MEMORANDUM NOTE DE SERVICE

To / À: Distribution

From / De: Steve Cox-Rogers

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Date
October 30, 2001

Subject / Object: **2001 ASSESSMENT UPDATE FOR MORICE-NANIKA SOCKEYE**

The Morice-Nanika sockeye stock has been assessed by DFO since the late 1940's. The stock received considerable attention in the 1950's and early 1960's with the completion of the Moricetown Fishways on the Bulkley River (Palmer 1967). During the 1960's, 1970's and 1980's the stock was the focus of substantial study conducted as a direct result of Alcan's Kemano Completion Project initiative for the Morice-Nanika (Sheperd 1979). In the mid-1990's, the productive potential of the stock was reviewed and updated (Shortreed et al 1998). Over the past two years both DFO and Wet'suewet'en Fisheries have been addressing Morice-Nanika stock status with respect to productive potential and exploitation rate trends in both the mixed-stock commercial and terminal food fisheries. Management actions in 2001 focused on reducing Morice-Nanika harvests, in both Canadian commercial and in-river food fisheries, to address recent declines in escapement for this stock since the late 1990's. A previous memo (Cox-Rogers 2000) addressed 2000 impacts and pertinent background information for this stock.

Escapement Trends

The B.C. 16 escapement record (Table 1, Figure 1) and total in-river Bulkley stock (Table 1, Figure 2) data for Morice-Nanika sockeye indicates that, prior to about 1954 or so, total in-river Bulkley returns were apparently quite strong (the average 1940-49 stock was 70000 fish). A period of marked decline in annual returns began after 1954. The decline continued throughout the 1960's, 1970's, and 1980's with annual average returns into the Bulkley of between 1700-9000 fish. During the early to mid 1990's, returns into the Bulkley were much stronger with the decade average close to 32000 fish. In-river returns since 1998, however, have been similar to the 1960-1980 average returns. For example, the 2000 visual spawning ground escapement estimate for Nanika River was just 3000 fish and the total in-river return to the Bulkley was estimated at 4905. For 2001, a mark-recapture estimate of spawning ground escapement was 5047 fish into the Bulkley (past Moricetown Canyon) with spawners distributed in the Nanika River, Morice Lake, and Atna Lake (Appendix 1). Several field surveys of the Little Bulkley system by Wet'suewet'en Fisheries in 2001 found few or no sockeye in the outlet area below Maxan Lake (Ron Austin, Wet'suewet'en Fisheries, pers. comm).

