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Southwest Region
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September 22, 2003 F/SWR4:SAE

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To the Parties Addressed above:

This concerns the National Marine Fisheries Services' (NOAA Fisheries) comments on the Draft License Applicantion (DLA) submitted by PacifiCorps in support of its efforts to develop a Final License Application for the Klamath Hydroelectric Project (Project) (FERC No. 2082). These comments are provided pursuant to 18 CFR 4.38(c)(5); 18 CFR 16.8(c)(5). Attachment I. contains NOAA Fisheries comments on the DLA. Attachment II. contains NOAA Fisheries draft preliminary Section 18 prescription. Attachment III. contains NOAA Fisheries assessment of increased habitat resulting from various alternatives to improve fish Passage at the Project. It should be noted that NOAA Fisheries, in coordination with tribes and resource agencies, is continuing to evaluate fish passage at the Project and in so doing will be refining its section 18 prescription. As additional information becomes available, various fish passage alternatives and design considerations may be incorporated into a more detailed draft and final section 18 prescription.

We appreciate the opportunity to participate in PacifiCorp's (Applicant) "enhanced traditional" Licensing Process for the Klamath Project. We are, however, concerned with preliminary constraints placed on the level of analyses to be conducted as well as the current pace of relicensing. For certain resource areas the Applicant and its consultants are reluctant to finalize study plans. For other resource areas the Applicant is opting to conduct literature reviews in lieu of essential field work or to conduct coarse, screening analyses without allowing for the additional time necessary to conduct the more detailed field studies these cursory analyses are intended to identify. The NOAA Fisheries is seriously concerned with the current failure to develop a license application in a timely fashion. It is important to note that the Applicant has not advanced beyond first stage consultation.[1] Accordingly, it is now clear that the Applicant will not develop a complete administrative record upon which to base our prescriptions and recommendations within statutory filing deadlines.[2] Without the additional information that such studies would generate, NOAA Fisheries will apply the precautionary principle and recommend conservative measures in order to ensure adequate protections are prescribed as part of the licensing process.

Pre-Application Consultation

The Federal Power Act (FPA), Endangered Species Act (ESA), Magnuson-Stevens Fishery Conservation and Management Act, Fish and Wildlife Coordination Act, and National Environmental Policy Act require FERC to consult with resource agencies and the public when processing License Applications for hydroelectric projects. In order to meet these obligations FERC has developed regulations that require Applicants to consult with resource agencies and affected Indian tribes on project design, the impact of the proposed project, reasonable hydropower alternatives, and the studies needed to be done. The same consultation rules apply to existing Licensee's filing for relicense and potential applicants filing for an original License (underlined for emphasis).

The FERC has developed regulations governing pre-filing consultation in 18 CFR 4.38(b); 18 CFR 16.8(b). Under these regulations, prior to filing its Application, a potential Applicant must consult with resource agencies and Indian tribes on project design, the impact of the proposed project, reasonable hydropower alternatives, and the studies needed to be done. As stipulated in FERC's regulations, pre-filing consultation has three stages:

> "*(1) initial review of the project and any proposed modifications, and the determination of necessary studies; (2) completing the studies requested during the first stage, deciding on appropriate protection, mitigation, and enhancement measures, and preparing and reviewing a draft application; and (3) providing a final application that incorporates information generated during the first two stages of consultation*."

The License for the Klamath Project will expire on March 1, 2006. Pursuant to FERC's "traditional" licensing process the Applicant provided its First Stage Consultation Document (FSCD) on December 15, 2000. In NOAA Fisheries comments on the FSCD, we informed the Applicant that the FSCD was deficient (pursuant to 18CFR16.8) and provided our respective resource management goals and objectives as well as specific study recommendations. Also,

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[1] Hydroelectric Project Licensing Handbook Federal Energy Regulatory Commission, Washington, DC. April 2001. Section 2.2.1 Consultation
"*First stage consultation ends when a set of resource-by-resource study plans and detailed documentation of the agency consultation process have been completed*" 18 CFR 16.8(b)

[2] 18CFR16.8

since December 2000, the Applicant has conducted numerous and frequent meetings concerning study plan development. Further, NOAA Fisheries provided additional letters including a second and third round of detailed comments identifying deficiencies in the pre-filing consultation process and recommending studies.

By letter dated February 22, 2002, the Applicant agreed to work collaboratively with stakeholders to collect existing information and to conduct studies necessary to evaluate a full range of options for restoring fish passage at the Klamath Hydroelectric Project. Further, the Applicant agreed to expand this collaborative approach to all other resource areas and to convene a plenary group to develop a Process Protocol Document to guide the decision making process. NOAA Fisheries is participating in this "collaborative" process. However, the Process Protocol has not been adhered to in all cases. Consequently, many of our concerns have either not been addressed or have been deferred indefinitely. Accordingly, while NOAA Fisheries has identified significant project related resource impacts and identified specific studies and study methods to analyze these impacts, the Applicant has been reluctant to finalize study plans. Therefore, although most major issues and necessary studies have been identified for some time now, the First Stage Consultation Process is incomplete and the Applicant has yet to fully address comments filed to date.

Under FERC's regulations, Second Stage Consultation ends with the Applicant's submital of a DLA. After reviewing the DLA, NOAA Fisheries finds that the DLA lacks information necessary to comply with FERC's pre-Application filing regulations. Under 18 CFR 4.51 (f)(3), Report on Fish, Wildlife, and Botanical Resources, the Applicant is required to prepare a report discussing fish, wildlife, and botanical resources in the vicinity of the project and the impact of the project on those resources. With the failure to finalize major study plans and the absence of results from studies, the DLA does not contain a detailed or comprehensive discussion of natural resources or identification of impacts. Further, given the expiration date for the current License it is unlikely that the Final License Application will contain the required information.

Under 18 CFR 16.8, Identification of Protection Mitigation and Enhancement measures (PM&E) the Applicant is required to provide proposed PMEs. There are no PMEs under consideration by the Applicant in its DLA (Draft Executive Summary, Page 10-1). Given the current lack of study results, it is unlikely that the Final License Application will contain PME's adequate to address Project impacts or to meet FERC's requirements governing the contents of a Final License Application, as stipulated under 18 CFR 4.38 and 18 CFR 16.8, 18 CFR 4.41, or 4.61 and 18 CFR 16.10.

Summary and Conclusion

NOAA Fisheries has serious concerns regarding the current failure to develop a license application in a timely fashion. Although we repeatedly made clear our interests (listed potential impacts and recommended studies) in writing, during meetings, phone conversations, and e-mail messages our comments have not been addressed in study plans. Therefore, it is unlikely that all studies necessary for a full and adequate consideration of relevant resource issues as required by the FPA and other applicable laws can be conducted in time to meet the deadline for filing a

License Application. We are also concerned that delay in developing study plans not compromise the quality or availability of information necessary to form the basis for our prescriptions and recommendations or result in an inordinate delay in issuing a new license. A lengthy delay in issuing a new license may result in irreparable harm to sensitive resources through the ongoing impacts of current project facilities and operations. Or, in the absence of information, the Applicant may propose a new License based upon a generalized adaptive management scheme that defers mitigation to a later date and therefore, constitutes a defacto and indefinite extension of relicensing. Adaptive management should be used to refine specific measures contained in the new License for this Project. However, using an adaptive management scheme to defer information collection and basic licensing decisions until after the License is issued, is unacceptable.

Given the Applicants failure to complete first stage consultation and the significant impact of Project facilities and operations on ESA listed species, we respectfully request that FERC and the Applicant consult with the tribes and resource agencies on interim protective measures to serve as the basis for any annual licenses.[3] Because of the impending license expiration date, an aggressive schedule for meetings and study plan development is necessary to finalize study plans in time to allow for field sampling activities. This effort will require a proportional commitment from the Applicant. Thank you for your cooperation in the above. If you have questions concerning these comments, please contact Mr. Steve Edmondson at (707) 575-6080.

Sincerely,

Joseph R. Blum
Acting Northern California Supervisor
Habitat Conservation Division

Attachments

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[3] In Platte River Whooping Crane Critical Habitat Maintenance Trust v. FERC, 876 F.2d 109 (D.C.Cir. 1989) the Court determined that FERC was obligated to evaluate the need for wildlife protective conditions in the annual licenses issued to two hydroelectric projects on the Platte River.

Enclosure

ATTACHMENT I.

National Marine Fisheries Service's (NOAA Fisheries) comments on the Draft License Application (DLA) for the Klamath Hydroelectric Project, FERC No. 2082

September 23, 2003

BACKGROUND

The PacifiCorp's (Aplicant) License for the Klamath Project (Project) Federal Energy Regulatory Commission (FERC) #2082, consisting of six dams and two associated facilities will expire in 2006. The Project is located on the Klamath River, south-central Oregon, and Siskiyou County, north-central California. Project water is stored primarily in Upper Klamath Lake in the headwaters of the Klamath River Basin. Project facilities are located upstream of Iron Gate Dam (IGD), owned and operated by Applicant, which is currently a barrier to anadromous salmonid migrations in the mainstem Klamath River. The development of dams in this location of the Klamath River began with Klamathon Dam prior to 1900. Copco No. 1 dam was completed in 1918, and by 1921 Link River Dam was constructed to supply water for irrigated agriculture and wildlife refuges, and to supply power. The construction of Copco No. 2 dam was completed in 1925, supplying more hydroelectric power. Due to high fluctuations in flow releases from Copco, the U.S. Bureau of Fisheries recommended an "equalizing dam" be constructed below Copco No. 2 dam to stabilize flows. IGD construction was completed in 1962 and is located at approximately river mile 190. A minimum flow regime was prescribed in the current FERC license.

Habitat loss is a major factor contributing to the decline of salmon and steelhead populations in California (NMFS 1996, NMFS 1996a, Myers et al.1998). Activities contributing to the loss of salmonid habitat include forestry practices, agriculture, urbanization, water diversion, and the construction of on-stream projects such as electrical and gas transmission corridors and highway crossings. Hydropower development and related water management activities have drastically altered natural hydrologic conditions and aquatic habitat in the Klamath River, resulting in substantial reductions in salmonid abundance. Aside from simply blocking access to historic habitat, hydropower development has adversely affected fish populations in a variety of other ways: migration delay resulting from insufficient flows or habitat blockages; stranding of fish resulting from rapid flow fluctuations; significant habitat alteration which reduces the carrying capacity for salmonids and their forage species and increased mortality resulting from alterations in ambient water temperatures thus exacerbating water quality impacts (Palmisano 1993). In several listings of Pacific salmonids under the ESA, NOAA Fisheries has identified impacts associated with hydropower development as factors in the decline of these species (62 FR. 43,937, 43,942). Numerous studies acknowledge that flow releases from IGD affect the quantity and quality of aquatic habitat in the mainstem Klamath River in California. Investigations into an appropriate flow regime below IGD have resulted in several recommendations, and ongoing data collection and analysis efforts are expected to provide for refined recommendations in the future.

NOAA FISHERIES INTEREST IN THIS PROCEEDING

The NOAA Fisheries is responsible for protecting and managing a variety of marine animals, including Pacific salmon, groundfish, halibut, and marine mammals and their habitats under the

Endangered Species Act (ESA)(16 U.S.C. §§ 1531 *et seq.)*, Federal Power Act, the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (16 U.S.C. 1801 et seq.), and Reorganization Plan Number 4 of 1970, and other laws.

An important goal of NOAA Fisheries is to ensure that the processes of negotiation, and public and environmental review will result in decisions that provide for full and adequate protection, mitigation and enhancement of anadromous fish and other resources affected by the Project, in accordance with our statutory obligations under the FPA, the ESA, MSA and other relevant jurisdictional authorities.

Essential Fish Habitat

The 1996 amendments to the Magnuson-Stevens Fishery Conservation amd Management Act set forth a number of new mandates for NOAA Fisheries, regional fishery management councils, and other federal agencies to identify and protect important marine and anadromous fish habitat.[4] The Councils, with assistance from NOAA Fisheries, are required to delineate "essential fish habitat" (EFH) for all managed species. Federal action agencies which fund, permit, or carry out activities that may adversely impact EFH, are required to consult with NOAA Fisheries regarding the potential effects of their actions on EFH, and respond in writing to our recommendations. In addition, NOAA Fisheries is required to comment on any state agency activities which would impact EFH.

Endangered Species Act

The purpose of the ESA is conserve endangered and threatened species and the ecosystems upon which they depend. To this end, the ESA provides for prohibitions on the "take" of endangered and threatened species. Section 7 of the ESA establishes a policy that all Federal agencies will seek to conserve listed species by utilizing their authorities to carry out conservation programs for such species. Furthermore, Federal agencies must ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any listed species. When listed salmon or steelhead may be affected by a Federal action, the Federal agency must consult with NOAA Fisheries.

National Environmental Policy Act

The National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 et seq.) is the foundation of modern American environmental protection in the United States and its commonwealths, territories, and possessions. The implementing regulations for NEPA require that Federal action agencies must analyze the direct and indirect environmental effects and cumulative impacts of project alternatives and connected actions.

[4] Chinook salmon and coho salmon are managed under the Pacific Coast Salmon Fishery Management Plan.

Under § 102 (2) (c) of NEPA, a "detailed statement" of "alternatives to the proposed action" is central to the EIS and forms the basis for any subsequent Record of Decision. The EIS's analysis should be sufficiently detailed to reveal the agency's comparative evaluation of the environmental benefits, costs and risks of the proposed action and each reasonable alternative. NEPA's alternatives requirement is subject to a "rule of reason" and that necessarily governs which alternatives the agency must discuss, and the extent to which it must discuss them.[5] Given the national priority to conserve listed species established by the ESA, as indicated by the Supreme Court in *Tennessee Valley Authority v. Hill*, dam removal should be considered a reasonable alternative to be analyzed (437 U.S. 153).[6] Further, FERC has the authority (and statutory obligations under section 10(a)(1) of the FPA) to consider dam decommissioning.[7] [8]

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[5] In its document, "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations" the CEQ states: "The degree of analysis devoted to each alternative in the EIS is to be substantially similar to that devoted to the "proposed action." Section 1502.14 is titled "Alternatives including the proposed action" to reflect such comparable treatment. Section 1502.14(b) specifically requires "substantial treatment" in the EIS of each alternative including the proposed action. This regulation does not dictate an amount of information to be provided, but rather, prescribes a level of treatment, which may in turn require varying amounts of information, to enable a reviewer to evaluate and compare alternatives." Id.

