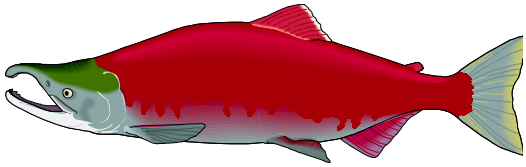

Skeena River Sockeye Salmon

Background

Anadromous sockeye salmon (Oncorhynchus nerka) occur throughout the temperate North Pacific Ocean. They spawn in rivers and lakes from the southern Kuril Islands north to Kamchatka on the Asian coast, and from the Columbia River north to Alaska on the North American coast. Although sockeye salmon exhibit remarkable variation in life history, they typically emerge from nests in gravel as free-swimming fry in the spring, spend one or two years rearing in a freshwater nursery lake, and then migrate to the ocean where they spend another two or three years before returning to their natal stream to spawn and die.

In Canada, the Skeena River is second only to the Fraser River in its capacity to produce sockeye salmon. At least 70 distinct spawning sites and 27 lakes are utilized by sockeye salmon within the Skeena watershed. These nursery lakes are distributed from the coast to the high interior regions and vary widely in size and productivity (Fig. 1). The 500-square-km Babine-Nilkitkwa lake system is the largest natural lake in British Columbia and supports the largest single sockeye salmon population in Canada. The Babine population has accounted for 75-95 % of Skeena sockeye salmon production, averaging more than 3.8 million adult fish annually since 1990. Fry recruitment is greatly enhanced by spawning channels in the Fulton River and Pinkut Creek, which typically account for more than 70 % of smolt production from the Babine-Nilkitkwa lake system.

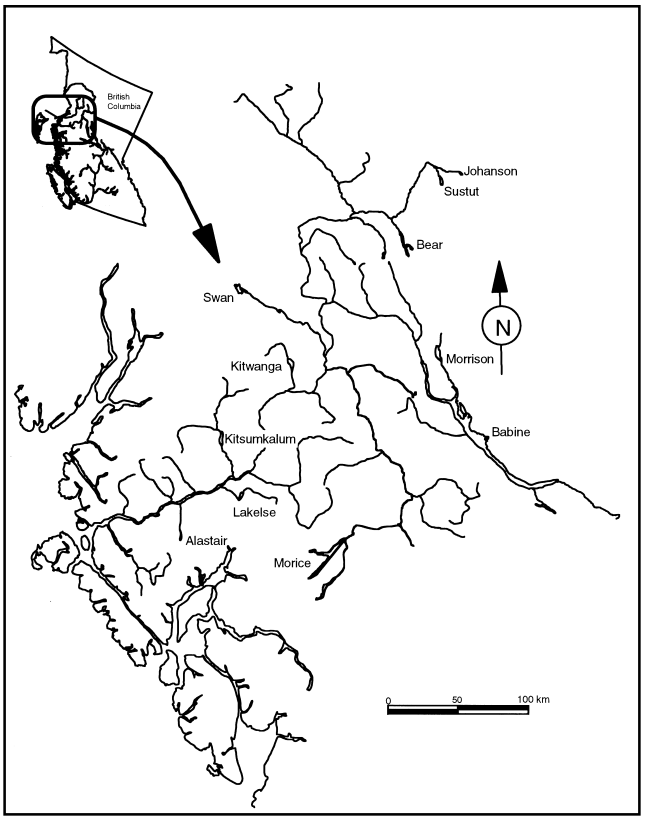

Figure 1. Map of the Skeena River showing principal nursery lakes for sockeye salmon.

Skeena sockeye salmon smolts migrate to sea in late April through June, then move northward along the coast and offshore into the North Pacific Ocean. Most mature at age 4 or 5, although males ("jacks") also commonly mature at age 3. The maturing fish return from offshore waters of the North Pacific Ocean through Southeast Alaska and enter the Skeena terminal fishing areas from late June through mid-August (The run typically peaks on July 23.) Spawning occurs from late July to October, but timing differs among populations largely as an adaptation to local water temperature regimes.

Fisheries

First Nations

Sockeye salmon are an important food for First Nations and aboriginal fisheries have operated in the Skeena River for at least 5,000 years.

Members of three First Nations, in 17 aboriginal communities harvest Skeena sockeye salmon: the Carrier-Sekani (Babine Lake area), Gitksan Wet'suwet'en (middle and upper Skeena) and Tsimshian (lower Skeena and adjacent ocean areas). Catches for food, social or ceremonial purposes have averaged 150,000 fish in recent years (Fig. 2). Since 1993, new opportunities have also developed for First Nations to selectively harvest sockeye salmon considered surplus to Skeena spawning requirements. First Nations selectively harvested 500,000 surplus fish in 1996, but no surplus was available in 1997 and 1998.