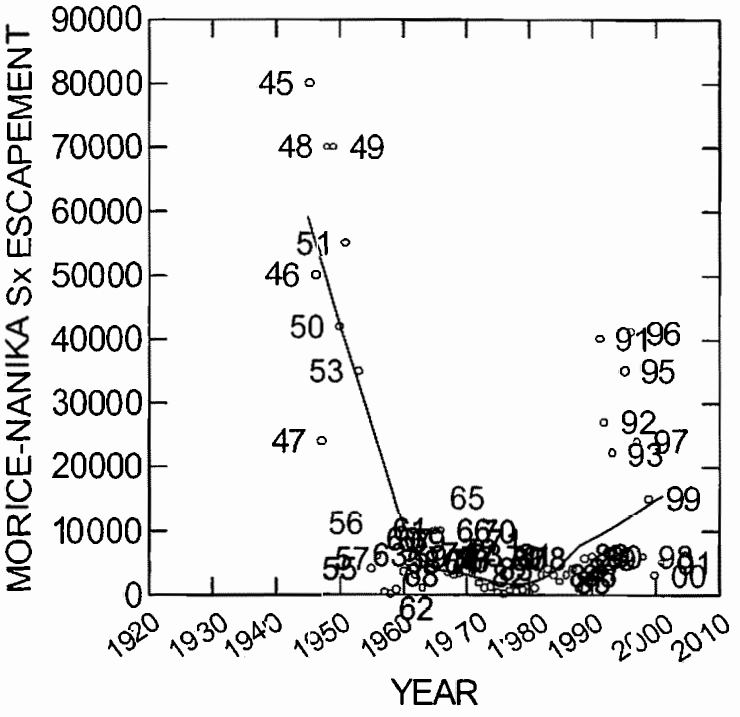

Figure 1. Morice-Nanika Escapements 1945-2001

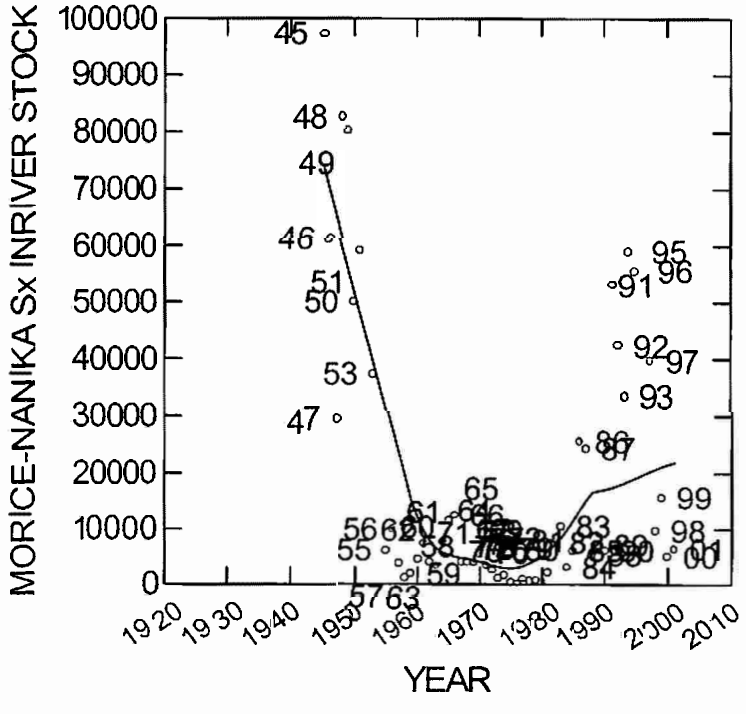

Figure 2. In-River Bulkley Stock (Catch+Esc) 1945-2001

Recent trends in escapement, despite the good returns in the 1990's, are still well below the predicted optimum for this stock. From Shortreed et al (1998), optimal escapements for the Morice-Nanika system range from 116300 based on spawning capacity to 137000-211000 based on PR model calculations of lake rearing capacity. Shortreed et al (1998) recommends an optimum escapement target of 110000 spawners for this system based on a consideration of the modified PR model estimate (137000) and spawning ground capacity. More recent consideration of spawning capacity suggest the optimum escapement target should be closer to the 137000 PR model estimate (Ken Shortreed, DFO, pers comm.).

Catch Trends

Morice-Nanika sockeye are harvested in marine commercial fisheries in south-southeast Alaska and Canada (Areas 1-5), in mainstem Skeena River food and ESSR fisheries below Hazelton, and in the native food fishery at Moricetown Canyon. From about 1900 to 1964, a major native food fishery also took place at Hagwilget Canyon on the lower Bulkley River.

-In-River Fisheries

In-river food fishery catches at Moricetown have mirrored the escapement record (e.g. catch has increased with abundance, Table 1, Figure 3). Average catches at Moricetown were approximately 7000 from 1930-1939, 7000 from 1940-1949, 1400 from 1950-1959, 1400 from 1960-1969, 300 from 1970-1979, 8100 from 1980-1989, and 11000 from 1990-2000. The highest food fish catch on record occurred in 1995 (24000). The 2000 Moricetown catch was 1905. The 2001 Moricetown catch was 1289.

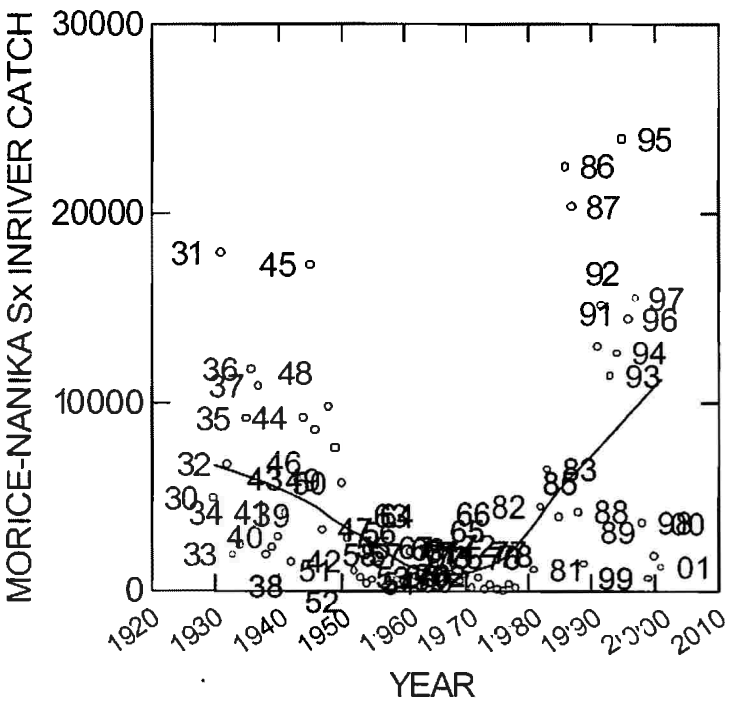

Figure 3. In-River Morice-Nanika Sockeye Catch at Moricetown Canyon 1930-2001

Calculated harvest rates for the food fishery (within the Bulkley system) are shown in Figure 4. Harvest rates show a fair amount scatter and have declined in recent years coincident with reduced returns since the mid-1990's. It is likely that errors in the catch or escapement data are responsible for a significant portion of the variability seen in figure 4, although harvest rates do appear highest in the late 1950's and throughout the 1980's. Average in-river harvest rates on Morice-Nanika sockeye were 0.43 from 1950-59, 0.26 from 1960-69, 0.20 from 1970-79, 0.57 from 1980-1989, and 0.28 from 1990-2000. The Moricetown harvest rate on Nanika sockeye was 0.39 in 2000 and 0.20 in 2001.

