Robson Bight (Michael Bigg)

Ref. No.: 707

ECOLOGICAL RESERVES COLLECTION
GOVERNMENT OF BRITISH COLUMBIA
VICTORIA, B.C.
V8V 1X4

To: G.E. Reid
Head, Fisheries Section

Date: October 7, 1993

File: 39000-01
Protected Areas

Re: Summary of summer steelhead waters in Vancouver Island Region, including estimated stock status and run timing

As requested, the following summarizes our current knowledge of the distribution of summer steelhead in the Vancouver Island Region, including stock origin, estimated population size and run timing:

STREAM	ORIGIN	POPN STATUS	RUN TIMING
Chemainus	wild	≤50	May-August
Puntledge	wild	≤50	August-October
Puntledge	hatchery	50-100	August-October
Campbell	hatchery	100-300	May-August
Campbell	wild	<10	May-August
White	wild	100-200	May-August
Eve	wild	≤50	May-August
Tsitika	wild	200-300	May-August
Kaipit (Nimpk-ish)	wild	≤50	May-August
Kokish	wild	50-150	May-August
Upper San Juan	wild	≤50	May-August
Harris-Hemmingsen	wild	50-100	May-August
Gordon	wild	250-350	May-August
Caycuse	wild	200-300	May-August
Nitinat	wild	50-100	May-August
Sarita	wild	≤50	May-August
Nahmint	wild	100-250	May-August
China	wild	≤50	May-August
Mactush	wild	≤25	May-August
Cous	wild	50-75	May-August
Stamp	wild	300	July-September
Stamp	hatchery	500-1000	July-September

Ash	wild	50-100	July-September
Effingham	wild	≤50	May-August
Toquart	wild	50-100	May-August
Burman	wild	≤50	May-August
Upper Gold	wild	200-300	May-August
Heber	wild	150-300	May-August
Perry	wild	100-200	May-August
Artlish	wild	≤50	May-August
Tahsish	wild	50-100	May-August
Zeballos	wild	≤50	May-August
Mahatta	wild	50-150	May-August
Marble	wild	50-150	May-August
Power	wild	≤50	May-August
Nasparti	wild	≤50	May-August
Kwalate	wild	≤50	May-August
Clear (Kingcome)	wild	≤50	May-August
Kakweiken	wild	≤50	May-August

Obviously we have considerable work to do to monitor these stocks and improve our estimates of current population size, run timing and distribution within individual watersheds. This is an on-going management responsibility, but one with some urgency with respect to the Ministry's commitment to biodiversity and species at risk.

Please advise should you require further information.

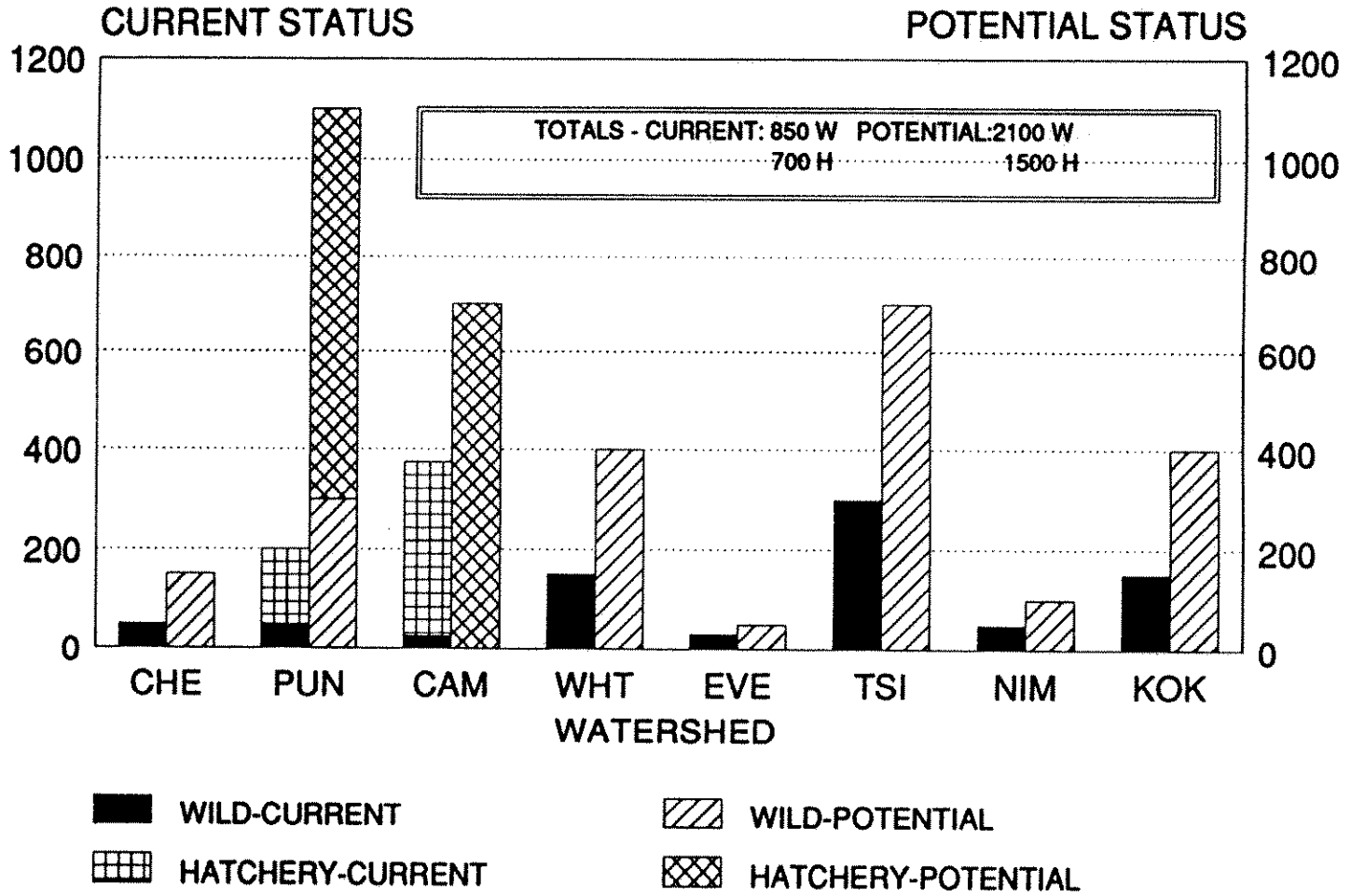
J. C. Wightman
Senior Fisheries Biologist

JCW/

cc: D.W. Rimmer, Fisheries Biologist
F.N. Axford, Fisheries Technician
L.B. Carswell, Fisheries Technician

Figure 3.