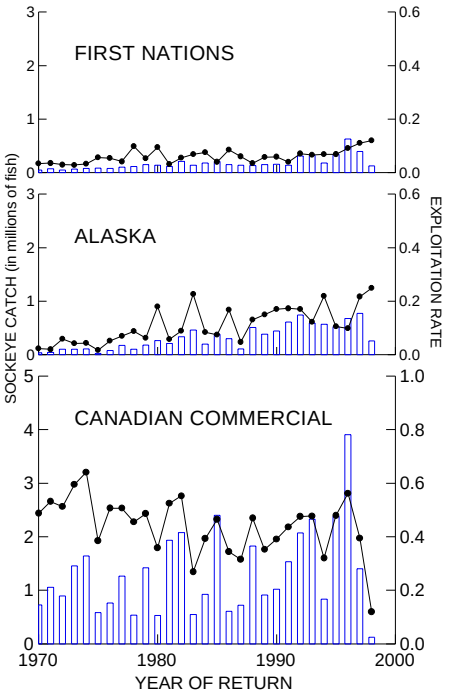

Figure 2. Trends in catches (bars) and exploitation rates (line) by fishery.

Commercial

The commercial salmon fishery on Skeena sockeye salmon began with the first cannery operations in 1877. Sockeye salmon were harvested predominantly by gillnets in the Skeena River until the 1930s when powered vessels moved out to ocean fishing areas. In recent times, 200 to 1,000 gillnet vessels have fished from the Skeena River mouth to outside fishing areas 70 km distant, accounting for about 75% of the harvest of Skeena sockeye. A seine fishery was introduced in the 1950s and grew rapidly through the next two decades. As many as 350 seine vessels have fished Skeena sockeye, predominantly in the outside fishing areas. Significant reductions in the gillnet and seine fleets have recently been achieved through the Fisheries and Oceans Canada fleet restructuring initiative. The Canadian commercial catch of Skeena sockeye salmon has generally increased since 1970 to a record high of 3.7 million fish in 1996 (Fig. 2). However, fishing effort was severely restricted in 1997 and 1998 because of low sockeye salmon abundance.

Many Skeena sockeye salmon migrate homeward through Southeast Alaska and a significant proportion of the total run is harvested in Alaskan gillnet and seine fisheries (Fig. 2). The Pacific Salmon Treaty limits catch in Alaskan fisheries directed at Skeena sockeye salmon, but other interceptions occur as incidental harvests in Alaskan pink and chum salmon fisheries.

Recreational

Opportunities for sport fishing on surplus enhanced sockeye salmon in the Skeena River have been provided in recent years. However, the recreational fishery remains extremely limited, with catches estimated to be only a few thousand fish.

Resource Status

The management of Skeena sockeye salmon involves a compromise between the dual objectives of maximizing catch from a single productive stock (enhanced Babine sockeye salmon) and maintaining production from a diversity of less productive salmon populations. Accordingly, sockeye fisheries in Area 4 are managed to moderate harvest rates (42%) and timed to reduce the incidental catch of Skeena coho and steelhead, as well as the earlier-migrating non-Babine sockeye. The aggregate escapement goal for Skeena sockeye salmon is 900,000, but management has typically aimed to increase both escapement and exploitation rate when abundance is high.

A daily fishery model is used to evaluate alternative management scenarios and to estimate run size in-season. The gillnet test fishery at Tyee in the lower Skeena River provides daily escapement indices that are calibrated against reliable escapement counts at the Babine River fence. A comprehensive monitoring program on the fishing grounds provides in-season estimates of commercial catch and effort. In-season forecasts of total abundance based on these data have proven to be relatively accurate by the second or third week of the fishery.

Abundance and Exploitation Rate

Skeena sockeye salmon abundance has increased dramatically since 1970 because of enhancement efforts at the Babine Lake Development Project and favourable marine survival. Over the same period, exploitation rates in the Canadian commercial fishery have actually declined because of increasingly restrictive management actions to protect less productive populations of steelhead, coho and chinook. In contrast, the exploitation rate in the Alaskan fishery has increased steadily from an average of 3 or 4% in the early 1970s to 17% in the 1990s. Total exploitation rate for the aggregate Skeena sockeye salmon run has averaged 65% since 1990, exceeding 70% only in 1992, 1996 and 1997 (Fig. 3). In part, the higher exploitation rates in the 1990s reflect selective harvesting of enhanced sockeye salmon in-river and in terminal ocean areas.

