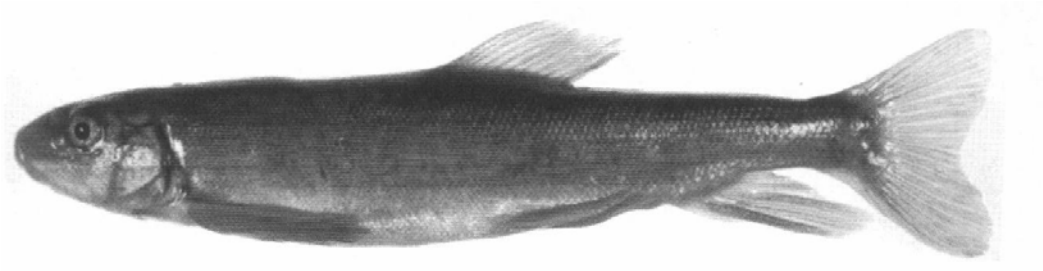
COSEWIC
Assessment and Update Status Report

on the

Salish Sucker
Catostomus sp.

in Canada



ENDANGERED
2002

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE IN
CANADA

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COMITÉ SUR LA SITUATION DES
ESPÈCES EN PÉRIL
AU CANADA

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

COSEWIC 2002. COSEWIC assessment and update status report on the Salish Sucker *Catostomus* sp in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 27 pp.

Previous report:

McPhail, J.D. 1986. COSEWIC status report on the Salish Sucker *Catostomus* sp. in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 29 pp.

Production note: COSEWIC would like to acknowledge Alex E. Peden for writing the status report on the Salish Sucker *Catostomus* sp. prepared under contract with Environment Canada.

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Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC du Meunier de Salish (*Catostomus* sp.) au Canada

Cover illustration:
Salish Sucker — Photograph courtesy Alex Peden.

Catalogue No. CW69-14/198-2003E-IN
ISBN 0-662-34243-7

COSEWIC
Assessment Summary

Assessment Summary – November 2002

Common name
Salish Sucker

Scientific name
Catostomus sp.

Status
Endangered

Reason for designation
The Salish Sucker has a very restricted Canadian range within which populations are in decline as a result of habitat loss and degradation resulting from urban, agriculture and industrial development.

Occurrence
British Columbia

Status history
Designated Endangered in April 1986. Status re-examined and confirmed in November 2002. Last assessment based on an update status report.

COSEWIC
Executive Summary

Salish Sucker
Catostomus sp.

Species Information

The Salish sucker (*Catostomus* sp.) has yet to be scientifically named as a species. Genetic and morphological data indicate it is distinct from the longnose sucker (*Catostomus catostomus*), the species from which it evolutionarily diverged in the Chehalis Refugium during Pleistocene Glaciation. Longnose suckers might occur in the lower Fraser River Valley, but the extent of their interaction and geographic proximity to Salish suckers needs clarification, especially after the recent discovery of a population near Harrison Lake (first known occurrence north of Fraser River). The status of Salish suckers was summarized by McPhail (1986, 1987) and considered endangered by COSEWC due to reduced population numbers caused by urban and agricultural encroachment. When comparing population estimates with large Gee traps, Pearson ($1998_{a,b,c,}$) found that earlier studies using different methods underestimated population sizes. Final evaluation for population size must wait completion of Pearson's thesis expected in 2002or 2003.

Distribution

Globally

Salish suckers inhabit three lakes and a slough draining into Puget Sound, the Skagit, Nooksack and Green river drainages in Washington state; and the lower Fraser Valley drainages of Canada.

Within Canada

Salish suckers presently (2002) occur in the lower Fraser and Nooksack drainages of British Columbia. These include the Salmon River plus various creek systems (Atchelitz, Bertrand, Fishtrap, Miami, Salwein, and Semmihault and some of their tributaries. The Campbell River population is extirpated.

Habitat

Salish suckers inhabit coastal streams and small rivers. Recent captures suggest larger Salish suckers are most abundant in deep-water marshy headwaters of streams containing heavy cover.

Biology

Salish suckers spawn between April and July with their eggs adhering to rocks. Their fecundity is unknown. Salish suckers live to five years, and their life history is similar to that of longnose suckers. Salish suckers are smaller than longnose suckers, the largest known specimen being 244 mm (fork length).

Population Size and Trends

About 1998, populations in the Nooksack and Salmon rivers systems were found to be larger than previously thought, possibly a few thousand. A dissertation anticipated in 2002-03, will update population status (Pearson 2001 *pers. com*.). Recent efforts to enhance sucker habitat in Bertrand and Fishtrap creeks require evaluation. Others streams with Salish suckers are heavily impacted by human encroachment. The species is extirpated from the Campbell River. Though unknown in the Sumas, their presence was reconfirmed in 2002, at Salwein Creek tributary to Vedder-Sumas system. It could have occurred historically in areas between the Sumas, Nooksack, Salmon and Sumas rivers.

Limiting Factors and Threats

Salish suckers are severely impacted by agriculture, industry and urbanization. Cooperative projects between community groups, local government and provincial agencies have improved summer habitat in Pepin and Bertrand creeks as well as the Salmon River. Because these projects were not specifically directed toward Salish suckers, their effect on population numbers is unknown.

Special Significance of the species

Along with Nooksack dace (*Rhinichthys* sp.), sympatric Salish suckers represents one of British Columbia's few faunal elements to have diverged in the Chehalis refugium of Washington during Pleistocene Glaciation. The species is genetically and morphologically distinct from longnose suckers. As yet, there is no agreement as to whether the Salish sucker represents a distinct species.

Existing Protection

Although existing Provincial and Federal regulations apply, the strongest protection arises from the good will, generosity and cooperation between educational and academic groups, environmental organizations, and local industry. The Pepin Brook

Streamkeepers worked to improve sucker habitat. Strong public communication has occurred locally with local residents surprisingly well informed on the status of the Salish sucker and Nooksack dace.

Summary of Status

Salish suckers were considered endangered in 1986 (COSEWIC 2002). New information and methods of capture by researchers at University of British Columbia (UBC) found Salish suckers more widely distributed than previously thought in the lower Fraser valley. On the other hand, environmental degradation of sucker habitat continues (one population extirpated and others seriously depleted). There has been cooperation and generosity demonstrated by residents who assisted habitat restoration in the Langley and Salmon River areas and under the sponsorship and guidance of municipal/provincial authorities and UBC researchers. A few local industries that previously impact watersheds assisted projects. Whether there has been any positive affect to improve sucker habitat is so far, unknown and unproven. Despite efforts to improve habitat for Salish suckers, suckers in Semmihault Creek (spelled as Semiault, Pearson 1998c) are in serious trouble. Those in the Campbell R are extirpated. Whether any Salish suckers occurred in the Sumas River is unknown, however, this might have been a historically significant route of dispersal between the USA and Canada and between Canadian creeks after the Pleistocene. Given occurrences in isolated creeks connected to the lower Fraser River (Salmon & Vedder rivers plus Chilliwack and Miami Creeks), Salish suckers must have historically occurred in intervening water ways such as the Fraser River, their present habitats suggestive of relict refugia.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determines the national status of wild species, subspecies, varieties, and nationally significant populations that are considered to be at risk in Canada. Designations are made on all native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fish, lepidopterans, molluscs, vascular plants, lichens, and mosses.

COSEWIC MEMBERSHIP

COSEWIC comprises representatives from each provincial and territorial government wildlife agency, four federal agencies (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biosystematic Partnership), three nonjurisdictional members and the co-chairs of the species specialist groups. The committee meets to consider status reports on candidate species.