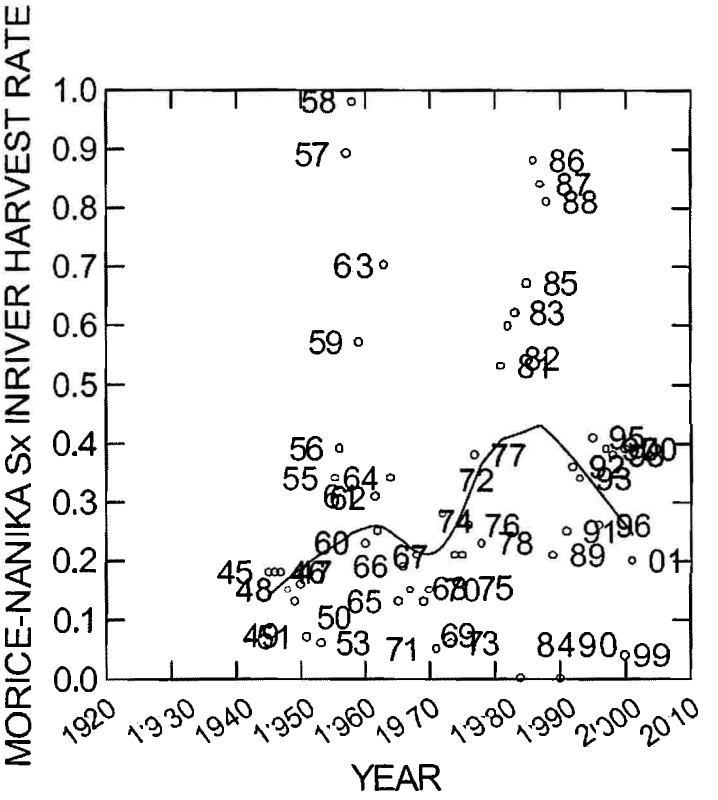

Figure 4. In-River Morice-Nanika Sockeye Harvest Rates 1945-2001

-Marine Commercial Fisheries

Catch estimates for Morice-Nanika sockeye do not exist for marine commercial fisheries in Alaska or in Canadian Areas 1-5 and so marine exploitation rates cannot be calculated directly. An alternative option is to use harvest rate analysis to compute catches and escapements indirectly (Cox-Rogers 1994, Cox-Rogers 2000).

Annual catch, escapement, harvest rates, and exploitation rates for Morice-Nanika sockeye in the Area 1-5 marine fishery were calculated by applying known weekly sockeye harvest rates (source, Les Jantz, DFO) from 1956-2001 to the expected weekly proportions of Morice-Nanika sockeye migrating through the

fishery (normal curve peak W/E July 1-8, s.d. = 1.5 weeks). Morice-Nanika run-timing was assumed stable among years. For 2001, in-river food fish catches of Morice-Nanika sockeye in the mainstem Skeena River below Hazelton were calculated by applying known weekly harvest rates for the IFF fisheries to the weekly escapements of Morice-Nanika sockeye calculated past the Tyee escapement boundary. Travel times for Morice-Nanika escapement moving upriver were 1 week Tyee to Terrace, 1 week Terrace to Hazelton, and 1 week Hazelton to Moricetown.

The calculated pattern of Morice-Nanika marine exploitation from 1956-2001 (Table 1) is shown in Figure 5. Marine exploitation rates have varied over time without consistent trend and range from an average of 0.14 from 1956-59, 0.35 from 1960-69, 0.32 from 1970-1979, 0.21 from 1980-89, and 0.32 from 1990-2000.

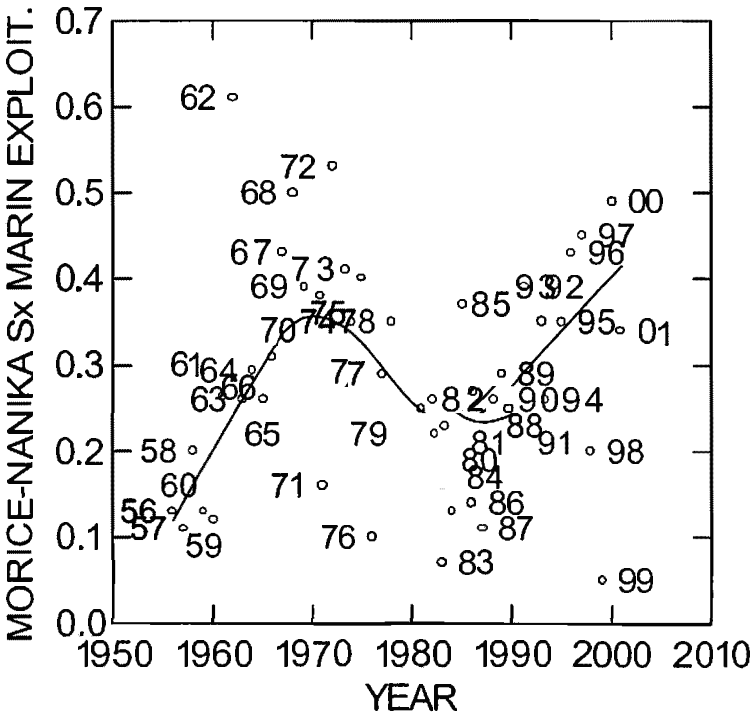

Figure 5. Morice-Nanika Sockeye Marine Exploitation 1956-2001

-2001 **Fishery Impacts**

Commercial fishing opportunities in Area 3/4/5 were reduced in 2001 during the migration timing of Morice-Nanika sockeye. As a result of these management actions, marine exploitation on Morice-Nanika sockeye was estimated to be 30% less in 2001 comparedto 2000. The estimated 2001 Area 1-5 exploitation rate on Morice-Nanika sockeye was estimated to be 0.29 with a total marine exploitation of 0.34 (Table 2). In comparison, the estimated 2000 Area 1-5 exploitation rate on Morice-Nanika sockeye was estimated to be 0.44 with a total marine exploitation of 0.49 (Table 3).

