UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
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November 15, 2010

David Miller, Division Administrator
Federal Highway Administration
PO Box 21648
Juneau, Alaska 99802

Dear Mr. Miller:
The National Marine Fisheries Service (NMFS) has reviewed the Essential Fish Habitat (EFH) Assessment included in the Knik Arm Crossing Biological Opinion dated April 2010. The Alaska Division of the Federal Highway Administration (FHWA) and Knik Arm Bridge and Toll Authority (KABATA) propose the construction of a bridge spanning Knik Arm from the Municipality of Anchorage to the Matanuska-Susitna Borough.

Under Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), federal agencies are required to consult with the Secretary of Commerce on any action that may adversely affect Essential Fish Habitat (EFH). EFH has been designated in the project area for anadromous salmon. EFH for salmon consists of the aquatic habitat necessary to allow salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to healthy ecosystems.

The proposed bridge crossing of Knik Arm would be located approximately 1.25 miles north of Cairn Point and would span approximately 2.5 miles. The preferred alternative design proposes an 8,200 foot long pile supported bridge connected to solid fill armored approach piers extending from the eastern and western shorelines. The bridge structure would be supported on piles with 275 foot spans rising to a height approximately 80 feet above mean lower low water (MLLW) at the navigable opening. The western pier approach would be approximately 3,000 feet long and the eastern pier approach approximately 2,000 feet. Each approach would be approximately 300-500 feet wide at the seabed. According to current descriptions the rip-rap armored approaches would remain slightly submerged even at MLLW on the terminus of an ebb tide, and would become progressively submerged to depths of over 30 feet at mean higher high water (MHHW) at the terminus of the flood tide.

Effects of the Project on EFH

As noted in our comments on the Draft Environmental Impact Statement (EIS), dated November, 2006, and on the Final EIS, dated February, 2008, the proposed bridge with extensive solid fill approaches would adversely affect EFH for salmon. These impacts are based on the direct and indirect effects of building the bridge and approaches, as well as secondary effects of new development that would be likely to occur on the western side of Knik Arm after the bridge is in place. Based on the information in the EFH Assessment we still conclude that the No-Action alternative is the best option for the conservation of Upper Cook Inlet salmon runs. However, the following comments relate to the impacts from a build alternative as presented in the EFH Assessment.

We concur with the statements in the EFH Assessment indicating that the relationships and interactions of fish populations, the influence of fresh and salt water mixing, nutrient loading, and the chemical and biological complexity and turbidity in Knik Arm are not completely understood. NMFS also agrees with FHWA's conclusion on page 29 that "...the project would adversely affect EFH because of the direct, construction, indirect, and cumulative impacts..." However, NMFS disagrees with FHWA's subsequent reasoning that "... those impacts would generally be due to construction and would be short term and local." While we concur that impacts from construction may be "short term and local," we do not agree that direct, indirect and cumulative impacts would be "short term and local." Additionally, while the EFH assessment correctly identifies that the preferred alternative would result in the loss of 90 acres of EFH and could alter migratory corridors for salmon, we disagree that this alteration would not adversely affect EFH. From the perspective of salmon runs, increased construction impacts to EFH associated with building a longer bridge (with less fill) would be preferable to the long term impacts resulting from significant fill, as proposed in the preferred alternative.

NMFS is concerned with direct impacts associated with the loss of intertidal habitat in Knik Arm that would result from the construction of the solid fill piers. Additionally, we are concerned that the pier approaches would impact juvenile salmon by restricting tidal flows and creating velocity barriers. Installation of 5,000 feet of riprap pier in the intertidal zone (i.e., nearly a mile of solid fill barrier across more than a third of the width of Knik Arm) would (1) alter tidal flows; (2) create tidal velocities at the distal end points of the piers that subject migrating salmon to greater stress than the existing shallow water migratory corridor; and, (3) likely decrease survival of outbound juvenile salmon. Further discussion supporting our rationale can be found in the enclosure.

EFH Conservation Recommendations

NMFS offers the following EFH Conservation Recommendations pursuant to Section 305(b)(4)(A) of the Magnuson-Stevens Act:

1) Eliminate potential adverse impacts to salmon migratory corridors in Knik Arm by avoiding solid fill and constructing the bridge approaches on piles similar to those proposed for the middle section of the crossing.