[6] *See* S. Rep. No. 307, 93d Cong., 1st Sess. 3 (1973) (stating "[a]ll agencies, departments, and other instrumentalities of the Federal government are directed to cooperate in the implementation of the goals of this Act").

[7] See FERC Policy Statement on Decommissioning, RM-93-23-000. Further, many new licenses contain broad provisions authorizing FERC oversight, to the point of reserving authority

The NOAA Fisheries recommends that the Commission determine that the proposed major new License constitutes a major federal action affecting the quality of the human environment and prepare a draft and final Environmental Impact Statement (EIS) pursuant to the applicable requirements of the NEPA, 42, U.S.C. §§ 4321 et seq., and implementing regulations promulgated by the Council on Environmental Quality at 40 C.F.R. Part 1500. We recommend that the draft anf Final EIS include the range of alternative identified by agencies, tribes and non-governmental organizations (NGO) through this relicensing process and updated to reflect the full range of reasonable alternatives and issues identified, (1) by the Klamath River Basin Federal Working Group; (2) as an Offer of Settlement that may be subsequently filed in this proceeding based on the pending negotiations; and (3) in comments received in response to the Commission's REA Notice and any future Notice soliciting comments.

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to require project decommissioning in certain cases. *See, e.g.*, 66 F.E.R.C. ¶ 61,316 (March 18, 1994) (license order for Reusens Hydropower Project).

[8] In the Edwards Dam proceeding FERC found that fish protection devices at the project were economically infeasible and thus inconsistent with his obligation "to make licensing decisions that represent the best comprehensive use of the waterway". Accordingly, FERC ordered the project decommissioned and the structures removed. 65 F.E.R.C. at 64,083; see Federal Power Act § 10(a), 16 U.S.C. § 803(a) (1988).

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[11] See FERC Policy Statement on Decommissioning, RM-93-23-000. Further, many new licenses contain broad provisions authorizing FERC oversight, to the point of reserving authority to require project decommissioning in certain cases. *See, e.g.,* 66 F.E.R.C. ¶ 61,316 (March 18,

Federal Power Act (FPA)

Section 18 of the FPA

Section 18 of the FPA expressly grants to the Department of Commerce and the Department of the Interior (Departments) exclusive authority to prescribe fishways. Section 18 states that the Commission must require construction, maintenance, and operation by a licensee at its own expense of such fishways as may be prescribed by the Secretary of Commerce or the Secretary of the Interior. Fishways prescribed under Section 18 by the Departments are mandatory upon the Commission. Within the Department of the Interior, the authority to prescribe fishways is delegated from the Secretary of the Interior to the FWS Regional Directors. Within the Department of Commerce, the authority to prescribe fishways is delegated to the NOAA Fisheries Regional Administrators.

Section 10(j) of the FPA

Under Section 10(j) of the FPA, licenses for hydroelectric projects must include conditions to protect, mitigate damages to, and enhance fish and wildlife resources, including related spawning grounds and habitat. These conditions are to be based on recommendations received from federal and state fish and wildlife agencies. The Commission is required to include such recommendations unless it finds that they are inconsistent with Part I of the FPA or other applicable law, and that alternative conditions will adequately address fish and wildlife issues. Before rejecting an agency recommendation, the Commission and the agencies must attempt to resolve the inconsistency, giving due weight to the agencies' recommendations, expertise, and statutory authority. If the Commission does not adopt a 10(j) recommendation, in whole or in part, it must publish findings that adoption of the recommendation is inconsistent with the purposes and requirements of Part 1 of the FPA or other applicable provisions of law, and that conditions selected by the Commission adequately and equitably protect, mitigate damages to, and enhance fish and wildlife, including related spawning grounds and habitat.

Section 10(a)(1) of the FPA

Resources agencies may also recommend conditions under section 10(a)(1) of the FPA. However, the Commission may accept, modify, or reject those conditions under the

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1994) (license order for Reusens Hydropower Project).

[12] In the Edwards Dam proceeding FERC found that fish protection devices at the project were economically infeasible and thus inconsistent with his obligation "to make licensing decisions that represent the best comprehensive use of the waterway". Accordingly, FERC ordered the project decommissioned and the structures removed. 65 F.E.R.C. at 64,083; see Federal Power Act § 10(a), 16 U.S.C. § 803(a) (1988).

comprehensive development standard of Section 10(a)(1) without attempting to resolve inconsistencies or making the findings required by section 10(j).

Authority to Recommend Studies During Relicensing

The Code of Federal Regulations (CFR) at 18 CFR 16.8(b)(4) direct interested resource agencies to provide a potential applicant with written comments. The NOAA Fisheries have identified studies that are necessary to assess the environmental and social consequences of the proposed relicensing. Under 18 CFR each interested resource agency and Indian tribe must provide a potential applicant with written comments:

i) Identifying its determination of necessary studies to be performed or information to be provided by the potential applicant;
ii) Identifying the basis for its determination;
iii) Discussing its understanding of the resource issues and its goals and objectives of these resources;
iv) Explaining why each study methodology recommended by it is more appropriate than other available methodology alternatives, including those identified by the potential applicant pursuant to paragraph (b) (1) (vi) of this section;
v) Documenting that the use of each study methodology recommended is a generally accepted practice; and
vi) Explaining how the studies and information requested will be useful to the agency or Indian tribe in furthering its resource goals and objectives.

SPECIES DESCRIPTION AND STATUS

The ESA defines a "species" to include any "distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." NOAA Fisheries published a policy describing how it would apply the ESA definition of a "species" to anadromous salmonid species (56 FR 58612). More recently, NOAA Fisheries and FWS published a joint policy, consistent with NOAA Fisheries' policy, regarding the definition of distinct population segments (61 FR 4722). To be considered an Evolutionary Significant Unit (ESU), a population must satisfy two criteria: (1) It must be reproductively isolated from other population units of the same species, and (2) it must represent an important component in the evolutionary legacy of the biological species. The first criterion, reproductive isolation, need not be absolute, but must have been strong enough to permit evolutionarily important differences to occur in different population units. The second criterion is met if the population contributes substantially to the ecological/genetic diversity of the species as a whole. Section 3 of the ESA defines the term "endangered species" as "any species which is in danger of extinction throughout all or a significant portion of its range." The term "threatened species" is defined as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range."

Coho Salmon{tc \l2 "Coho Salmon}

Coho salmon are native to the north Pacific Ocean. The historic distribution of coho salmon in North America included coastal streams from Alaska south to northwestern Mexico (Moyle 1976; Weitkamp *et al*. 1995). Currently the San Lorenzo River in Santa Cruz County, California is thought to have the southern-most persistent population of coho salmon in North America (Weitkamp *et al*. 1995). Coho salmon are also found in Asia from the Anadyr River, Russia, south to Hokkaido, Japan and tributaries of Peter the Great Bay on the Sea of Japan (Hart 1973; Sandercock 1991).

Life History and Biological Requirements**{**tc \l3 "Life History and Biological Requirements**}**

Coho salmon are typically associated with small to moderately-sized coastal streams characterized by heavily forested watersheds; perennially-flowing reaches of cool, high-quality water; dense riparian canopy; deep pools with abundant overhead cover; instream cover consisting of large, stable woody debris and undercut banks; and gravel or cobble substrates. The life history of the coho salmon in California has been well documented by Shapovalov and Taft (1954) and Hassler (1987). In contrast to the life history patterns of other anadromous salmonids, coho salmon in California generally exhibit a relatively simple 3-year life cycle. Adult salmon typically begin the freshwater migration from the ocean to their natal streams after heavy late-fall or winter rains breach the sand bars at the mouths of coastal streams (Sandercock 1991). Delays in river entry of over a month are not unusual (Salo and Bayliff 1958; Eames *et al*. 1981). Migration continues to March, generally peaking in December and January, with spawning occurring shortly after returning to the spawning ground (Shapovalov and Taft 1954).

Female coho salmon choose spawning sites usually near the head of a riffle, just below a pool, where water changes from a laminar to a turbulent flow and there is small to medium gravel substrate. The flow characteristics of the location of the redd usually ensure good aeration of eggs and embryos, and the flushing of waste products. The water circulation in these areas also facilitates fry emergence from the gravel. Preferred spawning grounds have nearby overhead and submerged cover for holding adults; water depth of 10-54 cm; water velocities of 20-80 cm/s; clean, loosely compacted gravel (1.3-12.7 cm diameter) with less than 20 percent fine silt or sand content; cool water (4-10°C) with high dissolved oxygen (8 mg/l); and an intergravel flow sufficient to aerate the eggs. The lack of suitable gravel often limits successful spawning in many streams.

Each female builds a series of redds, moving upstream as she does so, and deposits a few hundred eggs in each. Fecundity of coho salmon is directly proportional to female size; coho salmon may deposit from 1,000-7,600 eggs (reviewed in Sandercock 1991). Coho salmon may spawn in more than one redd and with more than one partner (Sandercock 1991). The female may guard a nest for up to two weeks (Briggs 1953). Coho salmon are semelparous, they die after their first spawning season.

The eggs generally hatch between 4 to 8 weeks, depending on water temperature. Survival and development rates depend on temperature and dissolved oxygen levels within the redd. According to Baker and Reynolds (1986), under optimum conditions, mortality during this period can be as low as 10 percent; under adverse conditions of high scouring flows or heavy siltation, mortality may be close to 100 percent. McMahon (1983) found that egg and fry survival drops sharply when fines make up 15 percent or more of the substrate. The newly-hatched fry remain in the gravel from two to seven weeks until emergence from the gravels (Shapovalov and Taft 1954).

Low summer flows reduce potential rearing areas, may cause stranding in isolated pools, and increase vulnerability to predators (Sandercock 1991). Also the combination of reduced flows and high ambient air temperatures can raise the water temperature to the upper lethal limit of 25°C for juvenile coho (Brett 1952). As they grow, they often occupy habitat at the heads of pools, which generally provide an optimum mix of high food availability and good cover with low swimming cost (Nielsen 1992). As the fish continue to grow, they move into deeper water and expand their territories until, by July and August, they are in the deep pools. Juvenile coho salmon prefer well shaded pools at least 1 m deep with dense overhead cover; abundant submerged cover composed of undercut banks, logs, roots, and other woody debris; preferred water temperatures of 12-15°C, but not exceeding 22-25°C for extended time periods; dissolved oxygen levels of 4-9 mg/l; and water velocities of 9-24 cm/sec in pools and 31-46 cm/sec in riffles. Water temperatures for good survival and growth of juvenile coho salmon range from 10-15°C (Bell 1973; McMahon 1983). Growth is slowed considerably at 18°C and ceases at 20°C (Stein *et al*. 1972; Bell 1973).

Preferred rearing habitat has little or no turbidity and high sustained invertebrate forage production. Juvenile coho salmon feed primarily on drifting terrestrial insects, much of which are produced in the riparian canopy, and on aquatic invertebrates growing in the interstices of the substrate and in the leaf litter in the pools. As water temperatures decrease in the fall and winter months, fish stop or reduce feeding due to lack of food or in response to the colder water, and growth rates slow down. During December-February, winter rains result in increased stream flows and by March, following peak flows, fish again feed heavily on insects and crustaceans and grow rapidly.

In the spring, as yearlings, juvenile coho salmon undergo a physiological process, called smoltification, which prepares them for living in the marine environment. They begin to migrate downstream to the ocean during late March and early April, and out migration usually peaks in mid-May, if conditions are favorable. At this point, the smolts are about 10-13 cm in length. After entering the ocean, the immature salmon initially remain in nearshore waters close to their parent stream. They gradually move northward, staying over the continental shelf (Brown *et al*. 1994). Although it is thought that they range widely in the north Pacific, movements of coho salmon from California are poorly known.

<u>Population Trend</u>

Available historical and recent coho salmon abundance information is summarized in the NOAA Fisheries' coast-wide status review (Weitkamp et al. 1995). Following are some excerpts from this document.

Gold Ray Dam adult coho passage counts provide a long-term view of coho salmon abundance in the upper Rogue River. During the 1940s, counts averaged ca. 2,000 adult coho salmon per year. Between the late 1960s and early 1970s, adult counts averaged fewer than 200. During the late 1970s, dam counts increased, corresponding with returning coho salmon produced at Cole Rivers Hatchery. Coho salmon run size estimates derived from seine surveys at Huntley Park near the mouth of the Rogue River have ranged from ca. 450 to 19,200 naturally-produced adults between 1979 and 1991. In Oregon south of Cape Blanco, Nehlsen et al. (1991) considered all but one coho salmon population to be at "high risk of extinction." South of Cape Blanco, Nickelson et al. (1992) rated all Oregon coho salmon populations as "depressed."

Brown and Moyle (1991) estimated that naturally-spawned adult coho salmon returning to California streams were less than one percent of their abundance at mid-century, and indigenous, wild coho salmon populations in California did not exceed 100 to 1,300 individuals. Further, they stated that 46 percent of California streams which historically supported coho salmon populations, and for which recent data were available, no longer supported runs.

No regular spawning escapement estimates exist for natural coho salmon in California streams. California Department of Fish and Game (CDFG) (1994a) recently summarized most information for the northern California region of this ESU. They concluded that "coho salmon in California, including hatchery populations, could be less than six percent of their abundance during the 1940s, and have experienced at least a 70 percent decline in the 1960s." Further, they reported that coho salmon populations have been virtually eliminated in many streams, and that adults are observed only every third year in some streams, suggesting that two of three brood cycles may already have been eliminated.

The rivers and tributaries in the California portion of this ESU were estimated to have average recent runs of 7,080 natural spawners and 17,156 hatchery returns, with 4,480 identified as "native" fish occurring in tributaries having little history of supplementation with non-native fish. Combining recent run-size estimates for the California portion of this ESU with Rogue River estimates provides a rough minimum run-size estimate for the entire ESU of about 10,000 natural fish and 20,000 hatchery fish (May 6, 1997; 62 FR 24588).