DEFINITIONS

Species	Any indigenous species, subspecies, variety, or geographically defined population of wild fauna and flora.
Extinct (X)	A species that no longer exists.
Extirpated (XT)	A species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A species facing imminent extirpation or extinction.
Threatened (T)	A species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
Not at Risk (NAR)**	A species that has been evaluated and found to be not at risk.
Data Deficient (DD)***	A species for which there is insufficient scientific information to support status designation.

* Formerly described as “Vulnerable” from 1990 to 1999, or “Rare” prior to 1990.
** Formerly described as “Not In Any Category”, or “No Designation Required.”
*** Formerly described as “Indeterminate” from 1994 to 1999 or “ISIBD” (insufficient scientific information on which to base a designation) prior to 1994.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list.

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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

COSEWIC Status Report

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2002

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SPECIES INFORMATION

Name and Classification

Phylum:	Chordata
Subphylum	Vertebrata
Class:	Osteichthys
Order:	Cypriniformes
Family:	Catostomidae
Genus:	*Catostomus*
Species:	*Catostomus* sp.
Evolutionary Significant Unit:	*Catostomus* sp. (Nooksack River drainage)
Common Name:	Salish Sucker. Meunier Salish

The Salish sucker (*Catostomus* sp.; Fig. 1, 2, 3) was first found in Washington in 1947 and first observed in Canada at White Rock, British Columbia in 1950's (McPhail 1983 & 1986). It was last seen in the Campbell River in 1976. Fortunately additional populations were found elsewhere, particularly in the Salmon River and tributaries of the Nooksack River. A species name has yet to be provided owing to the assumed allopatric distribution of Salish suckers in relation to its closest relative, the longnose sucker (McPhail and Taylor 1999). Difficulty of evaluating the populations as biological species is further exacerbated by the allopatric occurrences of each population (McPhail, 1986; Pearson, $1998_{a,c}$}. Cannings and Ptolemy 1998 emphasized McPhail's comments that geologically, the Salish sucker is a "species in the making". COSEWIC records the species as endangered (Campbell 1990).

Figure 1. Salish sucker from the extirpated population in Campbell River. (see Appendix 1).

Description

McPhail and Carveth (1994) noted mophological differences between Salish and longnose suckers as did McPhail and Taylor (1999) who discussed the following:

1/ - lip length, lip width, post-pelvic length and caudal peduncle depth differ (Table 1), but were not as distinct as molecular data;
2/ - one unique Cytochrome *b* haplotype (#7) distinguishing them from all northwestern longnose suckers;
3/ - two unique ND2 $_{MT}$DNA haplotypes (#'s 13 & 14), - # 14 was found only in the Pepin Creek population (Nooksack Drainage).

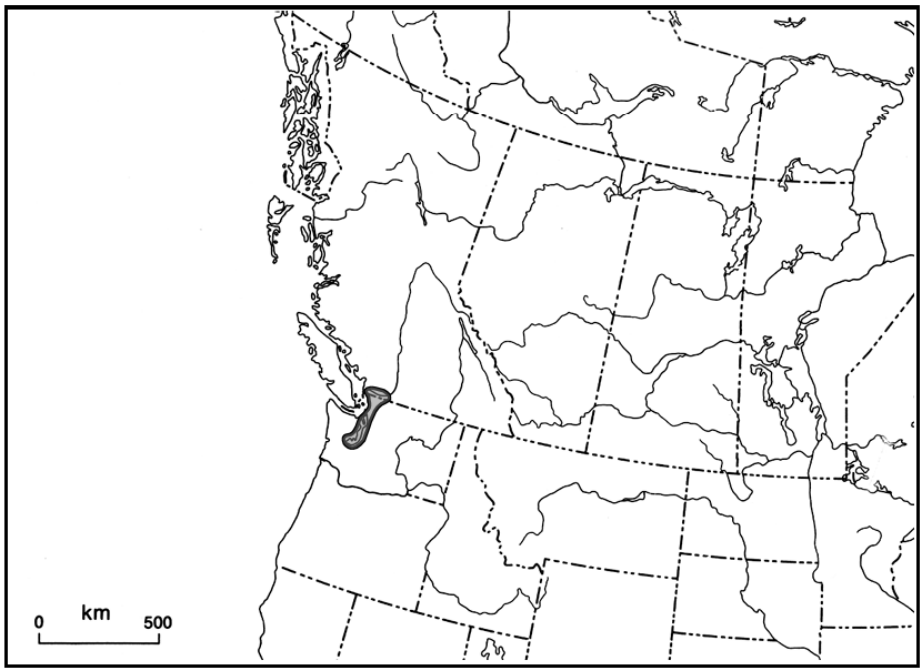

Figure 2. Distribution of Salish sucker in North America.

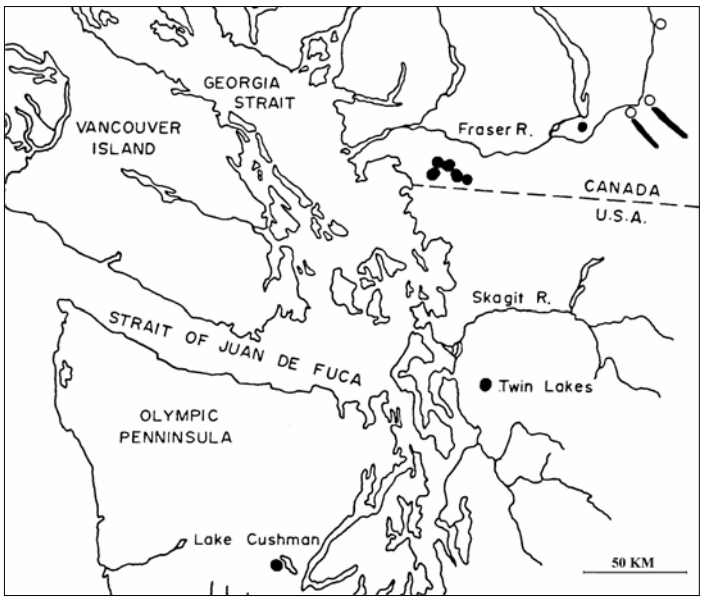

Figure 3. Distribution of Salish suckers ("●") in Washington and British Columbia modified form McPhail (1986), McPhail and Taylor (1999) & Pearson (1998$_a$; see Table 6 & 7). Eastern-most dot ("●"} lies below Harrison Lake (Pearson (2001 & 2002 pers. comm.). Hollow dots ("❍") represent closest verifiable populations of longnose suckers. Sites recorded by BC Ministry Sustainable Resources, Fisheries Data Warehouse (2001) that records Longnose suckers in lower Fraser River, Pitt Lake and Alouette River (Tables 3) do not have reliable enough data for inclusion.

Table 1. Morphological differences between Salish and longnose suckers (McPhail and Carveth1994; McPhail & Taylor 1999)

Character	Salish sucker	Longnose sucker
Lateral line Scales	Usually fewer than 100	Usually more than 100
Snout shape	Snout short & blunt	Snout long & pointed
Mouth position	Snout barely overhangs snout	Snout clearly overhangs snout
Mouth shape	Small	Large
Mouth length	Equal to eye diameter	Greater than eye diameter

These differences suggest the Salish sucker represents an "Evolutionary Significant Unit" within the *Catostomus* complex, but not necessarily at the species level. McPhail and Taylor (1999) reported Salish sucker populations to be separated by 60 km of Fraser River water from the nearest known population of longnose suckers, whereas, Blood (1993) reported the distance to be 45 km. Unpublished molecular data from Miami Creek (below Harrison Lake) now confirms the first known occurrence of Salish suckers north of the Fraser River (Pearson *pers. comm.* 2001). This closes the geographic gap between Salish and longnose suckers between 26 to 30 km (perhaps 40 creek and river miles, see Figure 3). If each population should meet, questions arise as to whether they: 1/ - behave as biological species; 2/ - historically coexisted long enough to test criteria of biological species; 3/ - different enough to minimize genetic introgression in sympatry and ecologically overcome competition for resources?