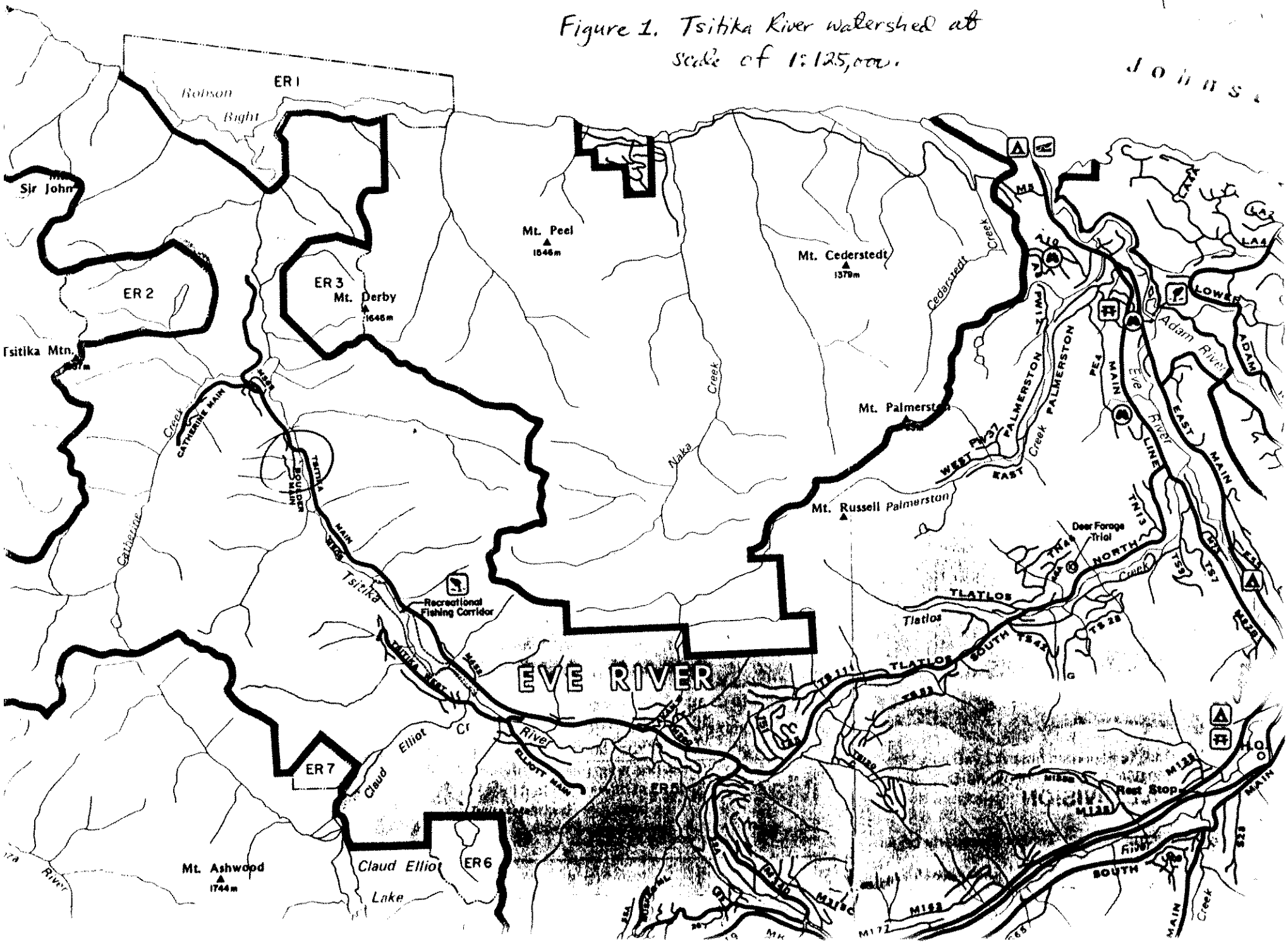
EAST COAST VANCOUVER IS. SUMMER STEELHEAD STREAMS



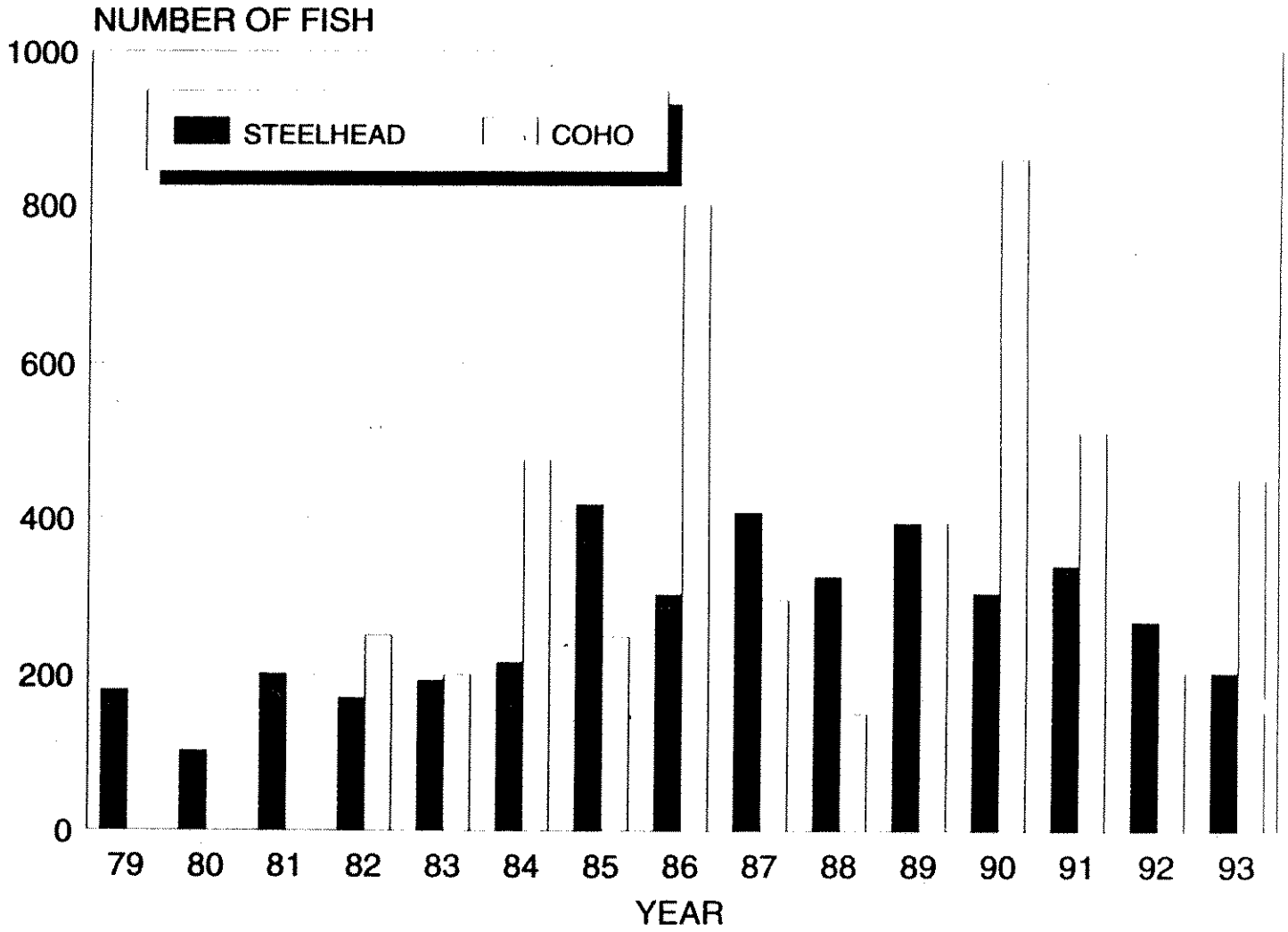
LEGEND:

CHE - Chemainus R.
PUN - Puntledge
CAM - Campbell
WHT - White
EVE - Eve
TSI - Tsitika
NIM - Nimpkish
KOK - Kokish

Figure 1. Tsitika River watershed at scale of 1:125,000.