<u>Klamath River Basin Population Information</u>

Limited information exists regarding coho salmon abundance in the Klamath River Basin. Adult coho salmon have been counted in a few Klamath River tributaries; however, these counts are incomplete because they are typically only made incidentally to their purpose of determining fall chinook salmon escapement and they may not account for fish that spawn below the weirs. Once the counting of fall chinook ends, the counting weirs are removed prior to high winter flows and therefore counting efforts may not include a portion of the coho salmon migration. In addition, some juvenile trapping occurs on the Klamath River and tributaries. Unfortunately, these counts are also focused on fall chinook and therefore incomplete with regard to sampling for coho salmon juveniles. As such, both adult and juvenile counts are valuable for documenting the presence of coho salmon in specific areas during key time periods, but less valuable for determining population status or trends. However, they do highlight the low abundance and precarious status of coho salmon populations in the Klamath River Basin.

Historic Presence

The historical distribution of coho salmon in the Klamath River is uncertain. Snyder (1931) stated that "*(s)ilver salmon are said to migrate to the headwaters of the Klamath to spawn. Nothing definite was learned about them from inquiry because most people are unable to distinguish*". In response to considerable controversy concerning the historical distribution of coho salmon in the Klamath River the CDFG (2002) undertook a detailed analysis of historical records and life history requirements for coho. The CDFG concluded that:

> *"Substantial coho salmon populations appear to have been present in the upper Klamath River in 1910 as evidenced by the egg collections made at the Klamathon racks during the initial year of operation. The relatively large number of females required to produce the number of eggs collected that year and in subsequent years suggests that native coho salmon were well established in the Klamath River upstream of Iron Gate Dam's location. For the reasons described above, it is unlikely that these runs could have originated from the plants made in the Trinity River in 1895. Coho salmon were well documented in the Shasta and Scott rivers long before the construction of Iron Gate and Trinity River hatcheries and the subsequent introductions of large numbers of non-native coho salmon at the hatcheries. Based on the above discussions, the Department believes that coho salmon are native to the upper Klamath River system, including the Scott and Shasta Rivers, and historically occurred in these streams prior to any hatchery stocking".*

Adult data

Adult salmon counting weirs are operated in Bogus Creek and the Shasta and Scott rivers. In addition, coho salmon adult counts are also made at the Trinity River weir in Willow Creek. Between 1981 and 1986 (four sample years), an average of five coho salmon adults (range: 0-12) were counted in Bogus Creek (CDFG unpublished data). Between 1992 and 2000 (nine sample years), an average of four coho adults (range: 0-10) were counted in Bogus Creek (CDFG unpublished data). Typically, coho salmon are first observed at the weir in the first or second week of October.

Weir and video observations of coho salmon in the Shasta River have yielded an average of approximately eight coho salmon adults (range: 0-24) between the years 1991-2000 (CDFG unpublished data). During the 1991-2000 period, coho salmon have been observed at the Shasta River weir as early as September 25 (CDFG unpublished data). These adult counts during two years out of nine account for approximately 44 percent of the fish during this period and there was only one or zero fish counted during four of the ten years (CDFG unpublished data). Further evidence of the decline of the Shasta River coho salmon population is found in a comparison of counts from the 1970's with counts from the 1990's during years when trapping began and ended at about the same time (began first week of September, ended second week of

November). During the years 1970, 1972, 1973, and 1977, an average of 217 adult coho salmon were counted (CDFG unpublished data). During the years 1991-1993 and 1995, an average of seven adult coho salmon were counted (CDFG unpublished data). These data suggest a dramatic decline in the status of Shasta River coho salmon.

Weir counts in the Scott River averaged twenty-five fish (range: 5-37) during the 1982-1986 period (CDFG unpublished data) and four adults (range: 0-24) between the years 1991-1999 (CDFG unpublished data). Again, this information should include a qualification that one year accounted for approximately 65 percent of the total number of coho observed during the 1991-1999 period and zero coho were observed in four of the nine years (CDFG unpublished data). Coho salmon were observed in the Scott River during the 1991-1999 period as early as September 21.

Adult coho salmon counts in the Trinity River weir better reflect the total number of coho found in the Trinity River because the counts are made relatively low in the system below much of the spawning habitat. Unfortunately, these counts are incomplete as well because the weir is typically removed by the second week of November and trapping does not occur every day. Therefore, the trapping effort may not include a portion of the run and even relatively small day to day differences in fish counts may skew the results. In addition, the majority of the fish trapped are of hatchery-origin, and 100 percent marking of hatchery coho salmon has only recently occurred so estimates of naturally-produced coho are only available since the 1997 return year (CDFG 2000a). The results of counting from these three years yields an estimated 198, 1001, and 491 naturally produced adult coho salmon for the 1997-1998, 1998-1999, and 1999-2000 seasons, respectively (CDFG 2000a). Coho salmon were first observed at the Trinity River weir during the week of September 10 during the 1999-2000 trapping season (CDFG 2000a).

<u>Juvenile data</u>
The USFWS operates downstream juvenile migrant traps on the mainstem Klamath and Trinity rivers. Again, the incomplete trapping record provides limited information in terms of abundance or trends, but does indicate the presence of coho at different life stages during certain times of the year. Indices of abundance (expanded from actual numbers trapped) for coho salmon smolts from trapping conducted on the Klamath River at Big Bar yielded an average of 548 naturally-produced smolts (range: 137-1268) for the 1991-2000 period (USFWS 2000). Trapping at Willow Creek on the Trinity River yielded an average of 2,975 coho salmon smolts (range: 565-5084) for the same period (USFWS 2000). These low numbers do provide insight into the limited size of coho salmon populations in the Klamath River Basin, although some early outmigrants may be missed. Even if these numbers were doubled to account for time when trapping did not occur, these populations would be considered extremely low.

In 1997, the USFWS completed a report that described the life history periodicities for anadromous salmonids, including coho salmon, in the Klamath River Basin (USFWS 1997a). The USFWS determined, both through the operation of juvenile outmigrant traps and review of relevant literature, that coho salmon fry are present in the mainstem Klamath River from at least

April through late July and coho yearlings are present from mid-March through August. Both coho salmon yearlings and fry have been observed in every month of the summer. Also, both USFWS (1997a) and CDFG (1994b) indicated that coho salmon fry emigrated from some tributaries to the mainstem Klamath River soon after emergence. The USFWS (1997a) concluded that coho salmon juveniles likely rear year-around in the mainstem Klamath River between IGD and Seiad Creek.

In summary, information on coho salmon population status or trends in the Klamath River Basin is incomplete, but what information exists suggests adult populations are small to nonexistent in some years. Existing information also indicates that adult coho salmon are present in the Klamath River in early September and juvenile coho salmon are present in the mainstem Klamath River throughout the year, including the summer months.

ESA Status

Listing History**{**tc \l2 "Listing History**}**

The SONCC coho salmon ESU was listed as threatened under the ESA on May 6, 1997 (62 FR 24588). This ESU includes coho salmon populations between Cape Blanco, Oregon, and Punta Gorda, California. An interim rule under section 4(d) of the ESA was published on July 18, 1997 (62 FR 3847) applying the prohibitions contained in section 9(a) of the ESA to the California portion of the ESU. Critical habitat was designated for the SONCC coho salmon ESU on May 5, 1999 (64 FR 24049). Critical habitat includes all waterways, substrate, and adjacent riparian zones below longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). The NOAA Fisheries has identified twelve dams in the range of these ESUs that currently block access to habitats historically occupied by coho salmon.

{tc \l2 "**}**SONCC Coho Salmon Critical Habitat

Designated critical habitat for SONCC coho salmon occurs downstream of IGD (May 5, 1999; 64 FR 24049). In designating critical habitat, NOAA Fisheries focuses on the known physical and biological features (primary constituent elements) within the designated area that are essential to the conservation of the species. These essential features may include, but are not limited to, spawning sites, food resources, water quality and quantity, and riparian vegetation. Within the essential habitat types (spawning, rearing, juvenile migration corridors), essential features of coho salmon critical habitat include adequate: (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) safe passage conditions (May 5, 1999; 64 FR 24049).

Steelhead{tc \l2 "Steelhead}

Klamath Mountains Province (KMP) steelhead occur in the Klamath River, but are not currently listed under the ESA (April 4, 2001; 66 FR 12845). Steelhead are native to the north Pacific Ocean and in North America are found in coastal streams from Alaska south to northwestern Mexico (Moyle 1976; Busby *et al*. 1996). At this time NOAA Fisheries has listed only the anadromous life form of rainbow trout: steelhead.

Life History and Biological Requirements{tc \l3 "Life History and Biological Requirements}

Steelhead spend from one to five years in saltwater, however, two to three years are most common (Busby *et al.* 1996). Some return as "half-pounders" that over-winter one season in freshwater before returning to the ocean in the spring. The distribution of steelhead in the ocean is not well known. Coded-wire tag recoveries indicate that most steelhead tend to migrate north and south along the continental shelf (Barnhart 1986).

The timing of upstream migration is correlated with higher flow events, such as freshets or sand bar breaches, and associated lower water temperatures. The minimum stream depth necessary for successful upstream migration is 13 cm (Thompson 1972). The preferred water velocity for upstream migration is in the range of 40-90 cm/s, with a maximum velocity, beyond which upstream migration is not likely to occur, of 240 cm/s (Thompson 1972; Smith 1973). There are two types of steelhead, summer steelhead and winter steelhead. Summer steelhead return to freshwater during June through September, migrate inland toward spawning areas, overwinter in the larger rivers, and then resume migration to natal streams and spawn (Meehan and Bjornn 1991). Winter steelhead return to freshwater in autumn or winter, migrate to spawning areas, and then spawn in late winter or spring. Upstream migration of winter steelhead occurs from September through May with the peak run occurring in February (CDFG 1997). Most spawning takes place from January through April. Steelhead may spawn more than once before dying (iteroparity), in contrast to other species of the *Oncorhynchus* genus. Repeat spawning rates typically range from 13-24 percent in California coastal streams.

Because rearing juvenile steelhead reside in freshwater all year, adequate flow and temperature are important to the population at all times (CDFG 1997). Generally, throughout their range in California, steelhead that are successful in surviving to adulthood spend at least two years in freshwater before emigrating downstream. Emigration appears to be more closely associated with size than age. In Waddell Creek, Shapovalov and Taft (1954) found steelhead juveniles migrating downstream at all times of the year with the largest numbers of age 0+ and yearling steelhead moving downstream during spring and summer. Smolts can range from 14-21 cm in length.

Steelhead spawn in cool, clear streams featuring suitable water depth, gravel size, and current velocity. Intermittent streams may be used for spawning (Barnhart 1986; Everest 1973). Reiser and Bjornn (1979) found that gravels of 1.3-11.7 cm in diameter and flows of approximately 4 cfs were preferred by steelhead. The survival of embryos is reduced when fines of less than 6.4 mm comprise 20-25 percent of the substrate. Studies have shown a higher survival of embryos when intragravel velocities exceed 20 cm/hr (Phillips and Campbell 1961; Coble 1961). The number of days required for steelhead eggs to hatch is inversely proportional to water temperature and varies from about 19 days at 15.6^{o}C to about 80 days at 5.6^{o}C. Fry typically emerge from the gravel two to three weeks after hatching (Barnhart 1986).

Upon emerging from the gravel, fry rear in edgewater habitats and move gradually into pools and riffles as they grow larger. Older fry establish territories which they defend. Cover is extremely important in determining distribution and abundance, with more cover leading to more fish (Bjornn and Reiser 1991). Young steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles. In winter, they become inactive and hide in any available cover, including gravel or woody debris.

Water temperature influences the growth rate, population density, swimming ability, ability to capture and metabolize food, and ability to withstand disease of these rearing juveniles (Barnhart 1986; Bjornn and Reiser 1991). Rearing steelhead juveniles prefer water temperatures of 7.2-14.4^{o}C and have an upper lethal limit of 23.9^{o}C. They can survive up to 27°C with saturated dissolved oxygen conditions and a plentiful food supply. Fluctuating diurnal water temperatures also aid in survivability of salmonids (Busby *et al.* 1996).

Dissolved oxygen (DO) levels of 6.5-7.0 mg/l affected the migration and swimming performance of steelhead juveniles at all temperatures (Davis *et al.* 1963). Reiser and Bjornn (1979) recommended that DO concentrations remain at or near saturation levels with temporary reductions no lower than 5.0 mg/l for successful rearing of juvenile steelhead. Low DO levels decrease the rate of metabolism, swimming speed, growth rate, food consumption rate, efficiency of food utilization, behavior, and ultimately the survival of the juveniles.

During rearing, suspended and deposited fine sediments can directly affect salmonids by abrading and clogging gills, and indirectly cause reduced feeding, avoidance reactions, destruction of food supplies, reduced egg and alevin survival, and changed rearing habitat (Reiser and Bjornn 1979). Bell (1973) found that silt loads of less than 25 mg/l permit good rearing conditions for juvenile salmonids.

<u>Status of California Steelhead Stocks</u>
Historically, steelhead likely inhabited most coastal and many inland streams along the west coast of the United States. During this century, however, over 23 indigenous, naturally reproducing stocks have been extirpated, and many more are at risk for extinction. The most recent data show current summer and winter steelhead abundance is well below estimates from the 1980s, and is greatly reduced from levels in the 1960s (65 FR 6960).

Only two estimates of historical (pre-1960s) abundance are available: an average of about 500 adults in Waddell Creek in the 1930s and early 1940s (Shapovalov and Taft 1954), and 20,000 steelhead in the San Lorenzo River before 1965 (Johnson 1964). In the mid-1960s, 94,000 steelhead adults were estimated to spawn in central California rivers, including 50,000 and 19,000 fish in the Russian and San Lorenzo rivers, respectively (CDFG 1965). Recent estimates indicate an abundance of about 7,000 fish in the Russian River (including hatchery steelhead) and about 500 fish in the San Lorenzo River. These estimates suggest that recent total abundance of steelhead in these two rivers is less than 15 percent of their abundance 30 years ago. Recent estimates for several other streams (Lagunitas Creek, Waddell Creek, Scott Creek, San Vincente Creek, Soquel Creek, and Aptos Creek) indicate individual run sizes of 500 fish or less. Steelhead in most tributaries to San Francisco and San Pablo bays have been virtually extirpated (McEwan and Jackson 1996). Fair to good runs of steelhead apparently still occur in coastal Marin County tributaries. In a 1994 to 1997 survey of 30 San Francisco Bay watersheds, steelhead occurred in small numbers at 41 percent of the sites, including the Guadalupe River, San Lorenzo Creek, Corte Madera Creek, and Walnut Creek (Leidy 1997).