DISTRIBUTION

Global Distribution

Salish suckers occur in streams of the lower Fraser Valley and Puget Sound, Washington (Figs. 2, 3 & 4), including two lakes near Puget Sound and apparently a slough in Washington (Blood 1993; McPhail 1986). Headwater capture of Nooksack headwaters during the Pleistocene probably allowed Salish suckers to disperse into lower Fraser Valley of British Columbia as may have occurred in the interconnected Sumas Rivers, although the latter needs more confirmation (see Table 2). McPhail and Taylor (1999) analyzed specimens from Canadian waters as well as from Twin Lakes, Green River, Lake Whatcom and Lake Cushman from Washington State.

Canadian Distribution

Prior to the first accounts of Salish suckers (McPhail 1987), Scott and Crossman (1973) assumed suckers in the lower Fraser River were longnose suckers. Previously considered allopatric to each other, possible historic contact between Salish and longnose suckers requires further examination, especially after the discovery of Salish suckers in Miami Creek, a Tributary to Harrison Lake in the eastern portion of the lower Fraser Valley (Pearson *pers. comm.* 2001). Fry and adults of longnose suckers undoubtedly flush down the Fraser River from time to time and might provide potential

Table 2. Distribution of Salish sucker in British Columbia (see Figure 4).

Note:- Chilliwack Creek sometimes confused with Chilliwack River. Following major watercourses enter Fraser River or Georgia Strait separately (Fig. 4): "A"= Campbell River; "B", - via Nooksack R., Washington; "C", into Fraser River from the south; and "D", Fraser from the north. Populations highlighted in bold face used for morphometric and molecular comparisons between Salish and Longnose suckers (McPhail & Taylor 1999).

Drainage	Water Body	McPhail 1984	Pearson 1998a			Pearson *pers. comm*. 2001-02
			# samples	Sites on maps	Length of creek habitat	Discussion
A – Campbell R.	Campbell R.	Extirpated (last seen 1976)		None found	not published	Extirpated
B – Nooksack R.	Cave Ck.	See drainages "B" below	**5**	Present – 2 sites	See "B" below	See drainages "B" below
B - "	Bertrand Ck.	Juveniles 1983	**?**	At 2 sites	3.2 km?	present
B – "	**Pepin Ck.**	Yes	**14**	at 9 sites	6 km	more than first thought
B - "	Fishtrap Ck.	no suckers	**10**	At 12 sites	11 km	Not discussed
C – Salmon R.	**Salmon R.**	Now, in headwaters	**9**	at 6 sites	9 km	well known
C – Chilliwack Creek	**Semmihault Ck.**	Not recorded	Not recorded	1 site?	1 km?	likely in trouble
C – Chilliwack Creek	Atchelitz Ck.	Not recorded	Not recorded	1 site?	1 km?	new find
C – Vedder R.	Salwein Ck.	Found in 1984	Not recorded	1 site?	1km?	Thought extirpated -found last year
M – S. of Harrison L.	Miami Ck.	Not recorded	Not recorded	Not recorded	1 km?	new, no survey
	approximate total extant km stream habitat =				**= 34 km**	

*** "**Semmihault" spelled as "Semiault" Pearson (1998a & b).

sources of gene flow into Salish sucker populations, should they reproduce. Although McPhail and Taylor (1999) reported that Salish suckers are separated by 60 km from longnose suckers without evidence of genetic introgression, the Miami Creek populations close the linear distance to 26 km (30 to 40 creek and river miles). The BC Fisheries Data Warehouse (2002) records longnose suckers from the Alouette and Pitt rivers and the lower Fraser River (Tables 3 & 4). Unfortunately, prior to 2000, there was no program such as the BC Fisheries "*Quality Assurance*" Program, to confirm field identifications, and identification errors were known to have reached 20 to 25% for some contractors (Peden *pers. comm*. 2002, also McPhail *pers. comm.* 2002).

Table 3. Reputed records of longnose suckers recorded by BC Ministry Sustainable Resource Management Webb page: "http://www.bcfisheries.gov.bc.ca/fishinv/" *Records for* Fraser River, region 2 (DFO district 1, subdistrict 29J, Watershed code 100). Generally sucker identifications for lower Fraser Valley not reliable enough for confident identifications [coment in text]. They demonstrate need for a vouchering process for verification of sucker records in the lower Fraser River in order to monitor level of potential contact and hybridization (if any) between Salish and longnose suckers.

Gazetted Name	Consultant	Map 1	Point 1	Type 1	Map 2	Point 2	Type 2	Refs & Dates	Waterbody Identifier
Alouette R.	No fish caught	092G02	2	29C				HQ2030 1-Feb 1998	00000LFRA
Fraser R.		093B08	5018	U	093B08	5019	D	5058 1-Jan1992	00000TABR
Fraser R.		093B15	5001	U	093B16	5018	D	5058 1-Jan1992	00000TABR
Fraser R.		093G02	10	P				HQ0453, 1-Jan1989	00000TABR
Fraser R.		093G02	11	P				HQ0453, 1-Jan1989	00000TABR
Fraser R.		093G02	5008	U	093G02	5009	D	5058, 1-Jan1992	00000TABR
Fraser R.		093I04	9	P				HQ0453, 1-Jan1989	00000TABR
Fraser R.			1	W				FHQ001, 1-Feb1948 FHQ002, 1-Feb1973	00000TABR
Pitt R.		224	W	1				EW070, 1-Jan1994	00000LFRA
Pitt R.	Triton Environ. Consultants/ FDIS	093G.017						10/7/98	Tilbury Slough
Pitt River & Lake	Triton Environ. Consultants/ FDIS	092G07						10/2/81	Widgeon Slough

Rosenfeld (2000) suggested that the Sumas watershed may have previously connected populations in the Vedder (i.e. Salwein Creek) and Nooksack systems. They probably contained suitable habitat prior to agricultural development of the region and would have been open to the Nooksack drainage during floods. He further speculated that numerous creeks within the study area may have previously contained suitable habitat and been open to colonization via tributaries to the Fraser River, The Salmon being a notable example. He further stated that the apparent absence of suckers in the intervening watersheds might have been a sampling artifact, because few biologists are capable of reliably identifying Salish suckers. Rosenthal believes distributional studies have been hampered by inefficiency in standard sampling methods. Such assumptions obviously must account for habitability of present-day habitat.

Table 4. Reputed Salish Suckers Records of BC Ministry Sustainable Resource Management Webb page: "http://www.bcfisheries.gov.bc.ca/fishinv/". Records are from Fraser River, region 2 (DFO district 1, subdistrict 29J, watershed code 100). There is potential duplication of records between Tables 3 & 7 collated by two different sources. Presented here in lieu of extensive listing of museum records*.