In freshwater, a small number of Morice-Nanika sockeye were estimated to have been caught in the Skeena River food fishery below Terrace in 2001 (Table 2). No ESSR fisheries were initiated below Terrace

in 2001. A moderate IFF harvest of Morice-Nanika sockeye occurred at Moricetown Canyon in 2001 (20% of the in-river stock, Table 2).

In summary, exploitation rates for the 2001 Morice-Nanika return were estimated at 0.05 in U.S. waters, 0.29 in Canadian Area 3/4/5, 0.002 in IFF fisheries below Hazelton, and 0.13 in the Moricetown IFF fishery (Table 2). Total exploitation (marine+food fishery) on Morice-Nanika sockeye was less in 2001 (0.48, Table 2) compared to 2000 (0.70, Table 3). Calculated total run size in 2001 (9659) was very similar to 2000 (10013). For 2001, 486 fish were estimated to have been caught in the south-southeast Alaska fishery, 2820 in the Canadian Areas 1-5 fishery, just 19 in the in-river Skeena IFF fishery, and 1289 in the Moricetown fishery (Table 2).

Lake Productivity

Limnetic fish data from Morice Lake were collected in the fall of 1993 and limnological data were collected once monthly in 1978 and 1980 (Shortreed 2001). The surveys indicated that Morice Lake had excellent physical conditions for juvenile sockeye. However, the lake is ultra-oligotrophic. Zooplankton biomass is very low, which results in very slow growth rates for sockeye fry. Age 0 fall fry averaged only 0.8g, among the lowest recorded for a B.C. nursery lake. Sockeye stomachs were only 30% full and contained mostly bosminids. 90% or more of the returning adults are offspring of two-year old smolts, which confirms the lakes' low productivity and deficient food supply.

Current factors limiting sockeye production in Morice Lake include a) low escapements and fry recruitment b) low in-lake growth and/or survival and c) nutrient limitation (Shortreed 2001). Morice Lake was fertilized in 1980 and responded positively, with a 35% increase in phytoplankton biomass and a 60% increase in zooplankton biomass. As such, Morice Lake is considered a good candidate for nutrient additions (Shortreed 2001). Lake fertilization in conjunction with increased escapements would be the most effective restoration technique for Morice Lake sockeye (Shortreed et al 1998). It would increase fry growth rates and would possibly increase productivity by reducing the proportion of age-2 smolts.

Discussion

The adult return to the Morice-Nanika each year is determined by the interaction between freshwater production for the brood year (s), marine survivals for the production from the brood years (s), and overall fishery exploitation on the production from the brood year (s). The Morice-Nanika sockeye stock is in the lower end of the range of productivities of Skeena wild stocks. However, its unlikely that excessive exploitation has been responsible for the historic fluctuations in escapement seen for this stock (compare Figures 1 and 5). It's more likely that Morice-Nanika sockeye are responding to changing freshwater or marine productivity.

As background, total catches of Skeena sockeye have been steadily increasing coincident with increasing production from the enhanced component from Babine Lake. Exploitation rates have not shown the same coincident increase but have remained rather stable, as sockeye harvest rates were constrained by concerns for steelhead and coho. Sockeye escapements to most of the wild non-enhanced sockeye populations in the Skeena have been stable or increasing despite the sustained high harvest rates on the Skeena run as a whole (Wood et al 1998). Presumably this has been a direct result of continuing efforts to harvest the mid-timing Babine stock as selectively as possible (Wood et al 1998). Survivals may also have been high enough in recent years (for the less productive wild stocks) to offset the sustained high

exploitation rates. However all escapements to wild non-enhanced sockeye stocks within the Skeena system are still much too low (e.g. exploitation is too high) if the objective is to fully utilize lake rearing habitat and maximize smolt production (Wood et al 1998).

Morice-Nanika sockeye, up until 1998 or so, seemed to be following the same trend of increasing escapements as other wild Skeena stocks. For some reason, however, returns to the Morice-Nanika in 2000 and 2001 have been going in the opposite direction and may be returning to the lower return levels seen in the 1960's through 1980's. It's difficult to predict future production trends for this stock at this time. Given the marked trend towards lower escapements in 2000 and 2001, minimizing harvest impacts during the migration timing of Morice-Nanika sockeye in 2002 and beyond will be required if increased escapements are desired. Realizing the full productive potential of Morice Lake might, however, require lake fertilization in conjunction with increased escapements.

Suggested 2002 assessment programs

Escapement Estimation

1) beach seine tagging and dipnet recovery of sockeye passing through Moricetown Canyon
2) fall assessment of mark rates on the upper Morice-Nanika
3) fall assessment of lake spawning distribution and mark rates in Morice Lake
4) fall assessment of spawning ground distribution and mark rates in Atna River/Atna Lake
5) fall assessment of spawning ground distribution and mark rates in Little Bulkley River

Catch Estimation

1) continued harvest rate/exploitation rate modeling
2) sockeye stock I.D. at Tyee and in Area 3/4/5 commercial fisheries, and in-river IFF/ESSR fisheries

Lake Productivity

1) Morcie Lake spawning area capacity assessment update
2) Morice Lake capacity assessment update

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Table 1. Nanika Sockeye Assessment Data: 1951-2000

