies in The Dalles, John Day, and McNary pools.

Based on the research conducted in 1997 and 1998, the Working Group determined that Caspian terns nesting on Rice Island in the Columbia River estuary were having a significant impact on survival of juvenile salmonids. Conversely, California and ring-billed gulls were consuming comparatively few juvenile salmonids, and research on the diets of these two species was discontinued after 1998.

In 1999, a pilot study was conducted to evaluate the efficacy of colony relocation as a way to reduce the impacts of Caspian terns nesting in the Columbia River estuary on Columbia Basin juvenile salmonids. Results from this study suggested that moving terns from Rice Island to a newly restored colony site at East Sand Island might reduce the number of juvenile salmonids consumed by the terns.

In 2000, management agencies successfully relocated to East Sand Island 94% of the Caspian terns that formerly nested on Rice Island. As a result, juvenile salmonids comprised 44% of the prey items of terns nesting at East Sand Island, compared to 91% of prey items at Rice Island.

2.2 PROPOSED ACTION - AVIAN PREDATION RESEARCH

This project proposes to continue the research on Caspian terns, double-crested cormorants, and glaucous-winged/western gulls begun in 1997 (see Appendix A for a list of previous research). Much of the focus will be to measure the salmonid smolt consumption rate of managed Caspian terns in the Columbia River estuary; of unmanaged tern, cormorant, and gull populations located in the estuary; and of unmanaged upriver tern populations. In addition, it proposes to study the impacts of this research on the population of brown pelicans roosting on East Sand Island in the Columbia River estuary and to study the potential impact of re-establishing a tern colony in Grays Harbor, Washington.

Consumption estimates are based on a state-of-the-art bioenergetics modeling[4] approach. These estimates provide the cornerstone for decisions made by the Working Group about which bird populations to manage and how to manage them. Bioenergetics models are comprised of a number of input variables that must be accurately measured in the field in order to generate reliable estimates of avian predation on juvenile salmonids. Acquiring these diet composition data for Caspian terns and double-crested cormorants nesting in the Columbia River estuary necessitates lethal sampling of both species and the analysis of stomach contents. With the relocation of most of the Rice Island Caspian tern colony to East Sand Island, it is anticipated that tern diets will change. Also, competition between terns and cormorants for available forage fish in the vicinity of East Sand Island will intensify, and diet composition of cormorants nesting there may shift in

[4] Bioenergetics modeling is the way annual consumption of juvenile salmonids by different bird populations is estimated. This mathematical model is made up of several input variables such as the number of birds in the population, the percent of their diet that is salmon, the energy content of the salmon consumed, and the metabolic rate or energy requirements of the birds. Research centers around accurately measuring these input variables so that a model can be constructed to reliably estimate salmon consumption by specific bird populations.

compensation. Consequently, there is a strong interest among the federal, state, and tribal agencies of the Working Group to continue monitoring the diet composition of these two species and their dependence on juvenile salmonids as a food source.

Ten specific actions are listed below and described in more detail in sections 2.2.1 through 2.2.10.

1. Survey managed Caspian tern colonies in the Columbia River estuary and along the Washington coast. See Figure 1.

2. Study the food habits, energy requirements, and smolt consumption rates of managed adult and pre-fledging Caspian terns nesting in colonies in the Columbia River estuary.

3. Determine foraging distribution, foraging range, and habitat use of managed Caspian terns in the Columbia River estuary and along the Washington coast.

4. Survey unmanaged double-crested cormorants and glaucous-winged/western gulls nesting colonies in the Columbia River estuary and unmanaged Caspian terns nesting on the lower Columbia River above John Day Dam.

5. Study the food habits, energy requirements, and smolt consumption rates of unmanaged double-crested cormorants nesting in the Columbia River estuary and unmanaged Caspian terns nesting on the lower Columbia River above John Day Dam.

6. Determine foraging distribution, foraging range, and habitat use of unmanaged double-crested cormorants nesting in the Columbia River estuary and unmanaged Caspian terns nesting on the lower Columbia River above John Day Dam.

7. Study the food habits of double-crested cormorants nesting in Grays Harbor.

8. Monitor effects of this research on endangered California brown pelicans roosting on East Sand Island.

9. Under the direction of the Working Group, ensure tern colony restoration by removing predatory birds from East Sand Island Caspian tern colony.

10. Provide technical assistance to the Interagency Caspian Tern Working Group.

2.2.1 Survey managed Caspian tern colonies in the Columbia River estuary and along the Washington coast.

Methods: Surveys of the distribution and size of Caspian tern colonies in the Columbia River estuary and along the Washington coast will be conducted. Ground-based, boat, and aerial surveys using fixed-wing aircraft will be conducted to identify new colony sites. Radio telemetry and re-sightings of banded adults will be used to study dispersal patterns and habitat use of terns from the Columbia River estuary. Additionally,

approximately 500 adult terns from Rice Island would be captured using rocket nets and marked with unique color combinations of plastic leg bands. This marked population will allow researchers to measure adult survival and to track movements of individual birds among colonies and through time. The rocket netting on Rice Island would be conducted in mid-April, prior to nest initiation. Once colonies become established, aerial photo census techniques will be used to estimate breeding population size at each colony.

Once Caspian terns settle at breeding colonies, productivity of those colonies would be measured. Nesting success would be compared with previous years and among colonies as a means to assess the suitability of the tern breeding colonies. Clutch size, hatching success, nestling survival rate, and overall nesting success (proportion of nests where at least one egg was laid that produced at least one fledgling) for a sample of nests on each colony would be determined.

Schedule: Fieldwork: March-August. Data analysis: May-January.

2.2.2 Study the food habits, energy requirements, and smolt consumption rates of managed Caspian terns nesting in the Columbia River estuary.

Methods: Collect up to 160 adult Caspian terns (10 per week) as they transport fish in their bills back to the colony on East Sand Island. This activity will be accomplished during a 16-week period from April through July, encompassing the entire Caspian tern nesting season on East Sand Island. Previous studies have shown that diet composition changes week to week during the nesting season, sometimes dramatically. Ten samples per week for the entire 16-week nesting season is considered a minimum sample size for accurately describing tern diet composition. Adult terns carrying fish would be shot with 12-gauge shotguns. The bill-load fish would be collected, identified to species, and analyzed at Oregon State University to determine proximate composition and energy content. The stomach contents of collected terns would be analyzed to determine taxonomic composition of the diet. All of these data would be used as input to the bioenergetics model for estimating the number of various salmonid species consumed by the East Sand Island Caspian tern colony throughout the nesting season. Diet would be assessed to determine whether the colony relocation had the desired effect in reducing (1) the proportion of the diet that consists of the various species of juvenile salmonids and (2) the total number of juvenile salmonids of each species consumed. Results from the radio-telemetry study will be used to further assess changes in diet associated with colony relocation.

Appendix B describes in detail the lethal sampling of Caspian terns.

Data and information on food requirements of young Caspian terns will be obtained by raising chicks in captivity where food intake, energy intake, and growth rates of young terns can be measured on a daily basis. A total of 20 Caspian tern hatchlings (1-4 days post-hatch) will be collected from the East Sand Island colony on one day in late May or early June. Hatchlings will be transported to the field station in Gearhart, Oregon and

kept warm with heat lamps until capable of independent thermoregulation. Chicks will be kept indoors in individual containers (5-gallon buckets) to insure no competition for food.

The 20 collected hatchlings will be randomly assigned to one of two diet treatments: (1) restricted diet designed to support normal growth rates of chicks in the wild, and (2) ad libidum food (all they can eat) in order to support maximum growth rates. Each chick will be kept in a separate cage so that food consumption can be monitored individually. The cages will consist of 5-gallon plastic buckets, equipped with a raised floor of hardware cloth so that excreta drain into the bottom of the bucket. All buckets will be cleaned and sterilized daily. The daily rations or ad lib food will be provided in four daily feedings at about 08:00, 12:00, 16:00, and 20:00 PDT. Prior to each feeding, the amount of fish fed to each chick will be weighed so that total mass of food consumed per day will be known for each captive-reared chick. The diet for both diet groups will consist of frozen bait herring. Juvenile herring are a natural and preferred prey of Caspian terns and readily available from local sources. The diet of thawed bait herring will be supplemented with a multiple vitamin (Seatabs) to preclude thiamin or vitamin E deficiencies that sometimes occur in captive animals fed frozen fish. Each day, prior to the first feeding, the body mass, wing length, culmen[5] length, and outer primary length of each chick will be measured until each chick is 45 days old.

When captive-reared chicks reach 45 days of age (normal fledging age), they will either be donated to educational facilities such as the Oregon Coast Aquarium (the Curator of Birds at OCA has said he is interested in acquiring 6-10 of the fledglings that are raised) or sacrificed for determination of body composition using proximate analysis techniques.

Schedule: Field: April-August. Data analysis: April–January.

2.2.3 Determine foraging distribution, foraging range, and habitat use of managed Caspian terns in the Columbia River estuary and along the Washington coast.

Methods: **Radio telemetry** would be used to determine the foraging distribution and range of terns nesting on newly established colony sites in the estuary and along the Washington coast. Data collected will be compared to telemetry results from the previous year to help assess changes in habitat use associated with colony relocation. The movements of the radio-tagged birds will be tracked using fixed and mobile receiver units both within the estuary and along the Washington coast.

Foraging conditions can be inferred from parental attendance, parental exchange rates, and activity of piscivorous waterbirds at the breeding colony, as well as the distribution and numbers of birds at foraging sites. Nest attendance (% of time parents remain on or near the nest), parental exchange rates (frequency with which the two members of a pair relieve each other of nest attendance duties or deliver food to young), and activity

[5] The dorsal ridge of a bird's bill.

(frequency of transfers of food to young) would be monitored from blinds in order to minimize the risk of observer influence on bird behavior. Attendance, exchange rates, and activity levels will be analyzed with respect to time of day, tide stage, tide amplitude, season, weather, nearby smolt releases, river flow rates, and other environmental factors in order to assess the relative importance of these factors in influencing foraging success.

Schedule: Field: April-August. Data analysis: May–January.

2.2.4 Survey unmanaged double-crested cormorants and glaucous-winged/western gulls nesting in the Columbia River estuary and unmanaged Caspian terns nesting on the lower Columbia River above John Day Dam.

Methods: As directed by the Working Group, smolt consumption rates of piscivorous waterbird colonies that are not managed in fiscal year 2001 will be monitored. Study populations would include double-crested cormorant and glaucous-winged/western gull colonies in the estuary, and upriver Caspian tern colonies at Three Mile Canyon and Crescent islands.

Aerial photos would be taken to estimate breeding population size. The photos of each breeding colony are taken once, late in the incubation period. The photos are taken from a fixed wing aircraft flying at an altitude of at least 1,000 feet using a large format, high resolution camera. Results would be compared to population estimates in previous years to determine population trends and trajectory. In addition, productivity of the double-crested cormorants on East Sand Island will be monitored as part of this study. Productivity of cormorants nesting on East Sand Island will be determined by monitoring clutch size, hatching success, and nestling survival in a representative sample of nests that are visible from observation blinds near the eastern part of the cormorant colony. The relationship between implemented management actions and changes in recruitment and reproductive success at unmanaged colonies would be assessed, thereby helping to determine the potential for future impacts of unmanaged colonies on the survival of juvenile salmonids.

Schedule: Field: May-August. Data analysis: May–January.

2.2.5 Study the food habits, energy requirements, and smolt consumption rates of unmanaged double-crested cormorants nesting in the Columbia River estuary and unmanaged Caspian terns nesting on the lower Columbia River above John Day Dam.

Methods: Collect up to 120 adult double-crested cormorants (12 each week) as they transport fish in their stomach and esophagus back to the colony on East Sand Island. This activity would be accomplished during a 10-week period from early April to late June, encompassing the pre-nesting and incubation stages of the nesting season. Adult cormorants will be shot with 12-gauge shotguns.

Appendix B describes in detail the lethal sampling of double-crested cormorants.

During the nestling-rearing stage (mid-June to late July), diet samples would be collected non-destructively by obtaining regurgitations from nestlings on the East Sand Island colony. Collection of cormorant chick regurgitations will take place at night during 6 different forays into the cormorant colony to collect 12-15 regurgitations.

Adult stomach contents and chick regurgitations would be analyzed in the lab to determine taxonomic composition of the diet. When whole or nearly whole fish are recovered in samples, they would be collected, identified by species, and analyzed to determine proximate composition and energy content. All of these data would be used as input to the bioenergetics model for estimating the number of juvenile salmonids consumed by the East Sand Island cormorant colony throughout the nesting season.

Field metabolic rates of double-crested cormorants would be measured during the chick-rearing period using the doubly labeled water technique.[6] A maximum of 30 adult double-crested cormorants that are raising broods at the East Sand Island colony would be captured using nooses or landing nets and injected with doubly labeled water during the period of June 20 through July 10, in order to measure their daily energy expenditure. Energy expenditure rates are a crucial input variable for the bioenergetics model to estimate salmonid smolt consumption by the cormorant population in the Columbia River estuary. Daily energy expenditure of double-crested cormorants has not been previously measured, either by the OSU/CRITFC/RTR research team or by any other group.

Researchers would attempt to recapture all adult cormorants injected with doubly labeled water within 50 hours of injection using non-lethal means. Recaptured cormorants will have a small sample of blood collected and then will be released again unharmed. If attempts to recapture injected cormorants by non-lethal means are unsuccessful, then injected cormorants will be recaptured lethally using either high-powered pellet guns or .22 rifles equipped with suppressors. No more than 20 injected cormorants will be recaptured lethally, and none will be taken lethally if 20 injected cormorants are captured non-lethally.

Daily energy expenditure (DEE) of nesting cormorants is likely to differ between the sexes because of gender differences in body size and reproductive behavior. Fifteen measurements of DEE for each sex would be minimal sample size for this experiment.

Schedule: Field: April-August. Data analysis: April-January.

[6] The doubly labeled water method uses two stable isotopes, deuterium and oxygen-18, mixed in water, to measure carbon dioxide production over a period of one to several days. Measurements of carbon dioxide production can be converted to energy expenditure if the composition of the food is known. This technique is the only available accurate method to measure the energy expenditure rates of wild animals going about their normal daily activities.

2.2.6. Determine foraging distribution, foraging range, and habitat use of the unmanaged double-crested cormorants nesting in the Columbia River estuary and unmanaged Caspian terns nesting on the lower Columbia River above John Day Dam.

Methods: Radio telemetry will be used to determine the foraging distribution and range of tagged double-crested cormorants nesting in the Columbia River estuary. The birds would be netted at night and tagged, then their movements tracked using fixed and mobile receiver units both within the estuary and along the Washington coast. Telemetry results will be used to assess the range of foraging habitats and locales (e.g., deep-water channels, shallow sloughs, sheltered bays, points of land, etc.) used by double-crested cormorants. This information would then be used to help develop management initiatives to reduce impacts of cormorants on juvenile salmonids in the estuary, if warranted by the results.

Foraging behavior of terns nesting at colonies on Three Mile Canyon and Crescent islands would be assessed using road-based surveys. Surveys would be designed to sample the range of foraging habitats and locales used by Caspian terns on the lower Columbia River (e.g., deep-water channels, shallow shoreline areas, mainstem hatcheries and hydroelectric dams, mouths of tributaries, etc.). These surveys provide the foundation of management initiatives to reduce the impacts of upriver terns on juvenile salmonids, if warranted by the results.

Schedule: Field: April-August. Data analysis: May–January.

2.2.7 Study food habits of double-crested cormorants nesting in Grays Harbor.

Method: Grays Harbor is one potential site for restoration of a former Caspian tern colony that existed during the 1980s, when as many as 4,000 pairs of Caspian terns nested on Sand Island. The Working Group is concerned that restoration of a Caspian tern colony in Grays Harbor may impact fisheries of salmonids and other forage fish species. In order to obtain baseline information on diets of piscivorous waterbirds in Grays Harbor, the researchers would collect regurgitations from about 120 cormorant chicks in nests located on channel markers in Grays Harbor. The species composition of fish identified in these regurgitations would provide data on potential diet composition of terns nesting in Grays Harbor.

Schedule: Field: June-August. Data analysis: May-January

2.2.8 Monitor research effects on endangered California brown pelicans roosting on East Sand Island.

Method: In addition to being the site of the largest double-crested cormorant breeding colony on the Pacific Coast of North America, the western end of East Sand Island is also currently the site of the largest night roost of California brown pelicans (*Pelecanus*

occidentalis californicus) in the Pacific Northwest. California brown pelicans are listed as endangered under the Endangered Species Act. Although brown pelicans do not nest on East Sand Island, the responsible federal regulatory agency (USFWS) is concerned that research activities at the East Sand Island cormorant colony might degrade this brown pelican roost site and that a "take" (as defined under the Endangered Species Act) will occur. Using an observation tower and boat-based surveys, the proposed research on brown pelicans would:

- monitor the effects of cormorant research activities on the behavior of roosting brown pelicans,
- monitor the numbers and distribution of brown pelicans using East Sand Island as a roost in relation to cormorant research activities,
- measure behavioral responses by roosting brown pelicans to other potential disturbances (both anthropogenic and natural), and
- investigate those environmental factors (weather, time of day, season, tide stage, etc.) that influence the use of East Sand Island as a brown pelican roost site.

Appendix C describes in detail the monitoring plan for the brown pelicans.

Schedule: Field: June–September. Data analysis: October–February.

2.2.9 As directed by the Interagency Caspian Tern Working Group, ensure tern colony restoration by removing predatory birds from East Sand Island tern colony.

Method: Gull control is considered a critical component of efforts to restore or establish a tern nesting colony. Glaucous-winged/western gulls are the primary predator of Caspian tern eggs and chicks at the Rice Island colony, causing heavy losses and low tern nesting success in some years. Gull control was an integral part of the successful effort to restore the Caspian tern colony on East Sand Island. In 1999, 183 "problem gulls" (gulls that entered the tern colony and removed eggs or chicks) were removed, and in 2000 an additional 40 gulls were removed. This level of gull control was sufficient to nearly eliminate gull predation as a cause of nest failure on the newly restored East Sand Island tern colony.