TSITIKA SNORKEL SURVEYS



X Data	STEELHEAD	COHO
79	180	
80	103	
81	201	
82	170	250
83	193	200
84	216	475
85	417	248
86	301	800
87	406	294
88	324	150
89	392	392
90	302	857
91	337	512
92	266	203
93	202	448

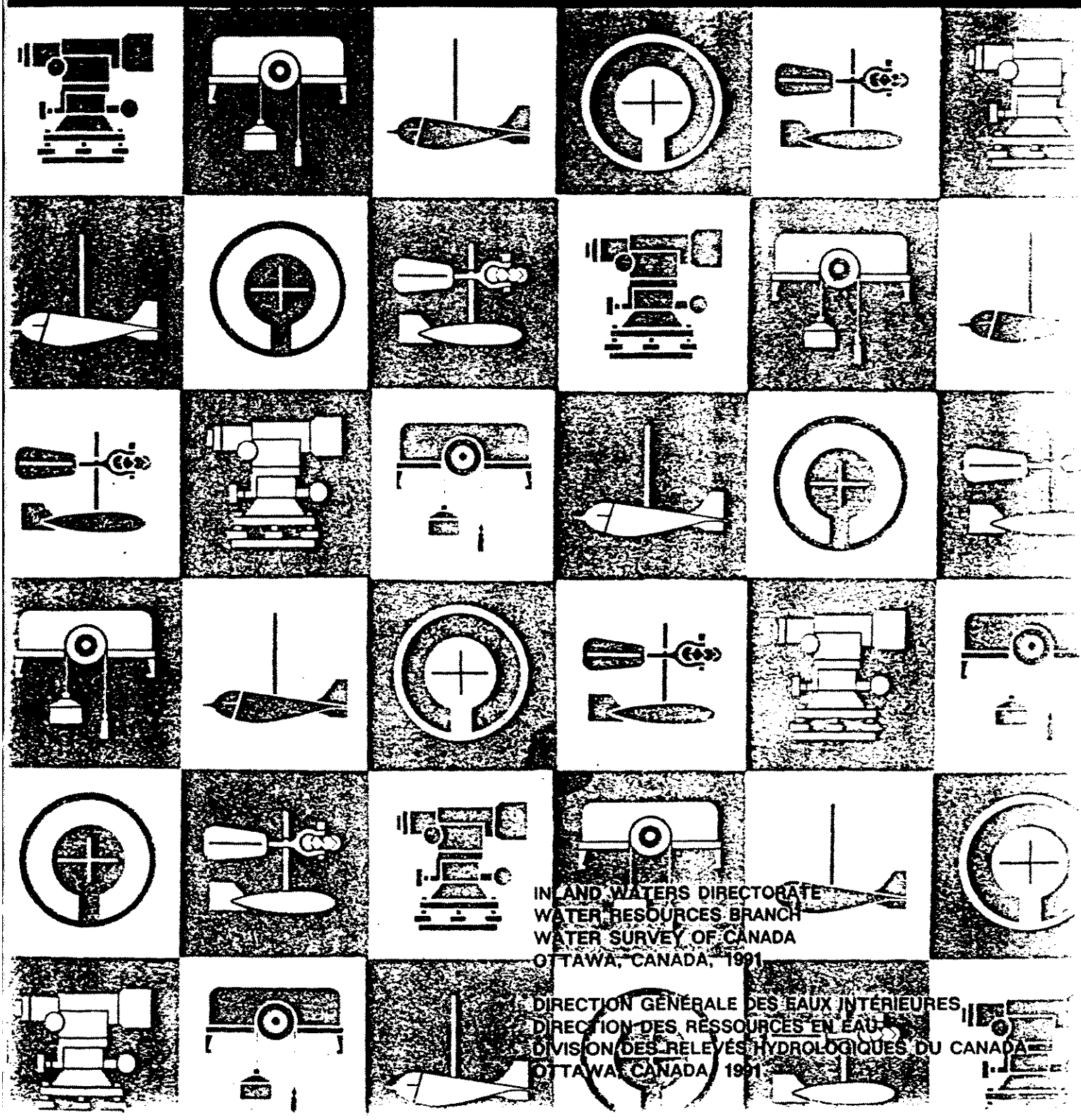
Historical Streamflow Summary

British Columbia

Sommaire chronologique de l'écoulement

Colombie-Britannique

TO/JUSQU'À **1990**



INLAND WATERS DIRECTORATE
WATER RESOURCES BRANCH
WATER SURVEY OF CANADA
OTTAWA, CANADA, 1991

DIRECTION GÉNÉRALE DES EAUX INTÉRIEURES
DIRECTION DES RESSOURCES EN EAU
DIVISION DES RELEVÉS HYDROLOGIQUES DU CANADA
OTTAWA, CANADA, 1991

TSITIKA RIVER BELOW CATHERINE CREEK - STATION NO. 08HF004

MONTHLY AND ANNUAL MEAN DISCHARGES IN CUBIC METRES PER SECOND FOR THE PERIOD OF RECORD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN	YEAR
1975	18.5	9.33	11.5	13.5	33.9	31.6	13.9	10.3	4.05	28.8	102	38.4	26.4	1975
1976	---	---	---	---	---	---	---	12.8	9.32	13.4	24.3	53.9	---	1976
1977	13.3	35.2	25.3	31.8	19.6	17.4	12.0	3.55	5.63	31.1	44.4	28.6	22.2	1977
1978	17.2	18.5	26.7	13.8	15.5	21.1	6.19	7.56	19.8	23.1	30.3	9.64	17.4	1978
1979	4.52	16.2	31.8	22.0	31.4	18.7	11.2	2.94	15.9	20.6	12.3	43.5	19.3	1979
1980	15.4	21.2	15.5	23.4	21.5	15.7	12.0	4.35	18.7	9.20	38.5	49.4	20.4	1980
1981	27.1	30.1	9.52	24.0	22.4	15.2	4.82	1.99	11.5	36.2	31.4	20.7	19.5	1981
1982	20.3	27.7	11.1	11.5	30.8	34.7	13.9	3.91	5.25	31.3	17.5	18.7	18.8	1982
1983	43.2	40.5	20.2	15.8	20.0	18.2	18.8	5.11	8.03	22.3	40.9	10.2	21.8	1983
1984	50.5	30.9	19.0	15.9	20.2	20.6	14.5	5.39	14.4	37.0	24.5	16.0	22.4	1984
1985	21.1	14.8	9.07	25.7	27.3	16.1	5.18	1.89	1.49	28.2	13.0	10.8	14.6	1985
1986	42.3	24.6	29.7	15.7	29.2	20.6	9.17	2.24	2.24	6.02	42.2	35.9	21.6	1986
1987	41.1	33.6	27.9	22.7	22.3	30.4	9.94	2.73	5.93	4.00	35.7	24.4	21.6	1987
1988	21.5	30.6	24.2	29.9	31.1	25.9	14.9	7.83	6.05	15.6	38.9	23.1	22.4	1988
1989	26.6	8.47	10.0	29.2	22.6	14.8	6.22	3.07	1.31	19.0	49.2	32.0	18.6	1989
1990	29.5	18.3	18.8	22.8	16.4	14.1	5.67	1.77	1.72	48.0	95.3	51.2	27.0	1990
MEAN	26.1	24.0	19.4	21.2	24.3	21.0	10.6	4.84	8.21	23.4	40.0	29.1	20.9	MEAN