2) Develop a comprehensive mitigation plan to offset the adverse effects of any unavoidable fill for the bridge approaches. Suitable mitigation to compensate for the proposed impacts to EFH in Knik Arm would be costly, and reducing the need for compensatory mitigation by reducing the amount of proposed fill would offset a substantial portion of the costs of a less damaging design for the crossing.

Under section 305(b)(4)(B) of the Magnuson-Stevens Act FHWA is required to respond to NMFS EFH Conservation Recommendations in writing within 30 days. If FHWA will not make a decision within 30 days FHWA should provide NMFS with a letter within 30 days to that effect and indicate when a full response will be provided. Should you have any questions, please contact Doug Limpinsel at 907-271-6379 or Doug.Limpinsel@noaa.gov.

We will respond under separate cover to your request for consultation under the Endangered Species Act regarding Cook Inlet beluga whales.

Sincerely,

Robert D Mecum

for James W. Balsiger, Ph.D.
Administrator, Alaska Region

Enclosure

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ENCLOSURE: NATIONAL MARINE FISHERIES SERVICE COMMENTS ON THE EFH ASSESSMENT FOR THE KNIK ARM CROSSING

General Comments

The rationale and conclusions in the EFH Assessment do not accurately describe the permanent impacts of the proposed solid fill approach piers as a migratory impediment to juvenile Pacific salmon. The hydrologic model and conclusions do not adequately describe the velocity barriers and tidal flows that juvenile salmon would encounter in their outward migration. Studies specific to Northwest salmon indicate near shore habitat modifications and subsequent degradation have had cumulative impacts to juvenile salmon.

Hundreds of scientific citations document the importance of natural near shore and intertidal habitat to salmonids and the adverse impacts of human influenced modifications of near shore zones. This document provides additional information that FHWA should consider in support of NMFS EFH conservation recommendations.

Specific Comments

Tidal Currents

In previous communications, NMFS has expressed concern regarding the proposed construction of solid fill piers in the intertidal zone. The piers (western pier approach approximately 2,000 feet and eastern pier approach approximately 3,300 feet) would encroach well into the intertidal zone. The structures would create tidal restrictions and introduce velocity barriers at the distal ends. While this point is raised it is not adequately presented and discussed in the EFH Assessment.

As stated in Section 5.2, Roadway and bridge approach construction, page 21.

> *"Flow velocities around the planned bridge abutments would be higher than velocities fishes currently experience traveling near the shoreline (KABATA 2006d). However, because of the surface roughness created by the large armor rock (3–5 feet in diameter) a wedge-shaped volume of flow (boundary-layer wedge) would exist in waters directly adjacent to the proposed bridge approaches. Hydrologic computations demonstrate that, even at maximum tidal flows (i.e., spring ebb and flood) the boundary-layer wedge would extend 43 feet from the abutment to a depth of 22 feet, within which the flow speed would be less than 0.5 foot per second (KABATA 2006d). Thus, a typical fry of approximately 1.3 inches (35 millimeters) length would be able to avoid entrainment (Smith and Carpenter 1987) as well as have opportunities for rest and shelter within the numerous crevices of the armor rock."*

NMFS understands the difference between the "*surface roughness*" created "*adjacent to the proposed bridge approaches*", and we conclude that tidal velocities may be less imposing along the lengths of the abutments nearest the natural shore line. However, this does not address our concern regarding velocities specific to the distal ends of the pier structures.

The Technical Memorandum (Colonell 2005) provides a more accurate description of the Boundary Layer Wedge (BLW) as "*an area where tidal velocities would be reduced to .51 ft/sec*", and juvenile salmon "*could seek refuge there*". The Technical Memorandum clearly states "*the BLW will expand and contract as tidal flow speeds wax and wane with the tidal cycle.*"

To simplify, the BLW is an unstable and constantly shifting current eddy that can be used by out migrating salmon smolt as refuge if, 1) juvenile salmon can find it, 2) juvenile salmon can swim through higher velocity currents to access it, and 3) juvenile salmon can maneuver out of it when the eddy collapses "*as tidal flow speeds wax and wane with the tidal cycle*".