Six steelhead ESU's have been identified in California. Five are federally listed at this time. Of the five listed ESU's, one is listed as endangered and four are listed as threatened.

Chinook Salmon

Chinook salmon historically ranged from the Ventura River in southern California north to Point Hope, Alaska, and in northeastern Asia from Hokkaido, Japan to the Anadyr River in Russia (Healey 1991). Myers *et al*. (1998) reports no viable populations of chinook salmon south of San Francisco, California. Although chinook salmon is a wide-ranging species, it is the least abundant Pacific salmon in North America (Moyle 1976; Page and Burr 1991).

Life History and Biological Requirements**{**tc \l3 "Life History and Biological Requirements**}**
Chinook salmon is anadromous and the largest member of *Oncorhynchus*, with adults weighing more than 120 pounds having been reported from North American waters (Scott and Crossman 1973; Page and Burr 1991). Chinook salmon exhibit two main life history strategies: ocean-type fish and river-type fish (Healy 1991). Ocean-type fish typically are fall- or winter run fish that spawn shortly after entering freshwater and their offspring emigrate shortly after emergence from the redd. River-type fish are typically spring- or summer-run fish that have a protracted adult freshwater residency, sometimes spawning several months after entering freshwater. Progeny of river-type fish frequently spend one or more years in freshwater before emigrating.

Chinook salmon generally remain in the ocean for two to five years (Healey 1991), and tend to stay along the California and Oregon coasts. Some chinook salmon return from the ocean to spawn one or more years before full-sized adults return, and are referred to as jacks (males) and jills (females). Fall-run chinook salmon upstream migration occurs from June through December with a peak in September and October. Spawning occurs from late-September through December with a peak in late-October. These fish typically enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas on the mainstem or lower tributaries of rivers, and spawn within a few weeks of freshwater entry (Healey 1991). Run timing is also, in part, a response to stream flow characteristics.

Egg deposition must be timed to ensure that fry emerge during the following spring at a time when the river or estuary productivity is sufficient for juvenile survival and growth. Adult female chinook salmon prepare redds in stream areas with suitable gravel composition, water depth, and velocity. Spawning generally occurs in swift, relatively shallow riffles or along the edges of fast runs at depths greater than 24 cm. Optimal spawning temperatures range between 5.6-13.9°C. Redds vary widely in size and location within the river. Preferred spawning substrate is clean, loose gravel, mostly sized between 1.3-10.2 cm, with no more than 5 percent fines. Gravels are unsuitable when they have been cemented with clay or fines or when sediments settle out onto redds, reducing intergravel percolation (62 FR 24588). Minimum intragravel percolation rate depends on flow rate, water depth, and water quality. The percolation rate must be adequate to maintain oxygen delivery to the eggs and remove metabolic wastes. The chinook salmon's need for a strong, constant level of subsurface flow may indicate that suitable spawning habitat is more limited in most rivers than superficial observation would suggest. After depositing eggs in a redd, adult chinook salmon guard the redd from 4 to 25 days before dying.

Chinook salmon eggs incubate for about 30 to 150 days, depending on water temperature. Successful incubation depends on several factors including dissolved oxygen levels, temperature, substrate size, amount of fine sediment, and water velocity. Maximum survival of incubating eggs and pre-emergent fry occurs at water temperatures between 5.6-13.3°C with a preferred temperature of 11.1°C. Fry emergence begins in December and continues into mid-April (Leidy and Leidy 1984). Emergence can be hindered if the interstitial spaces in the redd are not large enough to permit passage of the fry. In laboratory studies, Bjornn and Reiser (1991) observed that chinook salmon and steelhead fry had difficulty emerging from gravel when fine sediments (6.4 mm or less) exceeded 30-40 percent by volume.

After emergence, chinook salmon fry seek out areas behind fallen trees, back eddies, undercut banks and other areas of bank cover (Everest and Chapman 1972). As they grow larger, their habitat preferences change. Juveniles move away from stream margins and begin to use deeper water areas with slightly faster water velocities, but continue to use available cover to minimize the risk of predation and reduce energy expenditure. Fish size appears to be positively correlated with water velocity and depth (Chapman and Bjornn 1969; Everest and Chapman 1972). Optimal temperatures for both chinook salmon fry and fingerlings range from 12-14°C, with maximum growth rates at 12.8°C (Boles 1988). Chinook feed on small terrestrial and aquatic insects and aquatic crustaceans. Cover, in the form of rocks, submerged aquatic vegetation, logs, riparian vegetation, and undercut banks provide food, shade, and protect juveniles from predation.

The low flows, high temperatures, and sand bars that develop in smaller coastal rivers during the summer months favor an ocean-type life history (Kostow 1995). With this life history, smolts typically outmigrate as subyearlings during April through July (Myers *et al.* 1998). The ocean-type chinook salmon in California tend to use estuaries and coastal areas for rearing more extensively than stream-type chinook salmon. The brackish water areas in estuaries moderate the physiological stress that occurs during parr-smolt transitions.

<u>Status of California Chinook salmon Stocks</u>**{**<u>tc \l3 "Status of California Chinook salmon Stocks</u>**}**
Although northern coastal California streams support small, sporadically monitored populations of fall-run chinook salmon and the Central Valley supports four runs of chinook salmon, estimates of absolute population abundance are not available (Myers *et al*. 1998). Data available to assess trends in abundance are limited. Recent trends have been mixed, with predominately strong negative trends in the Eel River Basin and in streams that are farther south along the California coast (Myers *et al*. 1998). Five chinook salmon ESU's have been identified

in California. Three ESU's are federally listed at this time, one is listed as endangered and the other two are listed as threatened

NOAA FISHERIES RESOURCE GOALS AND OBJECTIVES

The FERC's Licensing Regulations direct resource agencies to list the resource management goals and objectives to serve as the basis for study recommendations and subsequent prescriptions and recommendations for Project "protections, mitigation, and enhancement measures" (PM&E) to be incorporated into the new License.

Resource Goals

1. Protect, conserve, enhance and recover native anadromous salmonids and their habitats by providing access to historic habitats and by restoring fully functioning habitat conditions.

2. Identify and implement measures to protect, mitigate or minimize direct, indirect, and cumulative impacts to, and enhance native anadromous salmonid resources, including related spawning, rearing, and migration habitats and adjoining riparian habitats.

Resource Objectives

1. ***Flows* -** Implement scheduled flows in the Klamath River and regulated tributaries to the benefit of native anadromous salmonids and their habitats. This includes providing a range or schedule of flows necessary to: a) optimize suitable habitat; b) stable flows during spawning and incubation of ingravel forms; c) flows necessary to facilitate the efficient migration of spawning adults, safe an timely emigration of smolts, and movement of rearing juveniles between feeding and sheltering areas; d) flows necessary to ensure redd placement in viable areas; and e) flows necessary for channel forming processes, riparian habitat protection and maintenance movement of forage communities. This also includes impacts of flood control, irrigation or other project structures or operations that act to displace individuals or their forage or destabilizes, scours, or degrades physical, chemical, or biological quality of habitat.

2. ***Water Quality* -** Modify project structures or operations necessary to mitigate direct, indirect, or cumulative water temperature and quality impacts associated with project structures and operations or enhance water temperature and quality conditions in salmonid habitat.

3. ***Water Availability* -** Coordinate operations with other projects, programs or initiatives, and/or use water transfers, water exchanges, water purchases or other forms of agreements to maximize potential benefits to anadromous salmonids from limited water supplies.

4. ***Fish Passage* -** Provide access to historic spawning, rearing and migration habitats necessary for salmonids to complete their life cycles and utilize seasonal habitats necessary to contribute to the recovery of coho, enhanced steelhead populations and other species of concern. This

includes modifications to project facilities and operations necessary to ensure the safe timely and efficient passage of upstream migrating adults, downstream passage of emigrating juveniles and passage necessary for juveniles to disperse and access habitat necessary for the seasonal movement of rearing juveniles to feeding and sheltering habitats.

5. ***Channel Maintenance*** **-** Implement flow regimes and non-flow related measures necessary to mitigate and minimize direct, indirect and cumulative impacts of project facilities and operations on sediment movement and deposition, river geometry, and channel characteristics. This includes impacts on stream competence, capacity, flood plain conductivity, bank stability and extent, duration, and repetition of high flow events. In addition, this includes impacts to habitat diversity and complexity such as pool riffle sequencing and instream cover.

6. ***Hatchery Operations*** **-** Minimize and mitigate the impact of hatchery facilities and/or operations on native, wild anadromous salmonids. This includes the direct, indirect and cumulative impacts of hatchery product on anadromous salmonids and the direct, indirect and cumulative impacts of hatchery facilities and operations on salmonids and their habitats.

7. ***Predation*** **-** Minimize and mitigate the impact of Project structures or operations that either have in the past or continue to introduce predators, create suitable habitat for predators, harbor predators, or are conducive to the predation of native anadromous salmonids.

8. ***Riparian Habitat*** **-** Protect, mitigate or minimize direct, indirect, and cumulative impacts to, and enhance riparian habitat and habitat functions necessary to mitigate and minimize direct, indirect and cumulative impacts of project facilities and operations.

9. ***Flow Ramping*** **-** Modify project structures or operations necessary to minimize impacts of flow fluctuations associated with increases of decreases in project discharges.

10. ***Coordination*** **-** In developing alternatives for relicensing, include a full range of alternatives for modifying project and non-project structures and operations to the benefit of anadromous salmonids and their habitats, while minimizing conflicts with operational requirements and other beneficial uses. This includes developing alternatives for greater coordination with other stakeholders and water development projects to ensure that, at a minimum, project structures and operations are consistent with on-going and future restoration efforts and potentially enhance these efforts.

PROJECT IMPACTS ON ANADROMOUS SALMONIDS

Salmonids require cool, clear, running water to support their freshwater life history stages (Bjornn and Reiser 1991). Incubating salmon eggs require clean gravel substrates. Juvenile habitats typically consist of free-flowing streams providing a complex of alternating shallow, swift riffles and low-velocity pools with abundant cover in the form of woody debris, boulders, and undercut banks. Dams convert natural stream habitats to artificial pond environments.

Habitats for salmonids are adversely affected by Project facilities because dams change stream flow patterns, reduce habitat diversity, diminish water quality, and create barriers to the natural instream movements of salmonids. Dams can also enhance the quality of habitats for species that are predators of juvenile salmon and steelhead.

Flows (*Resource Objective 1*)

Based upon modeling results, water releases from the Bureau of Reclamation's (BOR) Klamath Project (Link River Dam) would take 2-3 days to reach the IGD if the hydroelectric Project did not act to reduce travel time. With the hydroelectric Project in place and operating, that same release would take a week or more to reach IGD. In addition, the hydroelectric Project impounds approximately 5,900 acre feet of potential storage. To date, the Applicant has been unclear and not entirely responsive in providing information on Project operations. However, it is clear from flow records that the Applicant makes use of storage to "shape" releases and has the ability to provide minimum flows, on a daily, weekly, or even monthly basis that differ from the real-time inflow from Link River Dam (Eureka Times-Standard 2003) (personal communication Todd Olsen).

Hecht and Kamman (1996) viewed the hydrologic records for similar water years (pre- and post-Project) at several locations. The authors concluded that: (1) there was much less variability between mean, minimum, and maximum flows in the Klamath River at Keno prior to construction of the Project, and (2) the timing of peak and low flows changed significantly after construction of the Project, and operation increases flows in October and November and decreases flows in the late spring and summer as measured at Keno, Seiad, and Klamath. Their report also noted that water diversions in areas outside the Project boundaries occur as well. The IGD was completed by 1962 to re-regulate flow releases from the Copco facilities, but it did not restore the "pre-project" hydrograph.

The influence of IGD releases (relative to total Klamath River flow) decreases with distance downstream from the dam, and typically depends on time of year. The river reach between IGD and the Shasta River is heavily influenced by dam releases. During the July through October period between 1962 and 1991, IGD releases contributed an average of between about 60 and 85 percent of the river flow measured at Seiad. During this same period, IGD releases contributed an average of between about 50 and 65 percent of the river flow measured at Orleans. These averages increase during drought years. For example, monthly IGD releases contributed up to over 90 percent of the flow at Seiad during late summer in dry years.

Actual flows occurring in the Klamath River (measured at a given point) also depend on factors other than Project operations, including meteorological conditions (e.g., precipitation magnitude and timing) and other water management activities. Trihey and Associates (1996) recommended higher summer flows than the IGD FERC license minimums, as these additional flows are expected to "(1) reduce the growth of aquatic plants and algae, (2) provide additional wetted and surface turbulence in riffles, and (3) provide a larger volume of water in the river channel to decrease the amplitude of daily stream temperature cycles."

Biologists with the CDFG conducted habitat measurements and visual estimates and concluded that any reduction in discharge below about 1,000 cubic feet per second (CFS) would lead to a diminished fishery (Wales 1944). Wales (1944) also noted that any reduction in flows below 2,000 CFS, as measured around Fall Creek, would be expected to materially affect salmon and steelhead populations downstream to the Shasta River. In 1955, a CDFG biologist estimated that 1,000 CFS provided year-round would be required to maintain game fish at 1955 levels (Sletteland 1995).

On behalf of the Yurok Tribe, Trihey and Associates (1996) prepared a report including a quantification of the instream flows required to meet the needs of Tribal Trust species, including salmon and steelhead. In a companion report, Hecht and Kamman (1996) provided an analysis of the quantity and timing of historical stream flows and a discussion of the effect of Klamath Project operations on the flow regime. To estimate the minimum flow requirement, Trihey and Associates (1996) employed a modified Tennant (1976) method. This choice was driven, in part, by available data needed to utilize various estimation techniques. Sixty percent of the average pre-Project annual stream flow volume (estimated by Hecht and Kamman [1996]) was selected, and the recommended minimum IGD release schedule was “shaped” to more closely resemble the pre-Project hydrograph. The recommended monthly instream requirements for Tribal Trust species were estimated to be: 1,200 CFS in October, 1,500 CFS between November and March, 2,000 CFS in April, 2,500 CFS in May, 1,700 CFS in June, and 1,000 CFS between July and September.