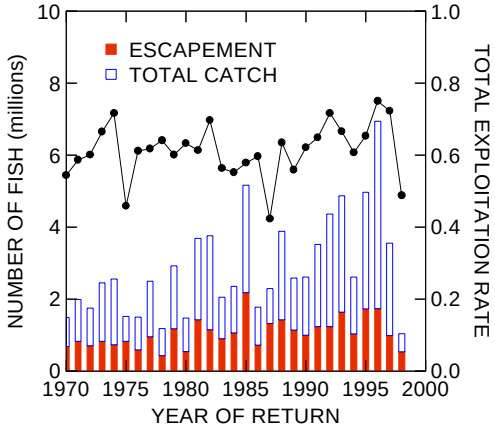

Figure 3. Trends in escapement (solid bar), total catch (open bar), and total exploitation rate (line).

Skeena sockeye salmon abundance declined dramatically in 1997 and 1998, as forecasted from observations of pre-spawning mortality and record low smolt abundance associated with parasite infections in Babine Lake.

Spawning Escapements and Freshwater Production

Escapements to enhanced sites in Babine Lake typically exceed spawning requirements such that on average, more than a third of the Babine fence count is surplus produced by the Babine Lake Development Project. This occurs because the enhanced Fulton and Pinkut runs cannot be harvested fully in mixed-stock fisheries without over-harvesting less productive populations. In contrast, escapements to the co-migrating, wild Morrison River run remain below escapement objectives and pre-enhancement levels. Recent escapements to other wild runs within Babine Lake whose run timing is either earlier or later than the enhanced Fulton and Pinkut runs are not statistically different from pre-enhancement levels.

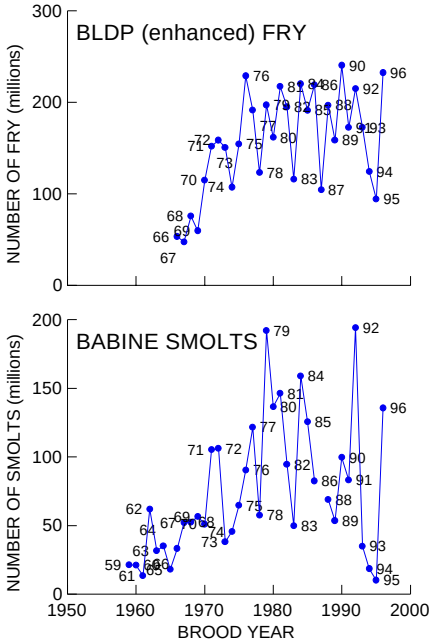

Figure 4. Trends in fry recruitment from the Babine Lake Development Project (upper panel) and total Babine smolt abundance (lower panel).

Smolt production from the main basin of Babine Lake has increased dramatically as a result of enhancement (Fig. 4). The enhanced Fulton and Pinkut runs now account for about 90% of fry recruitment to the main basin. Even so, the available data suggest fry recruitment is still below levels required to yield maximum smolt biomass and maximum adult returns. In contrast, wild smolt production from Nilkitkwa Lake appears to have declined to less than a quarter of the level observed before enhanced returns were first exploited in 1970.

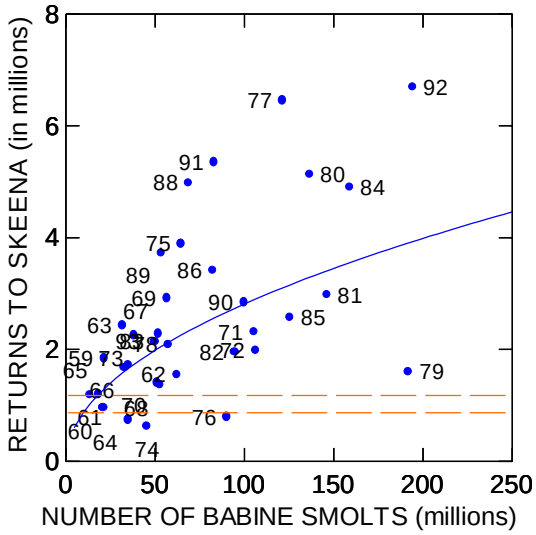

Figure 5. Relationship between Babine smolt abundance and subsequent adult returns to the Skeena River. Labels refer to brood year; dashed lines indicate poor adult returns expected from the 1994 and 1995 brood years.

Increased smolt production from the Babine-Nilkitkwa lake system has led to dramatic increases in adult returns (Fig. 5). However, the relationship between adult returns and smolt abundance is non-linear, perhaps reflecting competition among smolts. Even so, increased adult production could be expected from increased smolt production. The disparity between smolt-to-adult survival in even versus odd years noted by previous investigators is no longer evident.

Spawning escapements to other sockeye salmon populations in the Skeena watershed have been increasing steadily since the 1980s, presumably because of continuing efforts to harvest enhanced Babine sockeye salmon more selectively (Fig. 6). However, escapements were generally poor in 1998 due to a combination of low marine survival and excessive harvest of the early-timing runs. Alaskan fisheries accounted for over half of the total exploitation rate on Skeena sockeye salmon in 1998 because the Canadian commercial fishery was greatly restricted.