Swimming Velocities

The Smith studies (Smith and Carpenter 1987) cited in KABATA documents and the Technical Memorandum were reputable studies of the time and attempted to quantify salmonid swimming ability. However, this study was conducted in a controlled environment, essentially a large tube with steady one directional current flow. Smith, as well as investigators citing and/or conducting similar research identify several additional environmental factors that need to be considered when accurately assessing the ability of juvenile salmon to survive rapid velocities. Variables such as the species of salmon, general health, nutrition, age, size, and temperature, are all factors that influence swimming ability. In the case of Knik Arm or other subarctic estuaries where extreme tides are prominent, variables such as turbulence created by current eddies and gyres need to be accurately described and considered.

Each species of juvenile salmon has its own tolerance for different current velocities, so it is inaccurate to imply that one current velocity is tolerable to all five species of salmonid at various juvenile stages, where they will "*hold their own*" (Colonell 2005). Juvenile salmon encounter many environmental influences on their outbound migrations. The hydrologic models used here provide a description of possible tidal velocities, current eddies and sediment deposition around the proposed structures. These models do not accurately assess the cumulative impacts to juvenile salmon. That differentiation was not made clear in the EFH assessment. Juvenile salmon utilize the near shore and inter-tidal zones to avoid unpredictable tidal velocities and predation often found in deeper waters, as discussed further below.

Salmon in Estuaries

Countless studies have been conducted in the Northwest, as well as world wide, to gain a greater understanding of how intertidal near shore and estuary habitat support juvenile salmon populations.

A summary of results indicate that:

1) Human related manipulation and subsequent degradation of intertidal near shore habitat and migratory corridors have adverse impacts on juvenile salmon.
2) Juvenile salmon behave differently in the presence of armored or riprap structures along shore lines and estuaries.
3) Alteration of inter-tidal near shore habitat can alter natural species composition and abundance, and influence trophic interactions.

Although additional studies need to be conducted to gain a greater understanding of Knik Arm and its salmon populations, we disagree with the conclusion in Section 5.2, Page 20, Paragraph 3, of the EFH Assessment that Knik Arm intertidal and near shore habitat does not provide the ecological functions of refuge and smoltification.

> *"Many of the generalizations common to juvenile Pacific salmon use of near shore environments of clear-water estuarine habitat may be partially or totally inapplicable in Knik Arm. These include use of shallow water as refuge from predators (e.g., Heiser and Finn 1970); use of inter-tidal structures such as large woody debris, eelgrass, and kelp beds as refuge from predators (e.g., Brennan and Culverwell 2001); use of inter-tidal habitats due to abundance of epibenthic prey (e.g., Simenstad et al. 1982); and use of stream mouths and smaller estuaries for relief of osmoregulatory stresses (e.g., Meyers et al. 1998). Most of these functions are not provided for or are not necessarily exclusive to Knik Arm shorelines. Extremely turbid waters of Knik Arm reduce the necessity for using shallow waters to escape predation (e.g., Cyrus and Blaber 1987a and 1987b; Gregory and Levings 1998) and appear to obviate schooling behavior; the absence of natural inter-tidal structures limits near shore physical refugia; the distribution of food sources (e.g., crustaceans, amphipods, insects (Hemiptera and Diptera) and organic detritus and vegetative mats within both mid-channel and shoreline waters likely reduces dependence on littoral habitat for feeding; and reduced salinity within Knik Arm waters (averaging below 10 parts per thousand between June and August [KABATA 2006a]) coincident with peak juvenile use) provides favorable conditions for smoltification."*

A recent literature review (USFWS 2009), summarizing the results of surveys specific to Knik Arm, studies also cited in the KABATA Draft EIS, further indicate the presence of juvenile salmon captured in beach seines in intertidal near shore habitat.

> *"Houghton et al. (2005a) sampled Knik Arm from July – November in 2004 and April – July in 2005, spanning the entire juvenile outmigratory period. Juvenile*

salmon (all species combined) were the second most dominant in catches after threespine stickleback in 2004, and most abundant in beach seining in 2005 (Houghton et al. 2005a)."