Great horned owls are predators on adult terns at the colonies. Ravens and crows are predators on tern nest contents (eggs and young chicks). In 1999, two great horned owls were captured on the newly restored Caspian tern colony on East Sand Island. These two owls were causing extensive disruption and abandonment of the tern colony. If they hadn't been removed, the East Sand Island tern colony would probably have failed to be restored in 1999. Crows and ravens preying on tern eggs have been observed at the Rice Island colony. Although no ravens or crows have been removed from East Sand Island, these two species were included in the collecting permit request as a precaution in case a

few ravens or crows became habitual predators of tern nests on the newly restored tern colony. Great horned owls are also on the permit request as a precaution; if an owl starts to disrupt the colony on East Sand Island, it can be removed without seeking an emergency modification of the project's state and federal permits.

In 2001, no more than 50 problem gulls would be removed in order to ensure the continued use of the East Sand Island tern colony site by the bulk of the Columbia River estuary breeding population. Gull control would be used *only* if the Working Group determines it to be necessary for the continued use of the East Sand Island colony site by nesting Caspian terns. Gulls would be collected by shooting from a blind with a .22 long rifle. Up to 10 common ravens, 20 American crows, and 5 great horned owls would also be removed, if necessary, using the same method as that used for gull control.

The removal of predatory birds from East Sand Island represents a management activity, not a research activity. Researchers may be called upon by the Working Group to carry out this management action since they will be out on the site and are familiar with the bird populations there. Employing researchers to remove predatory birds has been determined by the Working Group to be the most logical and cost-effective way to conduct this work.

Appendix D lists the species that are part of the collection permit request.

Schedule: April 15-July 15.

2.2.10 Provide technical assistance to the Interagency Caspian Tern Working Group.

Method: Provide technical assistance and information to resource managers who are members of the Working Group in refining existing management initiatives and in developing alternatives to reduce avian predation on juvenile salmonids in the lower Columbia River. This will allow managers to make in-season adjustments to existing management initiatives so that management objectives can be met.

Schedule: Ongoing.

2.3 NO ACTION ALTERNATIVE

Under the No Action Alternative, BPA would not fund the project entitled "Avian Predation on Juvenile Salmonids in the Lower Columbia River." As a result, it most likely would not be implemented. This alternative would not allow evaluation and refinement of previously implemented management actions to reduce the consumption of juvenile salmonids by piscivorous waterbirds in the Columbia River estuary.

Table 1: Predicted Performance Summary

Decision Factor	Proposed Action	No Action
Consistent with the Council's Fish and Wildlife Program.	Consistent with Measures in Section 5 "Juvenile Salmon Migration" (5.7B.20, 5.7B.21, 5.7B.22.) of the Council's Fish and Wildlife Program.	Not consistent.
Administratively efficient and cost-effective.	Higher cost than No Action but costs and administrative efficiencies are maximized through maintaining continuity of the research effort.	No cost to BPA, but would not provide needed data to evaluate existing management actions.
Avoids or minimizes adverse environmental impacts.	Minimal impacts on birds. All impacts to birds being studied and those in the vicinity would be minimized to the extent possible while meeting the research needs.	No impacts from data collection activities but would not provide needed data to evaluate existing management actions. Could result in higher impacts to juvenile salmonid populations if data gathered by this research is not available to resource managers to properly manage populations of predatory birds.
Fulfills monitoring and evaluation goals identified as part of the adaptive management process for avian predation mitigation.	Proposes to provide data and analysis for use by entities seeking to develop management activities for avian predation mitigation.	Would not provide needed information.
Complements the activities of fish and wildlife agencies and appropriate Tribes.	Complements NMFS Biological Opinion on Hydrosystem Operations (NMFS 2000) and Council's Fish and Wildlife Program objectives. Also complements policies of the States of Oregon, Washington, and Idaho regarding the monitoring and evaluation of management to reduce impacts of avian predation on survival of Columbia basin juvenile salmonids.	Would not complement activities of others.
Consistent with the legal rights of the Tribes in the region.	The Columbia River Inter-Tribal Fish Commission participates as a member of the Caspian Tern Working Group and as cooperators in this research project.	Would not benefit tribal interests.
Implements the National Marine Fisheries Service (NMFS) Biological Opinion on Hydrosystem Operations (2000).	Would implement Action 102 of the 2000 NMFS Biological Opinion (Section 9.6.1.5.3 page 9-108).	Does not aid compliance with the Biological Opinion.
Compiles research data on the nesting and feeding behavior of piscivorous birds to aid in future Federal Columbia River Power System (FCRPS) planning and predator management.	Would provide required research.	Would not provide data and leaves a gap in the research.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS

3.1 AFFECTED ENVIRONMENT

Caspian tern breeding was first documented in the Columbia River estuary in 1984 when about 1,000 pairs were reported nesting on fresh dredged material on **East Sand Island** in the Columbia River estuary (see Figure 1). The island is the property of the U.S. Army Corps of Engineers and is posted against trespassing. Occasionally beachcombers land on the island during the seabird nesting season, and it is used by duck hunters in the fall. People (mostly sturgeon fishers) fish from boats near the island during the period when researchers work on the island.

Most of the Caspian tern colony moved up the river to **Rice Island** in 1986, probably because of vegetation development on East Sand Island. Rice Island originated in 1962 from dredged material disposal. The island has large, barren, sandy areas due to continued disposal actions, which are attractive to nesting terns. Rice Island belongs to Oregon Division of Land, and is not posted. Some sturgeon fishers also fish the area around Rice Island, but few are seen compared to the East Sand Island area. People, usually curious about all the birds, are rarely seen on Rice Island.

Caspian terns (*Sterna caspia*) are one of the more important predators of juvenile salmonids in the Columbia River basin. Caspian terns are the largest tern species in the world and strictly piscivorous. Until the 2000 breeding season, Rice Island was home to the largest Caspian tern colony in North America, with approximately 8,000 nesting pairs (Collis et al. 1999; Collis and Roby, unpublished data). The colony might even be the largest in the world (Cuthbert and Wires, in press). The best estimate of the current breeding population of Caspian terns in the Columbia River estuary is 19,354. This population increased 16% from 1997 to 1998, 11% from 1998 to 1999, and 10% from 1999 to 2000. The breeding population of Caspian terns in the Columbia River estuary is part of a larger Pacific Coast population whose breeding range extends from Baja California to the Bering Sea in Alaska. The current size of the Pacific Coast population of Caspian terns is estimated at 26,000 breeding adults. Thus the numbers of breeding terns in the Columbia River estuary constitutes about 74% of the total Pacific Coast population. This population has been expanding dramatically since the early 1960s: from 1960 to 1980 it increased by 75%, and from 1980 to 2000 it more than doubled. A recent estimate of the number of adult Caspian terns throughout North America was 68,000. Thus the numbers of Caspian terns nesting in the Columbia River estuary may represent nearly 30% of all Caspian terns that breed in North America, and the Pacific Coast population of Caspian terns may represent as much as 38% of continent-wide numbers.

Double-crested cormorants (*Phalacrocorax auritus*) are a common fish-eating waterbird in the lower Columbia River and estuary. A large cormorant colony has become established on a rock jetty at the west end of East Sand Island. Only 15 years ago, there were no double-crested cormorants nesting on East Sand Island and cormorant nesting pairs throughout the estuary numbered in the hundreds. Now East Sand Island

supports the largest double-crested cormorant colony on the Pacific coast of the U.S. and Canada. East Sand Island, plus nearby pilings and channel markers, supported a total population of roughly 7,500 breeding pairs in 1999. (Collis and Roby, unpublished data). This is consistent with continent-wide growth in double-crested cormorant populations and increasing frequency of conflicts with salmonid fisheries (Nettleship and Duffy 1995). Researchers estimate that cormorants nesting in the Columbia River estuary consumed between 2.2 and 9.2 million juvenile salmonids in 1998 (Collis et al. 1999).

Glaucous-winged/western gulls (*Larus glaucescens* x *L. occidentalis*) have established large breeding colonies located on three islands in the Columbia River estuary. These colonies have either grown substantially or become established during the last 15 years. In 1989, Douglas Bell (USFWS) recorded 880 pairs of glaucous-winged/western gulls nesting on East Sand Island. Since then, the breeding population of gulls on East Sand Island has increased by more than a factor of seven. The recent increases in breeding populations of glaucous-winged/western gulls in the Columbia River estuary are part of regional and national trends of expanding populations of large *Larus* gulls. Glaucous-winged and western gull populations are increasing dramatically throughout the Pacific Coast of North America. Gulls nesting in the Columbia River estuary consumed an estimated 0.4 – 3.9 million juvenile salmonids in 1998 (Collis et al. 1999).

The USFWS has identified several **threatened and endangered species**, listed under the Endangered Species Act, as occurring in or near the Columbia River estuary. These are the California brown pelican, bald eagle, western snowy plover, Stellars sea lion, Oregon silverspot butterfly, and one plant species, Howellia. In addition, NMFS has listed several species of anadromous fish as threatened or endangered.

California brown pelicans (*Pelecanus occidentalis californicus*), listed as endangered, have recently expanded their range northward during the post-breeding period, and now commonly occur along the coast of the Pacific Northwest in late summer (July-September). They generally roost at night on islands and other insular habitats, such as jetties and breakwaters. In the Pacific Northwest, three sites have recently supported large communal night-time roosts: East Sand Island in the Columbia River estuary, Gunpowder Island at the mouth of Willapa Bay, and Sand Island in Grays Harbor. Erosion of Gunpowder Island in the last few years has resulted in little use of this site as a pelican roost, and most pelicans now roost in either the Columbia River estuary or Grays Harbor.

East Sand Island is currently the largest communal roost site for California brown pelicans in the Pacific Northwest (R. Lowe and D. Pitkin, unpublished USFWS data). Protection of large traditional communal roosts was one of the primary objectives listed in the Brown Pelican Recovery Plan (U.S. Fish and Wildlife Service 1983). California brown pelicans roost primarily adjacent to the large double-crested cormorant colony on the western end of East Sand Island, presumably because both species forage in flocks primarily on marine fish (e.g. anchovy, mackerel, sardine and smelt) (Ward and Zahavi 1973). This site is also largely inaccessible to mammalian predators.

Wintering and resident bald eagles are known to forage along the Columbia River, and several resident pairs occur in the project vicinity. One pair nests on Miller Sands Island and previously attempted to nest on Rice Island. Another pair nests on the Washington mainland near East Sand Island. Western snowy plovers formerly occurred on Oregon beaches just south of the Columbia River, and a small population is present at Leadbetter Point, Willapa Bay, Washington. Oregon silverspot butterflies require very specific habitat and are not known to occur in the project area, nor does Howellia. Stellers sea lions are found near the mouth of the estuary (USCOE 2001).

Of 20 **evolutionarily significant units** (ESU) of naturally produced anadromous salmonids in the Columbia Basin, three are listed as endangered, nine are listed as threatened, one is proposed to be listed within the year, and one is under review. Six ESUs have been determined as unwarranted for listing. Two of these six ESUs, the Wenatchee and Okanogan sockeye salmon, represent rapidly declining stocks (USCOE). Listed stocks include spring/summer chinook, fall chinook, sockeye, steelhead and coho. Juveniles of all of these stocks must pass through the Columbia River estuary on their way to the ocean.

The USFWS also lists several threatened and endangered species in the vicinity of the upriver project locations near Three Mile Canyon and Crescent islands. Species include Canada lynx, bald eagle, Columbia spotted frog, and Washington ground squirrel.

For a more complete list of ESA-listed species, see Appendix E.

Grays Harbor, Washington, is located about 80 kilometers (50 miles) from the southern end of the state. The town of Westport, located at the mouth of the harbor, is a busy seaport. Wildlife identified within the harbor and on nearby land include Roosevelt elk, black bear, the northern spotted owl, peregrine falcons, the California gray whale, California brown pelicans, and thousands of ducks, geese, shorebirds and marine birds, which migrate along the Pacific Flyway to breed on offshore islands or feed in the large coastal estuaries of Grays Harbor.

3.2 IMPACTS OF PROPOSED ACTION

3.2.1 Survey managed Caspian tern colonies in the Columbia River estuary and along the Washington coast.

Environmental Consequences: Ground-based, boat, and fixed-wing aircraft surveys will be conducted to identify new colony sites. Once colonies become established, aerial photo census techniques, using fixed-wing aircraft, will be used to estimate breeding population at each colony. Fixed-wing aircraft fly at about 700 feet, high enough to not disturb birds in the area. Locations of nesting bald eagles would be plotted prior to radio telemetry aerial surveys so that pilots and field technicians know where they are and can avoid them (D. Roby personal communication). Ground-based and boat surveys are not expected to disturb birds or other species in the area.

Rocket-netting is used to capture birds in places where they congregate, in this case on the Rice Island tern colony site prior to nest initiation. The leading edge of a coated nylon net (mesh size 3.75 centimeters [1.5 in.]) is attached to three rockets that are fired simultaneously from a safe location away from the colony site. Once fired, the net flies at a height of 1.3 - 2 meters (4-6 ft.) off the ground, and when it lands (about 1-2 seconds after firing), covers an area of about 10 x 17 meters (30 ft. x 50 ft.). Birds are captured under the weight of the net and remain relatively still until removed by experienced bird handlers. Once removed from the net, birds are placed in specially designed bird storage boxes that are kept in a cool, dark place until the bird is banded and released (on average less than one hour from time of capture). Each adult would be banded with a unique color combination of plastic leg bands, weighed, and measured.

A total of 589 adult terns were rocket-netted on Rice Island last year with only one bird sustaining an injury (broken wing) as a result. This represents an injury/mortality rate of 0.17% associated with this capture method. Many more birds (20-50%) were within range of the net when it was fired and escaped capture unharmed (K.Collis, personal communication).

Based on the results of the operation in 2000, little or no Caspian tern injury or mortality is expected from the rocket-netting and handling of birds in 2001.

3.2.2 Study the food habits, energy requirements, and smolt consumption rates of adult and pre-fledging Caspian terns nesting in colonies in the Columbia River estuary.

Environmental Consequences: The project proposes to collect 10 Caspian terns per week (a maximum of 160) as they transport fish in their bills back to the colony on East Sand Island. They would be shot with 12-gauge shotguns at a location removed from the nesting colony and areas of human habitation. The number that would be collected in 2001 represents 0.83% of the breeding population in 2000. The 2001 breeding population of Caspian terns in the Columbia River estuary is expected to be at least 10% more than in 2000, suggesting that even if all 160 adult terns were collected, it would represent a small fraction of the population increment.

The proposed collection of up to 160 adult Caspian terns for diet studies would occur at the rate of 10 per week over the 16-week breeding season in 2001. The first three weeks of collection would be during the pre-laying period, so the collection of these 30 terns would not result in loss of eggs or chicks.

The next five weeks of collection would occur during the incubation period; therefore the 50 adult terns collected during this period would result in a loss of eggs. Average clutch size in the Columbia River estuary is 2.0 eggs per nest. Consequently, approximately 100 eggs would be lost. Hatching success of eggs averaged about 75% at East Sand Island; therefore, the loss of 100 eggs represents a loss of approximately 75 hatchlings. On East Sand Island in 2000, hatchling survival until fledging was about 41%; consequently, the loss of 100 eggs represents the loss of approximately 31 fledglings.

Based on published estimates of juvenile survival in Caspian terns from the Pacific Coast population (Gill and Mewaldt 1983), the loss of 100 eggs in 2001 would result in a reduction in adult recruitment to the population in 2004 of approximately 18 birds.

Collection of adult Caspian terns during the remaining 8 weeks of the breeding season would occur during the chick-rearing period. Loss of a parent early in the chick-rearing period when nestlings require constant brooding would result in loss of the entire brood. Caspian tern chicks however are highly precocial and capable of leaving the nest scrape and moving about the colony within a week of hatching. These older chicks require little brooding and could be raised by a single parent. Thus collections of adult terns later in chick rearing does not necessarily result in the death of their offspring. Assuming, though, that all young of terns collected during the chick-rearing period die, the collection of 80 adult terns could result in the loss of as many as 100 chicks. A chick's chances of survival to fledging age increases with chick age but survival of half grown chicks is about 75%. Consequently, the loss of 100 chicks represents a loss of about 75 fledglings. Based on the Gill and Mewaldt (1983) population model, 57% of these fledglings would survive to the beginning of their fourth year, the modal age of first reproduction. Therefore, approximately 43 fewer adults would recruit to the population in 2004.

The total reduction in adult recruitment expected in 2004 as a consequence of the lost productivity due to collection of 160 adult terns in 2001 is 61 birds. This magnitude of reduction in adult recruitment is not detectable using current state-of-the-art population census techniques for the East Sand Island Caspian tern colony.

In late May or early June, on one foray to the colony, twenty Caspian tern hatchlings would be collected as subjects for captive rearing experiments lasting about 45 days. Limiting the collection to one foray will minimize any impact on the colony due to human disturbance. One hatchling will be removed from each of 20 nests that contain two or three hatchlings. This procedure will minimize the impact of hatchling removal on the ultimate production of fledglings at the East Sand Island colony, as very few tern nesting pairs succeed in raising more than one chick per nesting attempt. Section 2.2.2 describes the measures taken to care for the hatchlings.

After the 45-day experiment, the now-fledging terms would be donated to a licensed educational facility for public display or sacrificed for determination of body composition and whole body energy content at the end of the experiments. Captive-reared terns will not be released into the wild because of concerns for potential disease transmission. Also, Caspian tern fledglings receive considerable post-fledging care from their parents (Cuthbert and Wires 1999); thus the survival chances of a fledgling tern unaccompanied by its parents is essentially nil.