Gazetted Name	MAP 1	Point 1	Type 1	REFS & DATES	Watershed Code	Waterbody Identifier
Beaverpond Lakes	7A	154610	W	BCLKS6360, 02/OCT/1994	238-510500-49700	00945 UOMI
Bertrand Ck	2	672833	W	EW082, 01/JAN/1993	970-046800-25200	00000L
				HQ0502, 01/JAN/1997 HQ0869, 01/NOV-1997		
"				HQ0881, 01/NOV-1998		
"				HQ0983, 01 NOV/1996		
Bertrand Ck	2	672833	W	(HQ2084, 01/MAR/1998	970-046800-25200	00000L
Bertrand Ck	2	672833	W	(HQ2247, 01/APR/1998	970-046800-25200	00000L
				(HQ2251, no date		
Bori Ck	2	092G01	1077U	(HQ0517, 01/JAN/1993	970-046800-25200-51616	00000L
Campbell R.	2	263216	W	29B-35, 01/JAN/1986	900-000500 2 29B	00000L
Cave Ck,	2	330254	W	HQ0881, 01/NOV/1998	970-046800-25200-	00000L
Cave Ck	2	330254	W	HQ2247, 01/APR/1998	970-046800-25200-43500	
East Fishtrap Cr	2	330291	W	(2FBSRY, 01/JAN/1995)	970-046800-26400-	00000L
Ennis Brook	2	330289	W	EW112, 01/JAN/1994	970-046800-26400-87800	00000L
"				2FBSRY, 01/JAN/1995		
"				EW041, 01/JAN/1990		
Fishtrap Ck	2	330283	W	EW056, 01/JAN/1990)		
"				HQ0826, 01/OCT/1995)		
"				HQ0869, 01/NOV/1997)		
"				HQ0881, 01/NOV/1998)		
Fishtrap Ck	2	330283	W	HQ1810, 01/SEP/1999		
"				HQ2247, 01/APR/1998 HQ2251, no date		

Gazetted Name	MAP 1	Point 1	Type 1	REFS & DATES	Watershed Code	Waterbody Identifier
Fishtrap Ck	2	330283	W	HQ2247, 01/APR/1998		
“				HQ2251, no date		
“				HQ2247, 01/APR/1998		
				HQ2251, no date		
“	2	676072	W	2FBSRY, 01/JAN/1995		
				EW082, 01/JAN/1993		
				EW104 01/JAN/1992		
Pepin (cont'd)				HQ0826 01/OCT/1995		
“				HQ0869, 01/NOV/1997		
“				HQ0881, 01/NOV/1998	970-046800-2520-38700	00000L
Pepin Creek	2	676072	W	HQ0881, 01/NOV/1998	970-046800-25200-38700	00000L
Pepin Creek	2	676072	W	HQ2247 01/APR/1998 HQ2251, no date	970-046800-25200-38700	00000L
Salmon River	2	092G02 381	P	EW082 01/JAN 1993	100-038800	
Salmon River	2	907	W	HQ2084, 01/MAR/1998 EW104, 01/JAN/1992	100-03880	00000L
Salmon River	2	907	W	HQ0869 01/NOV/1997	100-038800	00000L
				HQ2247, 01-APR-1998 HQ2251 no date	100-038800	00000L
Waechter Creek	2	330285	W	2FBSRY 01/JAN/1995	970-046800-26400-75400	00000L
“	2	1561	W	SISSM01 01-JAN-1995		
Chilliwack River*	7A	15294	W	BCLKS6366 18-OCT-1994	100-593800-75000-40200	
“		1115263	W	HQ1564 01-MAR/1999	100-038800-78709	

*There is uncertainty as to whether this record is for Chilliwack River or Chilliwack Creek; this location should be verified (Peden, *pers. comm.* 2002)

Figure 4 illustrates headwater portions of the Sumas drainage (=”SU”) flowing northward to the Fraser River in Canada and southward to the Nooksack River in Washington. Rises of water levels enable northward and southward dispersal if suckers were present. However, agricultural development altered the Sumas River that used to drain Sumas Lake. Current maps illustrate a ditch where this lake had occurred (Canada Department of Mines and Energy Resources map, 1976).