Year	Estimated Nanika Alaska Catch	Estimated Nanika 1,3,4,5 Catch	Estimated Nanika Marine Escape.	Estimated Nanika Total Stock	Estimated Nanika Marine Exploit.	Estimated Nanika 1,3,4,5 h.r.	Nanika B.C. 16 Escape.	Palmer '87 Nanika Hagwilget Catch	Palmer '87 Nanika Motown Catch	DFO Nanika Motown Catch	Best Info Nanika Motown Catch	Inriver Bulkley Nanika Stock	Inriver Bulkley Nanika H.R
1930								9060	4920		4920		
1931								15055	17871		17871		
1932								7307	6715		6715		
1933								895	1912		1912		
1934								2337	2451		2451		
1935								6975	9111		9111		
1936								1772	11723		11723		
1937								1303	10864		10864		
1938								1419	1951		1951		
1939								4105	2320		2320		
1940								6786	2873		2873		
1941								1900	4150		4150		
1942								232	1571		1571		
1943								982	5927		5927		
1944								1035	9154		9154		
1945							80000		3533		17300	97300	0.18
1946							50000	2764	8673		8500	61264	0.18
1947							24000	2129	3279		3300	29429	0.18
1948							70000	2753	9829		9800	82553	0.15
1949							70000	2550	7590		7600	80150	0.13
1950							42000	2340	5735		5700	50040	0.16
1951							55000	1405	2805	2805	2800	59205	0.07
1952								1965	1087	1087	1100		
1953							35000	1630	727	727	700	37330	0.06
1954								2000	445	445	400		
1955							4000	1500	575	575	600	6100	0.34
1956	0.05	0.08	0.87	1.00	0.13	0.08	6000	2500	1429	30582	1400	9900	0.39
1957	0.05	0.06	0.89	1.00	0.11	0.06	400	3000	175	20434	200	3600	0.89
1958	0.05	0.15	0.00	1.00	0.20	0.15	25	000	1265	165	200	1025	0.98
1959	0.05	0.08	0.87	1.00	0.13	0.08	750	400	624	824	600	1750	0.57
1960	0.05	0.07	0.88	1.00	0.12	0.08	3500	523	473	473	500	4523	0.23
1961	0.05	0.25	0.70	1.00	0.30	0.27	5000	178	2092	2092	2100	7278	0.31
1962	0.05	0.56	0.39	1.00	0.61	0.59	3000	189	756	756	800	3989	0.25
1963	0.05	0.21	0.74	1.00	0.26	0.22	1000		2316	2316	2300	3300	0.70
1964	0.05	0.28	0.67	1.00	0.33	0.30	5000	226	2284	2284	2300	7526	0.34
1965	0.05	0.21	0.74	1.00	0.26	0.22	10000		1501	1501	1500	11500	0.13
1966	0.05	0.26	0.69	1.00	0.31	0.28	10000		2442	2442	2400	12400	0.19
1967	0.05	0.38	0.57	1.00	0.43	0.39	3400		598	598	600	4000	0.15
1968	0.05	0.45	0.50	1.00	0.50	0.48	3000		840	840	800	3800	0.21
1969	0.05	0.34	0.61	1.00	0.39	0.35	3300		516	516	515	3815	0.13
1970	0.05	0.33	0.62	1.00	0.38	0.35	4700		844	844	844	5544	0.15
1971	0.05	0.11	0.84	1.00	0.16	0.11	3300		185	185	185	3485	0.05
1972	0.05	0.48	0.47	1.00	0.53	0.50	1800		702	702	702	2502	0.28
1973	0.05	0.36	0.59	1.00	0.41	0.38	1000		67	67	67	1067	0.06
1974	0.05	0.30	0.65	1.00	0.35	0.32	1200		322	322	322	1522	0.21
1975	0.05	0.35	0.60	1.00	0.40	0.37	225		59	59	59	284	0.21
1976	0.05	0.05	0.90	1.00	0.10	0.06	100		36	36	36	136	0.26
1977	0.05	0.24	0.71	1.00	0.29	0.25	600		366	366	366	966	0.38
1978	0.05	0.30	0.65	1.00	0.35	0.31	500		150	150	150	650	0.23
1979	0.05	0.17	0.78	1.00	0.22	0.18	700					700	
1900	0.05	0.18	0.77	1.00	0.23	0.19	400					400	
1981	0.05	0.20	0.75	1.00	0.25	0.21	1000		1140	1140	1140	2140	0.53
1982	0.05	0.21	0.74	1.00	0.26	0.22	3000		4500	4500	4500	7500	0.60
1983	0.05	0.02	0.93	1.00	0.07	0.02	4000		6450	6450	6450	10450	0.62
1984	0.05	0.08	0.87	1.00	0.13	0.08	3000					3000	0.00
1985	0.05	0.32	0.63	1.00	0.37	0.34	2000			4000	4000	6000	0.67
1986	0.05	0.09	0.86	1.00	0.14	0.09	3000				22450	25450	0.88
1987	0.05	0.06	0.89	1.00	0.11	0.06	4000				20296	24296	0.84
1988	0.05	0.22	0.73	1.00	0.27	0.24	1000			4250	4250	5250	0.81
1989	0.05	0.24	0.71	1.00	0.29	0.26	5600				1450	7050	0.21
1990	0.05	0.21	0.74	1.00	0.26	0.22	6000					6000	0.00
1991	0.05	0.20	0.75	1.00	0.25	0.21	40000				13000	53000	0.25
1992	0.05	0.34	0.61	1.00	0.39	0.35	27000				15138	42138	0.36
1993	0.05	0.30	0.65	1.00	0.35	0.32	22000				11408	33408	0.34
1994	0.05	0.21	0.74	1.00	0.26	0.22					12629		
1995	0.05	0.30	0.65	1.00	0.35	0.32	35000				23912	58912	0.41
1996	0.05	0.38	0.57	1.00	0.43	0.39	41000			14453	14453	55453	0.26
1997	0.05	0.40	0.55	1.00	0.45	0.42	24000				15512	39512	0.39
1998	0.05	0.15	0.80	1.00	0.20	0.16	6000			3674	3674	9674	0.38
1999	0.05	0.00	0.95	1.00	0.05	0.00	15000				675	15675	0.04
2000	0.05	0.44	0.51	1.00	0.49	0.47	3000				1905	4905	0.39
2001	0.05	0.29	0.66	1.00	0.34	0.31	5047				1289	6336	0.20
30-39 AVG								5023	6984		6984		
40-49 AVG							58800	2348	5658		7018	70139	0.16
50-59 AVG	0.05	0.09	0.86	1.00	0.14	0.09	17897	1754	1487	6405	1370	21119	0.43
60-69 AVG	0.05	0.30	0.65	1.00	0.35	0.32	4720	279	1382	1382	1382	6213	0.26
70-79 AVG	0.05	0.27	0.68	1.00	0.32	0.28	1413		303	303	303	1686	0.20
80-89 AVG	0.05	0.16	0.79	1.00	0.21	0.17	2700		4030	4068	8067	9154	0.57
90-00 AVG	0.05	0.27	0.68	1.00	0.32	0.28	21900			9064	11231	31868	0.28