These 20 hatchlings represent 0.36% of the number of young terns that were fledged from the East Sand Island tern colony last year. Thus these collection activities would represent a small fraction of the population increment. Normally, about 40% of tern chicks that hatch do not survive until they fledge, and sometimes this percentage is much

higher. No Caspian tern hatchlings have been collected in previous years of this study. Thus, if the chicks are sacrificed, the impact would not adversely affect population levels.

3.2.3 Determine foraging distribution, foraging range, and habitat use of managed Caspian terns in the Columbia River estuary and along the Washington coast.

Environmental Consequences: Radio telemetry would be used to determine the foraging distribution and range of terns nesting on newly established colony sites in the estuary and along the Washington coast using fixed and mobile receiver units. Adult terns would be captured for radio-tagging using one of two methods: (1) rocket-netting on the Rice Island tern colony site prior to the initiation of nesting (up to 30 individuals) or (2) using noose mats to ensnare terns at their nest sites on the East Sand Island colony late in the incubation period (up to 46 individuals). As described in section 3.2.1, rocket-netting is a comparatively safe method of capturing large numbers of adult terns for marking (1 mortality in 590 captures). Noose mats have been used to capture over 200 adult Caspian terns on the East Sand Island and Rice Island tern colonies; this method has not resulted in any detectable injury to or nest abandonment by the captured adults.

Radio-tags are less than 2% of the body weight of the terns and would be attached to the base of the central tail feathers. The radio-tag would be shed by the bird when it molts its tail feathers at the end of the breeding season. Relocating radio-tagged terns would be accomplished using aerial telemetry from fixed-wing aircraft or detection by automated fixed receivers located at the East Sand Island and Rice Island colony sites. Fixed-wing aircraft fly at about 700 feet, high enough not to disturb birds in the area. Fixed receiver sites are in place and do not need to be installed. Relocating radio-tagged terns using radio telemetry would not harm terns and, once terns are radio-tagged, no additional handling of birds would occur. Nesting bald eagles would be avoided as described in section 3.2.1.

3.2.4 Survey unmanaged double-crested cormorants and glaucous-winged/western gulls nesting colonies in the Columbia River estuary and unmanaged Caspian terns nesting on the lower Columbia River above John Day Dam.

Environmental Consequences: Aerial photo census is not expected to disturb any birds in the area.

3.2.5 Study the food habits, energy requirements, and smolt consumption rates of unmanaged double-crested cormorants nesting in the Columbia River estuary and unmanaged Caspian terns nesting on the lower Columbia River above John Day Dam.

Environmental Consequences: The project proposes to collect up to 120 adult double-crested cormorants (12 each week during a 10 week period from early April to late June)

as they transport fish back to the colony on East Sand Island. This period constitutes the pre-nesting and incubation stages of the nesting season. Researchers have calculated the loss of productivity resulting from the removal of the 120 adult cormorants: it would result in the loss of 73 fledglings from the 2001 cohort, or the equivalent of approximately 22 fewer adult recruits to the breeding population in 2004. This magnitude of reduction in adult recruitment is not detectable using current state-of-the-art population census techniques.

Adult cormorants would be shot offshore far removed from East Sand Island using 12-gauge shotguns. This activity has been ongoing since 1997. To date, there has been no observed flushing reaction by brown pelicans, cormorants, or terns on East Sand Island in response to lethal sampling activities near or on East Sand Island (Roby and Collis, March 22, 2001). If roosting pelicans are present near traditional shooting sites, collecting activities will be postponed until the pelicans move of their own volition. Detailed records will be kept by the researchers of the time, location, and numbers of pelicans flushed from East Sand Island during any researcher activities.

Additionally, attempts would be made during the nestling-rearing stage (mid-June to late July) to non-lethally capture up to 30 adult cormorants on their nests to inject them with doubly labeled water (see section 2.2.5). So as to minimize disturbance to the rest of the cormorant colony, adults would be captured at night (22:00 to 04:00) using nooses or landing nets. After a one-hour equilibration period, a small blood sample would be collected from each injected adult, which would then be released back to the colony. During the following two nights, attempts to recapture all injected adults in order to collect final blood samples would be made. After collection of the final blood sample, injected cormorants would be released unharmed. If recapture of injected adults using nooses and landing nets at nests proves not to be feasible, then up to 20 injected adults would be collected using either high-powered pellet guns or .22 rifles equipped with suppressors in order to obtain final blood samples. No injected cormorants would be lethally collected if 20 are recaptured non-lethally.

The West Coast population of double-crested cormorants has been increasing over the last 25 years, and is currently estimated at about over 44,000 individuals. Therefore the East Sand Island cormorant colony supports about 30% of the regional breeding population of the species. If all 140 cormorants were lethally collected, it would amount to 1.1% of the total breeding population on East Sand Island. Thus this activity is not expected to affect the overall population of cormorants.

Cormorant nestlings regurgitate food spontaneously when disturbed by intruders in the colony. This allows researchers to collect diet samples from cormorants during the chick-rearing period without significantly harming the chicks or adults (i.e., an alternative method to assess diet is to collect adults using firearms). Night-time forays into the cormorant colony to collect nestling regurgitations would last less than 15 minutes, thereby limiting the disturbance to both roosting pelicans and nesting cormorants. Regurgitation collection activities would occur on no more than 6 nights during the nestling-rearing period, and would be restricted to that part of the cormorant colony

where pelicans rarely roost. On nights when more than 50 pelicans are roosting within 200 meters of the area where cormorant regurgitation collection is planned, activities will either be postponed or shifted to another area of the cormorant colony where roosting pelicans are not present.

Periodic entry into the double-crested cormorant colony by researchers may disturb and even harm cormorant eggs and young cormorant chicks. These impacts can include 1) egg chilling, potentially resulting in embryo death if the incubating parent does not resume brooding within a few hours; 2) exposure of young nestlings not yet capable of thermo-regulation, potentially resulting in nestling death due to hypothermia if the attendant adult does not resume brooding within a few hours; and 3) premature fledging by older cormorant nestlings, which can potentially result in death if the parents do not relocate and care for the fledgling after it leaves the nest. These impacts are not expected to be extensive or to have a significant impact on the productivity of the double-crested cormorant colony.

3.2.6 Determine foraging distribution, foraging range, and habitat use of unmanaged double-crested cormorants nesting in the Columbia River estuary and unmanaged Caspian terns nesting on the lower Columbia River above John Day Dam.

Environmental Consequences: On the East Sand Island breeding colony, up to 50 adult double-crested cormorants would be netted for radio-tagging. Work would be done early in the incubation period. All cormorants caught on the East Sand Island colony for radio-tagging will be captured using large landing nets at night. Netting at night has been used to capture over 100 adult double-crested cormorants on the East Sand Island colony in past years and has not resulted in any detectable injury to or nest abandonment by the captured adults. The netting will take place in June before brown pelicans arrive on East Sand Island; therefore, no disturbance of roosting brown pelicans is anticipated during this activity. It is expected that a maximum of 10 night-time entries will be required to net the 50 adult cormorants. Relocating radio-tagged cormorants would be accomplished as described in section 3.2.3 and would not harm cormorants.

Upriver tern colonies at Three Mile Canyon and Crescent islands would be assessed using road-based surveys, which would not harm terns, as birds would not be handled.

Fixed-wing aircraft fly at about 700 feet, high enough not to disturb birds in the area.

3.2.7 Study food habits of double-crested cormorants nesting in Grays Harbor.

Collection of chick regurgitations at cormorant nests in Grays Harbor, Washington would take place throughout the chick-rearing period, June 15 – July 31. Double-crested cormorants use channel markers for nesting in Grays Harbor. Four trips to Grays Harbor to collect cormorant chick regurgitations are planned; between 10 and 30 chick

regurgitations would be collected per trip, with a goal of collecting 100 chicks' regurgitations during the season. The diet composition of cormorants nesting in Grays Harbor would be used to evaluate the vulnerability of juvenile salmonids to avian predation in this estuary.

Cormorant nestlings regurgitate food spontaneously when disturbed by intruders. This allows researchers to collect diet samples from cormorants during the chick-rearing period without harming the chicks or adults. On a few occasions older cormorant chicks have been known to fledge prematurely when disturbed by researchers. As a result, nests with older chicks close to fledging will be avoided as part of this activity.

3.2.8 Monitor research effects on endangered brown pelicans.

Environmental Consequences: In March 2000, USFWS recommended that the U.S. Army Corps of Engineers initiate Section 7 consultation on potential disturbance to endangered California brown pelicans from cormorant research and other bird management activities. The scope of the cormorant research effort on East Sand Island increased in 2000, when a decommissioned navigation tower within the cormorant breeding colony was converted into an observation tower to facilitate day-time observation of nesting cormorants. Access to the tower was provided by a system of above-ground tunnels designed to shield researchers from view. Through this recent informal Section 7 consultation, USFWS concurred with the Corps' determination that the research was "not likely to adversely affect" brown pelicans based on a series of measures proposed by the researchers, including a plan to monitor potential disturbance to brown pelicans from cormorant research activities. Cormorant research during the 2000 breeding season included 15 night-time entries into the cormorant colony; daily census counts were designed to detect effects of these cormorant research activities on roosting brown pelicans. The Corps will be consulting with USFWS on the proposed 2001 research described in this document.

Brown pelicans roosting adjacent to the cormorant colony on East Sand Island may be disturbed during research forays into the cormorant colony to collect data. These potential disturbances include flushing small numbers of pelicans while (1) traveling on foot to or from the tunnel system that accesses the cormorant tower and observation blinds, (2) collecting regurgitations from cormorant nestlings on the cormorant colony at night, and (3) collecting adult cormorants as part of doubly labeled water experiments. Such disturbances can potentially result in short-term negative energy balance in brown pelicans but are not expected to result in mortality of adults or juveniles.

All cormorant research activities on East Sand Island will be restricted to the eastern end of the colony; the majority of cormorants nest to the west of the research area and most brown pelicans roost to the west of the research area as well. Once cormorants arrive on the colony (mid-April), the observation tower and other observation blinds would be accessed in such a manner as to minimize the potential for disturbance of nesting cormorants (Anderson and Keith 1980). Roosting pelicans arrive on East Sand Island after cormorants initiate nesting, and human activities that disturb nesting cormorants

also tend to disturb roosting pelicans because of facilitated alarm behavior. Consequently, efforts by cormorant researchers to minimize disturbance to nesting cormorants should also minimize disturbance to pelicans.

Access to the observation tower and blinds in the cormorant colony will occur only at low tide. Researchers will approach the cormorant colony from the direction of the tern colony (from the east), following the water's edge along the north shore of the island. Above-ground tunnels constructed of silt fencing normally allow researchers to access the tower and blinds from the north shore of the island without disturbing nesting cormorants or roosting pelicans. Travel on the north shore of East Sand Island will not result in any significant disturbance to brown pelicans, since brown pelicans usually do not roost on this shore. If roosting brown pelicans are present on the north beach, and thus likely to be flushed by researchers accessing the tunnels and cormorant blinds, travel to the blinds will be postponed until the pelicans move on their own volition. This approach also minimizes disturbance to nesting gulls (gulls disturbed into flight tend to cause behavioral responses in nesting cormorants and roosting pelicans as well).

Additional measures that will be taken to reduce the impact to brown pelicans include limiting night-time entry into the cormorant colony and conducting some research activities between May 7 and June 7, before brown pelicans arrive at East Sand Island to roost. Researchers would make six night-time visits to the cormorant colony, lasting not more than 15 minutes each, for the purpose of collecting cormorant chick regurgitations. These short forays would avoid areas where pelicans are roosting. Forays into the cormorant colony for the purpose of retrieving adult cormorants for the doubly labeled water experiments would last less than 5 minutes and occur on a maximum of 6 nights. These night-time forays into the cormorant colony would also occur in parts of the cormorant colony where pelicans have rarely been observed roosting. The 12 night-time entries are three fewer than the number made in 2000.

Periodic informal consultation with the USFWS will be conducted throughout the course of this study to determine if impacts to brown pelicans are significant enough to necessitate a change in protocol. In addition, if funding allows, video cameras with low-light sensitivity will be employed to provide an objective record of disturbance events at the brown pelican roost site. All records will be made available to USFWS staff for their review. As deemed necessary, changes will be made in the study protocol to reduce impacts to brown pelicans.

See Appendix C for the monitoring plan to measure the potential disturbance of brown pelicans.

3.2.9 Under the direction of the Interagency Caspian Tern Working Group, ensure tern colony restoration by removing predatory birds from East Sand Island tern colony.

Environmental Consequences: The removal of predatory birds from East Sand Island will occur only if deemed necessary by the Interagency Caspian Tern Working Group. In

2001, no more than 50 problem gulls would be removed, and only to ensure the continued use of the East Sand Island colony site by nesting Caspian terns. Gulls would be collected by shooting from a blind with a .22 long rifle. This technique has been used in the past and is known to be tolerated well by the terns nesting on the colony.

The breeding population of glaucous-winged/western gulls on East Sand Island is estimated to be about 13,000 individuals (population estimation is difficult because gulls frequently nest under vegetation and are not picked up in aerial photos used to census the population). Glaucous-winged/western gulls also nest at colonies on Rice Island (about 3,000 individuals) and Miller Sands Spit (about 2,400 individuals). Thus the total breeding population in the Columbia River estuary is about 18,400 individuals. Fifty adult gulls would constitute about 0.38% of the local breeding population on East Sand Island and 0.27% of the estuary-wide breeding population. Thus this level of removal is not expected to adversely affect the existing gull population.

Up to 10 common ravens, 5 great horned owls and 20 American crows would potentially be collected for predator control to facilitate tern colony restoration on East Sand Island if deemed necessary by the Working Group. Federal and state collecting permits include small numbers of these predators. These collection levels are not expected to adversely affect these bird populations.

See Appendix D for a complete listing of collection requests.

3.2.10 Provide technical assistance to the Interagency Caspian Tern Working Group.

Environment Consequences: Providing technical assistance and information to managers would not have any impact on the environment.

3.2.11 Effects on the human environment

Rocket netting and use of shotguns would occur at a great distance from any homes and should not be a disturbance. Any noise would be temporary and of short duration; it might be somewhat bothersome to people on the river near the islands, but no more than the hunting of waterfowl that occurs throughout the area during hunting season. Shotguns would be used only on or near East Sand Island, which is at least a kilometer from any human habitation and is also a popular waterfowl hunting area. Rocket nets would only be used at Rice Island, which is over 3 kilometers from the nearest human habitation. No shotguns or rocket nets would be used at any of the upriver sites (Three Mile Canyon or Crescent islands).

3.3 IMPACTS OF NO ACTION

Under the No Action Alternative, the Avian Predation on Juvenile Salmonids in the Lower Columbia River Research Project would not be funded by BPA and most likely

would not be implemented. Thus, previously implemented management actions to reduce the consumption of juvenile salmonids by piscivorous waterbirds in the Columbia River estuary would not be evaluated and refined. It is not consistent with the Northwest Power Planning Council's Fish and Wildlife Program, or the National Marine Fisheries Service Biological Opinion on Hydrosystem Operations.

Table 2: Summary of Affected Environment and Environmental Consequences

Environmental Resource	Existing Conditions	Proposed Action	No Action
Water quantity/quality	None currently affected	No change	No change
Floodplains and wetlands	None currently affected	No change	No change
Land use/visual	No new facilities would be constructed.	Potential temporary noise disturbance from rocket netting and shotguns.	No change
Socioeconomics	Not affected by the research.	No change	No change
Migratory birds	Migratory bird populations being studied are plentiful and increasing in the Columbia River system.	A tiny percentage of several migratory bird populations would be collected, but collections would not impact the overall population.	No change
ESA-listed brown pelicans	Brown pelicans roost on East Sand Island.	Measures would be taken to avoid disturbing pelicans while studying cormorants on East Sand Island. There would be no direct take of brown pelicans in the study. In 2000, Section 7 consultation concluded that the proposed action actions are not likely to adversely affect brown pelicans. Consultation for 2001 is being developed.	No change
Human environment	No one lives near the bird colonies. Recreational fishers and boaters use the waterways around the island.	Rocket netting and shotgun use would occur far from any homes. The noise would be temporary and of short duration but may bother people on the river near the islands.	No change

4.0 PERMITS REQUIRED

4.1 APPLICABLE REQUIREMENTS

Migratory Bird Treaty Act of 1918, as amended

This act prohibits the taking of migratory birds except as permitted through certain regulations. These regulations (50 CFR 21) authorize the taking of migratory birds through establishment of hunting seasons and issuance of various permits. Under the Migratory Bird Treaty Act (MBTA), take of migratory birds for scientific purposes is regulated by the USFWS. Collection activities will not occur until permits are in place.

National Environmental Policy Act

This EA is being prepared pursuant to the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 *et. seq*.) and the Council of Environmental Quality (CEQ) Implementing Regulations, which require Federal agencies to assess the impacts that their proposed actions may have on the environment. Based on information in the EA, BPA would determine whether the proposal significantly affects the quality of the human environment. If it does, an Environmental Impact Statement is required. If it is determined that the proposal would not have significant impacts, a Finding of No Significant Impact (FONSI) would be prepared, or a Categorical Conclusion (CX) (10 C.F.R. Part 1021) could be applied to this action.

States of Oregon and Washington Bird Collection Permits

Scientific take permits have been requested from the Oregon Department of Fish and Wildlife and the Washington Department of Fish and Wildlife. Collection activities will not occur until all permits are in place.

Threatened and Endangered Species and Critical Habitat

The Endangered Species Act of 1973, as amended, requires that Federal agencies ensure that their actions do not jeopardize Threatened or Endangered species and their critical habitats. The U.S. Army Corps of Engineers has consulted with the USFWS on the actions proposed in this EA as part of their consultation for the overall bird management program. USFWS concurred in the Corps finding of “not likely to adversely affect.” Consultation with USFWS for 2001 activities is being prepared. All conditions set forth will be complied with. See Chapter 3. Appendix E shows listed species in the project area.