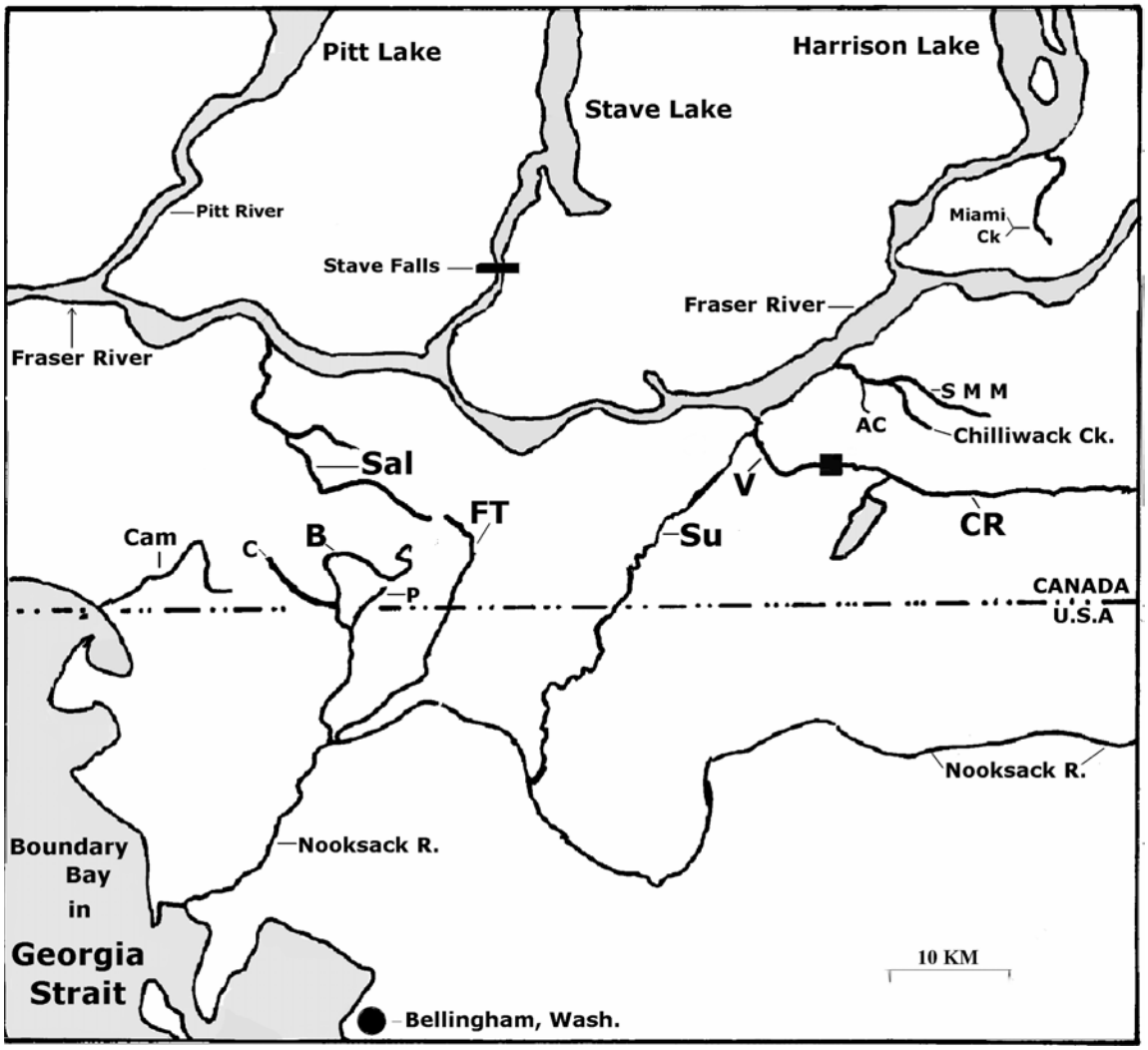

Figure 4. Stream drainages with Salish sucker populations (west to east): arrow below “**Cam**” points to extirpated Campbell River population; “**Sal**” = Salmon River; “**C**” = Cave Creek; “**B**” = Bertrand Creek (includes Howes Creek); “**P” =** Pepin Creek; “**FT**” = Fishtrap Creek [includes Enns Brook and Waechter Creek tributaries]; “**V**” = Vedder River and “**CR**” = Chilliwack River, not to be confused with Chilliwack Creek, are continuous, without records of Salish sucker, however its small tributary, “■”= Salwein Creek, represents the only known population in the Sumas/Vedder/Chilliwack system (creek too small to draw on map) and ultimately drain into the Fraser River; “**AC**”, Aitchelitch Creek flows and “**SMM**”, Semmihault Creek into Chilliwack Creek (latter not labeled); “**M**”, Miami Creek, drains into Harrison Lake. Headwaters of “**Sal**”, “**C**”, “**B**”, “**P**”, and “**FT**” represent best known populations (Pearson 1998a).

HABITAT

Habitat Requirements

Pearson (1998_c) stated that Salish suckers are found in a variety of habitats. More recently, he found them concentrated in deeper portions of marshy headwaters containing heavy cover (Pearson *pers. comm*. 2002). Within Canada, he found them in small lowland streams and associated ponds. Within streams, they were found in a variety of water velocities, depths, and hydraulic types but were most often captured in slow currents over sand or silt substrate in areas with in-stream vegetation and over-stream cover (Inglis et al. 1992). Winter habitat is unknown. But it seems likely that they require off-channel refuge during periods of high flow. Young-of-the-year of Salish suckers were found in similar habitats as adults, but seemed to prefer more overhanging vegetation (Inglis et al. 1992). They were encountered most frequently while seining ponded reaches.

Inglis further noted that temperature preferences and limits for Salish sucker remain unknown, although circumstantial evidence suggest that Salish and longnose suckers can survive at least short-term exposure to warmer temperatures. Both Salish and longnose suckers were commonly caught in waters above 20^{o} C in summer. Inglis also reported that Salish suckers have been caught and returned to a 21^{o} C isolated pool on Cave Creek along with salmon. When the pool was re-sampled, all the coho were dead. This researcher further noted the closely related longnose sucker to tolerate high temperatures with the upper lethal temperature being 26.9^{o} C after being acclimated to 14^{o} C. (Black 1953). Such temperature tolerances might occur with closely related Salish suckers, however such data are not yet available.

Trends

Habitats of Salish suckers have been lost in recent years due to agricultural, industrial and urban growth. The species no longer inhabits the Campbell River. It has never been found in the Sumas, Vedder and Chilliwack rivers between Chilliwack Creek and the Nooksack system except for the precarious Salwein Creek population. The presence of the latter suggests historic distribution required a wider distribution including the Sumas for the populations to be distributed as they are today. Unfortunately, there are no Canadian records of the species prior to 1950 to document occurrence. Salish suckers are extirpated from Howes Creek (a tributary to Bertrand Creek, Fig 4) and are restricted to specific portions of the other streams such as the Chilliwack, Salmon, Miami and Campbell drainages probably due to re-channeling, irrigation and polluted run-off from agriculture. The predominance of stream inhabiting Salish suckers in Canada seems inconsistent with American distributions that include two widely separated lakes plus what Blood (1993) described as a “slough”

Presently, public awareness of their status favors limited restoration within small sections of their former range. Riparian deforestation, on Agricultural Reserve Lands still continues, and there are severe sources of sediment and nutrients that locally

degrade or destroy sucker habitat. If current public interest in the species is maintained and the species remains in the same habitats as it does today there may be optimism for the species survival. Long term growth of agriculture, industry and urbanization threatens all populations and undermines restoration and possibly genetic diversity of Salish sucker populations (i.e., ND2 MTDNA haplotypes found only in Pepin Creek population).

There have been introductions of alien fishes from eastern North America, however there are no reports on the adverse effects of fish introductions, although fishes such as *Lepomis* and *Micropterus* undoubtedly consume fry and suitable sized adults. In particular, there have been no studies on the effects of introduced bull frogs on suckers in the study area. During 2000, several thousand juvenile bass were intercepted at a fish fence as they spilled out from ponds of a Pepin Creek tributary into the mainstem where there is the highest concentration of Salish suckers in Canada. Intense efforts to eradicate bass have failed and the fence is not longer operational due to funding constraints (Pearson per/ com. 2002).

Habitat Protection/Ownership

On Pepin Brook most of the lands and adjacent waters are owned municipally or industrially; portions the lands abutting Salwein Creek and the Salmon River are both privately or federally owned; all the other streams run through private lands: see Pearson ($1998_{a,b,c}$ & *pers. comm*. 2002) who provided the following information on protection/ownership).

Cave Creek (Fig 4):

A project for fish access over a dam has improved fish access. A project of headwater wetland restorations was judged unfeasible (Pearson *pers. comm*. 2002).

Bertrand Creek (Fig. 4):

Major fish habitat problems vary along the creek's length. Years of dredging and channelization in the headwaters have deprived the stream of in-channel complexity, and off-channel refuges and rearing habitat. Local stewardship groups have completed a number of successful projects to alleviate this problem. The middle reaches suffer from these problems in addition to lack of riparian shading and extensive livestock damage. Fencing and planting of this segment is the highest priority for enhancement work because of its temperature influence on the highly productive lower reaches. The lower reaches also contain localized areas of cattle damage and bank erosion which should be addressed.

Pepin Creek (Fig. 4):

The most critical habitat problem facing the creek was massive sediment loading from gravel pits in the upper reaches. Over 1m of clay has been deposited in the channel for a distance of at least 1 km downstream from the creek's origin. Cattle access has been largely curtailed in the lower reaches with fencing projects since 1995.

Riffle creation and localized control of reed canary grass may benefit the sucker and dace populations of the farmed areas near 0 Avenue. Thinning the thick stands of riparian alder through the forested areas of the ARLP [= Aldergrove Lake Regional Park] and underplanting them with conifers would greatly speed natural succession and the re-supply of large wood debris to the stream. Two experimental habitat creation projects have occurred recently on the property.

Fishtrap Creek (Fig. 4):

The main habitat problems in Fishtrap Creek are high summer water temperatures in the upstream reaches around Highway 1 and lack of instream complexity, off-channel habitat and riparian zone connections throughout most of the watershed. Riparian planting for temperature control in the headwaters and channel complexing initiatives (in conjunction with reed canary grass control) throughout the watershed are the overall enhancement priorities. In the longer term, measures to address storm water quality and quantities in urban areas are required.

BIOLOGY

General

The life history of Salish sucker is probably similar to that of longnose sucker, although Salish suckers are smaller and do not live as long. In British Columbia, there may be 5 year-classes (Pearson 1998$_c$). Older fish are known in Washington State. Males mature in their second year and females in their third year. Minimum spawning size is 87 mm for males and 95 mm for females. Maximum mean length is 192 mm at 4+ years, although the largest known specimen reaching 244 mm fork length was from Pepin Creek (Pearson 1998$_c$). Pearson (*pers. comm*. 2002) indicated there is very little reliable information regarding juveniles.