LOCATION - LAT 50 26 13 N DRAINAGE AREA, 360 km²
LONG 126 34 27 W NATURAL FLOW

TSITIKA RIVER BELOW CATHERINE CREEK - STATION NO. 08HF004

ANNUAL EXTREMES OF DISCHARGE AND ANNUAL TOTAL DISCHARGE FOR THE PERIOD OF RECORD

YEAR	MAXIMUM INSTANTANEOUS DISCHARGE (m³/s)	MAXIMUM DAILY DISCHARGE (m³/s)	MINIMUM DAILY DISCHARGE (m³/s)	TOTAL DISCHARGE (dam³)	YEAR
1975	1 010 AT 10:31 PST ON NOV 13 *	617 ON NOV 13 *	2.48 ON SEP 28	831 000	1975
1976	583 AT 21:42 PST ON DEC 15	256 ON DEC 15	3.99 ON OCT 21	---	1976
1977	541 AT 02:05 PST ON OCT 23	249 ON OCT 23	2.83 ON AUG 15	700 000	1977
1978	470 AT 22:09 PST ON NOV 06	317 ON NOV 07	2.47 ON AUG 09	549 000	1978
1979	295 AT 19:50 PST ON DEC 17	150 ON DEC 17	1.84 ON JAN 09	609 000	1979
1980	348 AT 20:00 PST ON DEC 10	246 ON DEC 10	2.80 E ON AUG 25	644 000	1980
1981	325 AT 05:35 PST ON OCT 31	239 ON OCT 31	1.26 ON AUG 23	614 000	1981
1982	191 AT 13:55 PST ON OCT 22	144 ON OCT 24	2.35 E ON SEP 01	594 000	1982
1983	373 AT 19:52 PST ON FEB 11	208 ON FEB 11	2.85 ON AUG 27	687 000	1983
1984	347 AT 05:02 PST ON JAN 04	234 ON JAN 04	2.87 ON OCT 02	708 000	1984
1985	160 AT 11:19 PST ON APR 01	137 ON OCT 19	0.773 ON OCT 08 *	459 000	1985
1986	409 ON JAN 18	200E ON JAN 18	0.920 ON SEP 21	683 000	1986
1987	447 AT 04:15 PST ON JAN 11	352 ON JAN 11	1.16 ON OCT 23	681 000	1987
1988	269 AT 17:43 PST ON NOV 05	146 ON FEB 11	2.08 ON SEP 18	709 000	1988
1989	477 AT 13:11 PST ON NOV 09	344 ON NOV 09	1.02 ON OCT 03	586 000	1989
1990	873 AT 12:35 PST ON NOV 23	586 ON NOV 11	0.855 ON SEP 27	850 000	1990
	E - ESTIMATED	* - EXTREME RECORDED FOR THE PERIOD OF RECORD		660 000	MEAN

WATER SURVEY OF CANADA
MAR 26 1992 PAGE 21
VANCOUVER, B.C. 14:09

TSITIKA RIVER BELOW CATHERINE CREEK

STATION NO. 08HF004

([redacted]) DAILY DISCHARGE IN CUBIC METRES PER SECOND FOR 1991

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
Dec 31	19.0 E												
1	17.0 E	102	18.1	8.66	10.8	11.8	9.84	3.10	24.0 E	1.01 E	3.00 E	36.0	1
2	14.0 E	186	13.7	9.59	15.1	10.6	11.0	3.08	14.0 E	1.00 E	6.40 E	35.7	2
3	11.0 E	88.7	11.3	9.69	19.0	8.88	10.7	3.03	8.00 E	0.970 E	14.0 E	45.9	3
4	5.00 E	136	9.53	15.3	20.3	7.80	9.13	2.96	4.40 E	0.950 E	32.0 E	68.3	4
5	7.00 E	111	8.16	15.7	21.9	7.50	7.70	2.90	3.10 E	0.940 E	21.0 E	83.6	5
6	5.50 E	41.8	7.45	16.6	23.2	10.5	6.68	2.86	2.70 E	0.920 E	11.0 E	104	6
7	4.30 E	65.0	6.63	15.8	20.8	16.7	6.25	3.14	2.40 E	0.900 E	70.0 E	72.6	7
8	3.90 E	41.0	6.43	12.0	21.3	17.3	6.40	71.5	2.30 E	0.870 E	52.0 E	78.3	8
9	3.75 E	35.1	6.46	10.7	18.0	16.0	6.24	31.4	2.10 E	0.850 E	30.0 E	112	9
10	3.75 A	39.3	6.30	9.40	14.0	23.0	5.95	14.6	1.80 E	0.840 E	20.0 E	84.8	10
11	14.8	36.0	5.70	7.51	14.7	19.8	6.38	8.71	1.60 E	0.830 E	110 E	89.2	11
12	70.2	30.5	5.50	6.79	18.8	14.4	7.26	6.79	1.65 E	0.810 E	85.0 E	72.9	12
13	114	24.7	5.04	6.99	17.5	13.6	7.94	5.41	1.55 E	0.800 E	64.2 A	56.0	13
14	52.0	106	5.15	7.71	14.6	11.7	8.89	4.69	1.40 E	0.800 E	30.0 E	44.3	14
15	44.2	115	4.99	8.47	14.1	11.0	23.4	4.17	1.35 E	1.50 E	55.0 E	38.8	15
16	43.7	56.0	4.98	11.2	17.5	13.4	16.2	3.86	1.30 E	4.00 E	161	36.3	16
17	49.8	33.8	5.00	15.2	15.7	12.4	15.3	3.53	1.28 E	3.40 E	117	34.8	17
18	66.8	31.8	5.02	17.3	15.0	11.1	10.5	3.15	1.27 E	3.00 E	68.2	35.3	18
19	33.0	91.6	5.24	19.5	23.6	11.6	7.90	2.95	1.24 E	3.70 E	195	35.3	19
20	21.5	62.8	5.28	22.3	24.2	14.5	6.57	2.70	1.23 E	3.30 E	96.4	37.2	20
21	16.0	34.3	5.29	23.1	18.4	14.7	7.73	2.56	1.20 E	4.80 E	51.6	53.3	21
22	14.0	23.4	5.04	22.3	13.0	12.4	7.34	2.46	1.16 E	4.00 E	37.1	45.0	22
23	12.6	18.9	4.47	18.7	9.94	11.8	6.57	2.31	1.14 E	2.60 E	32.8	37.4	23
24	11.1	16.2	4.08	17.2	10.6	11.5	6.23	2.07	1.10 E	2.00 E	65.8	37.6	24
25	10.0	14.8	3.79	12.9	10.3	12.1	5.66	1.81	1.07 E	1.70 E	74.3	46.2	25
26	8.92	18.6	3.55	10.2	11.4	11.5	5.17	2.03	1.06 E	1.50 E	46.0	244	26
27	8.07	25.1	3.18	9.17	11.1	10.3	5.12	16.7	1.06 E	1.40 E	34.8	174	27
28	7.84	23.9	3.05	8.42	10.6	10.1	4.69	31.6	1.05 E	1.33 E	35.5	126	28
29	7.08		3.51	8.15	12.9	10.5	4.23	103 A	1.04 E	1.31 E	34.3	96.0	29
30	7.03		4.87	8.29	13.3	10.1	3.74	65.0 E	1.03 E	1.50 E	28.7	75.0	30
31	7.52		6.76		11.9		3.32	38.0 E		2.00 E		73.1	31
TOTAL	700.17	1613.9	193.62	384.84	493.74	378.78	250.03	452.07	89.58	55.330	1682.10	2208.9	TOTAL
MEAN	22.6	57.6	6.25	12.8	15.9	12.6	8.07	14.6	2.99	1.78	56.1	71.3	MEAN
DAM3	60500	139000	16700	33300	42700	32700	21600	39100	7740	4780	145000	191000	DAM3
MAX	114	188	18.1	23.1	24.2	23.0	23.4	103	24.0	4.80	195	244	MAX
MIN	3.75	14.8	3.05	6.79	9.94	7.50	3.32	1.81	1.03	0.800	3.00	34.8	MIN