Fish and Wildlife Conservation

Provisions of the Pacific Northwest Electric Power Planning and Conservation Act (16 U.S.C. 839b et seq.) are intended to address system-wide fish and wildlife losses. This project is proposed to fulfill these obligations, as part of the Columbia River Basin Fish and Wildlife Program.

4.2 REQUIREMENTS NOT APPLICABLE

Safe Drinking Water Act

The proposed action would not affect a sole-source aquifer. No new injection wells would be required and no pollutants are expected to reach drinking water supplies.

Resource Conservation and Recovery Act

No hazardous materials would be used, discarded or produced by this project. Solid wastes would be disposed of at a landfill approved by the state of Washington.

Farmland Protection Policy Act

The project would not affect any prime, unique or other important farmland as defined in the Farmland Protection Policy Act (U.S.C. 4201 et seq.).

Noise Control Act

The proposed project would violate any local, state, or federal noise regulations.

Recreation Resources

The proposed project would not affect Wild and Scenic Rivers, National Trails, Wilderness Areas, National Parks, or other specially designated recreational areas.

Heritage Conservation

Federal historic and cultural preservation acts include the National Historic Preservation Act (16 USC 470-470w-6), the Archeological Resources Protection Act (16 YSC 470aa-470ll), the Archeological and Historic Preservation Act (16 USE 469-469c), the American Antiquities Act (16 USC 431-433), and the American Indian Religious Freedom Act (42 USC 1996). No activities proposed in this EA would adversely affect resources protected under these acts.

The Executive Order on Environmental Justice

The project would not adversely affect minority or disadvantaged groups. No adverse effects on any human groups or individuals are expected. This project would have a positive impact for minority/disadvantaged tribal populations.

Wetlands and Floodplains Protection

Wetlands and floodplains would not be affected by this project.

Permits for Discharges into Waters of the United States

Nothing will be discharged into waters of the United States.

5.0 CONSULTING AGENCIES AND INDIVIDUALS

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6.0 GLOSSARY

Endangered: Under the Endangered Species Act, those species officially designated by the National Marine Fisheries Service or U.S. Fish and Wildlife Service as in danger of extinction through all or a significant portion of their range. Endangered species are protected by law. See also *Threatened.*

Endangered Species Act (ESA): The Endangered Species Act of 1873, as amended, requires that Federal agencies ensure that their actions do not jeopardize Threatened or Endangered species.

Evolutionarily Significant Unit (ESU): A population that is reproductively isolated from other conspecific population units, and which represents an important component in the evolutionary legacy of the species. Used here to refer to a genetically distinctive group of Pacific salmon, steelhead, or sea-run cutthroat trout.

Interagency Caspian Tern Working Group (Working Group): This group was formed in May 1998 to develop a short-term plan for reducing salmon predation by Caspian terns nesting at Rice Island to be implemented before the 1999 juvenile salmonid out-migration. A system-wide, long-term plan to reduce predation by piscivorous (fish-eating) birds (terns, cormorants and gulls) on juvenile salmonids was another objective of this group. The Working Group is an inter-agency group consisting of participants from the U.S. Army Corps of Engineers, the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, Bonneville Power Administration, Oregon Department of Fish and Wildlife, Oregon Division of State Lands, Washington Department of Fish and Wildlife, Idaho Department of Fish and Game, the Columbia River Inter-Tribal Fish Commission (CRITFC), and research staff from CRITFC, Oregon State University and Real Time Research.

Managed populations: Breeding colonies of fish-eating waterbirds that are currently the target of management actions designed to reduce consumption of ESA-listed juvenile salmonids. Managed populations are currently restricted to colonies of Caspian terns in the Columbia River estuary.

Pacific Northwest Power Planning and Conservation Act: The Pacific Northwest Power Planning and Conservation Act of 1980 (16 U.S.C. 839 et. Seq.), which authorized the creation of the Northwest Power Planning Council and directed it to develop this program to protect, mitigate and enhance fish and wildlife, including related spawning grounds and habitat on the Columbia River and its tributaries.

Radio telemetry: The use of small, light-weight, battery-powered radio transmitters to track the movements, habitat use, and behavior of free-ranging wildlife. Special programmable receivers are used to detect the signals emitted by the transmitters and directional antennae allow the researcher to hone in on the source of the signal. Receivers can be portable and used in mobile tracking efforts (i.e., from aircraft or automobile), or fixed and connected to an automated data collection computer (DCC).

Smolt: The life-history stage of a salmonid that describes a fish that is migrating to, or about to enter the ocean.

Threatened: Under the Endangered Species Act, those species officially designated by the U.S. Fish and Wildlife Service as likely to become endangered within the foreseeable future through all or a significant portion of their range. Threatened species are protected by law. See *Endangered.*

Unmanaged Populations: Breeding colonies of fish-eating waterbirds that are not currently the target of management actions designed to reduce consumption of ESA-listed juvenile salmonids. Unmanaged populations include double-crested cormorants nesting on East Sand Island in the Columbia River estuary; glaucous-winged/western gulls nesting on East Sand Island, Rice Island, and Miller Sands Spit in the Columbia River estuary; Caspian terns nesting on Three Mile Canyon Island and Crescent Island in the John Day and McNary pools, respectively; and California and ring-billed gulls nesting on islands in the Columbia River above Bonneville Dam.

7.0 REFERENCES

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APPENDIX A. PAST ACCOMPLISHMENTS

Project information can be obtained at www.columbiabirdresearch.org

Year	Accomplishment
1996	Identify the locations and population size of major piscivorous waterbird colonies on the lower Columbia River.
1996	Recover PIT tags from the Rice Island Caspian tern colony in the Columbia River estuary.
1997	Determine the population size and trajectory of nine major piscivorous waterbird colonies on the lower Columbia River.
1997	Determine the diet composition of nine major piscivorous water bird colonies on the lower Columbia River.
1997	Recover PIT tags from the Rice Island Caspian tern colony in the Columbia River estuary.
1997	Use a bioenergetics approach to estimate the total number of juvenile salmonids consumed by the Rice Island Caspian tern colony.
1998	Verify and replicate estimates of predation on juvenile salmonids by Caspian terns nesting on Rice Island.
1998	Use a bioenergetics approach to estimate the total number of juvenile salmonids consumed by double-crested cormorants nesting in the Columbia River estuary.
1998	Collect information on the distribution, foraging range, and habitat utilization of Caspian terns in the Columbia River estuary.
1998	Monitor selected upriver piscivorous waterbird colonies to determine changes in population size and diet composition.
1998	Test the feasibility of social attraction methods to relocate the Caspian tern colony to a new nesting location as a means to reduce their impact on survival of juvenile salmonids.
1998	Recover PIT tags at the Rice Island tern and cormorant colonies and the Crescent Island Caspian tern colony.
1999	Test the feasibility of methods to deter tern nesting on Rice Island.
1999	Implement methods to encourage nesting (i.e., habitat modifications and social attraction) by Caspian terns at East Sand Island.
1999	Test hypothesis that terns can be relocated from an established colony site to a newly restored colony site using these methods (see above).
1999	Test hypothesis that terns nesting closer to marine habitats (i.e., East Sand Island) would consume fewer juvenile salmonids than terns nesting further upriver (i.e., Rice Island).
1999	Test hypothesis that you can control where terns forage by controlling where they nest.
1999	Test hypothesis that tern productivity would be similar or better at the newly restored colony site on East Sand Island as compared to the established colony site on Rice Island.
1999	Verify estimates of predation on juvenile salmonids by double-crested cormorants nesting in the Columbia River estuary.

1999	Monitor selected upriver piscivorous water bird colonies to determine changes in population size and diet composition.
2000	Monitor and evaluate the effects of management activities described in the 2000 Caspian Tern Management Plan.
2000	Establish and maintain a web site (www.columbiabirdresearch.org) that provides project information.
2000	Verify estimates of predation on juvenile salmonids by double-crested cormorants nesting in the Columbia River Estuary.
2000	Monitor selected upriver piscivorous waterbird colonies to determine changes in population size and diet composition.
2000	Recover PIT tags from the Caspian tern colony in Potholes Reservoir.
2000	Manuscript accepted for publication (October 2000) in Transactions of the American Fisheries Society entitled, "Colonial Waterbird Predation on PIT-Tagged Juvenile Salmonids in the Columbia River estuary: Vulnerability of Different Salmonid Species, Stocks, and Rearing Types."

APPENDIX B. LETHAL SAMPLING OF TERNS AND CORMORANTS FOR THE PURPOSE OF COLLECTING DIET INFORMATION IN THE COLUMBIA RIVER ESTUARY

Columbia River Avian Predation Study, 2001

Caspian terns

Proposed in 2001: We propose to collect up to 10 adult Caspian terns each week as they transport fish in their bills back to the colony on East Sand Island. This activity will be accomplished during a 16-week period from April through July, encompassing the entire Caspian tern nesting season on East Sand Island. We know from previous study that diet composition changes week to week during the nesting season, sometimes dramatically. Ten samples per week for the entire 16-week nesting season is considered a minimum sample size for accurately describing tern diet composition. Adult terns carrying fish would be shot with 12-gauge shotguns at a location removed (more than 1/4 mile) from the colony. Terns at the colony have exhibited no detectable reaction to our collection activities in the past. The bill-load fish would be collected, identified to species, and analyzed in the lab to determine proximate composition and energy content. The stomach contents of collected terns would be analyzed to determine taxonomic composition of the diet. All of these data would be used as input to the bioenergetics model for estimating the number of various salmonid species consumed by the East Sand Island Caspian tern colony throughout the 2001 nesting season.

Justification: We collect terns to obtain diet information from two sources: the fish being transported in the adult's bill ("bill loads") and contents of the stomach. Diet data from bill loads are used to (1) identify fish prey to species, particularly for the salmonid portion of the diet, (2) determine average size (mass) of each prey type (salmonid and non-salmonid), and (3) measure energy density for each prey type. All of these types of data are very important input for the bioenergetics model, which is used to estimate the number of fish prey consumed of each prey type during each breeding season. Analysis of stomach contents provides additional data on adult diet composition and a means to verify that adult diets have the same composition as the prey transported back to the colony as bill loads. In 2000, we sampled tern diets near both colonies because we have learned from earlier research that diets differ considerably between terns nesting at Rice Island and those nesting at East Sand Island. In 2001, we have proposed to collect adult terns only at the East Sand Island colony where we expect most of the estuary tern population will nest. We propose to collect data on tern diets throughout the 16-week nesting season because we have learned that there are major shifts in diet composition as the breeding season progresses.

Determination of the species breakdown of the salmonid portion of tern diets is not possible using recoveries of PIT tags because (1) many salmonid stocks are not PIT-tagged, (2) the data on availability of salmonid smolts that are not PIT-tagged are very poor, if they exist at all, (3) the PIT tag data collected so far indicate that Caspian terns do not prey on juvenile salmonids in proportion to their availability, and (4) PIT tags are recovered on the tern colonies after the terns have left at the end of the breeding season, and so only record the cumulative consumption

of PIT-tagged smolts throughout the breeding season. Also, we know nothing about the gut passage rates and recovery rates of PIT tags consumed by terns, how many are deposited on the colony vs. elsewhere, and how many are lost from the colony site due to wind and water erosion. PIT tags are very useful for evaluating the relative vulnerability of particular groups of PIT-tagged salmonids, but extrapolating that to all smolts migrating down the river is problematic, because the entire population is poorly described.

Determination of the species breakdown of the salmonid portion of tern diets is not possible from visual observation of fish in the terns' bills because of the similarities in appearance among the five salmonid species available in the Columbia River estuary (chinook, coho, sockeye, chum, and steelhead). Visual observation is very useful for obtaining frequency of prey types in the diet down to the taxonomic level of family, but these data are not sufficient as input for bioenergetics models--we need the breakdown by species. Also, to calculate the number of each salmonid species consumed, we need data on the average mass and energy content of each prey species. This has changed significantly in each year we have collected data and has had a major impact on the final estimate of number of juvenile salmonids consumed each year. For example, if terns take a higher proportion of large steelhead smolts, then they do not require as many fish overall compared to years when they take fewer steelhead and must meet their energy requirements by taking many more smaller chinook salmon smolts.

The proposed number of Caspian terns collected in 2001 represents 0.83% of the breeding population in 2000. The 2001 breeding population of Caspian terns in the Columbia River estuary is expected to be at least 10% larger than in 2000, suggesting that even if all 160 adult terns were collected, it would represent a small fraction of the population increment.

Double-crested cormorants

Proposed in 2001: We propose to collect up to 12 adult double-crested cormorants each week for 10 weeks as they transport fish in their stomach and esophagus back to the colony on East Sand Island. This activity would be accomplished from early April to late June, encompassing the pre-nesting and incubation stages of the nesting season. During the nestling-rearing stage, diet samples would be collected non-destructively by obtaining regurgitations from nestlings on the East Sand Island colony. Adult cormorants will be shot with 12-gauge shotguns at a location removed from the colony. Cormorants at the colony have exhibited no detectable reaction to our collection activities in the past. The stomach contents of collected cormorants would be analyzed to determine taxonomic composition of the diet. When whole or nearly whole fish are recovered in the stomach contents, they would be collected, identified to species, and analyzed in the lab to determine proximate composition and energy content. All of these data would be used as input to the bioenergetics model for estimating the number of juvenile salmonids consumed by the East Sand Island cormorant colony throughout the 2001 nesting season.

We propose to measure the field metabolic rates of double-crested cormorants during the chick-rearing period using the doubly labeled water technique. Measurements of energy expenditure rates in free-ranging, nesting adults are a crucial input for the bioenergetics model to estimate total food consumption by the cormorant population. (Energy expenditure rates of free-ranging

Caspian terns were previously measured.) The doubly labeled water experiments would be conducted during the period of June 20 – July 10.

We would attempt to capture up to 30 adult cormorants on their nests in order to inject them with doubly labeled water. So as to minimize disturbance to the cormorant colony, we would capture adults at night (22:00 – 04:00) using nooses or landing nets. After a one-hour equilibration period, we would collect a small blood sample from each injected adult and release it back to the colony. During the following two nights we would attempt to recapture all injected adults in order to collect final blood samples. After collection of the final blood sample, injected cormorants will be released unharmed. If recapture of injected adults using nooses and landing nets at nests proves not to be feasible, then no more than 20 injected adults would be collected using either high-powered pellet guns or .22 rifles equipped with suppressors in order to obtain final blood samples. Lethal collections would only be used as a last resort.

Daily energy expenditure (DEE) of nesting cormorants is likely to differ between the sexes because of gender differences in body size and reproductive behavior. Fifteen measurements of DEE for each sex would be minimal sample size for this experiment.)

Justification: Because cormorants transport food back to the nest in their stomachs, diet information on cormorants cannot be obtained through observation. During the non-chick rearing period, the only feasible way to assess cormorant diet is to collect stomach contents from adults by shooting them with a 12-gauge shotgun as they are en route to the colony after foraging. During the chick-rearing stage, diet samples can be collected non-destructively by obtaining regurgitations from nestlings on the colony. Although PIT tags have been recovered on the East Sand Island cormorant colony, these data cannot be used as a substitute for the collections of adult stomach contents and chick regurgitations for the reasons discussed in the section about Caspian terns, above.

The West Coast population of double-crested cormorants has been increasing over the last 25 years, and is currently estimated at over 44,000 individuals. Therefore the East Sand Island cormorant colony supports about 30% of the regional breeding population of the species. If all 140 cormorants were collected for food habits studies (120) and daily energy expenditure measurements (20), it would amount to 1.1% of the total breeding population on East Sand Island. Thus this activity is not expected to affect the overall population of cormorants.

APPENDIX C. MONITORING POTENTIAL DISTURBANCE OF BROWN PELICANS

The goal of the monitoring plan is to determine if research activities in the double-crested cormorant colony on East Sand Island are having an adverse effect on brown pelicans that roost on the island (i.e., causing a significant change in behavior, numbers, or distribution of pelicans in response to disturbance).

Monitoring Objectives

1. Measure the behavioral reactions of brown pelicans to researcher activities on the East Sand Island cormorant colony.
2. Monitor the effects of researcher activities on the numbers and distribution of brown pelicans roosting on East Sand Island.
3. Evaluate other extrinsic factors as they influence the numbers and distribution of brown pelicans roosting on East Sand Island, including:
   - date
   - time of day
   - tide stage
   - weather conditions
4. Assess the effects of other sources of disturbance, both anthropogenic and natural, on the behavior, numbers, and distribution of brown pelicans roosting on East Sand Island.

Objective 1

Using the observation tower and night vision enhancement optics, the behavioral reactions of brown pelicans would be monitored during all night-time entries by researchers into the cormorant colony. Behavioral reactions of individual pelicans to researcher activities would be scored for intensity (0 = no visible response, 1 = attentive response, 2 = alert response, 3 = alarm response, 4 = flight response). Data on the distance of individual pelicans from the researchers, the nature of researcher activities, and the type of potentially disturbing stimuli produced by researcher activities would also be collected. If pelicans flush in response to researcher activities, attempts would be made to determine numbers of pelicans flushed and outcomes (i.e., re-land immediately, relocate within the roost, or depart the roost altogether). If any day-time entry to the cormorant colony as part of doubly labeled water experiments becomes necessary, the type and intensity of behavioral reactions by brown pelicans to these disturbance events would be monitored as well.

Objective 2

The primary method of assessing the effects of cormorant researcher activities on numbers and distribution of roosting pelicans would be from boat-based surveys. Pelican research personnel would conduct boat-based counts of all brown pelicans roosting on East Sand Island and adjacent waters late the evening before and early the morning after each night-time entry to the cormorant colony by cormorant research personnel. Evening counts would be conducted between 19:00

and 21:00, and morning counts would be conducted between 05:00 and 07:00 the following morning. Evening and morning counts would be recorded for each sector of the East Sand Island coastline, which would be clearly delimited on a map of the island. Evening and morning counts would provide an overnight trend in number of brown pelicans for each coastline sector for each night when on-colony cormorant work is planned.