A final report prepared for the Department of the Interior provided substantial new analyses regarding flows required for fisheries below IGD (‘Phase 1 flow study report,’ INSE 1999 (Hardy Phase I study)). Additional estimates of pre-Project flows under various water year-types were developed, and the results of various methods applied to estimate the appropriate flow regime needed to meet the habitat requirements of salmon and steelhead were also included. Specifically, the Phase 1 flow study report discusses the potential use of many methods to determine instream flow requirements, and provides a summary of the results of those techniques used by INSE (1999) to estimate flow requirements. These techniques fall into two categories: hydrology-based methods and field-based methods. In light of the different flow regimes prescribed by these several techniques, and continuing uncertainty about which technique(s) should be employed in the Klamath River, results were averaged (on a monthly basis). The resulting flow regime was forwarded as an interim recommendation, until additional analyses can be completed. The INSE (1999) recommended the following interim monthly instream flows below IGD: 1,476, 1,688, 2,082, 2,421, 3,008, 3,073, 3,307, 3,056, 2,249, 1,714, 1,346, and 1,395 CFS, during October through September, respectively.

Following the Phase 1 flow study, a follow-up “Phase 2” effort began, and included extensive coordination with a Technical Team representing fishery co-managers, including USFWS, CDFG, U.S. Geological Survey, Yurok Tribe, Karuk Tribe, Hoopa Valley Tribe, and NOAA Fisheries. In the initial stages, data were collected for one dimensional and two dimensional physical habitat modeling. Insufficient information was available to develop Klamath River-specific coho salmon habitat suitability criteria (HSC) for use in physical habitat modeling for the Phase 1 study. During the Phase 2 flow study, preliminary “envelope” HSC incorporating those available in the literature for this species and life history stage were developed. Klamath River-specific HSC for chinook salmon fry and spawners were developed by the Technical Team and used in physical habitat modeling, and coho salmon fry generally require similar habitat characteristics. Because of the empirically observed importance of cover elements for small vulnerable fry (e.g., submerged and emergent vegetation), cover coding was incorporated into channel indices and used to more rationally reflect habitat suitability (Phase 2 Technical Team, pers. comm., 2000; INSE in prep.).

Preliminary draft physical habitat modeling results are now available for the IGD to Shasta River reach of the Klamath River and for the Shasta River to Scott River reach. These results and additional information continue to be evaluated by the Technical Team.

Coho salmon from the previous year’s cohort also migrate toward the sea as smolts during this period. The size of the fish, flow conditions, water temperature, dissolved oxygen levels, day length, and the availability of food all tend to affect the time of migration (Shapovalov and Taft 1954). In the Klamath River basin, coho salmon smolt migration generally occurs between March and June (Weitkamp et al. 1995) but continues into July (INSE 1999).

Several physiologic and behavioral changes accompany smoltification of Pacific salmonids, including negative rheotaxis and decreased swimming ability (McCormick and Saunders 1987). Both of these smolt attributes support the expectation that salmon and steelhead would outmigrate faster with higher water velocities and experience higher survival because of shorter travel time with associated lower mortality due to migratory delays, predation, and exposure to poor mainstem habitat conditions. Although the relationship between flow and smolt survival has not been studied in the Klamath River Basin, Cada et al. (1994) concluded that relevant studies in other geographic areas “generally supported the premise that increased flow led to increased smolt survival.” Based on available information, smolt survival in the Klamath River is expected to be higher with higher flows, and lower with lower flows.

Water Quality (*Resource Objective 2*)

In addition to the hydrologic changes resulting from the activities discussed above, human activities have also resulted in degraded water quality in the action area. The Klamath River, from source to mouth, is listed as water quality impaired (by both Oregon and California) under Section 303(d) of the Federal Clean Water Act (CWA). In 1992, the State Water Resources Control Board (SWRCB) proposed that the Klamath River be listed under the CWA as impaired for both temperature and nutrients, requiring the development of Total Maximum Daily Load (TMDL) limits and implementation plans. The United States Environmental Protection Agency (USEPA) and the North Coast Regional Water Quality Control Board (NCRWQCB) accepted this action in 1993. The basis for listing the Klamath River as impaired was aquatic habitat degradation due to excessively warm water temperatures and algae blooms associated with high nutrient loads, water impoundments, and agricultural water diversions (USEPA 1993).

In 1997, the NCRWQCB updated the 303(d) list and added dissolved oxygen as an additional limiting factor for aquatic habitat in the Klamath River (NCRWQCB 1998). The impairment listing regarding dissolved oxygen was prompted by a 1997 USFWS report. The USFWS' concerns included the current status of salmonid populations in the Klamath River, the effects of past and current land use on water quality, annual fish and temperature monitoring data, documented fish kills, and current water quality monitoring data which indicate that acute and chronic values for temperature and dissolved oxygen are observed in the mainstem Klamath River, particularly during some summer periods (USFWS 1997b). The Klamath River is scheduled to have TMDLs established for temperature, nutrients, and dissolved oxygen by December 31, 2004.

The fact that the Klamath River is listed for temperature, nutrients and dissolved oxygen is especially important due to the relationship between these three water quality parameters. As described by Campbell (1995), increased water temperatures and lower saturated oxygen concentrations typically occur in the Klamath River during summer months, the same time of year that the growth and respiration cycles of aquatic plants affect dissolved oxygen concentration. These three parameters interact synergistically, and can have a much greater impact on water quality and salmonids than either temperature or dissolved oxygen alone (Campbell 1995).

Nutrient loading leads to increased growth of aquatic plants and algae in the Klamath River channel. The growth of aquatic plants and algae fosters sediment accumulation which decreases the quality of salmonid spawning and rearing habitat and leads to decreased dissolved oxygen concentration and high pH values on a diel cycle (Campbell 1995). The increased growth of aquatic plants and algae can also retard water velocity at low stream flows, contributing to higher stream temperatures in the Klamath River (Trihey and Associates 1996).

Low flow conditions can cause an increase in absolute concentrations of water pollutants. In some geographic areas, high flows may result in lower concentrations of pollutants due to dilution (Campbell 1995). Increasing flows during summer months may improve water quality downstream, but the direct effect of IGD flows is diminished in the lower river during some times of the year. Another positive effect of increased flows on water quality is that of dampening the diurnal fluctuations in temperature and dissolved oxygen. Low stream flows compound high water temperature problems, because a smaller volume of water is more easily heated and cooled, causing larger diurnal changes in the water temperature of the Klamath River (Trihey and Associates 1996; INSE 1999).

The Klamath River has probably always been a relatively warm river (Hecht and Kamman 1996), although there are no historical data to confirm this nor characterize the historic temperature regime. More recently, using a weekly mean temperature of 15° C as a threshold for chronic salmonid stress and a daily mean temperature of 20° C as an acute threshold, the 1966-1982 Klamath River temperatures at Orleans violated the acute and chronic thresholds a substantial portion of the time (Bartholow 1995). Campbell (1995) analyzed water quality data for 22 sites in the Klamath basin, applying the 1986 USEPA criteria. The most common water quality criteria exceeded were temperature at all 22 sites, and dissolved oxygen concentration at 11 sites.

The INSE (1999) summarized a preliminary modeling effort to simulate water temperatures near Seiad Valley (river mile 129) under a number of summer flow scenarios between 200 and 3,000 CFS. From this “first approximation” analysis, INSE (1999) preliminarily concluded that the results demonstrated a clear relationship between flow release and thermal response in the river, and that at flows below about 1,000 CFS adverse thermal extremes were expected to be exacerbated.

Water Availability (*Resource Objective 3*)

The BOR operates its Klamath Project to provide water for agriculture, National Wildlife Refuges, and downstream aquatic habitat. In addition, Upper Klamath Lake is managed to maintain habitat for endangered fish under the United States Fish and Wildlife Service’s (USFWS) ESA jurisdiction. Other activities proposed by BOR include participation in salmon and steelhead monitoring activities in the Klamath River, the continued implementation of BOR’s Water Supply Initiative aimed at obtaining additional water supplies, conducting a feasibility study on raising the maximum operating water surface elevation of Upper Klamath Lake by up to 2 feet, implementation of several groundwater investigations, conducting an appraisal study on raising Gerber Dam by 3 feet, and development of a management plan for Agency Lake Ranch.

Under contract with the United States, the Applicant operates Link River Dam in accordance with BOR’s annual operations plans for the Klamath Project. This contract will expire coincident with the expiration of the current License. In addition, the Applicant owns and operates Keno Dam, J.C. Boyle Dam, Copco No. 1 and Copco No. 2 Dams, and IGD, downstream of BOR’s Klamath Project.

Project operations affect the availability of water for numerous beneficial uses. Further, the success of future initiatives to increase water supplies and better manage existing resources will likely hinge on the cooperation of the Applicant and FERC. Increasing future water supplies and improving the management of existing supplies has the potential to significantly benefit native anadromous salmonids.

Fish Passage (*Resource Objective 4*)

Within the Klamath River Basin, an estimated 20 percent of historical coho salmon habitat is no longer available (November 25, 1997; 62 FR 62741). This undoubtably decreased the production capacity of the basin. In addition to blocking migrations to and from the ocean, Project dams block the natural movements of juveniles from historic rearing habitat. Juvenile salmonids often migrate relatively long distances (*i.e.*, several km) in response to 1) changes in their environment (e.g., summer warming, pollution events), 2) changes in resource needs as they grow, and 3) competition with other individuals. The movements of stream-dwelling salmonids has been the subject of extensive research (Chapman 1962, Edmundson et al. 1968; Fausch and White 1981; Gowan et al. 1994). Although many juvenile salmonids are territorial or exhibit limited movement, many undergo extensive migrations (Gowan et al. 1994; Fausch and Young 1995). For example, salmonid fry often disperse downstream from headwater spawning sites. In California, hot summer temperatures can promote the movement and aggregation of juvenile steelhead into thermally stratified pools that provide coldwater refugia (Nielsen and Lisle 1994). Additional movements can occur as intraspecific competition for resources causes the additional dispersal of subordinate individuals (Chapman 1966; Everest and Chapman 1972; Hearn 1986). Downstream movements of juveniles may also occur in response to growth or simply because environmental conditions such as water depth or velocity are no longer suitable (Edmundson et al. 1968; Leider et al. 1986).

Anadromous production within the Klamath River has been in general decline throughout the 20th century. The Long Range Plan for the Klamath River Basin Conservation Area Fishery Restoration Program (Long Range Plan) clearly identifies the lack of passage through and beyond the Project Area as a significant impact to the Klamath River anadromous fishery. Significant and un-utilized anadromous habitat exists upstream of IGR. The current and potential quality and quantity of anadromous habitat upstream of IGD is unknown. Existing dams prevent access to historically productive low-gradient wetland habitat in the Upper Klamath Basin. Summer steelhead and spring Chinook are largely extirpated from their historical range in the upper mid-Klamath region and associated tributaries. IGD and Copco Dam prevent access to cold-water spring habitat in the Klamath River, located in the reach between JC Boyle Dam and the upper end of Copco Reservoir, which would function as suitable summer holding habitat to sustain these fish in the upper Klamath system.

Channel Maintenance and Riparian Habitat (*Resource Objectives 5*&8)

Project operations reduce production of juvenile salmonids by degrading the quality of nursery habitat for these species. As previously noted, juvenile salmonids prefer heterogeneous stream environments comprised of free-flowing riffle-pool complexes containing a mix of pools with ample cover and shallow, swift reaches supporting high production of freshwater invertebrates (Bjornn and Reiser 1991; Groot and Margolis 1991). The production of juvenile salmonids can be directly related to stream channel complexity (Fausch and Northcote 1992; Horan et al. 2000). Indeed, the abundance of juvenile coho salmon and steelhead trout in sections of some small California streams has been shown to be higher in streams with a diverse mix of habitat types and a high level of habitat complexity (National Park Service, unpublished data). Larkin (1977) reported that the abundance of coho salmon in a stream is limited by the number of suitable territories. More structurally complex streams containing boulders, logs, and bushes support larger numbers of coho salmon fry than simpler stream sections (Scrivener and Andersen 1982).

Woody debris providing needed shelter and cover for juvenile fish is often captured in project reservoirs and cleared from the impoundments. This removal of cover objects exposes juvenile fish to greater risks of avian predation. Object cover also provides fish with low-velocity refuges in areas of high velocity; its removal simplifies stream habitats and reduces a stream's value and carrying capacity as habitat for juvenile salmon and steelhead.

In general, stream habitat loss is the single biggest cause of declines of coho salmon in the Pacific Northwest (Brown et al. 1994). Coho salmon seem to be much less tolerant to environmental degradation than steelhead with whom they generally share their habitat (Baker and Reynolds 1986). Most coho salmon mortality naturally occurs during the freshwater stages, as the result of destructive high flow events, winter freezing, summer droughts, or simply a lack of rearing space (Sandercock 1995). Project operations exacerbate these conditions.

Starting around 1912, construction and operation of the numerous facilities associated with the Project have significantly altered the natural hydrographs of the upper and lower Klamath River. These facilities include the A-Canal, Lost River Diversion Dam, Copco Nos. 1 and 2 Dams, J.C. Boyle Hydroelectric Dam, IGD, and Keno Dam. Changes in the flow regime at Keno, Oregon, after the construction of the A-Canal, Link River Dam, and the Lost River Diversion Dam, can be seen in the 1930-to-present flow records. These changes include a reduction of average summer monthly flows, and alteration of the natural seasonal variation of flows to meet peak power and diversion demands (Hecht and Kamman 1996).

Hatchery Operations (*Resource Objective 6*)

Artificial propagation is also a factor in the decline of coho salmon due to the genetic impacts on indigenous, naturally-reproducing populations, disease transmission, predation of wild fish, depletion of wild stock to enhance brood stock, and replacement rather than supplementation of wild stocks through competition and the continued annual introduction of hatchery fish.

The Klamath and Trinity Basin coho salmon runs are now composed largely of hatchery fish, although there still may be wild runs remaining in some tributaries (CDFG 1994a). Because of the predominance of hatchery stocks in the Klamath River Basin, stock transfers into the Trinity and Iron Gate Hatcheries may have had a substantial impact on natural populations in the basin (July 25, 1995; 60 FR 38011).