SUMMARY FOR THE YEAR 1991
MEAN DISCHARGE, 23.3 M3/S
TOTAL DISCHARGE, 734000 DAM3
MAXIMUM DAILY DISCHARGE, 244 M3/S ON DEC 26
MINIMUM DAILY DISCHARGE, 0.800 M3/S ON OCT 13

MAXIMUM INSTANTANEOUS DISCHARGE, 337 M3/S AT 1235 PST ON Nov 19 (3.321 m)
Min. Inst. not available - Mano malfunction

A-MANUAL GAUGE
E-ESTIMATED

TABLE Nº 15 - JAN1 TO FEB4
TABLE Nº 16 - FEB5 TO DEC31

PREPARED BY: W Wall Mar 27/92
CHECKED BY: W Wall Mar 27/92
E. MAYERT APR 2/92

WATER SURVEY OF CANADA
MAR 10 1993 PAGE 24
VANCOUVER, B.C. 11:47

TSITIKA RIVER BELOW CATHERINE CREEK

STREAM VAX JAN/92

(DAILY) DAILY DISCHARGE IN CUBIC METRES PER SECOND FOR 1992

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DA
	73.1									3.39	95.8	32.2	1
Dec 31 1	318	161	36.6	7.47	42.8	16.9	8.71	1.31	1.42	3.01	47.7	20.5	2
2	190	143	27.0	17.1	71.1	10.8	6.89	1.31	1.31	2.90	38.2	14.1	3
3	81.0	389	22.8	20.1	58.4	8.56	6.22 A	1.32	1.29	3.42	88.5	10.9	4
4	49.3	178	19.8	10.9	35.3	7.83	5.75 E	1.32	1.28	3.03	47.8	8.57	5
5	30.5	114	21.3	8.18	30.3	7.67	5.35 E	1.31	1.30	2.67	119	7.46	6
6	19.4	62.4	22.7	7.41	29.2	8.09	4.83 E	2.79	1.31	2.31	127	6.41	7
7	13.0	37.0	17.8	7.05	17.8	7.76	4.60 E	4.19	1.86 A	1.97	51.0	7.27	8
8	10.4	25.2	12.6	6.32	12.1	7.61	4.45 E	4.08	8.67 E	1.86	32.5	10.7	9
9	181	16.3	10.3	5.53	11.2	9.45	4.30 E	4.65	4.64 A	2.54	21.8	8.04	10
10	291	13.9	9.55	4.90	14.3	32.9	4.83 E	3.90	2.99 E	6.47	17.1	6.35	11
11	124	12.8	9.80	4.34	11.4	22.7	4.30 E	2.89	2.25 E	5.97	13.7	5.25	12
12	68.4	12.9	11.7	4.34	9.10	13.3	4.40 E	2.17	1.98 E	5.16	13.5	21.9	13
13	45.1	22.7	26.4	5.52	7.97	15.5	4.85 E	1.88	1.86 E	4.15	13.8	70.0	14
14	37.0	27.0	26.8	6.99	7.75	20.4	4.80 E	1.66	1.75 E	3.21	11.5	34.6	15
15	170	19.2	21.1	9.49	7.86	14.3	4.30 E	1.58	1.63 E	2.76	10.6	23.7	16
16	131	17.3 E	16.4	71.7	8.44	10.8	3.80 E	1.46	1.60 E	2.74	9.39	18.0	17
17	64.7	15.4 E	14.3	95.9	9.20	9.55	3.30 E	1.43	1.34 A	65.7	12.7	12.4	18
18	39.8	13.5 E	11.3	66.7	9.40	8.25	2.80 E	1.37	1.21	82.4	32.5	10.3	19
19	30.6	11.5 E	9.21	36.1	8.27	7.87	2.30 E	1.33	1.27	347	26.0	8.83	20
20	37.6	9.20 A	8.05	37.1	7.31	8.29	2.00 E	1.31	3.56	114	28.1	7.88	21
21	48.2	39.0	7.49	29.7	6.31	8.66	1.90 E	1.28	4.25	107	33.9	15.3	22
22	56.4	101	7.40	24.3	6.01	8.53	1.76 A	1.24	3.35	493	20.6	35.5	23
23	197	50.7	7.32	14.4	5.97	8.03	1.68	1.21	16.0	132	13.1	41.7	24
24	196	48.6	7.53	10.4	9.05	7.10	1.54	1.18	36.6	43.1	9.87	26.3	25
25	149	88.0	7.53	10.4	15.7	6.37	1.50	1.14	19.0				
26	140	98.3	7.64	30.2	14.9	6.19	1.47	1.16	42.4	26.1	12.9	18.2	26
27	182	87.6	7.30	78.4	11.1	6.17	1.45	1.15	26.0	17.8	78.9	12.8	27
28	189	72.9	5.97	47.2	21.2	6.40	1.44	1.16	9.46	18.1	45.2	5.14	28
29	219	57.4	5.23	57.0	34.3	7.59	1.43	1.19	6.06	23.7	30.0	7.61	29
30	323		4.94	76.3	16.4	18.5	1.43	1.15	4.30	22.2	61.7	6.11	30
31	151		6.23		14.2		1.32	1.40		109		5.34	31
TOTAL	3782.4	1944.80	430.09	811.44	564.34	324.07	109.70	56.52	211.94	1658.66	1165.56	524.36	TO
MEAN	122	67.1	13.9	27.0	18.2	10.8	3.54	1.82	7.06	53.5	38.9	16.9	ME
DAM3	327000	168000	37200	70100	48800	28000	9480	4880	18300	143000	101000	45300	DA
MAX	323	389	36.6	95.9	71.1	32.9	8.71	4.65	42.4	493	127	70.0	MA
MIN	10.4	9.20	4.94	4.34	5.97	6.17	1.32	1.14	1.21	1.86	9.39	5.25	MI

A-MANUAL GAUGE

SUMMARY FOR THE YEAR 1992

MEAN DISCHARGE, 31.6 M3/S

TOTAL DISCHARGE, 1000000 DAM3

MAXIMUM DAILY DISCHARGE, 493 M3/S ON OCT 23

MINIMUM DAILY DISCHARGE, 1.14 M3/S ON AUG 25

MAXIMUM INSTANTANEOUS DISCHARGE, 702 M3/S AT 12:54 ON OCT 23 (GH. 4.449)