Table 2: 2001 Nanika River sockeye harvest rate analysis

Area 3/4 Run	Nanika
Other Fish Catch	0.05
Area 3/4/5 Run	0.95
ENTER peak week	27
Enter Weekly Code	5
ENTER S.D	1.5

Notes: 1) Area 1-5 weekly harvest rates come from 2001 run-reconstruction
2) Terrace-Hazelton harvest rates from 2001 IFF catch data and Tyee Esc
3) Moricetown Mark-Recap Escapement Estimate was 5047
4) Sx movement: 1 week Tyee to Terrace, 1 week Terrace to Hazelton, 1 week hazelton to Moricetown
5) Moricetown weekly harvest rates were adjusted to recreate the reported sockeye catch of 1289
6) Total stock calculated as esc/(1-cumulative exploitation)

Range Week Ending	2001 Week Ending	Stat Week	code	Prop	Area 1-5 h.r(1)	Area 1-5 catch	Area 1-5 Tyee esc	Ter-Haz h.r(2)	Ter-Haz Catch	Ter-Haz Esc	Motown h.r (3)	Motown Catch	Motown Esc	Calc. Tot. Stock
Jun 3	Jun 2	54 22	0	0.0010	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Jn 4-10	Jun 9	61 23	1	0.0072	0.0000	0.0000	0.0072	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	
Jn 11-17	Jun 16	62 24	2	0.0342	0.0039	0.0001	0.0341	0.0000	0.0000	0.0072	0.0000	0.0000	0.0010	
Ju 18-24	Jun 23	63 25	3	0.1039	0.0172	0.0018	0.1021	0.0000	0.0000	0.0341	0.0000	0.0000	0.0072	
Jn 25-1	Jun 30	64 26	4	0.2023	0.0510	0.0103	0.1920	0.0000	0.0000	0.1021	0.0000	0.0000	0.0341	
Jl 2-8	Jul 7	71 27	5	0.2526	0.3421	0.0864	0.1662	0.0000	0.0000	0.1920	0.0000	0.0000	0.1021	
Jl 9-15	Jul 14	72 28	6	0.2023	0.5490	0.1110	0.0912	0.0010	0.0002	0.1660	0.0000	0.0000	0.1920	
Jl 16-22	Jul 21	73 29	7	0.1039	0.5557	0.0577	0.0461	0.0150	0.0014	0.0899	0.3000	0.0498	0.1162	
Jl 23-29	Jul 28	74 30	8	0.0342	0.6025	0.0206	0.0136	0.0040	0.0002	0.0460	0.5150	0.0463	0.0436	
Jl 30-5	Aug 4	75 31	9	0.0072	0.4874	0.0035	0.0037	0.0100	0.0001	0.0135	0.6000	0.0276	0.0184	
Au 6-12	Aug 11	81 32	10	0.0010	0.3813	0.0004	0.0006	0.0140	0.0001	0.0036	0.6000	0.0081	0.0054	
Au 13-19	Aug 18	82 33	11	0.0001	0.3426	0.0000	0.0001	0.0150	0.0000	0.0006	0.4500	0.0016	0.0020	
Au 20-26	Aug 25	83 34	12	0.0000	0.0205	0.0000	0.0000	0.0330	0.0000	0.0001	0.0000	0.0000	0.0006	
Au 27-2	Sep 1	84 35	13	0.0000	0.0000	0.0000	0.0000	0.0190	0.0000	0.0000	0.0000	0.0000	0.0001	
Se 3-9	Sep 8	91 36	14	0.0000	0.0000	0.0000	0.0000	0.0530	0.0000	0.0000	0.0000	0.0000	0.0000	
Se 10-16	Sep 15	92 37	15	0.0000	0.0000	0.0000	0.0000	0.0140	0.0000	0.0000	0.0000	0.0000	0.0000	
Se 17-23	Sep 22	93 38	16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Se 24-30	Sep 29	94 39	17	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	
		Total		0.9497		0.2919	0.6578		0.0019	0.6559		0.1334	0.5225	
		h.r				0.3074			0.0029			0.2034		
		exploit.		0.0503		0.2919			0.0019			0.1334		
		cum explo		0.0503		0.3422			0.3441			0.4775		
		cal. fish		486		2820			19			1288	5047	9659