Predation (*Resource Objective 7*)

Project structures and operations may enhance the suitability of a stream as habitat for a variety of species that prey upon juvenile salmonids. Project operations can increase stream depths, reduce current velocities, and increase a stream section's turnover rate (i.e., the time required for a volume of water to pass through a stream section or impoundment). As a result, Project structures and operations have converted coldwater stream habitat into coolwater or warmwater habitats that are suitable for largemouth bass *(Micropterus. salmoides*), and other potential predators. Largemouth bass, a warmwater predator tolerant of temperatures over 30°C, may also benefit by the lacustrine habitat and warmer water temperatures created by Project impoundments (McCormick et al. 1981; Stuber et al. 1982). The combination of deeper water, warmer temperatures and slower current velocities afforded by Project facilities and operations provides more suitable habitat for many introduced and native predator species than under natural pre-project conditions.

Project facilities may also attract wading birds such as egrets and herons (Ardeidae). These wading birds are effective fish predators. A reduction in habitat area and habitat diversity and cover makes rearing salmonids more obvious targets to these predators. The belted kingfisher (*Ceryle alcyon*) and common merganser (*Mergus merganser*), other avian piscivores, also may benefit from Project facilities and operations.

Flow Ramping (*Resource Objective 9*)

Reductions in downstream flow have the potential to strand fishes along stream banks, or they may cause fishes to become isolated in small pools or other marginal habitats. Risk of stranding is generally highest where the channel slope in areas subjected to dewatering is gentle or irregular. Fishes stranded in dewatered areas are vulnerable to both dessication and increased predation from birds or mammals. Those that are stranded in isolated pools also become more vulnerable to predation, and they may be subjected to higher rates of mortality due to the effects of deteriorating water quality (*e.g.*, elevated temperatures).

The Copco facilities were operated in power-peaking mode, and flow releases fluctuated according to anticipated energy demands. Flows could vary by an order of magnitude or more within a 20 minute period, creating a hazard for both fish and fishermen. Fish and their food base were often stranded, resulting in mortality. The detrimental effect to the fishery was pronounced (KRBFTF 1991).

Project operations affect the survival of young-of-the-year salmonids through potential stranding of these fish during decreases in IGD flows. For example, an unpublished 2002 Karuk Tribe Department of Natural Resources Report states that on April 25, 2002, as flows below IGD declined due to a combination of a receding hydrograph and diminished releases from the project, 18 chinook fry and 101 coho fry were documented in isolated side channels. These fish were rescued by CDFG, FWS, Forest Service, and Karuk Tribal biologists and returned to the main stem. In addition, Project operations during the week of April 19, 1998, appear to have resulted in stranding of fish. Flows through IGD dropped from 3,300 CFS to 1,800 CFS, resulting in the stranding of salmonid fry as well as other fish species (USFWS 1998). The extent of mortality was unknown; however, USFWS biologists rescued 7 coho salmon fry and 738 chinook salmon fry in 3 isolated edge water pools. In 1999, a similar change in flows was implemented over a longer time period to decrease potential stranding (L. Dugan, Fishery Biologist, BOR, pers. comm., April 9, 1999). Given direct field observation of the stranding of Chinook and coho at the current ramping rates and mortality that is implicit in these observations, the National Research Council Committee (NRC 2002) found that the impacts of ramping rates specified in the NOAA Fisheries' April 6, 2001, Biological Opinion, including mortality of coho fry, due to hourly and daily ramping rates would continue to occur at times under the current ramping rates.

Regardless of ramping rates imposed upon the BOR in the current Biological Opinion (NMFS 2002), the Licensee owns, controls and operates Project facilities and is responsible to maintain and operate its project consistent with the terms and conditions of its FERC License, and in compliance with the Endangered Species Act (ESA). Through the FPA, FERC has the authority to condition the new license with ramping rate requirements necessary to minimize impacts on aquatic resources including listed coho salmon. To the extent that current Project operations, including ramping rates, are adversely affecting listed coho salmon, FERC must address these impacts during ESA section 7 consultation and in issuing a new License for the Project. FERC and PacifiCorps must implement those reasonable and prudent measures that NOAA Fisheries determines are necessary and appropriate to minimize impacts of incidental take.

COMMENTS ON DRAFT LICENSE APPLICATION

History of Pre-Application Consultation

The License for the Klamath Project will expire on March 1, 2006. Pursuant to FERC's "traditional" licensing process the Applicant provided its First Stage Consultation Document (FSCD) on December 15, 2000. In NOAA Fisheries comments on the FSCD, we informed the Applicant that the FSCD was deficient (pursuant to 18CFR16.8) and provided our respective resource management goals and objectives as well as specific study recommendations. Also, since December 2000, the Applicant has conducted numerous and frequent meetings concerning study plan development and received a second round of detailed comments from NOAA Fisheries recommending studies.

By letter dated February 22, 2002, the Applicant agreed to work collaboratively with stakeholders to collect existing information and to conduct studies necessary to evaluate a full range of options for restoring fish passage at the Klamath Hydroelectric Project. Further, the Applicant agreed to expand this collaborative approach to all other resource areas and to convene a plenary group to develop a Process Protocol Document to guide the decision making process. NOAA Fisheries is participating in this "collaborative" process. However, the Process Protocol has not been adhered to in all cases. Consequently, many of our concerns have either not been addressed or have been deferred indefinitely. Accordingly, while NOAA Fisheries has identified significant project related resource impacts and identified specific studies and study methods to analyze these impacts, the Applicant has been reluctant to finalize study plans. Therefore, although most major issues and necessary studies have been identified for some time now, the First Stage Consultation Process is incomplete and the Applicant has yet to fully address comments filed to date.

General Comments on the Adequacy of the Draft License Application

Contents of License Application Package

FERC's regulation 18CFR4.51(f) requires hydroelectric Project Licensees to provide a draft of the proposed License Application (DLA) for a major project on an existing dam after consulting tribes and resource agencies. Under sections (2) and (3), Applicants are required to report on water use and quantity and fish, wildlife, and botanical resources in the vicinity or impacted by the project. These reports must include descriptions of existing resources affected by the project, any anticipated continuing impacts of the project on resources, and proposed PM&E measures for the protection or improvement of such resources.

In order for FERC to issue a new Licenses the contents of the License Application package must be adequate for FERC to carry out its responsibilities under the NEPA, ESA, FPA and other relevant laws. The FPA requires that licensing be conditioned upon the inclusion of "adequate" fish and wildlife protection, mitigation, and enhancement measures. 16 U.S.C. § 808(a). The "adequacey" of such measures is based upon the relative effectiveness of each measure and whether the protection and enhancement provided by such measures is commensurate with, or otherwise sufficient in light of the Project impacts. In issuing a License FERC may not defer the selection of actual mitigation measures to future times or other decision-making processes. In *LaFlame v. FERC*, 852 F.2d 389, 400 (9th Cir. 1988), the Ninth Circuit held that reliance on a post-licensing study to fully develop a mitigation plan deprived FERC of any foundation upon which to base its conclusion that the project's impact would be "insignificant" for NEPA purposes. The court reasoned: "*We fail to see how mitigation measures can be explained when they have yet to be fully developed*".

Information Requirements for Second Stage Consultation

The Federal Power Act (FPA), Endangered Species Act, Magnuson-Stevens Fishery Conservation and Management Act, Fish and Wildlife Coordination Act, and National Environmental Policy Act (NEPA) require FERC to consult with resource agencies and the public when processing applications for hydroelectric projects. In order to meet these obligations FERC has developed regulations that require applicants to consult with resource agencies and affected Indian Tribes on project design, the impact of the proposed project, reasonable hydropower alternatives, and the studies needed to be done. <u>The same consultation rules apply to existing licensee's filing for relicense and potential applicants filing for an original license</u> (underlined for emphasis).

Accordingy to FERC's *Hydroelectric Project Licensing Handbook* (1991)(p 3-17):

> " *An Applicant should attempt to anticipate the information needs of a NEPA document and design studies accordingly.....Properly conducted environmental studies are those which provide the applicant, the Commission, and reviewing resource agencies and tribes clear and substantial information in three primary areas:*
>
> · *description of the environment affected by the proposed project and its reasonable alternatives;*

- *project effects, both beneficial and adverse; and*

- *protection mitigation and enhancement measures.*

Water quality should be evaluated and alternatives considered to improve water quality, dissolved oxygen, and temperature levels and minimize erosion and sedimentation associated with project operation.

Fisheries studies should evaluate existing resource and alternative project designs and operations to improve fish habitat and any needed fish passage......"

Conclusion Regarding the General Adequacy of the Draft Application for License
The DLA is lacking critical information or completed studies needed to assess project impacts; including fish passage and entrainment, fish assessment, macroinvertebrate and water quality, ramping rate, and instream flow studies. Therefore, the application is incomplete and does not provide sufficient information to evaluate the impact of the Project on fish and wildlife resources and support recommendations for protection, mitigation, and enhancement measures (PM&E's).

The Applicant has failed to address the "primary" information areas listed above and stipulated in FERC's licensing handbook. The DLA does not contain information on even basic study needs such as turbine mortality, ramping impacts, etc. Accordingly, the DLA lacks conclusions regarding impacts and does not contain PM&E measures. Further, throughout First Stage Consultation the Applicant's representatives repeatedly stated the Applicant's intent to avoid "NEPA level evaluations" and "NEPA alternatives analysis". Therefore, the tribes and resource agencies are unable to comment on Project impacts, proposed Project Alternatives or Proposed Protection, Mitigation and Enhancement Measures because the Applicant has failed to include this information in the DLA. Accordingly, the resource agencies' and tribes' are unable to exercise their commenting authorities as provided for under 18 CFR 4.38(c)(5); 18 CFR 16.8(c)(5).

A lack of comprehensive studies describing current conditions, project impacts and PM&Es, will necessitate that NOAA Fisheries prescribe conservative measures under sections 18, 10(j) and 10(a) to meet NOAA Fishereis resource management goals and objectives and federal statutory mandates. In developing its Final Licence Application the Applicant needs to expand the scope and detail of analyses to include results of appropriate field studies, identification of project impacts, and appropriate PM&E's for fish and wildlife and their habitats.

Specific Comments

The Applicant issued its First Stage Consultation Document in December 2000. NOAA Fisheries reviewed the document and provided writtent comments and identified important relicensing issues and recommended methodologies to collect information for assessing project impacts. In order to comply with FERC's licensing regulations these issues must be addressed in the Final License Application to support PM&Es for the new License. Project relicensing issues include the following:

- Hydrology and Project Operations
- Water Quality
- Fish Passage
- Channel Maintenance and Riparian Habitat
- Hatchery Operations
- Predation
- Flow Ramping
- Alternatives Analysis
- Economic Analysis
- Cumulative Impacts

Hydrology and Project Operations

The Applicant presents limited information regarding hydrology of the project area and the Klamath River in the Initial Statement; the Executive Summary; Exhibits A, B, and E, and the Water Resources Draft Technical Report (DTR). Important components of the hydrologic analyses have not been completed, are not presented in the DLA, or are not mentioned at all. The information presented in these documents does not fully identify the affected environment; the significant resources present, or proposed PM&E measures, as required by 18 CFR 16.8. The Applicants discussion of proposed uses (E-3-13) does not include a description of current conditions regarding project operations as a Project alternative . For example the Applicant fails to describe peaking, bypass reaches, flow regulation, etc. in regards to proposed uses.
Part of the Applicant’s rationale for not conducting a detailed or comprehensive analysis of Project impacts is the assertion that the Project has “comparatively little effect on basin flow regime” (DTR-5-17). The purpose of the DLA is to document the existing environment and impacts related to the Project; the relative magnitude of various impacts to hydrologic processes in the Klamath River as a whole is not a factor in determining the Applicant’s responsibilities to document Project impacts. As a rule, the level of analysis should be commensurate with the level of impact. Given the Projects demonstrated impacts on ESA listed suckers and coho salmon an in-depth and comprehensive analysis is warranted.

The discussion of Project effects on hydrology focuses on comparisons between flows out of Upper Klamath Lake and flows downstream from IGD. While this comparison is important, the omission of substantive discussion of hydrologic conditions in the river reaches between these points is not warranted. Project features occurring between Link River Dam and IGD include bypass reaches, regulating dams, and peaking facilities. Clearly a detailed analysis and accompanying discussion of project operations and hydrology for these reaches is needed. Without this information, the first objective of the hydrologic analysis outlined in the Water Resources DTR will not be met (DTR-5-1). A major objective of hydrologic analysis is to provide "data and information as needed to support other studies that will further evaluate Project flow effects and potential modifications on other resources" (DTR-5-1). The results presented to date are not sufficient to meet this objective.

Seasonal Flows

The capability of the Project to affect seasonal flow paterns or peak flows is not addressed. The Applicant describes current agreements with the BOR to illustrate lost flexibility in project operations (B-4-1), and thereby implies that the Project has no effect on seasonal flow patterns. However, this assumption is invalid because it fails to take into account possible Project alternatives to modify and re-operate Project facilities to use storage impounded by Project reservoirs, for other non-power beneficial uses including downstream resources.

Daily and Weekly Flows

A primary objective of the Applicants hydrologic analysis is to determine the "potential effects of PacifiCorp operations on the short-term hydrologic regime" (DTR-5-1). The analysis presented in the DLA is insufficient to draw conclusions regarding Project impacts and potential PME measures necessary to minimize the impacts of Project operations on sensitive resources. Project effects on the short-term (daily to weekly) flow regime are not described in sufficient detail for the Link River and Keeno Reaches, and are not described at all for the other reaches. "Snapshot" summaries are not sufficient for determining Project impacts or for analyzing future operating scenarios; short-term flow modeling as described in the Water Resources DTR should be completed. Results of short-term hydrodynamic modeling for the three primary flow operational scenarios (see DTR-5-6) are not presented in the DLA. The Water Resources DTR notes that peaking operations can affect aquatic resources but provides no discussion of the frequency, duration, or magnitude of impacts from such operations. Past and potential future effects of Project reservoirs on peak flows are not addressed. Instead, the Applicant incorrectly concludes that Project reservoirs do not have sufficient capacity to affect peak flows.