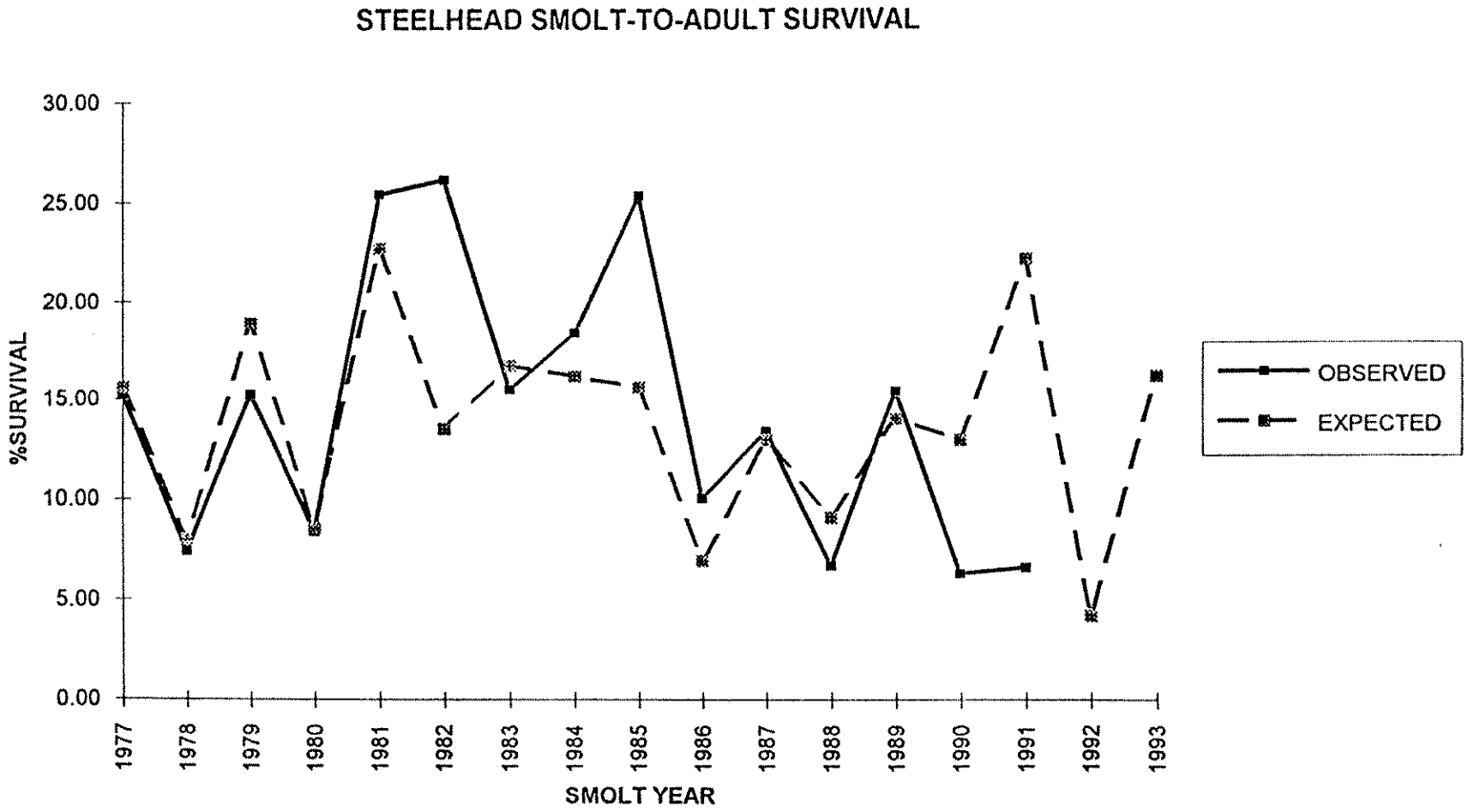
E-ESTIMATED

366 DAY(S) WITH DATA
0 DAY(S) WITH ICE
6 DAY(S) MANUAL DA
30 DAY(S) ESTIMATED
0 DAY(S) WITH NO D

PREPARED BY / DATE [illegible] Mar 24/93
CHECKED BY / DATE [illegible] Mar 25/93 C. ROBINSON
APPROVED BY / DATE E. MAYERT 93 03 23

Table No. 17 Jan. 1 - Jan 30

DRAFT



Observed survival rates of Keogh River steelhead during saltwater residence, from smolting to return as maiden-run adults (solid line), and the survival rate expected based on the relation of survival to smolt size (dashed line). Survival rates from the smolts that left in 1990 and 1991 are among the poorest on record. This is in contrast to rates observed during El Niño events in the '80's. The current and sustained warming trend in the Pacific Ocean is coincident with a 50% reduction in expected survival rate, compared to a 50% improvement from the 1982/83 conditions. Survival rate calculation for 1991 smolts is based on the assumption that returns of ocean-age 3 adults in 1994 will comprise 70% of the return. The age composition of returns from a smolt-year have never reached 70% age 3 adults, thus actual survival rates may be lower then estimated for 1991 smolts.

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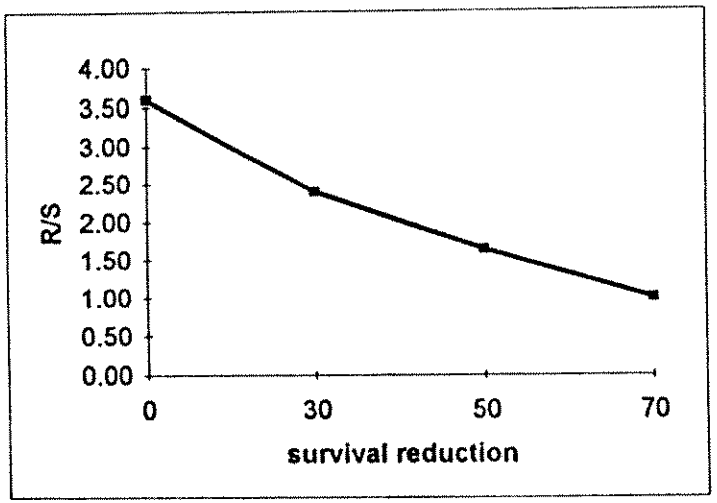

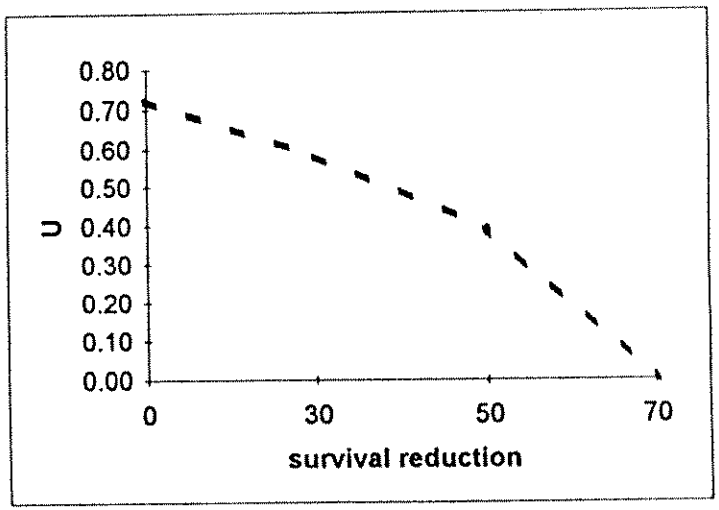

Unfavourable ocean conditions for steelhead affect both their growth and survival at sea. For Keogh River steelhead, a 50% reduction in smolt-to-adult survival rate may be coincident with a 3% reduction in female length or a 9% reduction in fecundity, thus the overall effect on productivity is a dramatic decline in recruits per spawner (R/S) and in the allowable harvest rate (U) at MSY. Survival rates from 1990 smolts were 51% below average expectation, and survival rates from 1991 smolts may be 70% below expected values. It is unclear if this trend will continue.

Figure 2. Relationships of major data compartments to estimated production of smolts and adults. General evaluation and monitoring will link (steelhead) adult counts and juvenile densities or standing crops. Intensive studies will link actual spawning escapements, redd counts, juvenile densities, and downstream migrants.