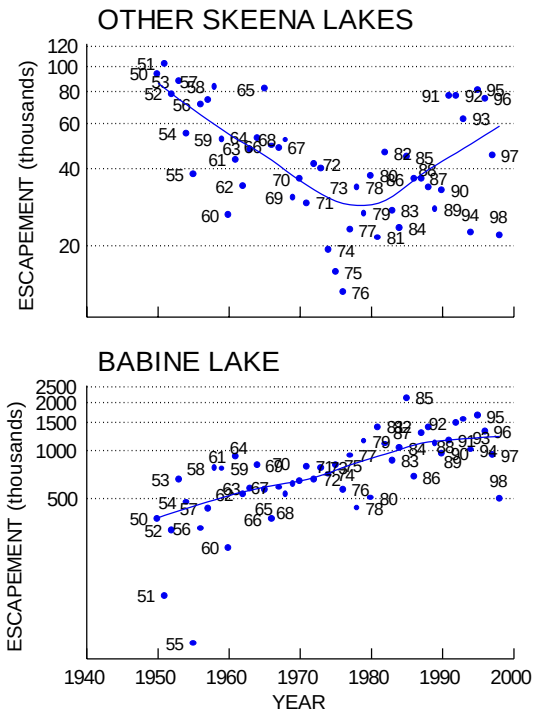

Figure 6. Trends in escapement in wild (upper panel) and enhanced (lower panel) populations.

Recent analyses of limnological and spawning ground survey data for the Skeena lakes indicate that in most cases, escapements are much too low to fully utilize lake rearing habitat and maximize smolt production. Minimum escapement goals or "limit reference points" are now being defined for the non-enhanced Skeena populations to ensure their conservation.

Outlook

Skeena sockeye salmon abundance is likely to be a record low in 1999, based on low Babine smolt abundance observed in 1995 and 1996 (Fig. 5), corroborated by the weak returns of sibling age

classes observed in 1998. The sibling forecast model indicates only a 75% chance that adult returns to the Skeena River will exceed 409,000 fish and a 50% chance that returns will exceed 578,000 fish. Fortunately, smolt production has now returned to average levels, and Skeena sockeye salmon returns are expected to improve in 2000 and return to average levels in 2001.

For More Information

Contact:

Chris C. Wood
Fisheries and Oceans Canada
Pacific Biological Station
3190 Hammond Bay Road
Nanaimo, B.C. V9R 5K6
TEL: (250) 756-7140
FAX: (250) 756-7053
EMAIL: woodc@dfo-mpo.gc.ca

Dave Peacock
Fisheries and Oceans Canada
417 2nd Avenue West
Prince Rupert, B.C.
V8J 1G8
TEL: (250) 627-3467
FAX: (250) 627-3411
EMAIL: peacockd@dfo-mpo.gc.ca

References

Burgner, R.L. 1991. Life history of sockeye salmon (Oncorhynchus nerka). pp. 1-117 in C. Groot and L. Margolis (ed.) Pacific salmon life histories, University of British Columbia Press, Vancouver.

Foerster, R.E. 1968. The sockeye salmon. Bulletin of the Fisheries Research Board of Canada 34:113p.

Shortreed, K.S., J.M.B. Hume, and C.C. Wood. 1997. Recommended escapements to secondary sockeye nursery lakes in the Skeena River system. PSARC Working Paper S97-9: 48 p.

Smith, H.D., and J. Lucop. 1966. Catalogue of salmon spawning grounds and tabulation of escapements in the Skeena River and Department of Fisheries Statistical Area 4. Fish. Res. Board. Can. MS Rep. Ser. (Biol.), Nanaimo, 882:1-7.

Wood, C.C., D.T. Rutherford, and L. Jantz. 1999. Trends in abundance and pre-season 1999 stock size forecasts for major sockeye, pink, and chum salmon stocks in northern British Columbia.Canadian Stock Assessment Secretariat Research Document 99/126: 50 p.

Wood, C.C., D.T. Rutherford, D. Bailey, and M. Jakubowski. 1998. Assessment of sockeye salmon production in Babine Lake, British Columbia with forecast for 1998. Can. Tech. Rep. Fish. Aquat. Sci. 2241: 50 p.

This report is available:

PSARC Secretariat
Pacific Biological Station
Nanaimo, BC V9R 5K6
Phone: (250) 756-7208
Fax: (250) 756-7209
E-Mail: psarc@pac.dfo-mpo.gc.ca
Internet Address: (www.dfo-mpo.gc.ca/csas)

ISSN 1480-4913 (for English series)
ISSN 1480-4921 (for French series)

La version française est disponible à l'adresse ci-dessus.

Correct citation for this publication

DFO, 1999. Skeena River Sockeye Salmon. DFO Science Stock Status Report D6-10 (1999).