Geomorphology

Linkages between the Project and geomorphic processes are of interest because of possible impacts to aquatic and riparian habitat. The information presented in Exhibit E (E-3-148 to 152) and the DTR (found in Chapter 6 of the Water Resources DTR) is incomplete. The DLA discussion of river geomorphology does not adequately characterize the existing environment and project impacts.

The cursory description of Klamath River geomorphology presented in Exhibit E (E-2-4) does not provide any information about the River downstream of IGD. A detailed description is important, given that Project effects on river geomorphology extend into this portion of the river.

The information used to describe the river between Link River Dam and IGD should also be described in greater detail. The discussion of Project impacts is substantially similar to "background" information presented in the Study Plan and does not incorporate study findings.

The Applicant has failed to propose PM&E measures and the study of geomorphic processes affected by the Project is incomplete. Accordingly, study objectives have not been met and Project impacts have not been sufficiently described to allow reviewing tribes and resource agencies to evaluate Project impacts and recommend PM&E measures. Further, none of the documents described in the literature review (Water Resources TR) are directly applicable to questions regarding the existing environment and potential Project impacts. The information in these documents is not adequate to comply with the informational requirements fo 18 CFR 16.

The DLA discussion of the discharge required to mobilize bed material (the "threshold of bed mobility") and bedload transport rates is lacking. Results depicting the threshold of bed mobility are presented for 5 of the 14 study sites. The Water Resources DTR notes that the calculations for the remainder of the sites will be completed in the future, contingent upon bedload sampling or flows sufficient to move tracer gravels (which might not occur until well after the License expires). Given that bedload sampling was conducted at the Shovel Creek site within the J.C. Boyle peaking reach (see DTR 6-12), it is not clear why bed mobility calculations for this site were not presented (see DTR). The Applicant omitted any discussion of suspended sediment transport rates. Aside from a summary of methods no results are presented. An accurate assessment of suspended sediment transport rates should be developed.

The Water Resources DTR includes (in Appendix 6) bedload transport rating curves developed using three different bedload transport models. However, the Applicant fails to describe the applicability of the various models, how each was calibrated and to explain the wide disparity in the results. Further, the range of flows covered by the bedload rating curves does not extend down to the flow at the threshold of bed mobility. Accordingly, the DLA does not provide information sufficient for making conclusions regarding the effects of Project related flow fluctuations on sediment transport.

The assessment of reservoir sedimentation presented in the DLA is incomplete. The primary objective of the reservoir bathymetry analysis was to support water quality model development. Consequently, bathymetry data is inadequate to describe the volume and character of sediments trapped in Project reservoirs. Completion of the surveys at tributary deltas is necessary to refine the estimates of sediment trapping and assess the effects of reduced sediment supply on fluvial processes and features in the river reaches downstream from dams.

Riparian

Discussion of riparian habitats in the DLA is limited to broad-scale descriptions of riparian resources and plant communities. The information presented lacks the specificity and detail required to assess the existing condition of the environment. There is no substantive discussion of Project impacts and no PM&E measures proposed. The DLA describes impacts to riparian areas caused by non-Project related activities and fails to describe the impacts of Project operations as required by 18 CFR 4.51 (f)(3). The Applicant should conduct studies necessary to evaluate Project impacts on riparian communities including impacts associated with sediment transport, flood plain connectivity, peaking operations, seed dispersal, riparian encroachment and bank modification.

Instream Flows

The Applicant has failed to finalize the study plan intended to support this section of the DLA. Outstanding and unresolved issues include habitat suitability criteria development, appropriate methods to be used in the Keno Reach, and PHABSIM output analysis. Field data collection has been ongoing without a final study plan. Because stream flow schedules will be central to Project Alternatives analysis and Final License Application development, this study is especially time sensitive and should be finalized as soon as possible.

<u>Peaking</u>

Adverse and often severe impacts to aquatic resources from hydro-peaking operations are well established in the scientific literature and previously documented for the J.C. Boyle Peaking Reach. The study plan intended to address these impacts remains in the conceptual phase and needs to be fully developed for review by tribes and resource agencies. The Applicant has failed to study the impacts of hydro peaking on aquatic resources and has failed to propose PM&E measures to address these impacts. Because hydro peaking schedules will be central to Project alternatives analysis and Final License Application development, this study is especially time sensitive and should be finalized as soon as possible.

<u>Ramping</u>

Ramping studies at Link River and J.C. Boyle fullflow reach were conducted by the Applicant in order to describe the occurrence of stranding and potentially the extent of stranding in these reaches. The Applicant provides no discussion of results from those study efforts. There are 33 side channels in the full flow reach which may contribute to heightened stranding risk. Stranding impacts or risks have not been described in the DLA or fish resources DTR.
The Applicant has refused tribe and resource agency requests to study the effects of ramping downstream of IGD. The Applicant holds that because Project operations do not affect ramping rates downstream of IGD, conducting studies are not its responsibility. Rather, the Applicant argues that ramping rates downstream of IGD are solely a function of BOR operations as dictated by Biological Opinions with the FWS and NOAA Fisheries.

Based upon modeling results, water releases from the BOR's Klamath Project (Link River Dam) would take 2-3 days to reach the IGD, if the hydroelectric Project did not act to reduce travel time. With the hydroelectric Project in place and operating, that same release would take a week or more to reach IGD. In addition, the hydroelectric Project impounds approximately 5,900 acre feet of potential storage. To date, the Applicant has been unclear and not entirely responsive in providing information on Project operations. However, it is clear from flow records that the Applicant makes use of storage to "shape" releases and has the ability to provide minimum flows, on a daily, weekly, or even monthly basis that differ from the real-time inflow from Link River Dam (Eureka Times-Standard 2003) (personal communication Todd Olsen).

Further, regardless of ramping rates imposed upon the BOR in the current Biological Opinion (NMFS 2002), the Applicant owns, controls and operates Project facilities and is responsible to maintain and operate its project consistent with the terms and conditions of its FERC License, and in compliance with the ESA. Through the FPA, FERC has the authority to condition the new license with ramping rate requirements necessary to minimize impacts on aquatic resources including listed coho salmon. To the extent that current Project operations, including ramping rates, are adversely affecting listed coho salmon, FERC must address those impacts during ESA section 7 consultation prior to issuing a new License for the Project. FERC and the Applicant must implement those reasonable and prudent measures that NOAA Fisheries determines are necessary and appropriate to minimize impacts of incidental take. Because ramping schedules will be central to Project Alternatives analysis and Final License Application development, ramping studies downstream of IGD are especially time sensitive and should be finalized as soon as possible.

Water Quality

Overall, there is a failure to describe water quality impacts in sufficient detail to allow reviewers to draw conclusions regarding Project related impacts and associated PM&E measures necessary to address impacts. For many water quality constituents, the water quality discussion seems to focus more on upstream/downstream comparisons that do not yield information on the effects of Project facilities and are not adequate for comparing and assessing the impacts of potential project alternatives on water quality. The discussion of existing data in Exhibit E focuses on effects of the BOR project operations and other effects unrelated to the Project. In addition the Applicant's use of averaging and "grouping" data points has the affect of obfuscating Project impacts within the context of seasonal processes and spatial patterns.

<u>Temperature</u>

The discussion of water temperature in the DLA focuses on average daily temperatures (DTR-3-18). This metric does not adequately describe conditions or impacts in the peeking reach, which experiences large daily temperature fluctuations. The DLA mentions the daily fluctuations of up to 12 degrees Celsius (DTR-3-16) but does not adequately explore the relationship between peaking operations and water temperature. The initial water temperature modeling results presented in the DTR provide a useful starting point for discussions of Project impacts.

<u>Other Water Quality Parameters</u>

The descriptive analysis presented in the DLA does not adequately represent the complex water quality dynamics in the river and reservoirs. The water quality modeling is incomplete and should be completed and expanded to broaden the geographic scope and include a full range of Project alternatives as recommended by the tribes and resource agencies. Numerous aspects of potential Project effects on water quality are mentioned in the text or discerned from figures but are not described in sufficient detail to allow reviewers to draw conclusions regarding Project impacts or develop PM&E measures to address these impacts. For instance:

· Dissolved oxygen (DO) appears to be lower at sites below J.C. Boyle, Copco, and IGD than at the next closest upstream river site, suggesting DO reductions as a result of water quality processes within Project reservoirs (Figure 3.7-9);

· Concentrations of chlorophyll-a appear to be higher below reservoirs than above (except for J.C. Boyle) (Figure 3.7-22), reflecting the presence of dense populations of a blue green algae, *Aphanizomenon*, in Project reservoirs (DTR-3-47); and

· The water Resources DTR (page 3-49) suggests that phosphorous (P) and nitrogen (N) are released from sediments due to anoxic conditions in the hypolimnion of Project reservoirs. A hypothesis presented on pages 3-54 regarding the stability of the hypolimnion in Copco and Iron Gate reservoirs and subsequent seasonal sequestering of P and N need more exploration.

The lack of multiparameter sites in the upstream portion of the J.C. Boyle Peaking reach precludes analysis of water quality trends in this reach or comparisons of nutrient processing between this and other reaches. More information is also needed to describe the abundance and role of attached algae and macrophytes that may effect water quality dynamics (DTR-3-49) and can be affected by Project operations (such as peaking or reductions in streamflow).

Water Quality Modeling

The results of the water quality modeling effort for parameters besides water temperature are not presented, even though “the modeling framework is substantially complete” (DTR-4-58). There is no discussion of DO in the Link River, Keeno, J.C. Boyle Bypass, and J.C. Boyle Peaking reaches. These results will be critical to the discussion of Project Impacts; without these results conclusions regarding project impacts on water quality can be determined and PM&E measures necessary to minimize project impacts on sensitive aquatic resources can not be developed.

Fish Passage

Fish passage at all 6 Klamath River mainstem dams is an ongoing impact of PacifiCorp’s hydroelectric project. Only Link River, Keno and JC Boyle dams have upstream fish passage facilities, while the California dams have no fish passage facilities and completely block native resident and anadromous fish movement. The Oregon dam fish passage facilities are ineffective and they do not meet federal or state passage criteria for anadromous salmonids, or lamprey.

Upstream Migration

The Applicant describes the facilities present at the Project, including basic information on passage structures and a limited history of fish passage facility purposes. Where existing passage facilities such as ladders or screens exist (J.C. Boyle, Keeno, and Link River dams), current performance standards of each facility was presented in the DLA and compared with current state and Federal passage criteria for resident species. The Applicant omits any discussion of continuing Project impacts to fish passage (DLA pg. 4-100) and fails to provide any PM&E measures to address these impacts. Although mentioned in the Fish Passage Design Memos, the Applicant has also failed to undertake studies necessary to determine impacts from false attraction arising from project discharges. The Applicant should study the need to provide draft tube or tailrace barriers at its facilities to determine the type of facility or operational modification necessary to avoid impacts from false attraction into Project discharges.

Fish Passage Planning and Evaluation Study 1.10 and the subset of anadromous fish related studies (1.17 and 1.18) have not been finalized. Although some information has been collected in the Fish Planning and Evaluation (Study 1.10), no interim or partial results are presented in the DLA (as has been done for other incomplete studies). Information that is currently available but not presented includes results of engineering reviews of proposed structural modifications, new facilities, or other fish passage options with potential associated costs described in the Fish Resources DTR.

NOAA Fisheries repeatedly recommended that the Applicant conduct a literature review and field survey to determine the historic use and potential viability of habitat currently blocked by Project facilities and potentially made available through improved fish passage. Because the Applicant has failed to provide the requested information, NOAA fisheries conducted a review of available information on the potential to restore access to anadromous salmonid habitat upstream of IGD (Edmondson 2003) (Fortune et. al. 1966) (Snyder 1931) (USDOI - BLM 2001, 2003). The results of this review are presented as Attachment III. of this document. Information on linear habitat was then applied to data obtained from the habitat rating worksheet for the Portland Gas and Electric Company's Deschutes River PASRAS model to determine potential smolt production (Burke and Dambacher). Smolt production per linear habitat available was calculated from the values for spring run Chinook salmon and steelhead for the three major reservoir arms on the Deschutes River. Unfortunately, similar values for fall-run Chinook salmon and coho salmon were not available at the time this document was being prepared. However, the values for spring run Chinook salmon (represented as SRC in Attachment III.) and steelhead (represented as SH in Attachment III.) should provide some context as to the potential benefit of increasing habitat for depressed salmonid stocks. Further, it should be noted that these values were derived from extensive literature review and field surveys for the Deschutes River and not the Klamath River. Hence, these values should be seen as a relative index value for comparing various fish passage scenarios rather than empirically based estimates of production. Based upon this work improved passage at the Project could provide an additional 279 to 312 miles of habitat (depending upon passage alternative) for Chinook salmon and steelhead and yield an annual increase in smolt production (index value) of 628,475 to 702,811 spring run Chinook salmon and 3,411,724 to 3,815,261 steelhead. Potential gains in coho habitat range from 45 to 77 miles.

Because fish passage will be central to Project Alternatives analysis and Final License Application, this study is especially time sensitive and should be finalized as soon as possible. However, rather than completing study plans and developing proposed PM&E measures the Applicant has proposed using an adaptive management approach to assess the potential for successfully providing salmon and steelhead with access to their former range. The adaptive management scheme proposed by the applicant would forestall the fish passage and reintroduction studies requested by the tribes and resource agencies untill well after the new License is issued and would defer implementing final mitigation (PM&E) indefinitely.

<u>Smolt Out Migration</u>
The scientific literature as well as resource agency and industry generated technical reports are replete with examples of significant impacts to fish populations resulting from entrainment and mortality at hydroelectric projects. Because of numerous site specific factors, entrainment and mortality can and does vary widely between different Projects. Therefore, a site specific evaluation is necessary in order to characterize impacts. This is particularly true in the case of the Klamath Hydroelectric Project where direct take of listed species is known to occur as a result of entrainment and mortality. However, the Applicant has rejected the resource agencies various requests for entrainment and mortality studies.