The authors further describe the seasonality, species composition and abundance or density of all five species of Pacific salmon found in Knik Arm (Nemeth 2007, Houghton 2005). The review clearly states, four of the five species of Pacific salmon (sockeye, Chinook, coho, and chum) were all identified in the juvenile phase in near shore beach seines. Chinook and coho juveniles enter the Arm at a larger body size, appear to use near shore habitats preferentially, and remain in the Arm for longer time periods. These findings strongly suggest that Knik Arm near shore areas appear to provide essential habitat functions for salmon, as has been documented in the literature elsewhere. NMFS disagrees with the EFH Assessment conclusions that imply otherwise.

Many studies indicate all juvenile salmon occupy shallows of estuaries and near shore zones during some phase of their outmigration to the sea, though timing, duration, and abundance vary throughout the year depending on species, stock, and life history stage (Quinn 2005, Levins 2001, Williams 2001, Simenstad 1999, Spence 1996, Thorpe 1994, Groot 1991, Emmett 1991, Thom 1987). Near shore habitat acts a physiologic transition zone supporting the smoltification process and osmoregulatory changes between fresh and saltwater ecotones (Fresh 2006, Quinn 2005, Healy 1982, Fresh 1981,). Sub-yearling salmon repeatedly move through low and high tide areas thus zones of low and high salinity (Healey 1982, Levy 1982). These habitats and associated processes are integral to the survival and growth of salmonids (Simenstad 1983, Simenstad 1991, Thom 1987, Spence 1996). This early juvenile estuarine phase has been described as the critical period to reach critical size to ensure open ocean survival (Beamish 1981).

Near shore shallows are extensively used by salmon as refuge from predators and high tidal velocities, early in their out-migration and rearing periods (Brennan 2004, Beamish 1998, Shreffler 1992, Simenstad 1983, Simenstad 1982, Healey 1982, Mavros 1981, Healey 1980). The size of juvenile salmon is directly related to the habitat they occupy in estuaries such as shallow, near shore habitat, intertidal flats, including salt marshes and tidal creeks (Levings 1994, Levings 1991, Levy 1982, Myers 1982, Simenstad 1982).

Juvenile Chinook and chum salmon prefer shallow areas along estuarine and marine shorelines, including beaches and mudflats (Simenstad 2000, Simenstad 1982). Chinook smolt have been captured in water depths of a few centimeters to a meter or more over gravel, sand, and mud substrates, with and without eelgrass present (Beamish 2001, Fresh 1981, Healy 1980). These natural substrates appear to be preferred over manmade substrate. In references cited in McLain 2010, Chinook salmon fry are found in lower densities along riprap than in beach (sand-mud) substrates, suggesting riprap may be less used by fry.

"Higher densities of juvenile salmon have been consistently reported in non armored areas (rip-rapped) rather than in riprapped areas elsewhere in the U.S. West Coast, suggesting juvenile salmon show an affinity for natural habitat

(Knudsen and Dilley 1987; Schmetterling and others 2001; Beamer and Henderson 1998). Installation of riprap has been shown to be detrimental to salmon (Chapman and Knudsen 1980; Garland and others 2002)."

Shoreline modifications have the most dramatic effect on near shore fish densities and behaviors when the alterations extend from the supratidal through the subtidal zone (Toft 2007, Toft 2004). Alhough admittedly difficult to quantify, altering habitats alters species composition (McLain 2010, Bilkovic 2008), with subsequent outcomes to predator and competitor abundance. This has been identified as a major cause in declines of Pacific salmonid populations (Fresh 2006, Fresh 1997). Despite recognition of the linkage between impacted estuaries, coastal ecosystems and fisheries production, development impacts continue to degrade and impact essential habitat (Peterson 2009).

In closing, some of the assumptions reflected in the EFH Assessment contradict our understanding of juvenile salmon behavior and the importance of intertidal near shore habitat. Available data from Knik Arm appear to support the conclusion that shallow water habitats in the project area are important to salmon biology and would be adversely affected by construction of the proposed solid fill bridge approaches. NMFS therefore recommends using a design for the proposed crossing that avoids solid fill barriers if possible, or else minimizes the amount of fill while protecting shallow water migratory corridors along the eastern and western shores.

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