Table 3: 2000 Nanika River sockeye harvest rate analysis (Updated Oct 10, 2001)

Area 3/4 Run	Nanika	
Other Fish Catch	0.05	
Area 3/4/5 Run	0.95	
ENTER peak week	27	
Enter Weekly Code	5	
ENTERS.D	1.5	

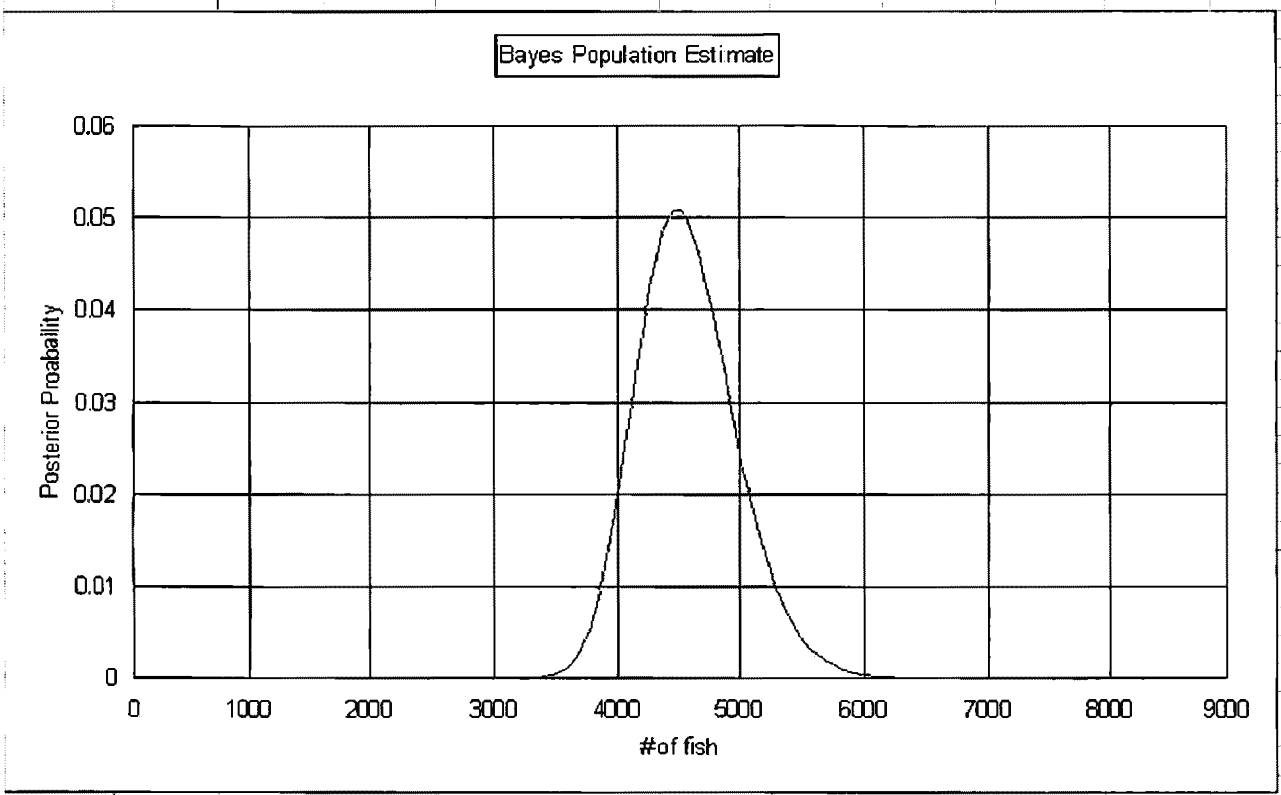
Notes: 1) Area 1-5 weekly harvest rates come from 2000 run-reconstruction
2) Terrace-Hazelton harvest rates calculated using inriver catch data (ff+essr) and weekly Tyee escapement
3) Moricetown actual annual harvest rate calculated as catch/catch+esc for 2000 (1905/1905+3000)
4) Sx movement: 1 week Tyee to Terrace, 1 week Terrace to Hazelton, 1 week hazelton to Moricetown
5) Moricetown weekly harvest rates were adjusted to recreate the reported annual harvest rate calculated in (3)
6) Total stock calculated as esc/(1-cumulative exploitation)