Field forms used in Tsitika biophysical inventory

STREAM: _____ SITE: _____ DATE: _____

METHOD: _____ ENCLOSURE: _____ AREA (m^2): _____ LENGTH(m) _____

SPECIES	ORIG	AGE	FL	CATCH 1 TALLY	CATCH 1 TOT	CATCH 2 TALLY	CATCH 2 TOT	WEIGHT	+C1	+C2	PVALUE
			0								
			1								
			2								
			3								
			4								
			5								
			6								
			7								
			8								

SAMPLE SITE HABITAT DESCRIPTION

UTM GRID _____

RAB CODE _____ STREAM NAME _____

SITE _____ DATE _____

HYDRAULIC TYPE _____ MSTM. OR SIDECH. _____ MAP GRADIENT __

FIELD GRADIENT _____ SAMPLE WIDTH _____ STREAM WIDTH __

CHANNEL WIDTH _____ MEAN DEPTH _____ MAX. DEPTH __ __

MEAN VELOCITY _____ MAX. VELOCITY _____ D/V METHOD __

STREAM DISCHARGE _____ TURBIDITY _____ D_{90} —

TEMPERATURE _____ TIME _____

COVER COMPONENTS

	LOG	BOULDER	IN. VEG.	OVER VEG.	CUTB
%					

SUBSTRATE BREAKDOWN

	FINES	SMALL GRAVEL	LARGE GRAVEL	COBBLE	BOULDER	BEDROCK
%						

SUBSTRATE COMPACTION _____ SAND _____

STREAM TRANSECT DATA

UTM CODE _____

RAB CODE _____ STREAM NAME _____

SITE REFERENCE _____ DATE _____

TRANSECT NO. _____

REACH _____ EST. DISCHARGE _____

HYDRAULIC TYPE _____ MAIN/SIDE CHANNEL _____

TRANSECT TYPE _____ METERED/ESTIMATED _____ MEAN/SURFACE _____

STREAM WIDTH _____ TRANSECT WIDTH _____ SITE WIDTH _____

NO. OF STATIONS _____

TRANSECT DATA (IN METRIC)

LENGTH	DEPTH	VELOCITY	LENGTH	DEPTH	VELOCITY

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Site No. #1, d/s of bridge Length(m) 24.5 Aug 13/91
Stream. Akan Creek Area(sq.m) 204.0

Method: electrofishing Enclosure: total

SPECIES /AGE	LENGTHmm MIN.	MAX.	MEAN LENGTH	MEAN WT.g	C 1	C 2	POP. n	n/ sq.m	g/ sq.m	n/ lin.m
RBT 0+	36	54	43.1	0.8	20	3	23.5	0.12	0.10	0.96
RBT 1+	104	108	106.0	12.8	2	0	2.0	0.01	0.13	0.08
RBT 2+	129	142	135.5	26.3	1	1	2.0	0.01	0.26	0.08
CT 1+	87	101	94.7	8.5	2	1	4.0	0.02	0.17	0.16
RBT Total					23	4	27.5	0.13	0.48	1.12
Salmonid Total					25	5	31.5	0.15	0.65	1.29

Sample Site Description

HYDRAULIC TYPE:	R/GLIDE
MSTM. OR SIDECH.:	M
MAP GRADIENT:	-
FIELD GRADIENT:	1.5
SAMPLE WIDTH (m):	8.4
STREAM WIDTH (m):	8.4
CHANNEL WIDTH (m):	22.0
MEAN DEPTH (m):	0.18
MAX. DEPTH (m):	0.40
MEAN VELOCITY (m/s):	0.20
MAX. VELOCITY (m/s):	0.65
D/V METHOD:	M
TURBIDITY:	0.99
TEMPERATURE (C):	14
TIME:	1330
COVER COMPONENTS (%):	>>
Log	0
Boulder	50
In. veg.	0
Over veg.	0
Cutbank	0
SUBSTATE COMPACTION:	low
SAND (%):	trace

Stream Transect Data

UTM CODE:	-
RAB CODE:	-
SITE REFERENCE:	#1
REACH:	1
TRANSECT NO.:	#1
TRANSECT TYPE:	whole
METERED/ESTIMATED:	M
STREAM WIDTH (m):	8.4
TRANSECT WIDTH (m):	8.4
No. of stations	11
SITE WIDTH (m):	8.4
No. of stations	11
STREAM DISCHARGE (m^3/S):	0.36
SUBSTRATE BREAKDOWN (%):	
Fines	trace
Sm. gravel	10
Lg. gravel	20
Cobble	40
Boulder	30
Bedrock	0
D 90 (cm):	50

Example of habitat/fish population data collected during watershed-wide biophysical assessments in August, 1991.

DRAFT

System Tsitika River Site Akan Creek, site #1

Total discharge (m^3/s)		0.36
(cfs)		12.56
Mean depth (m)		0.15
Mean velocity (m/s)		0.28
Mean probability of use :	FRY	0.79
	PARR	0.38

FRY

CELL	CUM. LENGTH	MEAN D.	PROB_D	MEAN V.	PROB_V	PROB_DV	WEIGHTED PROB_DV
START	0.00						
1	1.50	0.045	1.00	0.000	1.00	1.00	1.50
2	2.50	0.050	1.00	0.030	1.00	1.00	1.00
3	3.50	0.035	1.00	0.105	1.00	1.00	1.00
4	4.50	0.090	1.00	0.190	1.00	1.00	1.00
5	5.50	0.220	1.00	0.175	1.00	1.00	1.00
6	6.50	0.330	0.85	0.225	0.90	0.77	0.77
7	7.00	0.355	0.66	0.490	0.01	0.01	0.00
8	7.50	0.315	0.85	0.605	0.00	0.00	0.00
9	8.20	0.170	1.00	0.320	0.18	0.18	0.13
10	8.40	0.040	1.00	0.040	1.00	1.00	0.20

PARR

CELL	CUM. LENGTH	MEAN D.	PROB_D	MEAN V.	PROB_V	PROB_DV	WEIGHTED PROB_DV
START	0.00						
1	1.50	0.045	0.15	0.000	1.00	0.15	0.23
2	2.50	0.050	0.15	0.030	1.00	0.15	0.15
3	3.50	0.035	0.10	0.105	1.00	0.10	0.10
4	4.50	0.090	0.35	0.190	1.00	0.35	0.35
5	5.50	0.220	0.77	0.175	1.00	0.77	0.77
6	6.50	0.330	0.98	0.225	1.00	0.98	0.98
7	7.00	0.355	0.98	0.490	0.33	0.32	0.16
8	7.50	0.315	0.98	0.605	0.04	0.04	0.02
9	8.20	0.170	0.67	0.320	0.95	0.64	0.45
10	8.40	0.040	0.15	0.040	1.00	0.15	0.03

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Site No. #2, above bridge Length(m) 21.2 Aug 13/91
Stream. Akan Creek Area(sq.m) 113.4

Method: electrofishing Enclosure: -

SPECIES /AGE	LENGTHmm MIN.	MAX.	MEAN LENGTH	MEAN WT.g	C 1	C 2	POP. n	n/ sq.m	g/ sq.m	n/ lin.m
RBT 0+	36	52	44.5	0.9	8	3	12.8	0.11	0.10	0.60
RBT 1+	94	94	94.0	9.1	0	1	1.0	0.01	0.08	0.05
RBT 2+	169	169	169.0	40.1	1	0	1.0	0.01	0.35	0.05
CT 1+	122	122	122.0	18.6	1	0	1.0	0.01	0.16	0.05
DV CHAR	118	118	118.0	16.1	1	0	1.0	0.01	0.14	0.05
RBT Total					9	4	14.8	0.13	0.54	0.70
Salmonid Total					11	4	16.8	0.15	0.84	0.79