Reproduction

Salish suckers spawn in riffles over fine gravel at current velocities of up to 50cm/s (McPhail and Taylor 1996 ms) when water reaches 7^o or 8^{o}C (McPhail 1987). Pearson's recent studies (1998$_c$; *pers. comm.* 2002) indicated that spawning occurs from April to mid-July, with gametogenesis beginning in late summer in preparation for early spring spawning, but some females are not in reproductive condition until later. The period is very protracted with individuals in spawning condition having been captured throughout the summer, even as late as August at water temperatures in excess of 20^o C (Inglis et al. 1992; McAdam 1995ms; McPhail and Taylor 1996ms). Like other species in the genus, Salish suckers are broadcast spawners. No nest is built and the adhesive eggs stick to gravel and rocks. Predators quickly consume eggs exposed on the bottom, however, current washes additional spawn under gravel and cobble where they are protected. Assuming habits are similar to longnose suckers, Pearson further stated that eggs probably hatch in about 2 weeks (at 5 to 10^{o}C) with the fry remain in gravel for a further 1 or 2 weeks before emerging.

Age and Survival

Pearson (1998$_c$), McPhail (1987) and Inglis et al. (1992) indicate 5 year classes in British Columbia populations of Salish suckers, although older individuals are known from Washington (McPhail 1987). Males are sexually mature in their second year and females in their third year with the minimum size of spawners being 87 mm for males and 95 mm for females (McPhail and Taylor 1996 ms). The largest individual known from Canadian waters (244 mm fork length) was captured in Pepin Creek (Inglis et al. 1992). Growth size and age characteristics of Salish suckers were also found to be within the considerable range known for longnose suckers, although they are smaller and short lived. Pearson 1998$_c$; Inglis et al. 1992 noted mean lengths or Salish suckers during the summer of 1992 (Table 5).

Table 5. Mean lengths of Salish sukers.

Age	Mean Length (mm)	Standard Error
0+	---	---
1+	67.7	1.7
2+	118.8	2.5
3+	148.0	2.8
4+	192.0	4.0

Presumably, a variety of predators consume Salish sucker, not all of them well documented. Pearson (1998$_c$) alludes to surface ova being consumed by predators at spawning sites.

Potential predators include otters (*Lutra canadensis*), mink, (*Mustela vison*), herons (*Ardea herodias*), kingfishers or fish eating mergansers (i.e., *Lophodytes* sp. or *Mergus* sp.), plus predatory fish species, [i.e., *Oncorhynchus clarki*, *O. mykiss*, *Amieurus* sp, *Lepomis gibbosus*, and *Micropterus* sp.; -see Appendix 2].

Movement/Dispersal

Rosenfeld (2000) reporting on Pearson's work suggested that Salish suckers were most active at night and preferred a resting position in heavy cover for the daylight hours. Nightly movements were substantial with some fish ranging several hundred metres downstream and returning to their resting spot at daybreak. Species dispersal is possibly hampered by agricultural, industrial and urban encroachments affecting habitat quality. Whether occurrence of peripheral populations such as that reported in Miami Creek is due to historic colonization or recent immigration needs verification.

Nutrition and Interspecific Interactions

Rosenfeld (2000) reported that dietary information is limited to gut content analysis on 10 adults. Detritus and large numbers of chironomid head capsules were found. The diet of the young is unknown (McPhail 1987).

Adaptability

Being limited to drainages largely confined to Puget Sound and the southwestern-most portion of British Columbia, Salish suckers have shown little ability to disperse into other habits other than passively through headwater capture or human activity. They obviously have withstood some encroachment of urbanization, industry and agriculture provided water quality and habitat are within their limits of tolerance. Salish suckers appear to have responded poorly to agriculturally altered drainages.

POPULATION SIZES AND TRENDS

Evaluation of populations for Salish suckers (McPhail 1987; Pearson $1998_{a\&c}$; *pers. comm*. 2002) indicate four different major streams with 9 recognizable populations of Salish suckers. Pearson (*pers., comm.* – 2001) found assessments underestimate population size due to inefficient use of electroshockers and minnow traps for sampling. He employed larger Gee traps placed in mainstem marshes and beaver ponds where greater numbers were found. Previous estimates in Pepin Creek (Fig. 4) were about 500, but his mark-recapture techniques combined with use of "G" traps suggested that population numbered in the "low" thousands and appeared to be the healthiest Salish sucker population. A single beaver pond and associated marsh contained well over 1000 individuals (Rosenfeld 2000). Pearson did not know sizes of other populations but believed them to be smaller. In general, contractors in BC stream surveys misidentify 10 to 25% of voucher specimens (Peden pers. obs. 2002, McPhail 2002) and such data banks require careful scrutiny. McPhail (in Pearson 1998_c) reported Salish sucker populations to be secure over most of their Washington range. It is extirpated from the little Campbell River, but was recently rediscovered in Salwein Creek, a tributary of the Vedder-Chilliwack-Sumas system. Salish suckers disappeared from Howes Creek, a tributary of Bertrand Creek (Inglis et al. 1992, 1994)."

With the exception of areas being rehabilitated by volunteer community and industrial groups, the greater portion of Salish sucker habitat has been degraded, likely leading to fewer suckers than prior to human-induced habitat alterations.

LIMITING FACTORS AND THREATS

Salish suckers are very restricted to the lower Fraser Valley. Pearson ($1998_{a\&c}$) cites loss of riffle habitat important for spawning, sub-lethal temperature effects, and interactions with exotic species as important limiting factors (See Tables 6 & 7). Urbanization has been detrimental to suckers in the Nooksack drainages, although this is partly mitigated by conservation efforts in habitat restoration such as re-channeling of streams (Pearson, *pers. comm*. 2001).

Table 6. List of fish species inhabiting Salish sucker habitats. [From Pearson (1998$_c$): Code name of "L" presumed here to be lamprey, and "TR" to be trout. Names with (*) are historically alien to the lower Fraser Valley]

Fishtrap Creek:
Oncorhynchus clarki
Oncorhynchus mykiss
Oncorhynchus mykiss (Steelhead)
Oncorhynchus kisutch
Rhinichthys sp. (Nooksack dace)
Catostomus sp. (Salish sucker)
Gasterosteus aculeatus
Lepomis gibbosus *
trout (*Oncorhynchus* sp.)
lamprey (*Lampetra* sp.)

Bertrand Creek:
Oncorhynchus kisutch
Oncorhynchus clarki
Oncorhynchus mykiss
Oncorhynchus mykiss (Steelhead)
Ameiurus sp. Black Bullhead*
-note: Brown Bullhead is identification used by Carl and Clemens (1953), Scott & Crossman (1973) for Fraser valley catfish,
Rhinichthys sp. (Nooksack dace)
Catostomus sp. (Salish sucker)
Catostomus macrocheilus
Gasterosteus aculeatus
Cottus asper
trout (*Oncorhynchus* sp.)
lamprey (*Lampetra* sp.)

Cave Creek:
Oncorhynchus clarki
Oncorhynchus kisutch
Rhinichthys sp. (Nooksack dace)
Hybognathus hankinsoni
*Pimiphales promelas**
Catostomus macrocheilus
Catostomus sp. (Salish sucker)
Gasterosteus aculeatus
Lepomis gibbosus *
trout (*Oncorhynchus* sp.)

Pepin Creek:
Oncorhynchus kisutch
Oncorhynchus clarki
Oncorhynchus mykiss
Oncorhynchus mykiss (Steelhead)
Rhinichthys sp. (Nooksack dace)
Catostomus sp. (Salish sucker) (spawning)
Gasterosteus aculeatus
Lepomis gibbosus *
*Micropterus salmoides**
lamprey (*Lampetra* sp.)
trout (*Oncorhynchus* sp.)