Pelican research personnel would also conduct evening and morning boat-based counts to determine overnight trends in brown pelican numbers for nights when no research activity on the cormorant colony is planned. These counts would be used to obtain overnight trends for each coastline sector of the island as a "control" for overnight trends on nights when on-colony cormorant work is conducted. At least one "control" overnight count would be conducted within a few days of each night when on-colony cormorant work is conducted (paired sample design). For example, if there are four nights of on-colony cormorant work planned, there would be evening and morning counts to establish overnight trends for those four nights, and there would be evening and morning counts to establish overnight trends on at least four other nights. Differences between dawn and dusk counts on control nights versus nights of scheduled colony entries would be compared to determine whether pelicans appear to be departing the roost during the night in response to researcher activities. Dawn counts are expected to be generally similar or higher compared to dusk counts (Jaques and Anderson 1988, Jaques and Strong 1996). Differences in distribution of roosting pelicans between control nights and entry nights would also be examined. In addition to counts of roosting pelicans per sector, we would record the substrate type used for roosting (e.g., rock jetty, drift wood, sand beach, pile dike, bare ground, standing in water, floating in water). Weather conditions and tide stage during each evening and morning count would be noted.

After late evening boat-based counts, observers would attempt to monitor numbers of pelicans arriving and departing the roost against the remaining light of the sky from the vantage of the observation tower. This technique would be repeated in reverse the following morning, with numbers of pelicans departing the roost monitored in the very early morning hours prior to a complete census of pelicans on the island from the boat. Similar methods have been employed to evaluate night roosting and to address question of disturbance effects at other roost sites on the Pacific Coast (Jaques and Anderson 1987, Jaques and Anderson 1988, Jaques et al. 1994, Jaques and Strong 1996, Jaques 1998).

In addition to boat-based surveys, counts of pelicans at low tide from the observation tower in the cormorant colony a minimum of four days per week would be conducted. Counts of roosting pelicans from the observation tower are incomplete, because some primary pelican roosting areas on East Sand Island are not visible from the tower. Thus it is only possible to obtain a complete census of pelicans roosting on the island using boat surveys. Nevertheless, the area of the cormorant colony that is subject to researcher activities is visible from the observation tower, so counts of pelicans visible from the tower should reflect any progressive avoidance by pelicans of portions of the cormorant colony that are subject to researcher entry.

Boat-based counts would also be compared to counts from any available high resolution aerial photos as a method of validating boat-based counts. Bi-weekly summary reports of numbers and distribution of brown pelicans roosting on East Sand Island (simple spreadsheet format) would

be provided to the U.S. Fish and Wildlife Service. Dates and locations of up-coming cormorant night-time colony work would be included in the reports. U.S. Fish and Wildlife Service biologists would be welcome to participate in monitoring as their schedules permit.

Objective 3

Date, time of day, tide stage, and weather conditions (i.e., temperature, wind speed, wind direction, cloud cover, precipitation) would be recorded during all boat-based pelican surveys. Using multivariate statistical approaches, data would be analyzed on numbers and distribution of roosting pelicans to determine how pelican roosting behavior is influenced by these extrinsic factors. These same extrinsic variables would be recorded during counts of pelicans from the observation tower, and the same analytical approach would be used to assess the effects of various environmental factors on numbers and distribution of roosting pelicans, regardless of potential disturbance from researchers. Understanding the effects of other extrinsic factors provides a baseline for evaluating the effects of potential researcher disturbance.

Objective 4

Data on time-activity budgets of brown pelicans roosting on or near East Sand Island would be collected throughout the study period (June – September) in order to assess the effects of the following factors on pelican behavior: date, time of day, tide stage, weather conditions, natural disturbances (e.g., bald eagles, gulls, cormorants, mammalian predators), and anthropogenic disturbances (e.g., watercraft, aircraft, fishermen, beach combers). These data would help determine the relative impact of various types of disturbance on pelican behavior at East Sand Island. Such comparative data would also help place effects of cormorant researcher activities in the larger context of natural and anthropogenic disturbance of brown pelicans at night roosts (Brown 1990). These data would be a valuable contribution to the development of science-based management guidelines for brown pelican night roosts, both at East Sand Island and other roost sites along the Pacific Coast of the U.S.

All Objectives

Periodic consultation with the USFWS will be conducted throughout the course of this study to determine if impacts to brown pelicans are significant enough to necessitate a change in protocol. In addition, as funding allows, video cameras with low-light sensitivity will be employed to provide an objective record of disturbance events at the brown pelican roost site. All records will be made available to USFWS staff for their review. As deemed necessary, changes will be made in the study protocol to reduce impacts to brown pelicans.

APPENDIX D. DRAFT REQUEST FOR 2001 SCIENTIFIC COLLECTING PERMIT

Columbia River Avian Predation Project

01-05-01

Number	Species/Common Name	Specific Location (County)	Method
160	Caspian tern	Columbia River estuary-East Sand Island-Clatsop County, OR	firearms[1]
20	Caspian tern (chicks)	Columbia River estuary East Sand Island-Clatsop County, OR	hand collect[2]
50	Glaucous-winged/western gull hybrid	Columbia River estuary-barge in lower estuary near East Sand Island-Clatsop County, OR	firearms[3]
50	Glaucous-winged/western gull hybrid	Columbia River estuary-East Sand Island-Clatsop County, OR	firearms[3]
120	Double-crested cormorant	Columbia River estuary-East Sand Island-Clatsop County, OR	firearms[4]
20	Double-crested cormorant	Columbia River estuary-East Sand Island-Clatsop County, OR	firearms[5]
100	Double-crested cormorant (chick regurgitations)	Columbia River estuary-East Sand Island-Clatsop County, OR	hand collect regurgitations[6]
10	Common raven	Columbia River estuary-East Sand Island and barge in lower estuary-Clatsop County, OR	firearms[3]
20	American crow	Columbia River estuary-East Sand Island and barge in lower estuary-Clatsop County, OR	firearms[3]
5	Great horned owl	Columbia River Estuary-East Sand Island and barge in lower estuary-Clatsop County, OR	firearms[3]

Additional Notes:
[1]To be collected for stomach contents/bill load identification.
[2]To be collected for captive rearing to study chick bioenergetics, feeding rates, and behavior.
[3]Potentially collected for predator control to facilitate tern colony restoration.
[4]To be collected for diet analysis of stomach contents.
[5]To be trapped using spot lights/dip nets, released after doubly-labeled water injections, and potentially collected for final analysis.
[6]To collect chick regurgitations for diet analysis as an alternative to lethal diet sampling of adults.

APPENDIX E. LIST OF THREATENED AND ENDANGERED SPECIES

FEDERALLY LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES, CANDIDATE SPECIES AND SPECIES OF CONCERN THAT MAY OCCUR IN THE PROJECT AREA IN THE COLUMBIA RIVER ESTUARY AND ALONG THE WASHINGTON COAST.

LISTED SPECIES

Mammals		
Columbian white-tailed deer	*Odocoileus virginianus leucurus*	E
Marine:		
Right whale	*Balaena glacialis*	**E
Sei whale	*Balaenoptera borealis*	**E
Blue whale	*Balaenoptera musculus*	**E
Finback whale	*Balaenoptera physalus*	**E
Steller (=northern) sea lion	*Eumetopias jubatus*	**T
Humpback whale	*Megaptera navaeangliae*	**E
Sperm whale	*Physeter macrocephalus*	**E
Birds		
Marbled murrelet	*Brachyramphus marmoratus*…….CH T	
Aleutian Canada goose	*Branta canadensis leucopareia*……T	
Western snowy plover	*Charadrius alexandrinus nivosus*……..PCH T	
Bald eagle	*Haliaeetus leucocephalus*……..T	
Brown pelican	*Pelecanus occidentalis*…….. E	
Short-tailed Albatross	*Phoebastria albatrus*	E
Northern spotted owl	*Strix occidentalis caurina*…….. CH T	
Reptiles and Amphibians		
Marine:		
Loggerhead sea turtle	*Caretta caretta*	**T
Green sea turtle	*Chelonia myda*	**T
Leatherback sea turtle	*Dermochelys coriacea*	CH **E
Olive (=Pacific) ridley sea turtle	*Lepidochelys olivacea*	**T
Fish		
Chum salmon (Lower Columbia River)	*Oncorhynchus keta*	** T
Coho salmon (Oregon Coast)	*Oncorhynchus kisutch*	** T
Steelhead (Upper Willamette River/ Lower & Middle Columbia Rivers)	*Oncorhynchus mykiss*	** T
Steelhead (Snake River Basin)	*Oncorhynchus mykiss*	** T
Sockeye salmon (Snake River)	*Oncorhynchus nerka*	CH ** E
Chinook salmon (Lower Columbia River)	*Oncorhynchus tshawytscha*	** T
Snake River Chinook salmon (Spring/Summer/Fall Runs)	*Oncorhynchus tshawytscha*	CH ** T
Chinook salmon (Upper Willamette River)	*Oncorhynchus tshawytscha*	**T
Invertebrates		
Oregon silverspot butterfly	*Speyeria zerene hippolyta*	CH T

Plants		
Howellia	*Howellia aquatilis*	T
Bradshaw's lomatium	*Lomatium bradshawii*	E
Nelson's checker-mallow	*Sidalcea nelsoniana*	T

PROPOSED SPECIES

Fish		
Coastal cutthroat trout (SW Washington/Lower Columbia R.)	*Oncorhynchus clarki clarki*	PT

CANDIDATE SPECIES

Fish		
Coho salmon (Lower Columbia River)	*Oncorhynchus kisutch*	** CF
Steelhead (Oregon Coast)	*Oncorhynchus mykiss*	** CF

SPECIES OF CONCERN

Mammals	
White-footed vole	*Arborimus albipes*
Pacific western big-eared bat	*Corynorhinus (=Plecotus) townsendii townsendii*
Long-eared myotis (bat)	*Myotis evotis*
Fringed myotis (bat)	*Myotis thysanodes*
Long-legged myotis (bat)	*Myotis volans*
Yuma myotis (bat)	*Myotis yumanensis*
Birds	
Olive-sided flycatcher	*Contopus cooperi (=borealis)*
Little willow flycatcher	*Empidonax traillii brewsteri*
Amphibians and Reptiles	
Tailed frog	*Ascaphus truei*
Northern red-legged frog	*Rana aurora aurora*
Fish	
Green sturgeon	*Acipenser medirostris*
River lamprey	*Lampetra ayresi*
Pacific lamprey	*Lampetra tridentata*
Invertebrates	
Clatsop philocascan caddisfly	*Philocasca oron*
Plants	
Pink sand verbena	*Abronia umbellata* ssp. *breviflora*
Saddle Mountain bittercress	*Cardamine pattersonii*
Tall bugbane	*Cimicifuga elata*
Frigid shootingstar	*Dodecatheon austrofrigidum*
Queen-of-the-forest	*Filipendula occidentalis*
Saddle Mountain saxifrage	*Saxifraga hitchcockiana*
Bradshaw's lomatium	*Lomatium bradshawii* E
Nelson's checker-mallow	*Sidalcea nelsoniana* T

FEDERALLY LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES, CANDIDATE SPECIES AND SPECIES OF CONCERN THAT MAY OCCUR IN THE PROJECT AREA ABOVE JOHN DAY DAM

LISTED SPECIES

Mammals

Canada lynx	*Lynx canadensis*	T

Birds

Bald eagle	*Haliaeetus leucocephalus*	T

Fish

Columbia River chum salmon	*Oncorhynchus keta*	**T
Steelhead (Snake River Basin)	*Oncorhynchus mykiss*	**T
Steelhead (Middle Columbia River)	*Oncorhynchus mykiss*	**T
Snake River Sockeye salmon	*Oncorhynchus nerka*	CH **E
Salmon River tributary to the Snake River, Idaho.		
Snake River Chinook salmon	*Oncorhynchus tshawytscha*	CH **T
Spring/Summer/Fall runs in the Snake River		
Sockeye salmon	*Oncorhynchus nerka*	CH **E
Salmon River tributary to the Snake River, Idaho.		
Chinook salmon	*Oncorhynchus tshawytscha*	CH **T
Snake River spring/summer/fall runs		
Bull trout (Columbia River pop.)	*Salvelinus confluentus*	T

PROPOSED SPECIES

None

CANDIDATE SPECIES

Amphibians and Reptiles

Columbia spotted frog	*Rana luteiventris*

Mammals

Washington ground squirrel	*Spermophilus washingtoni*

SPECIES OF CONCERN

Mammals

Pale western big-eared bat	*Corynorhinus (=Plecotus) townsendii pallescens*
Pacific western big-eared bat	*Corynorhinus (=Plecotus) townsendii townsendii*
Small-footed myotis (bat)	*Myotis ciliolabrum*
Long-eared myotis (bat)	*Myotis evotis*
Long-legged myotis (bat)	*Myotis volans*
Yuma myotis (bat)	*Myotis yumanensis*
California wolverine	*Gulo gulo luteus*
Pacific fisher	*Martes pennanti pacifica*

Birds	
Northern goshawk	*Accipiter gentilis*
Western burrowing owl	*Athene cunicularia hypugea*
Ferruginous hawk	*Buteo regalis*
Olive-sided flycatcher	*Contopus cooperi (=borealis*)
Tricolored blackbird	*Agelaius tricolor*
Ferruginous hawk	*Buteo regalis*
Olive-sided flycatcher	*Contopus cooperi (=borealis)*
Amphibians and Reptiles	
Northern sagebrush lizard	*Sceloporus graciosus graciosus*
Fish	
Margined sculpin	*Cottus marginatus*
Pacific lamprey	*Lampetra tridentata*
Interior redband trout	*Oncorhynchus mykiss gibbsi*
Plants	
Northern wormwood	*Artemisia campestris* var. *womskioldii*
Laurence's milk-vetch	*Astragalus collinus* var. *laurentii*
Hepatic monkeyflower	*Mimulus jungermannioides*
Little mousetail	*Myosurus minimus* ssp. apus (= var. *sessiliflorus*)
Long-bearded mariposa-lily	*Calochortus longebarbatus longebarbatus*
Hepatic monkeyflower	*Mimulus jungermannioides*
Columbia yellow-cress	*Rorippa columbiae*
Spalding's campion	*Silene spaldingii*

(E) - Listed Endangered
(T) - Listed Threatened
(CH) - Critical Habitat has been designated for this species
(PE) - Proposed Endangered
(PT) - Proposed Threatened
(PCH) - Critical Habitat has been proposed for this species

Species of Concern - Taxa whose conservation status is of concern to the Service (many previously known as Category 2 candidates), but for which further information is still needed.

(CF) - Candidate: National Marine Fisheries Service designation for any species being considered by the Secretary for listing for endangered or threatened species, but not yet the subject of a proposed rule.

*** Consultation with National Marine Fisheries Service required.*

APPENDIX F. COMMENTS RECEIVED ON THE PRELIMINARY EA AND RESPONSES

Seven people commented on the Preliminary EA:

1. Deborah Jacques, U.S. Fish and Wildlife Service, Willapa Bay NWR
2. Dave Pitkin, U.S. Fish and Wildlife Service, Oregon Coast NWR Complex
3. Tara Zimmerman, U.S. Fish and Wildlife Service, Regional Nongame Program Coordinator
4. Carol Perugini, Shoshone-Paiute Tribe, Duck Valley Indian Reservation
5. Alan C. Clark, U.S. Fish and Wildlife Service
6. Jason Gibbsons, U.S. Department of Agriculture, Wildlife Services
7. Ed Melikian

Their comments are incorporated into this appendix and responses provided. Changes that were made to the EA in response to the comments are indicated in the responses. We have organized the comments and responses according to the sections of the EA.

BPA appreciates the efforts of those who took the time to review the document and submit comments.

2.1 Background

Comments

Effects on ESA species/return rates? Research has failed to show effect on returning fish or significant predation on ESA listed species, e.g. 2001 spring chinook run (1998 smolts) = strongest run in years. – Deborah Jacques

What is deemed *significant* effect on juvenile salmon smolts and how was this determined? How does that relate to % returning? – Deborah Jacques

What is desired level to reduce predation by Caspian terns and other birds? If no set point, then process can be indefinite. – Deborah Jacques

Why isn't Caspian tern relocation considered complete? Birds are clearly established, predation on salmon has been reduced. – Deborah Jacques

Response

The work covered under this Environmental Assessment includes research activities only. BPA's underlying need for action is to ensure that regional fish and wildlife managers have adequate information to assess the impacts of managed and unmanaged bird populations (i.e., terns, cormorants, and gulls) on the survival of juvenile salmonids from the Columbia River Basin, particularly ESA-listed stocks, to help determine effective management initiatives that will reduce predation impacts determined to be significant. BPA is not involved in the actual

management of the birds. Issues concerning specific management actions should be directed to the Interagency Caspian Tern Working Group (Working Group), made up of regional fish and wildlife managers, including the U.S. Fish and Wildlife Service. The United States Army Corps of Engineers has recently completed an Environmental Assessment and Finding of No Significant Impact on the proposed management actions for the next two years, entitled "Caspian Tern Relocation FY2001-2002 Management Plan and Pike Dike Modification to Discourage Cormorant Use, Lower Columbia River, Oregon." The EA has been revised to clarify this.

Comment

What happened to the double-crested cormorant colony at Rice Island? Should be stated that abandonment of that site was either intentional management (control) or inadvertent due to research, tern management. – Deborah Jacques

Response

To date there has been no direct management of the double-crested cormorant colony on Rice Island (i.e., no fencing, no grass planting, no hazing, etc.). It is possible that the abandonment by double-crested cormorants was an incidental impact of Caspian tern management activities on Rice Island. However, it should be noted that during the two years that *only* research activities took place on Rice Island (prior to the time management actions were implemented), the double-crested cormorant colony continued to nest there despite the ongoing research efforts.