The Applicant has also failed conduct resource agency recommended studies necessary estimate smolt travel time through existing project reservoirs. As witnessed by the intensive study efforts on the Columbia River, smolt travel time can be a critical (and often controllable) factor limiting adult escapement. A study to determine smolt travel time is also necessary to inform the design of effective downstream fish passage facilities. The analysis of various downstream fish passage alternatives may hinge on cumulative or single reservoir travel times. Accordingly the Applicant should empirically determine downstream smolt travel time for each Project reservoir under at least 3 different conditions of flow/reservoir elevations (high, medium, and low), and employ a quantitative analysis of surface currents, in concert with a tag recapture study and radio telemetry study, to track movement patterns and identify risks of residualism. This information should be comprehensive and rigorous enough to determine the out-migration travel times for smolts moving through project reservoirs to inform the development of fish passage options, to minimize project impacts on out-migrating juveniles and to identify a preferable range of flow/reservoir elevation conditions to facilitate juvenile out-migration under various fish passage options. Without the additional information that such studies would generate, NOAA Fisheries will apply the precautionary principle and recommend conservative measures in order to ensure adequate protections are prescribed as part of the licensing process.

Existing Fishery Resources

All Fishery Resource information refers the reader to the Fish Resources DTR. However, the studies designed to address important aquatic issues generally have not been approved by the Plenary. Accordingly, no conclusions can be reached based on the information provided in the DLA because study results are unavailable. The Applicant has failed to provide potential PM&E measures. The Applicant provides only a brief and cursory discussion of Klamath River Tributaries (E4.1.5). This discussion is missing a number of tributaries important to aquatic resources of the Klamath River including the Trinity River, Jenny, Camp, Scotch, Long Prairie, Edge, Tom/Hayden and Frain Creeks. There are likely additional tributary streams, (second order streams) that provide important values to the fisheries resources that are either within the Project boundary or affected by Project facilities and operations. Further, the Applicant provides no discussion of historic anadromous habitat upstream of IGD in section 4.1. Similarly, section

4.2 also lacks a discussion of historic anadromous habitat that would be accessible to salmon and steelhead under improved fish passage conditions at the Project. Under section 4.2.3 (Fish Species of Special Importance) the Applicant omits any discussion of ESA listed coho salmon previously occupying habitat within the current project area. These omissions should be corrected.

Genetics
The Applicant has failed to conduct recommended investigation of salmon and steelhead genetics. The genetic composition of present stocks needs to be characterized through literature reviews and laboratory DNA analysis. This study should extend downstream to the extent of Project effects and upstream of Upper Klamath Lake. Additional analysis is needed to characterize the genetic variability and integrity (similarity to historic composition) of fish stocks proposed for reintroduction.

Hatchery Operations
The Applicant provides only a very general description of Iron Gate Hatchery operations. In section 4.2.6 of Exhibit E. The Applicant presents the production goals for Iron Gate Hatchery but fails to include a discussion of impacts or propose any PM&E measures. The Applicant has omitted any information concerning genetic, behavioral, or ecological impacts of hatchery operations on naturally spawned populations. In addition, the Applicant should address the potential future role of the hatchery in facilitating the reintroduction of anadromous salmonids upstream of IGD and in developing stocks for the purpose of reintroduction.

In order to characterize the impacts of Iron Gate Hatchery operations on native fish and aquatic resources and the allow for the development of effective PM&E measures, hatchery studies should focus on the following questions:

- Have the Iron Gate Hatchery operations retained all upriver anadromous genotypes that were present prior to dam construction?

- Have the genetics of wild stocks and species within the Klamath Watershed been altered by Iron Gate Hatchery operations and how would this affect long-term sustainability?

- Is the current location and hatchery product release locations best suited to minimize impacts of hatchery operations and hatchery product on naturally spawned fish and aquatic resources?

- What potential role could the Iron Gate Hatchery play in contributing to the recovery of listed salmonids?

Economics
The Socioeconomic Study Plan has the outward appearance of providing a rational basis for FERC's upcoming decisions relative to the Application to relicense the Klamath Hydropower Project. The current economic state of affairs is described in Phase I, a wide range of

alternatives is examined in Phase II, and a narrow range of alternatives is compared in more detail in Phase III. However, this sequence is rational only if the analysis of Phase II shows that the alternatives examined in detail in Phase III are superior to those discarded. Unfortunately, the applicant insists that Phase III be devoted to a comparison of its proposal (unspecified) and PM&E measures (also unspecified) to current conditions. This approach may reveal the appropriate PM&E measures for the current Project, but will not provide for an economic comparison of potential Project alternatives necessary to comply with NEPA, FERC guidance on conducting economic analyses and the balancing provisions of the FPA (sections 4(e) and 10(a)).

Phase III, as now proposed, compares the projected future economic outcome if the proposed project and its PM&E measures are implemented with current economic conditions. The proper comparison for FERC to use in deciding on the best use of the river for the next couple of generations is between the future outcome with each proposed package of changes in the project and the future outcome with no changes in the project. Current and past conditions should be used to predict what future conditions will be given alternative actions, but the past and the present (near past) are not choices. Only under the assumption that, in the absence of any change in the license, future conditions will remain the same as present conditions, does the comparison of future scenarios to current conditions provide a measure of the effects of the proposed changes. For many of the economic and physical variables involved in such an analysis, the most reasonable approach is to assume that current values are our best estimate of future values. However, there are several key variables which we know are likely to change in the future regardless of FERC's actions. We may not be able to predict with accuracy what their values will be in the future, but we can put reasonable upper and lower bounds on them. In such cases it makes sense to consider what might happen at either extreme of the range established, as well as what would happen given our best point estimate. Some of the changes from current conditions which need to be considered in this light are the following:

- Fish populations: Various salmon and steelhead populations may continue to decline, may stabilize, or may increase, depending on the adopted alternative, other conditions independent of the Project, and the dynamics of the population in question. These populations may continue to decline in the future even if no project changes are made.
- Human population: Change of regional population and region activities may be expected. County governments usually have planning departments which try to anticipate future development and concomitant demand for resources and infrastructure.
- Costs of resources: It has been reported in the press (and stated by the Applicant during various meetings) that the Applicant will not renew its contract with the BOR for providing electrical power to Klamath Project irrigators at a price far below current market prices. If this comes to pass and irrigators are forced to buy power at market prices, their cost of pumping water will be increased by an order of magnitude. This effective increase in the price of delivering water to fields can be expected to decrease the derived demand for water from the Klamath Project as well as for pumped ground water. How large the decline would be and how much of the decline would be for surface water compared to ground water needs to be estimated. This can be

accomplished using the agricultural models referred to in the Study Plan. The applicant has argued that the BOR would find some other way to renew the power cost subsidy to agriculture should the Applicant decline to renew this contract. However, this speculation should be treated as one possible outcome, not as a fact. The agricultural model should be run on the assumption of no change in the price of electric power to the irrigators and the assumption that when the contract lapses in 2006 they will begin paying the market price for power. If the short run demand for water or the short run profitability of irrigated farming changes significantly, then the long run effects on demand for water, changes in cropping patterns, changes in agricultural runoff effects on Klamath water quality, and changes in farm employment should be investigated. If the comparison of alternatives is sensitive to this price parameter, then a more careful analysis may be called for.

It is difficult to determine from the Study Plan what economic issues will be examined by the Applicant. The landscape options will be given superficial consideration in Phase II, but the proposed actions to be examined in more depth in Phase III are completely unspecified. The socioeconomic study primarily will evaluate the economic effects of physical and behavioral factors identified in the other study areas. However, some of the factors which will be important for determining the outcome of the relicensing process can be anticipated. The following are issues which the socioeconomic study needs to examine in depth, whether in Phase II or Phase III.

1. Water quality modeling indicates that the hydroelectric project exacerbates existing water quality problems by raising water temperatures and reducing or arresting the assimilative capacity of the River so that nutrients build up and are heated in the Project reservoirs prior to release at IGD. Under current conditions, the Applicants failure to mitigate for these impacts may result in an increased burden on BOR serviced, irrigated agriculture, in the form of higher minimum flow requirements with a concomitant reduction in irrigation deliveries or other mitigation such as land retirement. The Applicant should estimate the current economic impact on agriculture and estimate benefits associated with Project alternatives that mitigate for water quality impacts (i.e. construction and operation of a temperature control device).

2. Based upon modeling results, water releases from the BOR's Klamath Project (Link River Dam) would take 2-3 days to reach the IGD, if the hydroelectric Project did not act to reduce travel time. With the hydroelectric Project in place and operating, that same release would take a week or more to reach IGD. In addition, the hydroelectric Project impounds approximately 5,900 acre feet of potential storage. To date, the Applicant has been unclear and not entirely responsive in providing information on Project operations. However, it is clear from flow records that the Applicant makes use of storage to "shape" releases and has the ability to provide minimum flows, on a daily, weekly, or even monthly basis that differ from the real-time inflow from Link River Dam (Eureka Times-Standard 2003) (personal communication Todd Olsen).

Because of the minimum lake elevation requirements for Klamath Lake imposed by the FWS issued BO and the minimum flow requirements imposed by the NOAA Fisheries issued BO, very little operational flexibility remains in BOR's irrigation deliveries. This lack of operational flexibility reduces estimated firm yield and adds the risk of unplanned reductions in irrigation deliveries. The Applicant's hydroelectric Project represents approximately 5,900 acre feet of largely unused storage. The Applicant should estimate the potential value to BOR irrigated agriculture and the cost to the Applicant if some or all of the hydroelectric Project's storage were used during the irrigation season to ensure maintenance of both minimum flows and irrigation deliveries.

3. Changes in recreation participation rates if reservoirs are eliminated.

4. Changes in recreation participation rates if runs of anadromous fish are restored to the Klamath above Irongate.

5. Changes in recreation participation rates below Irongate if coho and chinook stocks increase significantly.

6. Changes in Tribal per capita income if coho and chinook stocks increase significantly.

The Application for this relicensing should provide a balanced treatment of all the alternatives to be considered by FERC for the Klamath Project, including those of resource agencies, tribes, and other stakeholders. The Applicant's study plan focuses on its preferred alternative while providing only cursory treatment of other reasonable alternatives. NOAA Fisheries has repeatedly urged the Applicant to conduct its economic analysis in manner that objectively considers public benefits under all the alternatives. The FPA requires a balanced economic analysis of alternatives to the proposed project. In a paper published by FERC in 1991, Mr. James Fargo wrote:

> *"...the Commission says this: before they take action on a license application, they need a record that fully evaluates all developmental and non-developmental aspects - including the arguments of agencies and interveners on competing uses of the water resource.*
>
> *In any particular relicensing proceeding, we may find some resources more important, and give them more weight, than others. We must weigh and balance the resources most critical to the public interest in the specific waterway at issue. And to strike the proper balance, we must develop a complete record.*
>
> *To make sure the record is complete, we need to do engineering and environmental studies of the applicants' relicense proposals and alternative proposals"*

(Evaluating Relicense Proposals at the Federal Energy Regulatory Commission, James M. Fargo, Paper No. DPR-2, April 1991).[13] We agree with FERC and believe the Applicant should follow this guidance.

Analysis of Reasonable Alternatives

The NOAA Fisheries has repeatedly requested the Applicant model specific Project re-operation and fish passage alternatives, determined by NOAA Fisheries to be reasonable. However, as reflected several times in the meeting notes, it is the Applicants position that it will not engage in alternatives analysis nor will it collect information to facilitate such analyses. Rather, the Applicant has proposed to conduct cursory ("high level") reviews of 3 scenarios: status quo, run-of-river and complete removal of all facilities. These reviews are too broad and general to allow NOAA Fishereis to draw any conclusions regarding reasonable alternatives, Project impacts, or potential PM&E measures. The Applicant should comprehensively evaluate a full range of fish passage and Project operating alternatives that independently and cumulatively assesses each Project development for its upstream and downstream fish passage limitations and potential benefits available under a range of Project modifications. Analytical methods employed will need to be powerful enough to predict impacts to native anadromous salmonids and their habitats. This involves a comprehensive (and systematic) evaluation of dam removal for each of the Project developments and re-operation of the Project with selective withdrawal capability installed at IGD. The water quality and fish passage models should be integrated to ensure that each Project alternative is analyzed under both modeling efforts. In addition to this scenario modeling, NOAA Fisheries determines that the following fish passage and Project operating scenarios are reasonable alternatives to the Project as currently licensed and therefore should be fully modeled, analyzed in detail, and included as alternatives in FERC's NEPA analysis for this project:

A - Iron Gate Dam Out

IGD removed, Copco 1, Copco 2 and JC Boyle facilities operated as run-of-river hydropower facilities. State of the art upstream and downstream passage facilities and fish protection screening constructed and operated at Copco 1, Copco 2, JC Boyle, Keno, East Side and West Side facilities and Link River Dam. Install hydroelectric generating facilities at Keno Dam.

B - California Dams Out

Iron Gate, Copco 1 and Copco 2 dams removed, state of the art upstream and downstream passage facilities and fish protection screening constructed and operated at JC Boyle, Keno,

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[13] At another point in this same paper Mr. Fargo states that "no matter what you call the process, looking at a range of proposals for using a water resource gives the Commission a chance to improve the use of the resource by deciding which option gives the greatest benefit to the public."

East Side and West Side facilities and Link River Dam. Install hydroelectric generating facilities at Keno Dam.

C - Mainstem Dams Out
Iron Gate, Copco 1, Copco 2, JC Boyle, and Keno dams removed. Construct and operate state of the art upstream and downstream passage facilities and fish protection screening at East Side and West Side facilities and Link River Dam.

D - Maximize Cold Water Management
Move Hatchery Intake (Fall Creek is one potential option) and withdraw water from lowest point in Iron Gate Reservoir (new selective withdrawal structure with aeration, or mix releases from current outlet works with bypass outlet works) to maximize management of cold water pool.

E - Full Volitional Fish Passage
Construct and operate state of the art upstream and downstream passage facilities and fish protection screening at Iron Gate, Copco 1, Copco 2, JC Boyle, Keno, East Side and West Side facilities and Link River Dam. Install hydroelectric generating facilities at Keno Dam.

F - Increase Generation
Install hydroelectric generating facilities at Keno Dam investigate potential to enhance generation at other facilities.

Alternatives analysis should include detailed cost estimates for dam removal, construction, operation and maintenance, and monitoring for each alternative evaluated. Please be aware that the additional scenario modeling outlined above may likely generate additional reasonable alternatives requiring evaluation.

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