Salmon River:
Oncorhynchus kisutch
Oncorhynchus clarki
Oncorhynchus mykiss
Oncorhynchus mykiss (steelhead)
Catostomus sp. (Salish sucker)
Gasterosteus aculeatus
trout (*Oncorhynchus* sp.)

Table 7. Fish species co-occurring with salish suckers in tributaries of Nooksack and Upper Salmon rivers (Pearson 1998): "NDC" = Nooksack dace, "CO" = coho, "CT" = cutthroat trout, "RBT" = rainbow trout, "TR" = trout, "BMC" = brassy minnow, "CSU" = largecale sucker, "CAS" = prickly sculpin, "TSB" = threespine stickleback, "PMB" = pumpkinseed, "LMB" = largemouth bass, "FM" = fathead minnow, "BKH" = black bullhead, and "L" = lamprey species, TR = trout, *Oncorhynchus* sp.

Size	Creek	Date	Species	Gear	Reference
2	Fishtrap	Jul-Sep/90	NDC,CO,CT,RBT,TR,	E	4
3	Fishtrap	08/19/97	NDC, CT,TSB	S	1
6	Fishtrap	0S/29/92	TSB	E	2
9	Fishtrap	09/07/90	TSB	MT	3
"	"	09/09/97	PMB,TSB	S, MT	1
10	Fishtrap	09/07/90	CO, RBT,TSB,L	E	3
13	Fishtrap	06/28/95	PMB,TSB,L,Pacific giant salamander	E	7
14	Fishtrap	07/23/90	CO,RBT,CT	E	5
16	Fishtrap	09/07/93	CO,CT	E	6
20	Fishtrap	07/14/92	*CSU, TR, TSB*	E	2
26	Bertrand	09/09/97	NDC, CO, CT, TSB	S	1
36	Bertrand	06/05/92	NDC,CT,TR,TSB.L	E	2
42	Cave	06/26/92	NDC,CO,TR,TSB	E	2
43	Cave	07/30/97	CO,CT,FM,BMC,TSB	S	1
44	Cave	06/25/92	TR,FM,BMC,TSB	S	2
47	CAVE	O8/12/97	CO.PMB,FM,TSB	S	1
"	Cave	08/18/97	PMB,CO (dead)	S	1
53	Pepin	07/07/92	CO,CT,ST,TR.TSB,L	E	2
	Pepin	05/24/94		E	7
54	Pepin	07/28/92	CO,CT,ST,TR,TSB,L	E	2
55	Pepin	07/28/92	NDC,CO,CT,ST,TR,TSB	E	2
56	Pepin	07/08/97	CO,TSB	E	2
57	Pepin	07/17/92	CO,CT,TR,TSB,L	E	2
"	Pepin		CO,TSB	MT	1
58	Pepin	07/16/92	NDC,CO,CT,TR.	E	2
60	Pepin	05/19/92 - O5/21/920 -7/10/92	CT,TR,TSB,L	E	2
		Spring '93	SSU spawning condition	?	8
62	Pepin	05/19/92	CO,TSB	E	2
		07/12/97	CT,TSB	S, MT	1
		07/24/97	CO,CT,TSB	S, MT	1
		09/18/97	CO,CT,TSB,L	S, MT	1
63	Pepin	05/25/95	NDC, CO,CT,RBT,TSB	E	7
68	Pepin	07/09/97 -07/12/97	TSB	MT	1
72	Pepin	07/15/97	LMB,TSB	MT	1
73	Salmon	07/13/92	CT,ST,TR,TSB,L	E	2
		08/19/91	CO	S	10
75	Salmon	06/29/92	CO, TSB	E	2
76	Salmon	6/96		MT	1
		10/03/97	C O,TSB	S	1

Size	Creek	Date	Species	Gear	Reference
77	Salmon	Summer/96	-	MT	9
78	Salmon	10/3/97	CO	S	1
79	Salmon	10/3/97	CO, TSB	S.MT	1
84	Salmon	08/07/91	CO	S	10

GEAR TYPES: E = electroshocker, MT = mnnow traps, = seine

REFERENCES1, Pearson 1997 field notes
2,Inglis, et al. 1992, see literature cited
3,Lister and Associates 1991, fish coll. Rept., BC MoELP
4,Scott Resources Services 1990a, Rept., BC Ministry Environment Land Parks (=MoELP), Surrey file 40,2501
5,Scott Resources Services 1990b Rept., to MoELP, DFO permit 90-48
6,Scott Resources Services 1993 Rept., to MoELP

Pearson (1998_c) also noted that a large proportion of riffles in the native streams of Salish suckers have been lost due to dredging, siltation, and ponding due urbanization and extensive agricultural and aggregate extraction operations in the area. The increased runoff rates (and consequent lack of ground water recharge) have also reduced summer discharge levels dramatically in many reaches. Flows stop completely for up to two months during most summers in Cave Creek (Fig. 4), the upper Salmon River (Fig. 4), and many small tributaries across the species range. Low summer flows combined with nutrient loading producing water quality problems in headwater habitats are the major factors affecting Salish suckers (Pearson per. comm. 2002). Interactions with exotic species are undoubtedly a threat (Table 6 & 7). Terrestrial alien species of concern include the bull frog (*Rana catesbeiana*). The effect of exotic species on suckers are not studied nor extensively documented.

SPECIAL SIGNIFICANCE OF THE SPECIES

As Salish suckers are known only from three locations in Washington State, in contrast to four creek drainages (9 populations) within British Columbia, Canada supports the greatest number of known populations. Given encroachment by urban, industrial and agricultural activity, the viability of Salish suckers provides a biologically sensitive indicator of habitat quality. Salish suckers represent an Evolutionary Significant Unit (Waples 1995) because of:

- significant reproductive isolation due to geographic separation that effectively prevents contact with longnose suckers (water systems continuous enough between populations to have allowed dispersal and contact since the Pleistocene, however factors preventing contact have not yet been fully investigated),
- independent evolutionary histories suggesting adaptation to West Coast habitats within the lower Fraser Valley and Nooksack systems of Canada for

Salish suckers. In contrast, longnose sucker habitats occur further north and east,

- genetic/morphological differences suggesting habitat and environmental adaptations.

Genetic Traits

differing at Cytochrome *b* haplotype (#7), and two unique ND2 MTDNA haplotypes (#'s 13 & 14 - found only in the Pepin Creek population), their significance yet to be shown.

Phenotypic Traits

- lip length and lip width possibly related to feeding differences; - post pelvic length and caudal peduncle depth differences may indicate adaptations to swimming and mobility within their respective habitats. Differences in post-pelvic length and caudal peduncle length may be adaptations to water current or habitat, but their significance has yet to be investigated.

As inhabitants of stream bottoms, suckers are significant consumers of bottom organisms and provide sustenance for aquatic and terrestrial piscivores. Salish suckers and Nooksack dace also provide corroboration for theories of post-glacial dispersal of fish from a Chehalis Refugium after Pleistocene Glaciation.