2.2 Proposed Action- Avian Predation Research

Comment

Reasons for continuing work- stated that competition between terns and cormorants expected to intensify, diet composition of cormorants may shift. Diet may shift with many conditions. Fish stocks are variable. Does not justify ongoing research. – Deborah Jacques

Response

Your comment has been noted. The Working Group has recommended that this research continue.

Comment

Misleading and inaccurate use of term "Managed" vs. "Unmanaged". All migratory birds are managed by the USFWS as well as by state natural resource agencies. The use of the term "unmanaged" in this document refers to birds that are legally protected and monitored (which is part of management), but are not being controlled or limited (which is another form of management). The term "managed" in this document should be changed to "controlled" or "manipulated." The term "unmanaged" should be omitted. – Deborah Jacques

Response

Your comment has been noted. These terms have been defined in the glossary and used consistently throughout the document for the clarity of this EA.

Section 2.2.2

Comment

In determining species of bill-load fish, how and/or to what extent will lethal sampling of up to 160 adult Caspian terns be superior to non-lethal, remote observations of bill loads as adults return to the colony to feed chicks? During lethal sampling, bill loads may sometimes be unrecoverable after adults have been shot from the air, thus potentially wasting target data. Further, information on energy content of all common prey species potentially carried by Caspian terns as bill loads are readily obtainable by non-lethal means. Taxonomic composition of the adult tern diet is likewise obtainable through non-lethal means. – Dave Pitkin

Response

Determination of the species breakdown of the salmonid portion of Caspian tern diets is not possible from visual observation of fish in the terns' bills because of the similarities in appearance among the five salmonid species available in the Columbia River estuary (chinook, coho, sockeye, chum, and steelhead). Visual observation is very useful for obtaining frequency of prey types in the diet down to the taxonomic level of family, but these data are not sufficient as input for the bioenergetics model which will be used as part of this study. To calculate the number of each salmonid species consumed, data on the average mass and energy content of each prey species consumed is also needed. This has changed significantly in each collection year and has had a major impact on the final estimate of number of juvenile salmonids consumed each year. In addition, it has been the researchers' experience that bill loads are almost always recoverable after adult Caspian terns have been shot from the air (Roby and Collis, March 22, 2001). Additional information on the lethal sampling of Caspian terns can be found in the new Appendix B added to the final EA.

Comments

Collect alive up to 20 tern chicks for captive rearing experiments: How and/or to what extent does the "calibration" of undefined "fledgling health indices" contribute to project objectives? Although not directly stated in the EA, data obtained from captive rearing experiments designed to ascertain "maximum chick growth rates" and "normal growth rates" can be and likely will be used to develop an estimate of caloric requirements of chicks from hatching to fledging, which in turn could be extrapolated to illustrate total fish consumption by Caspian tern chicks in the lower Columbia River and estuary. A more accurate and scientifically-defensible measure of fish consumption by Caspian tern chicks could be obtained by recording all bill load deliveries at twenty randomly-selected nests within the Caspian tern colony. It is also very unlikely that many (or any) of the twenty captive-reared chicks could be placed with licensed educational

facilities. If this is truly an objective, then arrangements should be made well in advance, not upon completion of the experiment. – Dave Pitkin

The purpose of the proposal to collect and captive rear 20 tern chicks is unclear. The relevance of this activity and the need to calibrate fledgling health indices for purpose of reducing smolt predation in the estuary should be clarified. – Tara Zimmerman

Does the contracting organization have expertise in raising tern chicks? Captive rearing birds is labor intensive, expensive and often unsuccessful. Precocial and semi-precocial species can be particularly challenging to raise. – Carol Perugini

What is the projected length of the acclimation period? Nestlings/fledglings experience rapid growth during the first few weeks of life; any captivity-related delays may be confounding. – Carol Perugini

Since tern chicks are fed by the adults and energy requirements appear to be known ("slightly restricted diets to support normal growth rates…") then it would appear that adults, not chicks, regulate chick growth rates. The collection of adult terns for diet analysis may be more informative than a chick diet study. – Carol Perugini

How does the data gleaned from this captive breeding experiment translate into calibrating fledgling health indices given the limitations associated with laboratory experiments? – Carol Perugini

To compare nesting/non-nesting tern food intake the study should consider collecting terns prior to the onset of nesting (not post nesting as adult Caspian terns feed juveniles 5-7 month postfledging). – Carol Perugini

Response

The research group has been using a state-of-the-art bioenergetics modeling approach to estimate consumption of juvenile salmonids by Caspian terns and other colonial piscivorous birds nesting in the lower Columbia River. The output of the model has been the cornerstone of decisions by the Working Group about which bird populations to manage and how to manage them. The bioenergetics model requires a number of input variables in order to generate reliable estimates of Caspian tern predation on juvenile salmonids. Key input variables are the energy requirements of young terns during the growth and development period and the age-specific food requirements of young terns from hatching to fledging (leaving the natal colony). These inputs to the bioenergetics model, together with measures of numbers of tern chicks on the colony and the composition of their diets, allow the model to produce reliable estimates of numbers of fish consumed by the young terns raised during any particular breeding season. In some years, large numbers of fledgling terns may be produced on particular colonies; for example, in 2000 the East Sand Island tern colony produced over 5,500 tern fledglings. There are no published measurements or estimates of the food or energy requirements of young Caspian terns, nor are we aware of any unpublished studies or reports on the subject. Currently, the bioenergetics model for estimating fish consumption by the entire tern population has relied on estimates of

food requirements by tern chicks derived from allometric equations that have not been verified or validated for Caspian terns or closely-related species of similar size. Consequently, the estimates of food consumption by tern chicks from the current model may be biased by a factor of two or three, and thus lead to significant errors in the estimates of salmonid smolt consumption by young terns.

On an annual basis the research team has banded young Caspian terns just prior to fledging at several breeding colonies in the lower Columbia River. These banding efforts have been designed to produce a marked sample of terns in each cohort of young fledged. The recoveries of these banded fledglings are a key component of demographic models that are designed to understand the factors that limit size and growth of the Pacific Coast population of Caspian terns. In the process of banding the sample of fledglings, each fledgling has been weighed and measured to assess the average condition of fledglings at each colony in each year. Condition measures are useful in assessing (1) annual variation in food availability near the colony, (2) the effect of colony size, nesting density, and location on the productivity of Caspian tern breeding colonies, and (3) the impact of kleptoparasitism by gulls on the ability of adult terns to provision their young with food. These data can be used to judge and compare the suitability of particular colony sites for supporting tern reproduction. Previously collected data on the weight and condition of fledglings indicate that there are substantial differences among colonies and years. It is difficult to interpret this inter-annual and inter-colony variability without information on (1) maximum growth rates of Caspian tern chicks when food is provided in excess of what chicks will consume, and (2) food consumption rates sufficient to support normal growth rates relative to maximum food consumption rates. These data will allow us to understand the observed condition measures in the context of potential peak growth rates.

The data and information on food requirements of young Caspian terns described above can only be obtained by raising chicks in captivity where food intake, energy intake, and growth rates of young terns can be measured on a daily basis. Collecting these types of data on tern chicks that are provisioned by their parents in the colony is not feasible because of the sensitivity of the colony to human intrusion and the unacceptably high rates of nest failure associated with repeated entries to the tern colony to weigh chicks. Also, while the number of food items delivered to a chick by its parents can be determined by direct observation, the mass and energy content of those food items can not. Measuring caloric intake requires raising chicks in captivity.

The three primary objectives of this study are:

1. Determine the total amount of food energy required by Caspian tern chicks to support normal growth and development throughout the pre-fledging period.
2. Determine age-specific food energy requirements of Caspian tern chicks in order to support normal growth and development throughout the pre-fledging period.
3. Determine maximum growth rates and energy intake rates of Caspian tern chicks when provided with ad libidum food throughout the pre-fledging period.

A total of 20 Caspian tern hatchlings (1-4 days post-hatch) will be collected from the East Sand Island colony on one day in late May or early June. Limiting the collection to one foray on to the colony will minimize any impact on the colony due to human disturbance. One hatchling will be removed from each of 20 nests that contain two or three hatchlings. This procedure will

minimize the impact of hatchling removal on the ultimate production of fledglings at the East Sand Island colony, as very few tern nesting pairs succeed in raising more than one chick per nesting attempt. Hatchlings will be transported to the field station in Gearhart, Oregon and kept warm with heat lamps until capable of independent thermo-regulation. Chicks will be kept indoors in individual containers (5-gallon buckets) to insure no competition for food. When captive-reared chicks reach 45 days of age (normal fledging age), they will either be donated to educational facilities such as the Oregon Coast Aquarium (the Curator of Birds at the Aquarium has said he is interested in acquiring 6-10 of the fledglings that we raise) or sacrificed for determination of body composition using proximate analysis techniques. Captive-reared terns will not be released into the wild because of concerns for potential disease transmission. Also, Caspian tern fledglings receive considerable post-fledging care from their parents (Cuthbert and Wires 1999); thus the survival chances of a fledgling tern unaccompanied by its parents is essentially nil.

The 20 collected hatchlings would be randomly assigned to one of two diet treatments: (1) restricted diet designed to support normal growth rates of chicks in the wild, and (2) ad libidum food in order to support maximum growth rates. Each chick will be kept in a separate cage so that food consumption can be monitored individually. The cages will consist of 5-gallon plastic buckets, equipped with a raised floor of hardware cloth so that excreta drain into the bottom of the bucket. All buckets will be cleaned and sterilized daily. The daily rations or ad lib food will be provided in four daily feedings at about 08:00, 12:00, 16:00, and 20:00 PDT. Prior to each feeding, the amount of fish fed to each chick will be weighed so that total mass of food consumed per day will be known for each captive-reared chick. The diet for both diet groups will consist of frozen bait herring. Juvenile herring are a natural and preferred prey of Caspian terns and readily available from local sources. The diet of thawed bait herring will be supplemented with a multiple vitamin (Seatabs) to preclude thiamin or vitamin E deficiencies that sometimes occur in captive animals fed frozen fish. Each day, prior to the first feeding, the body mass, wing length, culmen length, and outer primary length of each chick will be measured until each chick is 45 days post-hatch. When captive-reared chicks reach fledging age, they will either be transported to the Oregon Coast Aquarium or other similar educational facility that maintains seabirds in captivity or, if no home can be found for the fledglings, they will be humanely sacrificed, placed in plastic bags, and frozen for later body composition analysis in the lab at OSU. Analysis of body composition will reveal the amount of stored fat that the tern chicks on the two experimental diets were able to deposit.

The above procedures have been used successfully by the Principal Investigator and his graduate students to raise in captivity over 40 tufted puffins, over 50 black-legged kittiwakes, and over 140 pigeon guillemots for similar captive-feeding trials (Romano 2000, Hovey et al. 2000). These three seabird species adapted well to captivity and, if supplied with food ad libidum, grew at rates considerably greater than those observed in the wild. When young nestlings were collected (as opposed to eggs) for the above trials, nestling survival was very high, 100% in the case of kittiwakes and puffins. Other species of terns have been raised successfully in captivity, and we are not anticipating any particular difficulties in raising this species in captivity.

More detail on these experiments has been added to the EA.

Section 2.2.4

Comment

States that smolt consumption rates will be monitored if (1) has been determined that there is potential for these populations to significantly affect survival of juvenile salmonids? What is *significant*? When will this be determined and how? Does this refer to all salmonids or only wild ESA salmonids? Smolt consumption will also be monitored if (2) if there is insufficient data, what is considered *sufficient (sample size?)*. – Deborah Jacques

Response

Researchers will gather information as part of this study under the direction of the resource managers, specifically the Interagency Caspian Tern Working Group, which is made up of representatives from the U.S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Army Corps of Engineers, Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, Idaho Department of Fish and Game, Columbia River Inter-Tribal Fish Commission, and the Northwest Power Planning Council. There is consensus among members of the Caspian Tern Working Group on the importance of and need for the research activities outlined in this Environmental Assessment. We have clarified this in the EA.

Comment

How will productivity of gulls and cormorants be determined? What are results from past? – Deborah Jacques

Response

Productivity of the double-crested cormorants on East Sand Island will be monitored as part of this study. Results from past productivity research exist only for double-crested cormorants since glaucous-winged/western gulls have not been studied previously. Productivity of double-crested cormorants nesting on East Sand Island would be determined by monitoring clutch size, hatching success, and nestling survival in a representative sample of nests that are visible from observation blinds near the eastern part of the cormorant colony. These results are available in the annual research reports posted at the website: www.columbiabirdresearch.org. The EA has been revised to include a more detailed description of the productivity research.

Section 2.2.5

Comment

Up to 120 adult cormorants would be collected over a 10-week period. Researchers should calculate losses of potential productivity resulting from the killing of incubating adults as additive to the loss of adult birds collected. – Dave Pitkin

Response

Of the maximum of 120 adult cormorants that would be collected during the period April 7 – June 15, approximately 60 would be collected during the incubation period. In 2000, the median laying date for cormorants nesting on East Sand Island was May 27, so at least half of the collected adults would be collected prior to egg-laying. Average clutch size (number of eggs per nest) for double-crested cormorants nesting at East Sand Island in 2000 was 3.58 eggs (n = 40 nests). Consequently, approximately 215 cormorant eggs would fail to hatch as a result of the collection of adult cormorants during incubation. Egg hatching success on the East Sand Island colony was 37.4% in 2000 (n = 143 eggs), largely due to egg predation by gulls. Consequently, the collection of adult cormorants would result in approximately 81 fewer chicks hatching on the colony. Nestling survival to fledging age was 89.6% in 2000; consequently, the collection of 120 adult cormorants prior to the chick-rearing period would result in a reduction in fledgling production at the East Sand Island colony of approximately 73 young. Age at first reproduction in double-crested cormorants is usually 3 years (Hatch and Weseloh 1999). First year survival has been estimated at 0.48, second year survival at 0.74, and third year survival at 0.85 (van der Veen 1973). Consequently, a loss of 73 fledglings from the 2001 cohort would result in approximately 22 fewer adult recruits to the breeding population in 2004. This magnitude of reduction in adult recruitment is not detectable using current state-of-the-art population census techniques for the East Sand Island cormorant colony. A summary of this information has been added to section 3.2.5 of the EA.

Comment

It is stated that cormorant nestlings will be banded during collection of regurgitations. Will the nestlings be banded by USFWS personnel or by researchers associated with the BPA project? There is no guarantee that USFWS personnel will be banding cormorant nestlings on East Sand Island in 2001. – Dave Pitkin

Response

No banding of cormorant nestlings will take place as part of this study. All references to banding of double-crested cormorant nestlings have been removed from the Environmental Assessment.

Comments

Determining field metabolic rates for cormorants is problematic and will likely be inaccurate. I will discuss further in section 3.2.5. – Dave Pitkin

It is stated that up to 30 adult cormorants could be lethally collected "as a last resort" if non-lethal means prove "not to be feasible." Please define the criteria used to determine "feasibility," and when and if the determination of "last resort" is reached. – Dave Pitkin

The methods for completing doubly labeled water procedures on 30 adult cormorants is incomplete. Recapture procedures should be more completely presented. – Tara Zimmerman

Field metabolic rates: Bioenergetics approach was used in 1998, were field metabolic rates calculated then? This technique was used in 2000 at East Sand Island (Why can't those values be used in the model?). Field metabolic rates are going to be biased upwards due to chronic disturbance at the colony. Birds may spend more time away from colony after being caught. Birds not recaptured on first night will be chased, or exposed to gunshots twice, making those caught on second night especially inflated. What was behavior of such birds last year? Did they return to nests and attend normally? Should be done at a colony that is not subject to constant stress (Desdemona Sands or other). What happens if some of the 30 birds injected with doubly labeled water are never relocated? Will additional birds be captured to bring the sample size back up to 30? –Deborah Jacques

Response

A maximum of 30 adult double-crested cormorants that are raising broods at the East Sand Island colony would be captured and injected with doubly labeled water in order to measure their daily energy expenditure. Energy expenditure rates are a crucial input variable for the bioenergetics model to estimate salmonid smolt consumption by the cormorant population in the Columbia River estuary. Daily energy expenditure of double-crested cormorants has not been previously measured, either by the OSU/CRITFC/RTR research team or by any other group. Previous attempts to estimate fish consumption rates of double-crested cormorants have relied on allometric equations relating metabolic rate to body size, and these prediction equations are subject to considerable error. The doubly labeled water technique is the only validated and widely used method for measuring daily energy expenditure in free-ranging birds, and is considered by avian physiological ecologists to be accurate and unbiased when practiced by experienced researchers (Lifson and McClintock 1966, Nagy 1980, Bryant and Westerterp 1983, Bryant and Tatner 1991, Deerenberg et al. 1995, Speakman 1997). The method has been used extensively for measuring field metabolic rates of a wide variety of colonial seabirds, particularly during the chick-rearing period (Adams et al. 1986, Gabrielsen et 1987, Gabrielsen et al. 1992, Thompson et al. 1998, Golet et al. 2000). The Principal Investigator on the research team has had extensive experience over the last 20 years using the doubly labeled water technique to measure daily energy expenditure in seven different species of seabirds (Roby and Ricklefs 1986; Ricklefs et al. 1986, Taylor et al. 1997, Collis et al. 1999; Jodice et al., in press).

An attempt will be made to recapture all adult cormorants injected with doubly labeled water within 50 hours of injection. Recaptured cormorants will have a small sample of blood collected and then they will be released again unharmed. We will attempt to recapture by non-lethal means a minimum of 20 injected cormorants, and if accomplished, none of the injected cormorants will be lethally collected. If attempts to recapture injected cormorants by non-lethal means are unsuccessful, then injected cormorants will be recaptured lethally. No more than 20 injected cormorants will be recaptured lethally. Average brood size in 2000 was 1.9 chicks per active nest. Thus if 20 adult cormorants injected with doubly labeled water were lethally collected, and the collected bird's mate was not able to successfully raise any members of the brood, then approximately 38 nestlings would fail to survive to fledging. This reduction in fledging success would result in approximately 12 fewer adult recruits to the cormorant population in 2004. This magnitude of reduction in adult recruitment is not detectable using

current state-of-the-art population census techniques for the East Sand Island cormorant colony. This information has been summarized in the EA.

