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Bulkley Valley Centre for Natural Resources Research & Management

An integrated assessment of the cumulative impacts of climate change and industrial development on salmon in Western BC

Fish: Summary of objectives and knowledge for decision support

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Executive Summary

Status: The pilot area includes the Stikine and the Nass Rivers: two of the largest river systems in BC. These river systems have high fish values, providing habitat for all species of Pacific salmon, steelhead and several resident fish populations, including blue-listed bull trout and dolly varden. The Iskut River, Stikine's major tributary, provides spawning and rearing habitat for up to 40 percent of the wild salmon in the system. Commercial and aboriginal fisheries are carried out in the lower Stikine watershed. Pacific salmon and steelhead species are extremely important to the Gitanyow and Nisga'a fisheries in the Nass watershed. Under the terms of the *Nisga'a Final Agreement*, a Joint Fisheries Management Committee, including representatives from Canada, BC and Nisga'a is tasked with co-operatively planning and managing Nisga'a fisheries.

Societal objectives: Fish are valued for their role in maintaining healthy aquatic ecosystems and for their contribution to salmon-grizzly ecosystems. They are highly valued for their contribution to aboriginal, sport and commercial fisheries in the area. Federal objectives aim to "...maintain healthy and diverse salmon populations" and identify salmon conservation as the highest priority in resource management¹. Similarly, BC First Nations aim to maintain healthy aquatic ecosystems that are resilient to change. The Province of BC aims to maintain a naturally rich and sustainable freshwater fish resource. The Cassiar Iskut-Stikine LRMP has the goal of maintaining "healthy aquatic and riparian ecosystems and the species that they support within their natural range...". The Nass SRMP and Gitanyow Land Use Plans have the goal of maintaining fish and their habitat, based on the federal Wild Salmon Policy.

Habitat: Freshwater streams provide important habitat for reproduction and growth of salmon and resident fish. High mortality of fish in the early life stages results from natural predation, siltation, high water temperatures, low oxygen concentration, loss of stream cover, and reductions in river flow. Estuaries and their associated wetlands provide vital nursery areas for the salmon prior to their departure to the open ocean.

Risk factors: Overfishing, habitat loss and climate change pose significant threats to fish populations. Overfishing is the primary risk.

Overfishing is controlled by license quotas and by access restrictions. Even moderately-high quotas can pose a high risk of overfishing to small salmon stocks in a mixed stock fishery, where harvest targets cannot be set for each stock. Providing road access to remote lakes and streams increases risk to certain species. For example, populations of long-lived, slow-maturing species like lake trout can be substantially affected. Similarly, bull trout congregate in stream pools and can be heavily impacted by illegal fishing. **Retaining road-free buffers of > 500m around water bodies substantially reduces risk due to fishing.**

¹ The Federal government manages salmon; the province manages non-salmon freshwater fisheries and also sea-run steelhead, cutthroat and Dolly Varden.

Fish habitat, consisting of water, substrate and biota, can be impacted in several ways:

- Development activities that expose soil, or increase overland flow, can increase **fine sediment**² delivery to streams, choking fish and burying spawning beds. The effects are most pronounced in the relatively-few, warm and productive clear-water streams that occur in the pilot area. Roads and stream crossings have been common sources of sediment, historically, depending on construction and maintenance standards. The construction phase of almost all projects causes high sediment delivery, but for a limited period.
- Development that increases landslide risk can increase **coarse sediment** delivery and alter stream morphology and substrate. Increased coarse sediment can fill pools, cover spawning habitat and reduce channel complexity, potentially impacting spawning, staging, rearing and overwintering habitats. **Cut and fill slopes and poor drainage systems on unstable terrain—especially fans in the pilot area—pose high risk.** Landslide risk related to roads can be largely mitigated by following best management practices.
- **Toxic chemicals** affect water quality and can kill fish and their food. Fuel and oil spills are a risk on sites where equipment is used. Mine sites produce high volumes of highly acidic, toxic tailings. Tailings pond failure poses a low probability, but high consequence, risk.
- **Minimum flows** must cover fish and their spawning habitat. **Point-source development can alter streams in extreme ways.** Streams can be buried—filled in by tailings impoundments. Streams can be diverted, leaving historic streambeds without water. Streams can be mostly diverted into penstocks (large pipes), leaving a small percent of water flowing in the original channel for several kilometers and potentially leaving spawning habitat above water. Poorly designed dams can prevent fish passage and can interrupt flows and kill fish downstream. Minimum flow levels, warm water sources such as diversion ditches, and forest clearing affect stream temperature. Temperatures can become too high for survival or for successful spawning of temperature sensitive species and can affect competition among species.

Climate change greatly increases uncertainty about achieving fish objectives. It is generally accepted that climate-related changes in fresh water and the ocean ecosystems will have a major impact on the population ecology of Pacific salmon. The specific factors that regulate Pacific salmon abundance (and are responsible for the recent declines) are not well understood, however, making it difficult to predict the impacts of climate altered ecosystems.

² Ongoing work aims to develop hydrological models that can roughly predict coarse and fine sediment delivery and flow level.