Although most British Columbians do not know Salish suckers, or difference between Salish and longnose suckers, there has been considerable publicity on the plight of suckers near the local communities that Salish suckers occupy. Considerable coverage was given by the local press and recognition by many municipal, provincial and academic institutions. Locally, small communities are well informed. Pearson (1998_{a}) reported results from landowner surveys, and stated that 40% of respondents were aware that creeks supported endangered fish species; half of the respondents were able to name either or both the Salish sucker and Nooksack dace. Outside the lower Fraser area, the citizens if British Columbia would not know these species.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

In 1986, the Salish sucker was listed as endangered (COSEWIC 2002). Washington State ranked the species as S1 S2. The BC Conservation Data Centre ranked Salish sucker S1. Cannings and Ptolemy (1998) also noted the species in six localities and declining, however their data did not include findings of Pearson ($1998_{a,b\ \&c}$) nor his unpublished data indicating that one, possibly two populations are larger than previously thought (Pearson per. comm. 2002). Pearson particularly emphasized that the apparent change in numbers is a methodological artifact and based on habitat loss in all streams over the past few decades, the populations trend being one of decline. Cannings and Ptolemy (1998) also noted a global ranking of G1.

IUCN (2002) indicated Salish sucker endangered in 1990 and 1994, unspecified in 1996 and there was no entry for 2000.

Pearson (1998_a) discussed a number of potential habitat enhancement methods including riffle creation, habitat complexing, off-channel habitat creation, livestock fencing, riparian planting, control of reed canary grass (*Phalaris arundinacea*), storm water quality and stopping or reversing hydrographic changes.

Through past encouragement of the BC Ministry of Water, Land, and Air Protection and participation of staff and students from the University of British Columbia, monitoring of Salish sucker populations continues along with Nooksack dace (*Rhinichthys* sp.). Local residents and industry contributed to the enhancement of Salish sucker habitat. There is a good baseline for some populations, but none beyond presence/absence for many. There is some prospect of continued monitoring of populations, but this is far from certain given current funding prospects (Pearson per. comm. 2002).

Given occurrences of Salish suckers adjacent to private land, the first priority for long-term protection required cooperation of landowners and local municipal governments, along with assistance from the Provincial Government. Existing federal and provincial regulations affecting environmental standards provide some protection, as do present fishery, wildlife, agricultural and urban regulations. As of Jan. 2002, the BC Ministry of Water, land, and Air Protection was responsible for managing all freshwater fish species of British Columbia, although the newly elected provincial government's fiscal policies could affect standards of protection. Major interest to protect Salish suckers has resulted in several restoration projects (Rosenfeld 2000).

SUMMARY OF STATUS REPORT

The Salish sucker (*Catostomus* sp.) is known from six different drainages of the lower Fraser Valley that flow into the Fraser River or rivers and lakes flowing onto Puget Sound, Washington. It has not yet been scientifically described as a species. It is morphologically and genetically different from its closest relative, the longnose sucker indicating a distinct Evolutionary Significant Unit. Populations appear to be severely reduced due to encroachment of industry, agriculture and urbanization. Unfortunately, past sampling utilized small electroshockers, seines and G traps. Use of larger Gee traps was initiated in 1998, and this proved to be more efficient and indicated populations were more numerous than previously thought, especially in backwater and deeper pools. Salish suckers probably occurred in the Sumas and nearby areas before human caused changes during the early 20th century. A population in Salwein Creek was thought to be extirpated, but has been recently rediscovered. Its presence there suggests Salish suckers must have historically passed through the Sumas/Vedder/ Chilliwack river systems before immigrating into Salwein Creek and perhaps other populations existed there before the impact of agriculture or other human activity. Salish suckers were also found in a creek on the north side of the Fraser River near Harrison Hot Springs. When that population immigrated north of the Fraser and what its relationships are to populations on the south side of the Fraser River are unknown.

The biology of the Salish sucker is similar to that of the Longnose sucker. It reportedly breeds in its second year and can reach five years of age. Spawning success varies year to year. The species' future is threatened by loss of riffles and side ponds due to dredging, siltation, ponding, as well as agriculture and aggregate extraction operations. Increased runoff rates and lack of groundwater recharge has reduced flow at other times of the year, and flow completely stops in small tributaries during the most productive time of the year (Pearson 1998**c**). Loss of riparian cover may significantly harm suckers, particularly juveniles. Removal of off-channel habitat may harm suckers during periods of high flow. As yet, temperature increases do not appear to have dramatically affected Salish suckers.

Although numerous community groups contributed to enhancement of sucker habitat, population increases have yet to be demonstrated.

TECHNICAL SUMMARY

***Catostomus* sp**
Salish Sucker, Meunier Salish

DISTRIBUTION:

Range: British Columbia
Extent of Occurrence: **<**100km^2
Area of occupancy: <20 km^2
Habitat Trend: Declining

POPULATION INFORMATION:

Total number in Canadian population: <10000
Number of mature individuals in Canadian population: 500 to a few 1000
Generation time: ♂♂ 2 years, ♀♀ 3 years
Population trend Declining
Rate of population decline: _historically reduced, extirpated in one river; new studies indicate species more widely distributed than first thought (i.e. new sampling methods). Populations likely more widespread before Salish suckers were discovered. Over-all trend is declining abundance.
Number of populations within Canada: 9
Is the effective Canadian population fragmented? YES
number of individuals in subpopulations: 1500 to 5000 in each of the sampled creeks, other creeks likely have fewer
number of extant sites: 4 comprising 9 creeks (some now isolated within creeks)
number of historic sites from which species has been extirpated: 1, possibly 2.
Does the species undergo fluctuations? Unknown

THREATS

Agriculture, urban and industrial development is leading to deterioration of water quality as well as habitat loss and degradation.

RESCUE POTENTIAL

Does species exist outside Canada? YES
Is immigration known or possible? Possible, unlikely since U.S. populations are low in number
Would individuals from nearest foreign population be adapted to survive in Canada? Unknown (different gene pool)
Would sufficient suitable habitat be available for immigrants? In some streams, but habitat is in decline.

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ACKNOWLEDGEMENTS

Much of the text of this report is quoted directly from Mike Pearson, a doctoral student at the University of British Columbia. He also provided much personal (unpublished) information, most of it likely appearing in his dissertation expected in 2002-2003. Tyese Patten, Master of Science candidate, similarly contributed a summary of her studies on public relations and community involvement with sucker habitat restoration. Jordan Rosenfeld, Fisheries Research Section, Ministry of Water, Land & Air Protection (University of British Columbia), provided valuable reports in the literature cited. Dr. J. D. McPhail was the first to inform the writer of the existence of Salish sucker and provided a specimen for the Royal BC Museum collections. Funding provided by the Canadian Wildlife Service, Environment Canada.

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BIOGRAPHICAL SUMMARY OF CONTRACTOR

Alex E. Peden received his master's degree from the University of British Columbia in 1964 and doctorate at the University of Texas at Austin in 1970. After receiving a postdoctoral appointment at the National Museum of Canada, he was appointed Curator of Marine Biology at the British Columbia Provincial Museum in 1971. He participated in ichthyological collection and/or fisheries work in southeastern USA, Mexico, Northwest Territories, Alaska, Bering Sea and waters adjacent to British Columbia. He devoted much of his career in documenting the diversity of fish species of the Canadian West Coast, and contributed COSEWIC status reports of western Canadian fish species

since 1980. Peden documented the first occurrences of more than 60 marine fish species inhabiting marine waters off British Columbia.

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COLLECTIONS EXAMINED

For the most part, there are few museum collections of Salish suckers, although there are likely many preserved specimens on shelves of researchers who have conducted surveys in Salish sucker habitats. The Royal BC Museum has one specimen (Fig. 1), caught from the now extirpated Campbell River population (BCPM 989-135) caught in 1987. University of BC Records can now be retrieved through Fish Base [http://www.fishbase.org/search.cfm].