Comment

The collection period coincides with the arrival of endangered brown pelicans. Could this cause pelicans to abandon or fail to roost on East Sand Island? – Carol Perugini

Response

Collection of cormorant chick regurgitations would take place at night during 6 different forays into the cormorant colony to collect 12-15 regurgitations. This number of samples can be collected in less than 15 minutes, thereby limiting the disturbance to both roosting pelicans and nesting cormorants. Collection of cormorant nestling regurgitations would occur in the eastern part of the cormorant colony, where roosting pelicans are generally not prevalent. On nights when more than 50 pelicans are roosting within 200 meters of the area where cormorant regurgitation collection is planned, activities can either be postponed or shifted to another area of the cormorant colony where roosting pelicans are not present. This information has been added to the EA.

Comment

Since cormorant chicks are fed by the adults, can't chick diet be inferred from adult diet analysis? – Carol Perugini

Response

Yes, chick diet can be inferred from adult diet analysis, but adult diet analysis requires that adult cormorants be lethally collected for stomach contents analysis. The research team seeks to avoid lethal collection of adult cormorants by collecting regurgitations from nestlings, a non-lethal technique for determining diet composition. But nestling regurgitations can only be collected during the chick-rearing period; adults must be collected to obtain diet information during the pre-laying and incubation stages of the nesting cycle.

Comment

To determine field metabolic rate of nesting adults, could adults be taken from another site (one without brown pelicans?) What about conducting this experiment with Grays Harbor adult cormorants? – Carol Perugini

Response

Researchers have considered this option and concluded that the proposed measurements of daily energy expenditure in nesting double-crested cormorants can only be obtained at the East Sand Island cormorant colony. This is the only site where the researchers have been able to live-capture and recapture adult cormorants without causing significant nest failure. This is because

the tunnel and blind system at the East Sand Island cormorant colony allows access to cormorant nests without disturbance to adults on neighboring nests.

Comment

Accomplishments state that in 2000, estimates of predation by cormorants on juvenile salmonids were *verified*. Why verify again? – Deborah Jacques

Response

Researchers have agreed to continue to collect information on double-crested cormorants to determine if there is any year-to-year variation in predation and/or if there is any relationship between the cormorants' diet and management activities. This supplemental data will also be used in conjunction with other ongoing studies and management actions being implemented in the region this year, such as those being conducted by the National Marine Fisheries Service (fish sampling activities) and the United States Army Corps of Engineers (pile dike excluder construction).

Section 2.2.8

Comment

What if early monitoring suggests severe negative impacts to the roosting population of brown pelicans? No provision is made to stop/curtail East Sand Island activities should the monitoring activities, once begun, indicate detrimental effects to brown pelicans. – Carol Perugini

Response

Periodic consultation with the USFWS will be conducted throughout the course of this study to determine if impacts to brown pelicans are significant enough to necessitate a change in protocol. In addition, if funding allows, video cameras with low-light sensitivity will be employed to provide an objective record of disturbance events at the brown pelican roost site. All records will be made available to USFWS staff for their review. As deemed necessary, changes will be made in the study protocol to reduce impacts to brown pelicans. This information has been added to section 3.2.8 of the EA.

Comment

USFWS is stated to be concerned that pelicans will abandon East Sand Island as a roost site. This would be highly unlikely because pelicans have few or no alternate night roost sites in the Columbia River estuary. The level of disturbance that would result in complete abandonment would have to be monumental, however, it is possible that some individuals will elect to abandon or avoid the site. A more accurate statement is that there is concern that the roost site will be *degraded* by the activities of researchers and that "take" will occur. - Deborah Jacques

Response

The EA has been modified in response to your comment.

Comment

Pelicans are likely to be chronically disturbed by researcher activities on the island, causing energetic stress which can reduce fitness, survival, and use of preferred foraging and roosting habitat. Mortality of pelicans in their first year has been estimated at greater than 75%, the leading cause of death is starvation. Pelicans spend most of their daily time budget resting and maintaining their plumage at coastal roosts. Disturbance at roosts can drain energy reserves, and if the birds are unable to compensate by increased food intake, then body condition will decline with repeated exposure to stressors that result in frequent flapping flight, floating in cold water, being forced out of favored microclimates or being forced to commute to distant roosts away from preferred prey resources. - Deborah Jacques

Response

We agree that there is the potential for researcher activities on East Sand Island to disturb roosting brown pelicans. These potential disturbances include flushing small numbers of pelicans while (1) traveling on foot to or from the tunnel system that accesses the cormorant tower and observation blinds, (2) collecting regurgitations from cormorant nestlings on the cormorant colony at night, and (3) collecting adult cormorants as part of doubly labeled water experiments. Such disturbances can potentially result in short-term negative energy balance in brown pelicans, but is not expected to result in mortality of adults or juveniles. No carcasses of brown pelicans have been detected at the East Sand Island roost, and no weak or emaciated pelicans have been recovered. There is no scientific evidence that research activities on East Sand Island have or will result in a disturbance to brown pelicans to an extent sufficient to reduce individual fitness. That is why the researchers have proposed the monitoring activities outlined in Appendix C of the EA. As discussed above, researchers will also consult with USFWS periodically throughout the course of the study to determine whether the amount of disturbance warrants a change in the research protocol. This information has been added to Section 3.2.8 of the EA.

Section 2.2.9

Comments

Rice Island was once considered the largest Caspian tern colony in North America (Collis et al. 1999; Collis and Roby, unpub. data) and perhaps in the world (Cuthbert and Wires, in press). Over 94% of those terns are now nesting on East Sand Island, where nesting success was nearly four times higher that at the Rice Island colony (Bonneville Power Administration, Preliminary EA 2001). These claims seem to indicate the very firm establishment of the Caspian tern colony on East Sand Island, and no further gull control should be necessary to encourage the approximately 20,000 Caspian terns now nesting on East Sand Island. The need to remove

predatory birds is refuted by BPA and researcher data, and no predatory birds of any species should be collected. – Dave Pitkin

It is stated that *gull control is considered a critical component of any effort to restore or establish a tern colony*. While gull control has been used on the east coast in reestablishing tern colonies that are very small or endangered, that model no longer applies to the situation at East Sand Island. The tern colony is firmly established, in fact is possibly the "largest in the world," and has had a high rate of reproductive success. Gulls are natural predators on west coast seabird colonies and will not cause colony abandonment at a site like this, but will tend to prey on birds/nests at the periphery of the colony. – Deborah Jacques

It is totally illogical to artificially boost tern reproductive success at East Sand Island by removing native predators such as gulls when your goal is to limit numbers of terns and reduce consumption of fish in the estuary. The absurdity of this measure brings up questions as to the motives and credibility of the persons suggesting that this "management technique" be continued. – Deborah Jacques

Response

Researchers will *only* carry out the removal of predatory birds from East Sand Island if deemed necessary by the Interagency Caspian Tern Working Group. Researchers may be called upon to carry out this management activity since they will be out on the site and are familiar with the bird populations there. Employing researchers to remove predatory birds has been determined by resource managers to be the most logical and cost-effective way to conduct this work.

Table 1. Predicted Performance Summary

Comment

Under the Decision Factor "Avoids or minimizes adverse environmental impacts," it is stated that the Proposed Action will have "minimal impacts on birds. All impacts to birds being studied...would be minimized to the extent possible." This statement is false. I've illustrated above how much of the proposed lethal sampling is unnecessary, and how it could be avoided. A factual statement about quantitative impacts to birds is required here. – Dave Pitkin

Response

Researchers have chosen the methods that will result in the least impacts to birds while allowing them to collect the necessary data. It has been determined that lethal sampling is required to collect information essential for this study. Caspian terns will be collected to obtain diet information from two sources: the fish being transported in the adult's bill ("bill loads") and contents of the stomach. Determination of the species breakdown of the salmonid portion of tern diets is not possible from visual observation of fish in the terns' bills because of the similarities in appearance among the five salmonid species available in the Columbia River estuary (chinook, coho, sockeye, chum, and steelhead). Visual observation is very useful for obtaining frequency of prey types in the diet down to the taxonomic level of family, but these data are not

sufficient as input for bioenergetics models. Because double-crested cormorants transport food back to the nest in their stomachs, diet information on cormorants cannot be obtained through observation. During the non-chick rearing period, the only feasible way to assess cormorant diet is to collect stomach contents from adults by shooting them as they are en route to the colony after foraging. The EA has been modified to clarify the statement in question.

Comment

In Table 1, for the decision factor avoids or minimizes adverse environmental impacts, under the proposed action it states "minimal impacts on birds." I don't think that has been determined. Isn't that the purpose of monitoring disturbance to pelicans (Appendix C)? There may be considerable impacts to pelicans. Along the same line, in Section 3.2.8 it says that access to the cormorant colony will occur only at low tide along the water's edge to minimize disturbance to gulls, which may, by flushing, disturb pelicans. It has not been determined that this approach minimizes disturbance to pelicans. – Alan Clark

Response

The research protocol outlined in the Preliminary Environmental Assessment is the same as the one that was determined last year by the USFWS to be the least likely to disturb brown pelicans. Due to concerns expressed by some USFWS staff, the monitoring outlined in Appendix C was added to document the amount of disturbance actually taking place. In addition, as a result of comments on the Preliminary EA, periodic consultation with the USFWS will be conducted throughout the course of this study to determine if impacts to brown pelicans are significant enough to necessitate a change in protocol. Also, if funding allows, video cameras with low-light sensitivity will be employed to provide an objective record of disturbance events at the brown pelican roost site. All records will be made available to USFWS staff for their review. As deemed necessary, changes will be made in the study protocol to reduce impacts to brown pelicans. This information has been added to section 3.2.8.

Comment

It is stated that the action is predicted to have minimal impacts on birds and that the project is short-term and temporary. The project is entering it's fifth year, which by most standards is all ready considered longer than "short-term." What is the projected life of the project? – Deborah Jacques

Response

Work on this project will continue on as long as resource managers (Working Group) direct it to. We agree that the project is not short-term, and have modified the text to reflect this concern.

Comment

Under the Decision factor "Consistent with the legal rights of the Tribes in the region," it is stated that "if bird predation on fish can be decreased, (it) would contribute to restoration of tribal fishing rights." None of the actions proposed for 2001 will lead directly to decreased bird

predation on fish, because they are research actions, not management actions. The only management action, "Ensure tern colony restoration by removing predatory birds from East Sand Island..." is likely to increase rather than decrease bird predation on fish, and is unnecessary for reasons listed in section 2.2.9. – Dave Pitkin

Response

You are correct in stating that none of the research actions covered by this EA will directly decrease bird predation on fish. We have changed that statement in the EA. The management action that is addressed, removing predatory birds from East Sand Island, will only be done at the request of the resource managers in the Interagency Caspian Tern Working Group. The Columbia River Inter-Tribal Fish Commission represents some of the Tribes as a member of the Working Group and as cooperators in this research project.

Section 3.1

Comments

The paragraph beginning "California brown pelicans..." ends with the statement that California brown pelicans roost adjacent to cormorants on the western end of East Sand Island presumably because both species forage on fish (Ward and Zahavi 1973). No data are presented to indicate how foraging preferences may influence roost site selection for brown pelicans. Freedom from mammalian predators is a much more likely factor in brown pelican roost site selection, and would largely explain the low tolerance to human presence that brown pelicans roosting on East Sand Island exhibit. – Dave Pitkin

California Brown Pelican: It is stated that pelicans roost adjacent to the cormorant colony at the western end of ESI because both species feed on fish. This is an overly simplistic and misleading view of the factors that are involved in pelican roost site selection in the Columbia River and surrounding region. Interspecific social facilitation of food finding is probably a very minor factor affecting pelican roost site choice in the Columbia River. The leading factor is probably the fact that East Sand Island is the only true island that does not support mammalian predators in the lower estuary. The reason pelicans are largely restricted to the west end during the summer is probably because the disturbance by researchers precludes them from freely using other parts of the island. A survey in late August, 2000, after the researchers departed, showed more than 50% of all pelicans (>2,000 birds) roosting east of the cormorant observation blind. If the intention of the statement was to implicate pelicans as salmon-eaters, it should be noted that these birds rarely forage upstream from the Astoria bridge and are known to prey primarily on anchovy, sardine, mackerel, and smelt throughout their Pacific coast range. – Deborah Jacques

Response

The text has been modified to include this information as appropriate. However, we disagree with the statement that pelicans are restricted to the west end of East Sand Island during the summer because of disturbance by researchers. Small numbers of brown pelicans roost along the shoreline of East Sand Island at the east end, adjacent to the Caspian tern colony, when

researchers are active, and the numbers of pelicans roosting on the eastern half of the island may increase substantially when the wind is from the west. Brown pelicans, however, generally and consistently tend to roost on the shoreline adjacent to the cormorant nesting colony. The cormorants are in the middle of the nesting season when most pelicans arrive in the Columbia River estuary during June and July, after their own breeding season has been completed further south. Pelicans are taxonomically related to cormorants, and both species forage in flocks on fish. Interspecific social attraction seems a plausible explanation for the observed tendency of brown pelicans to roost adjacent to the cormorant colony. Once the cormorants leave the colony at the end of the breeding season in early August, this attraction for pelicans to roost on the shoreline near the cormorant colony likely declines.

Comment

In the paragraph beginning "Of 20 evolutionarily significant units...," no distinction is made between wild stocks and hatchery-raised stocks, although significant behavioral differences between the two stocks have been noted in the wild, and that these behavioral differences likely lead to differential susceptibility to avian predation. Differential susceptibility to avian predation is supported by data gathered by BPA-funded researchers. The distinction between wild and hatchery-raised fish is central to the question of avian predation on juvenile salmonids in the lower Columbia River, but is not mentioned in the Preliminary Environmental Assessment. – Dave Pitkin

Response

This issue is not covered in the research funded by BPA that is the subject of this Environmental Assessment. Findings from previous work by the researchers on this subject are summarized in the following article: Collis, K., D.D. Roby, D.P. Craig, B.A. Ryan, and R.D. Ledgerwood. In press. Colonial waterbird predation on PIT-tagged juvenile salmonids in the Columbia River estuary: Vulnerability of different salmonid species, stocks, and rearing types. Trans. Amer. Fisheries Soc. NMFS is also currently addressing this issue in their research.

Comment

The most direct way to preclude terns from nesting on Rice Island would be to render the habitat inappropriate. Why is there continual preparation of tern habitat on the site? Has abandonment as a disposal site and vegetation of Rice Island been considered? – Deborah Jacques

Caspian terns feed on surface schooling fish, such as anchovy and sardine, in natural systems. The predation rate on salmon smolts in the Columbia River is artificially high because smolts are trained in the hatcheries to feed at the surface and many are not healthy when released into the estuary due to passage through and over dams as well as artificial transport. Research money would be better spent developing different ways to rear smolts in hatcheries. – Deborah Jacques

Double-crested Cormorant: Part of the recent increase in numbers of birds at the East Sand Island colony occurred after birds from the colony at Rice Island relocated to East Sand Island.

The relocation followed heavy disturbance and habitat alteration at Rice Island. – Deborah Jacques

Glaucous-winged/western gulls: The recent increases in gulls at East Sand Island is concurrent with decreased populations in Willapa Bay. Lack of appropriate nest habitat due to island erosion is thought to be a leading cause for loss of gull populations and productivity in Willapa Bay. – Deborah Jacques

Response

Your comments have been noted. These are management issues, not research issues; we suggest you take them up with the Interagency Caspian Tern Working Group.

Comments

Grays Harbor: Note presence of California Brown Pelicans. – Deborah Jacques

Please clarify the occurrence of Brown Pelicans in Grays Harbor. – Tara Zimmerman

Response

This information has been included in the Environmental Assessment.

Section 3.2.2

Comments

A maximum of 160 Caspian terns are proposed for lethal collection in 2001. Resultant loss of chicks and/or potential productivity should be considered additive to the number of adults killed by researchers. Captive rearing of twenty Caspian tern hatchlings is unnecessary for reasons stated above. It is also stated that "about 40%" of hatched tern chicks fail to survive to fledging. Is this figure based on data obtained from work done by researchers on Rice Island? Fledging rates on Rice Island during BPA-funded research were extremely (abnormally) low early in the research project, but increased dramatically after researchers adopted low-impact methods that greatly reduced their levels of disturbance to the Caspian tern colony. – Dave Pitkin

Lethal collection of each adult collected during the nestling stage will probably lead to chick mortality, as the bird's mate is likely to abandon nesting effort. This loss should be factored into the assessment. – Deborah Jacques

Impacts on Cormorants through lethal sampling. Need to calculate loss of nests/productivity into the population effect. – Deborah Jacques

The analysis of the proposed collection of 160 Caspian Terns and 120 Double-Crested Cormorants is insufficient to determine the significance of this take on regional (Pacific Northwest) and local (Columbia River Estuary) populations. Currently this section only identifies the percent take of the current adult population. We recommend including an

assessment of the impact of the proposed take on local productivity and recruitment. This could include the estimated loss of annual productivity of the estuary tern population; the predicted impact of this loss to the expected recruitment of the year 2001 age cohort into the future breeding population; and the expected population growth rates (percent change) with and without the proposed take based on known estimates of average productivity and growth already provided in the document. It is unlikely that demographic data suitable for completing a detailed population model is available or even necessary for the proposed level of take; however, a discussion of the above factors (and perhaps others), would further elucidate the environmental consequences of the proposed collections. – Tara Zimmerman

Response

The proposed collection of up to 160 adult Caspian terns for diet studies would occur at the rate of 10 per week over the 16-week breeding season in 2001. The first three weeks of collection would be during the pre-laying period, so the collection of these 30 terns would not result in loss of eggs or chicks. The next five weeks of collection would occur during the incubation period, so the 50 adult terns collected during this period would result in a loss of eggs. Average clutch size in the Columbia River estuary is 2.0 eggs per nest. Consequently, approximately 100 eggs would be lost. Hatching success of eggs averaged about 75% at East Sand Island, so the loss of 100 eggs represents a loss of approximately 75 hatchlings. On East Sand Island in 2000, hatchling survival until fledging was about 41%; consequently, the loss of 100 eggs represents the loss of approximately 31 fledglings. Based on published estimates of juvenile survival in Caspian terns from the Pacific Coast population (Gill and Mewaldt 1983), the loss of 100 eggs in 2001 would result in a reduction in adult recruitment to the population in 2004 of approximately 18 birds. Collection of adult Caspian terns during the remaining 8 weeks of the breeding season would occur during the chick-rearing period. Loss of a parent early in the chick-rearing period when nestlings require constant brooding would result in loss of the entire brood. But Caspian tern chicks are highly precocial and capable of leaving the nest scrape and moving about the colony within a week of hatching. These older chicks require little brooding and could be raised by a single parent. Thus collections of adult terns later in chick rearing does not necessarily result in the death of their offspring. If we assume, however, for the purposes of estimating lost productivity, that all young of collected terns die, the collection of 80 adult terns during chick-rearing could result in the loss of as many as 100 chicks. A chick's chances of survival to fledging age increases with chick age, but survival of half grown chicks is about 75%. Consequently, the loss of 100 chicks represents a loss of about 75 fledglings. Based on the Gill and Mewaldt (1983) population model, 57% of these fledglings would survive to the beginning of their fourth year, the modal age of first reproduction. Therefore, approximately 43 fewer adults would recruit to the population in 2004. In conclusion, the total reduction in adult recruitment expected in 2004 as a consequence of the lost productivity due to collection of 160 adult terns in 2001 is 61 birds (18 + 43). This magnitude of reduction in adult recruitment is not detectable using current state-of-the-art population census techniques for the East Sand Island Caspian tern colony. This information has been added to the EA.