Range Week Ending	2000 Week Ending	Stat Week	code	Prop	Area 1-5 hr (1)	Area 1-5 catch	Area 1-5 Tyee esc	Ter-Haz hr (2)	Ter-Haz Catch	Ter-Haz Esc	Motown hr (3)	Motown Catch	Motown Esc	Calc. Tot. Stock
Jun 3	Jun 3	54 22	0	0.0010	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Jn 4-10	Jun 10	61 23	1	0.0072	0.0000	0.0000	0.0072	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	
Jn 11-17	Jun 17	62 24	2	0.0342	0.0100	0.0003	0.0338	0.1671	0.0012	0.0060	0.0000	0.0000	0.0010	
Ju 18-24	Jun 24	63 25	3	0.1039	0.0160	0.0019	0.1020	0.0167	0.0008	0.0333	0.0000	0.0000	0.0060	
Jn 25-1	Jul 1	64 26	4	0.2023	0.4090	0.0827	0.1195	0.0059	0.0006	0.1014	0.0000	0.0000	0.0333	
Jl 2-8	Jul 8	71 27	5	0.2526	0.6030	0.1523	0.1003	0.0287	0.0034	0.1161	0.0000	0.0000	0.1014	
Jl 9-15	Jul 15	72 28	6	0.2023	0.5880	0.1185	0.0837	0.0367	0.0037	0.0966	0.0000	0.0000	0.1161	
Jl 16-22	Jul 22	73 29	7	0.1039	0.6670	0.0693	0.0346	0.0314	0.0026	0.0811	0.8500	0.0821	0.0145	
Jl 23-29	Jul 29	74 30	8	0.0342	0.4550	0.0156	0.0188	0.0636	0.0022	0.0324	0.8250	0.0669	0.0142	
Jl 30-5	Aug 5	75 31	9	0.0072	0.3770	0.0027	0.0045	0.0564	0.0011	0.0176	0.8000	0.0259	0.0065	
Au 6-12	Aug 12	81 32	10	0.0010	0.2680	0.0003	0.0007	0.1380	0.0005	0.0039	0.7000	0.0123	0.0053	
Au 13-19	Aug 19	82 33	11	0.0001	0.0110	0.0000	0.0001	0.1547	0.0001	0.0006	0.7000	0.0027	0.0012	
Au 20-26	Aug 26	83 34	12	0.0000	0.0000	0.0000	0.0000	0.0690	0.0000	0.0001	0.7000	0.0004	0.0002	
Au 27-2	Sep 2	84 35	13	0.0000	0.0000	0.0000	0.0000	0.1034	0.0000	0.0000	0.0000	0.0000	0.0001	
Se 3-9	Sep 9	91 36	14	0.0000	0.0000	0.0000	0.0000	0.0040	0.0000	0.0000	0.0000	0.0000	0.0000	
Se 10-16	Sep 16	92 37	15	0.0000	0.0000	0.0000	0.0000	0.0887	0.0000	0.0000	0.0000	0.0000	0.0000	
Se 17-23	Sep 23	93 38	16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Se 24-30	Sep 30	94 39	17	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	
			Total	0.9497		0.4436	0.5061		0.0181	0.4900		0.1904	0.2996	
			hr			0.4671			0.0318			0.3885		
			exploit.	0.0503		0.4436			0.0181			0.1904		
			cum explo	0.0503		0.4939			0.5100			0.7004		
			cal. fish	503		4442			161			1906	3000	10013

APPENDIX 1. 2001 Morice-Nanika Escapement Estimation

2001 Moricetown Sockeye Tagging

Total sockeye tagged by seine crew	784	M	**Bayes Population Estimate**	**Point**	**4514**
Total sockeye catch at fishway	962	C		**lower**	**3814**
Total sockeye tags recovered at fishway	163	R		**upper**	**5364**
Total sockeye tags above Moricetown	1350				
			Peterson Population Estimate	**Point**	**4521**
calculated Mark rate at dipnet fishery	**0.17**			**v**	**102777.66**
assumed rate of seine tag loss	0.025			**lower**	**3893**
calculated Mark rate above Moricetown	**0.30**			**upper**	**5149**



Raw data (SR) and notes

784 sockeye tagged in beach seine fishery
566 un-marked sockeye tagged in dipnet fishery
233 un-markedsockeye not tagged in dipnet fishery
163 sockeye tagged in beach seine fishery and recaptured in dipnet fishery

-tagging started about two after sockeye started moving e.g. population estimate is likley an underestimate of escapement above Moricetown

-beach seine marks out= 784 M
-total dipnet catch is 566+233+163 = 962 C
-total tags out above Motown falls is 784+566 = 1350
-total tags recovered in dipnet fishery is 163 R

-mark rate in dipnet fishery = 163 /962= .17
-mark rate above Motown = 1350/4395= .31
4514.30

Modified 'Petersonestimate — **Bayes Estimate is from BAYESTA G.xls**

N=(((M+1)(C+1))/(R+1))-1

V= ((N^2)(C-R))/((C+1)(R+2))

95% C.L. = N +/- 1.96 SQRT(v)

APPENDIX 1 cont'd. 2001 Morice-Nanika Escapement Estimation

Spawning Ground Assessments Nanika 2001

Nanika Mark Rates			Actual Observed Unmarked	Actual Observed Marked	Actual Observed Total	Avg Observed Unmarked	Avg Observed Marked	Avg Observed Total	Calculated Mark Rate
		# passes							
20-Sep	Reach 1	1	0	0	0	0	0	0	
	Reach 2	2	66	32	98	33	16	49	
	Reach 3	11	944	241	1185	86	22	108	
	Reach 4	0	0	0	0	0	0	0	
	Reach 5	1	6	2	8	6	2	8	
	Total		1016	275	1291	125	40	165	0.24
27-Sep	Reach 1	1	2	2	4	2	2	4	
	Reach 2	1	31	28	59	31	28	59	
	Reach 3	1	95	32	127	95	32	127	
	Reach 4	1	96	22	118	96	22	118	
	Reach 5	1	4	1	5	4	1	5	
	Total		228	85	313	228	85	313	0.27
	Total		1244	360	1604	353	**125**	**478**	**0.26**
							R	C	

Adjusted esc. Above Moricetown

Peterson Population Estimate	Point	**5047**
	v	351630.49
	lower	3885
	upper	6210