

16 March 2010

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Mr. Noble holds a B.Sc. in Zoology (UBC) and has retired after a lengthy and diverse career in BC fisheries. From 1974 – 1995 he held a managerial position with BC Packers in which he was involved in the net and troll fishery acquiring all species of salmon, i.e. sockeye, from the Skeena and Nass Rivers, Smith's, River's Inlet, Barkley Sound, Johnstone Straits, Bristol Bay (Alaska) and the Fraser River fisheries. In 1985 he founded the Langara Fishing Lodge in the Queen Charlotte Islands. Although Mr. Noble currently has no financial interests in the fishery, he is concerned over the apparent deterioration of the fishery and would like to provide his insights to the Commission.

Fry and Smolt survival from spawning grounds to the estuary

It appears that Fisheries has done a good job in getting the spawners back to the spawning grounds. However, there may be some issues as to what happens to the resulting fry and smolts after they leave the lakes. Things may have changed since I was last involved in the fishery, but it appears that the only location where exiting fry are counted is at Chilko. There is no way to know how the fry are doing after that point, as they move down further into the Fraser River and estuary.

You have to systematically try to determine what if anything has happened, has changed in the Fraser River and the estuary lately that might be responsible for the change. While cattle and dairy farming has remained relatively constant along the river, and isn't likely a cause for the recent sockeye decline, other changes might need investigation. For example, increased water temperatures, global warming may be a factor to explore. Another is the exponential increase in blueberry and cranberry production further along the river. Are these farms using pesticides that may be affecting the water quality? Are there discharges and physical topographic changes in the estuary coming from the Roberts Bank expansion – is that huge unnatural breakwater creating a huge “smolt predator haven trap?” Are log booms increasing anoxic pools that suffocate smolts?

As you move along their critical path into the estuary and towards the ocean, other environmental changes might be of concern, such as loss of habitat for smolts, which require shelter as they pass through. Fish farm processing plants might also be or have been unknowingly releasing sea lice, which are scraped off the fish as they are processed – do they/ can they survive in brackish water? There have also been large populations of predators at the mouth of the Fraser, such as sea lions and seals. It may be important to consider why these populations are there, what they are feeding on and whether the species further down the food chain might be implicated in the sockeye decline. Predators may be capable of eating an enormous amount of fish.

Because of all these potential challenges to fry and smolt survival that exist between the spawning grounds and the ocean, it is important for managers to know exactly how many fry leave the lakes and to map out a population grid to see where along the way mortality is occurring, the critical path. It would be useful to consult with Upper Fraser River First Nations, they are very familiar with physical aspects of the river and able to recommend smolt counting locations.

Smolt and Juvenile survival in the near ocean

Around February or March, smolts and juveniles make their way out of the gulf. At this time, it is important to halt the other fisheries, such as the small-mesh shrimp fishery, the mid-water trawls for plankton and possibly gulf hake fishery. These fisheries may be causing incidental catch mortality, or by-

catch, which may not always be reported. There are no independent observers to record the degree of by-catch harm to smolts and fishers often do not work hand-in-hand to share such information in fear of potential fishery closures. The gulf herring roe fishery does not appear to affect the smolt migration.

Fisheries assumes that the majority of smolt migration then comes out through Johnstone Strait as opposed to around the San Juans. At this point there is really nothing along the migration route that may be affecting the smolts up through the Johnstone Straits other than perhaps sea lice from farmed salmon processing plants. Coincidentally, there are two fish farm processing plants directly above and below Seymour Narrows. Directly above and below Seymour Narrows are two excellent smolt holding areas, Menzies Bay and Deepwater Bay, where smolts could be potentially very vulnerable to sea lice predation. To confirm whether the numbers along the Straits are being affected by sea lice, or the fish farms, it would be useful to apply sonar or hydroacoustic equipment to track smolt numbers before and after they pass the Broughton Archipelago. Such tracking technology is described in the March 2010 issue of the Economist (page 147) and could be applied to sockeye. With known numbers of smolts travelling along the Straight, managers could then assess whether this area is a source of mortality or whether the next step on the critical path - ocean factors might be involved.

Juvenile and Adult survival in the open ocean

The only pelagic fish that appears to be increasing in numbers on the BC coast are pilchards – need to determine if they are potential predators. The Fraser, Nass, Skeena Rivers, River's, Smith's Inlet fisheries are all experiencing the same problem of declining sockeye returns. However, if the smolts are getting out into the ocean and not returning, then perhaps there are ocean issues to investigate. One suggestion is that ocean productivity may be down such that there isn't enough food for the juveniles to feed on. However, the Alaskan Bristol Bay fishery has continually been very good so that may rule out food shortages.

Another possibility is that changing ocean temperatures and gulf streams might be causing Fraser River sockeye to migrate further out to feed than they otherwise would, raising their susceptibility to being caught in the high-seas fishery. Whereas the Bristol Bay sockeye are believed to stay North of the Aleutians,¹ the Fraser River sockeye may go out as far as 170 degrees East longitudinally to feed, and may be caught by large high-seas fishing boats operated by Koreans, Russians or Japanese fishers. I have heard that the Russian fishers obtained a record sockeye catch last year, and it may be useful to consider whether part of this catch included Fraser River sockeye in international waters.

Note that market conditions for canned sockeye salmon may also provide some insight. The price of Grade A canned sockeye salmon has remained relatively constant despite three successive years of closed fishery along the Fraser. This means that the world production of high grade sockeye salmon for canning must still be provided from somewhere and it would be useful to know where. John West is a UK-based importer/exporter of canned salmon and may be a good resource for information on the canned salmon market. DNA testing of canned salmon would determine if Fraser River sockeye.

Going forward

With a quota system and the Pacific Salmon Commission's determination of catch numbers, it is unlikely that the cause of the sockeye salmon decline is over-catch commercially, sport, or First Nations. With that in mind, additional research into the actual causes of fish mortality may be required. However such

¹ Additional information on the Bristol Bay fishery may be obtained from the National Marine Fisheries Service (NMFS) based in Seattle under the National Oceanic Atmospheric Administration (NOAA).

research should be designed to have practical applications towards saving the fishery macro manage. For example, instead of researching natal-stream homing, why not focus research on the causes and effects of sockeye mortality, to determine exactly where along the migration path the fish are disappearing and then address those causes?

We might also want to adopt programs such as those in place in England, where custodians may be assigned to select rivers to protect the salmon habitat and ensure their abundant return. These programs will cost money, but if harvests are produced as a result, then the profits can go back towards funding the programs. The Pacific Biological Station Nanaimo or Bamfield may be candidates for getting such programs running. In summary, the deteriorating sockeye dilemma can be resolved by progressively starting to eliminate some of the grey areas. It is not an exact science but analyzing specific representative samples/data with a high degree of confidence, eliminating that cause and then moving on to the next path trying to isolate and eliminate it as well will eventually narrow down the problem(s) and manifest the subsequent solutions.