Section 3.2.5

Comment

It is proposed that up to 30 adult cormorants will be "non-lethally captured" and injected with doubly labeled water to determine their energy requirements. Capture is highly stressful to birds, and will cause an increased metabolic rate in the injected subjects. Furthermore, these same birds will be recaptured within 48 hours to obtain another blood sample, again causing increased stress leading to an elevated metabolic rate. This will almost undoubtedly skew the data obtained by researchers, resulting in a metabolic determination for cormorants that will be higher than normal. How will this problem be addressed by researchers. – Dave Pitkin

Response

The additional energy expenditure experienced by birds during capture is not detected by the doubly labeled water technique. Energy expenditure is measured after the initial blood sample is collected immediately before release, and before the final blood sample is collected immediately after recapture. Recapture does not involve severe disturbance to the bird for any extended period; recapture usually involves little disturbance prior to capture, and minimal struggling after capture and before the final blood sample is collected. Because the doubly labeled water method measures energy expenditure over a period of 24-48 hours, the short-term stress associated with release and recapture do not significantly elevate measurements of daily energy expenditure. Previous studies that have employed the doubly labeled water technique and simultaneous collection of time-activity budget data have confirmed that after release, injected birds generally return to their normal activities within a short period. In cases where normal behavior does not resume soon after release, energetically inexpensive behaviors like roosting, preening, or sleeping are the norm. Thus a systematic bias toward elevated measures of daily energy expenditure is not expected.

Comments

It is stated that banding of nestlings "...would be coordinated with USFWS staff from Lewis & Clark National Wildlife Refuge." There is no guarantee that USFWS staff will conduct banding efforts on East Sand Island in 2001. If USFWS staff fail to band cormorants on East Sand Island in 2001, how will researchers determine their forays into the cormorant colony? – Dave Pitkin

Section 3.2.5 contains the statement "Banding of nestlings would be done in conjunction with collection of chick regurgitations, and would be coordinated with USFWS staff ....." The banding is a separate study being conducted by USFWS staff (namely myself). It is true that, to minimize the number of visits to the colony, if banding occurs this year it will be done at the same time regurgitations are collected. However, banding would be done on only one or a maximum of two nights (not all six nights that regurgitations are collected), or possibly not at all if it is determined that it results in a major disturbance to brown pelicans. – Alan Clark

Response

No banding of cormorant nestlings will take place as part of this study. All references to the banding of double-crested cormorant nestlings have been removed from the Environmental Assessment.

Comments

I think the EA should be a little more up front concerning negative impacts to cormorants. The last sentence in Section 3.2.5 is "This research activity would disturb but not permanently harm young cormorants." Entering a nesting colony is a highly intrusive act. The adults leave the site immediately. Cormorants are somewhat asynchronous. Almost always, there are some late nests with newly hatched, naked young and/or incubating eggs. Very small young need to be brooded almost continually and are likely to die of hypothermia if the adults are frightened away. Incubating eggs may be broken by the departing adults or by larger chicks that are attempting to evade the researchers. – Alan Clark

Field Metabolic Rate: Collection of regurgitation samples from chicks is not necessarily non-destructive at this scale. Chicks can perish from hypothermia, separation from nest, fleeing into the water, or adults may abandon nests. – Deborah Jacques

Response

The researchers agree that entering the double-crested cormorant colony may disturb and even harm cormorant eggs and young cormorant chicks. These impacts can include egg chilling, potentially resulting in embryo death if the incubating parent does not resume brooding within a few hours; exposure of young nestlings not yet capable of thermo-regulation, potentially resulting in nestling death due to hypothermia if the attendant adult does not resume brooding within a few hours; and premature fledging by older cormorant nestlings, which can potentially result in death if the parents do not relocate and care for the fledgling after it leaves the nest. These impacts are not expected to be extensive or to have a significant impact on the productivity of the double-crested cormorant colony. The sentence from the EA quoted in the first comment has been changed and this information added.

Comment

This research is highly invasive and is likely to have major impacts on the pelican roost at East Sand Island and should be conducted elsewhere. Lethal sampling of cormorants is expected to disturb pelicans. There have been two studies documenting disturbance from pelicans by gunshots at other roost sites. No data has been provided on the reaction of pelicans to shooting at East Sand Island over the past several years. Night-time forays into the colony to capture and recapture doubly labeled water birds and collect chick regurgitations are expected to have the most severe effects. Our observations in 2000 demonstrated that during a night-time foray into the cormorant colony by researchers, thousands of pelicans were flushed from the island repeatedly, and were forced to float or stand in the river until dawn. Walking out to the observations tower is expected to cause disturbance and displacement of pelicans in some cases.

No data has been provided on the flushing distance of pelicans at ESI or the tidal height necessary to avoid daily disturbance. – Deborah Jacques

Response

Shooting of double-crested cormorants will take place offshore far removed from East Sand Island. Collecting of Caspian terns for diet studies occurs on East Sand Island, but at locations removed from shorelines where brown pelicans roost or cormorants nest. This activity has been ongoing since 1997. To date, there has been no observed flushing reaction by brown pelicans, cormorants, or terns on East Sand Island in response to lethal sampling activities near or on East Sand Island (Roby and Collis, March 22, 2001). If roosting pelicans are present near traditional shooting sites, collecting activities would be postponed until the pelicans move of their own volition. Detailed records would be kept by the researchers of the time, location, and numbers of pelicans flushed during any researcher activities that result in pelicans flushing from East Sand Island.

Night-time forays into the cormorant colony to collect nestling regurgitations would last less than 15 minutes. Regurgitation collection activities would occur on no more than 6 nights during the nestling-rearing period, and would be restricted to that part of the cormorant colony where pelicans rarely roost. If pelicans are present in the area where regurgitation collection is planned, the collection activities would either be shifted to another part of the cormorant colony where pelicans were not present or the activity postponed. The text has been modified to reflect these concerns.

Comment

East Sand Island has become more important to pelicans in the Pacific NW due to the loss of traditional roost habitat in Willapa Bay. A shift in numbers of pelicans to the Columbia River has taken place in association with island erosion at Willapa Bay. The cormorant research at East Sand Island has and will continue to interfere with USFWS efforts to monitor and evaluate use of pelican roost sites in the region as part of a ten-year federally mandated project. – Deborah Jacques

Response

Your comment is noted. This is a management issue, not a research issue; we suggest you take this up with the Interagency Caspian Tern Working Group.

Comment

Need to explain the decrease in number of cormorant nests at East Sand Island by about 1,000 from 1999-2000. That is a significant decline and suggests a disturbance effect. The effect on the colony as a whole should be evaluated, all disturbances of cormorants should be quantified. – Deborah Jacques

Response

Over the past few years, the double-crested cormorant colony on East Sand Island has shifted eastward *toward*, not away from, researcher activities. This suggests there may be a reason for the decline other than disturbance by researchers. The west end of the island, where cormorants previous nested, has been abandoned by nesting cormorants. Research has indicated a high incidence of bald eagle use on the west end of the island. One possible explanation for the abandonment of the west end of East Sand Island by the cormorant colony may be a bald eagle disturbance effect.

Section 3.2.6

Comments

Up to 50 adult cormorants would be netted for radio-tagging. It is stated that "Cormorants are captured and radio tags are attached the same way they are for terns...." Terns will be captured using cannon nets. Are cannon nets proposed for use on cormorants on East Sand Island? If so, this will cause tremendous disruption to Endangered California brown pelicans roosting adjacent to and within the cormorant colony. This must be stated clearly in the Preliminary Environmental Assessment. – Dave Pitkin

This activity is likely to add to the cumulative negative impacts on pelicans. How many additional night time entries into the cormorant colony are expected to net the 50 adult cormorants? – Deborah Jacques

Response

All cormorant caught on the East Sand Island colony for radio-tagging will be captured using large landing nets at night. Rocket-nets will only be used to capture Caspian terns, and only on Rice Island prior to the initiation of egg-laying. The netting of up to 50 double-crested cormorants for radio tagging will take place before brown pelicans arrive on East Sand Island, so no disturbance of roosting brown pelicans during this research activity is anticipated. It is expected that a maximum of 10 additional night time entries will be required to net the 50 adult cormorants. This activity will be accomplished by the beginning of June. The text has been modified to include this information.

Section 3.2.7

Comment

It seems likely that some cormorant chicks will jump or fall off of the channel markers into the water during this procedure. This should be mentioned as a possible negative impact. – Deborah Jacques

Response

The researcher's experience over the past 4 years indicates that young double-crested cormorant chicks do not abandon their nests during this procedure (Roby and Colllis, March 22, 2001). On one or two occasions some older chicks have fledged prematurely when disturbed by researchers. As a result, nests with older chicks close to fledging will be avoided as part of this activity. This information has been added to the EA.

Section 3.2.8

Comment

I suggest that it be made clear in the EA that each visit to the cormorant colony involves three potential disturbances to pelicans: (1) when researchers travel the north shore to enter the blinds, (2) when researchers leave the blinds and enter the colony, and (3) when researchers travel back to base along the north shore. Thus, pelicans may be disturbed more than once in a night. The EA does not make it clear how many total visits to the colony are likely to occur when pelicans are present. In Section 3.2.8 it says there were 15 visits in 2000 (not necessarily all when pelicans were present). Six, eight, or ten visits might result in significant impacts to pelicans. Shouldn't there be a fall-back plan if the pelican monitoring shows major disturbance during the first couple of visits? Perhaps curtail the number of visits? East Sand Island is the only pelican night roost for the Columbia Estuary and possibly much of Willapa Bay. I'm sure that none of us wants to take a chance that pelicans will abandon it due to repeated disturbance. – Alan Clark

Response

Travel on the north shore of East Sand Island will not result in any significant disturbance to brown pelicans, since brown pelicans usually do not roost on this shore. This route was approved by the USFWS as the one that would result in the least impacts to brown pelicans. If roosting brown pelicans are present on the north beach, and thus likely to be flushed by researchers accessing the tunnels and cormorant blinds, travel to the blinds will be postponed until the pelicans move on their own volition. Tunnels will be used to access the blinds so as to eliminate disturbance to brown pelicans and double-crested cormorants during this activity. Six night-time visits to the cormorant colony not lasting more than 15 minutes each would occur for the purpose of collecting cormorant chick regurgitations. These short forays would avoid areas where pelicans are roosting. Forays into the cormorant colony for the purpose of retrieving adult cormorants collected as part of the doubly labeled water experiments would last less than 5 minutes and occur on a maximum of 6 nights. These night-time forays into the cormorant colony would also occur in parts of the cormorant colony where pelicans have rarely been observed roosting. Periodic consultation with the USFWS will be conducted throughout the course of this study to determine if impacts to brown pelicans are significant enough to necessitate a change in protocol. In addition, as funding allows, video cameras with low-light sensitivity will be employed to provide an objective record of disturbance events at the brown pelican roost site. All records will be made available to USFWS staff for their review. As

deemed necessary, changes will be made in the study protocol to reduce impacts to brown pelicans. The EA has been modified to address these concerns.

Comments

There are many flaws in this study. The primary flaws are 1) that it is likely to result in additional disturbance to pelicans, and 2) there is no definition of what a *significant* change in behavior, numbers, or distribution will be, 3) the observations will be conducted by a new graduate student that has little prior experience with pelicans, 4) the work will be subject to bias due to the fact that the graduate advisor is a Principal Investigator in the avian predation work. – Deborah Jacques

This study would be better conducted by using remote surveillance video cameras positioned at several locations on the island to monitor pelican response to various research activities. I suggest that the recordings be analyzed by personnel not associated with the Avian Predation Research and made available to the FWS and other interested agencies for review. I suggest that it be required that FWS personnel are notified in advance of at least 5 scheduled events of each aspect of the cormorant research so that agency biologists have the opportunity to observe pelican response to such activities. – Deborah Jacques

The 2000 efforts by OSU to document pelican response to disturbance have not been provided for FWS review to date, but may be useless in addressing the pertinent questions. It was discovered about mid-season, that the graduate student in charge of counting the pelicans was severely underestimating the numbers due to lack of experience and poor study design. – Deborah Jacques

Cat Brown, U.S. Fish and Wildlife Service, Oregon State Office is coordinating ongoing efforts to identify measures necessary to protect and monitor Brown Pelicans on East Sand Island. – Tara Zimmerman

Response

The research protocol outlined in this Preliminary Environmental Assessment is the same as the one that was determined last year by the USFWS to be the least likely to disturb brown pelicans. Periodic consultation with the USFWS will be conducted throughout the course of this study to determine if impacts to brown pelicans are significant enough to necessitate a change in protocol. In addition, as funding allows, video cameras with low-light sensitivity will be employed to provide an objective record of disturbance events at the brown pelican roost site. All records will be made available to USFWS staff for their review. As deemed necessary, changes will be made in the study protocol to reduce impacts to brown pelicans. This information has been included in the EA.

Section 3.2.9

Comment

Removal of predatory birds is unnecessary for reasons stated above under Section 2.2.9. – Dave Pitkin

Response

Researchers will *only* carry out the removal of predatory birds from East Sand Island if deemed necessary by the Interagency Caspian Tern Working Group. Researchers may be called upon to carry out this management activity since they will be out on the site and are familiar with the bird populations there. Employing researchers to remove predatory birds has been determined by resource managers to be the most logical and cost-effective way to conduct this work.

Table 2. Summary of Affected Environment and Environmental Consequences

Comment

Under the Decision Factor "Socioeconomics," it is stated that the Proposed Action will result in "more fish in the Columbia River system." This statement is false. Proposed actions are research actions, not management actions, and will not directly influence the number of fish in the Columbia River system in 2001. – Dave Pitkin

Response

We agree. The text has been modified to reflect this concern.

Comment

Under the Decision Factor "ESA-listed brown pelicans," it is stated that "measures would be taken to avoid disturbing pelicans...," that "there would be no direct take of brown pelicans in the study," and that "the proposed actions are not likely to adversely affect brown pelicans." This is misleading and avoids the requirements of the summary as stated in the table heading. A summary must include known effects to pelicans (e.g., pelicans will be disturbed a minimum of x nights during research activities). – Dave Pitkin

Response

The Environmental Assessment does not need to reach conclusions about the severity of the impacts, just the extent of them. The severity of the impact will be discussed in the Finding of No Significant Impact.

Appendix B. Monitoring Potential Disturbance of Brown Pelicans

Comment

Video cameras with low-light sensitivity should be employed to provide an objective record of disturbance events at the brown pelican roost site. These cameras are now relatively inexpensive (>$700) and are extremely capable in very low light situations. They should be used to record disturbances occurring on nights when research is being conducted in the cormorant colony, and on nights when no research is occurring in the colony (paired sample design). Two cameras could easily be mounted on tripods and deployed from two windows in the observation tower, thus providing coverage of the cormorant colony and most of the roosting pelicans near the cormorant colony. During very large disturbance events, it will be difficult for a single human to adequately observe activities within the brown pelican roost area. An objective record of large disturbance events (as witnessed by USFWS biologists during the 2000 season) will be critical in evaluating "research effects on endangered brown pelicans" as stated in the Preliminary Environmental Assessment. – Dave Pitkin

Response

If funding allows, video cameras with low-light sensitivity will be employed to provide an objective record of disturbance events at the brown pelican roost site. These records will be made available to USFWS staff for their review. This has been added to the monitoring plan, which is Appendix C in the final EA.

Miscellaneous

Comments

Finally, I don't mean to be entirely negative. I have been impressed by the dedication and caring of Dan Roby, Ken Collis, Don Lyons and the other post-docs, students, and technicians working on the study. I know they are doing their absolute best to minimize impacts to the birds. I am concerned for the future of pelicans and cormorants on East Sand Is., as I know they are also. – Alan Clark

We have no issue with the EA, it looks really good and we understand it is basically to fund the research of Roby and Collis. – Jason Gibbsons, USDA Wildlife Services

Who cares about the fish? Who cares if birds eat the fish? Think about this. - Ed Melikian

Response

Your comments have been noted.

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