Sample Site Description

HYDRAULIC TYPE:	R/P
MSTM. OR SIDECH.:	M
MAP GRADIENT:	-
FIELD GRADIENT:	1.75
SAMPLE WIDTH (m):	-
STREAM WIDTH (m):	-
CHANNEL WIDTH (m):	-
MEAN DEPTH (m):	-
MAX. DEPTH (m):	-
MEAN VELOCITY (m/s):	-
MAX. VELOCITY (m/s):	-
D/V METHOD:	-
TURBIDITY:	0.99
TEMPERATURE (C):	15.5
TIME:	1630
COVER COMPONENTS (%):	
Log	0
Boulder	60
In. veg.	0
Over veg.	5
Cutbank	0
SUBSTATE COMPACTION:	low
SAND (%):	-

Stream Transect Data

UTM CODE:	-
RAB CODE:	-
SITE REFERENCE:	2(parr)
REACH:	-
TRANSECT NO.:	1
TRANSECT TYPE:	whole
METERED/ESTIMATED:	M
STREAM WIDTH (m):	5.8
TRANSECT WIDTH (m):	5.8
No. of stations	9
SITE WIDTH (m):	5.8
No. of stations	9
STREAM DISCHARGE (m^3/S):	0.38

>> SUBSTRATE BREAKDOWN (%):	
Fines	trace
Sm. gravel	10
Lg. gravel	15
Cobble	25
Boulder	50
Bedrock	0
D 90 (cm):	75

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System Tsitika River Site Akan Creek, site #2

Total discharge (m^3/s)		0.38
	(cfs)	13.36
Mean depth (m)		0.20
Mean velocity (m/s)		0.33
Mean probability of use :	FRY	0.43
	PARR	0.56

FRY

CELL	CUM. LENGTH	MEAN D.	PROB_D	MEAN V.	PROB_V	PROB_DV	WEIGHTED PROB_DV
START	0.00						
1	0.30	0.020	1.00	0.000	1.00	1.00	0.30
2	1.30	0.115	1.00	0.275	0.55	0.55	0.55
3	2.30	0.200	1.00	0.340	0.13	0.13	0.13
4	3.30	0.305	0.85	0.275	0.55	0.47	0.47
5	3.80	0.340	0.85	0.460	0.01	0.01	0.00
6	4.30	0.250	0.98	0.600	0.00	0.00	0.00
7	4.80	0.230	1.00	0.355	0.13	0.13	0.07
8	5.80	0.120	1.00	0.005	1.00	1.00	1.00

PARR

CELL	CUM. LENGTH	MEAN D.	PROB_D	MEAN V.	PROB_V	PROB_DV	WEIGHTED PROB_DV
START	0.00						
1	0.30	0.020	0.10	0.000	1.00	0.10	0.03
2	1.30	0.115	0.45	0.275	1.00	0.45	0.45
3	2.30	0.200	0.77	0.340	0.92	0.71	0.71
4	3.30	0.305	0.98	0.275	1.00	0.98	0.98
5	3.80	0.340	0.98	0.460	0.40	0.39	0.20
6	4.30	0.250	0.86	0.600	0.04	0.03	0.02
7	4.80	0.230	0.86	0.355	0.92	0.79	0.40
8	5.80	0.120	0.45	0.005	1.00	0.45	0.45

Figure 7. Actual versus predicted trout/char densities by size (g) for the Tsitika River, August, 1991.

* MAINSTEM SITES ONLY!!

NO_3 - NITROGEN = 30-80 µg·L⁻¹

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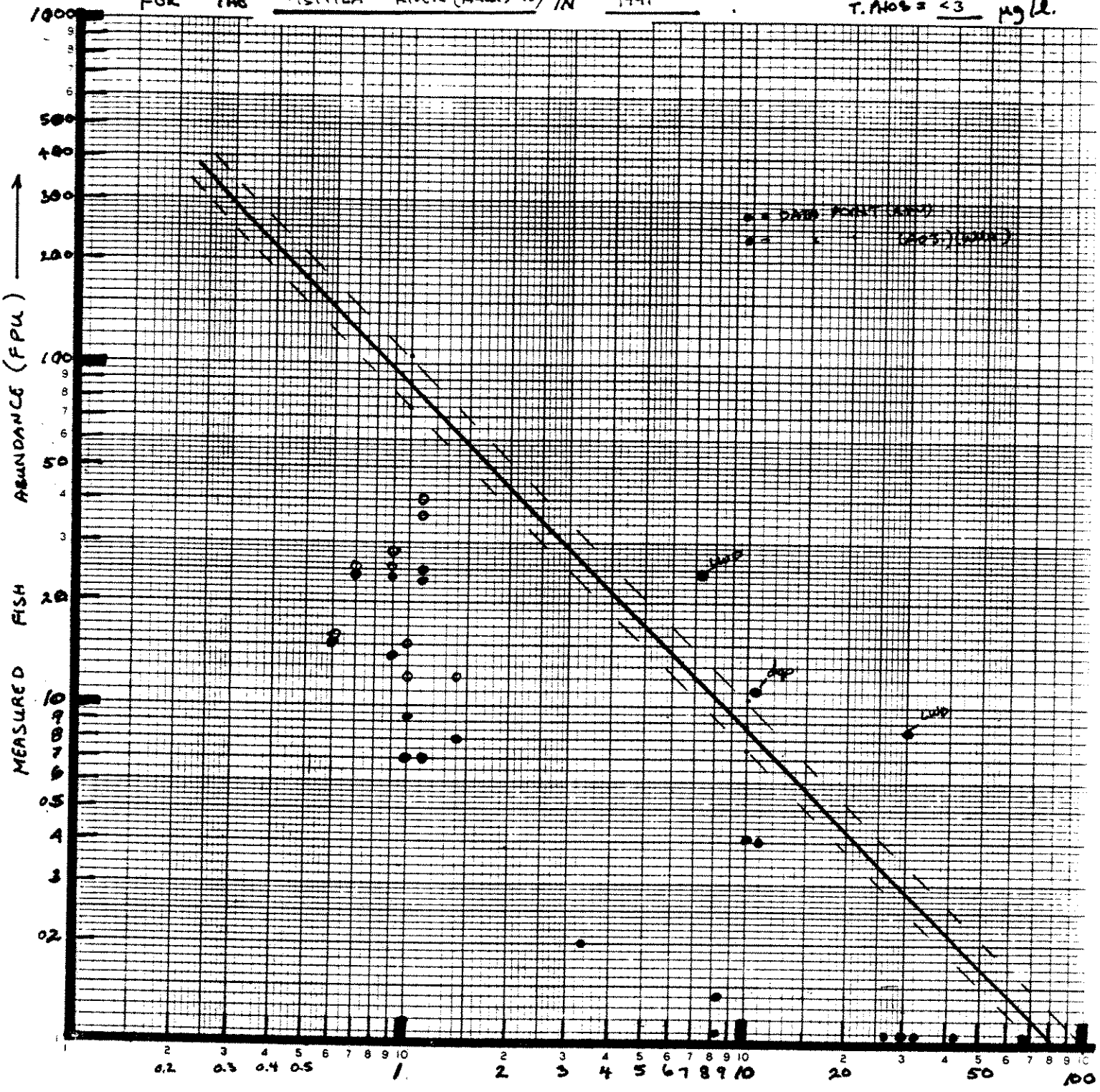
SCATTERGRAM OF ACTUAL (MEASURED) JUVENILE TROUT/CHAR DENSITY VERSUS MEAN SIZE WITH SOLID LINE DEPICTING MAXIMUM (THEORETICAL) FOR THE TSITIKA RIVER (AUG 13-15) IN 1991.

T.ALK = 5-6 mg/l
T.PHOS = <3 µg/l.



Full Logarithmic, 3 × 3 Cycles

Figure 8. Actual versus predicted trout/char densities by size (g) for tributaries to the Tsitika River, 11 August, 1991.
* TRIBUTARIES ONLY !!

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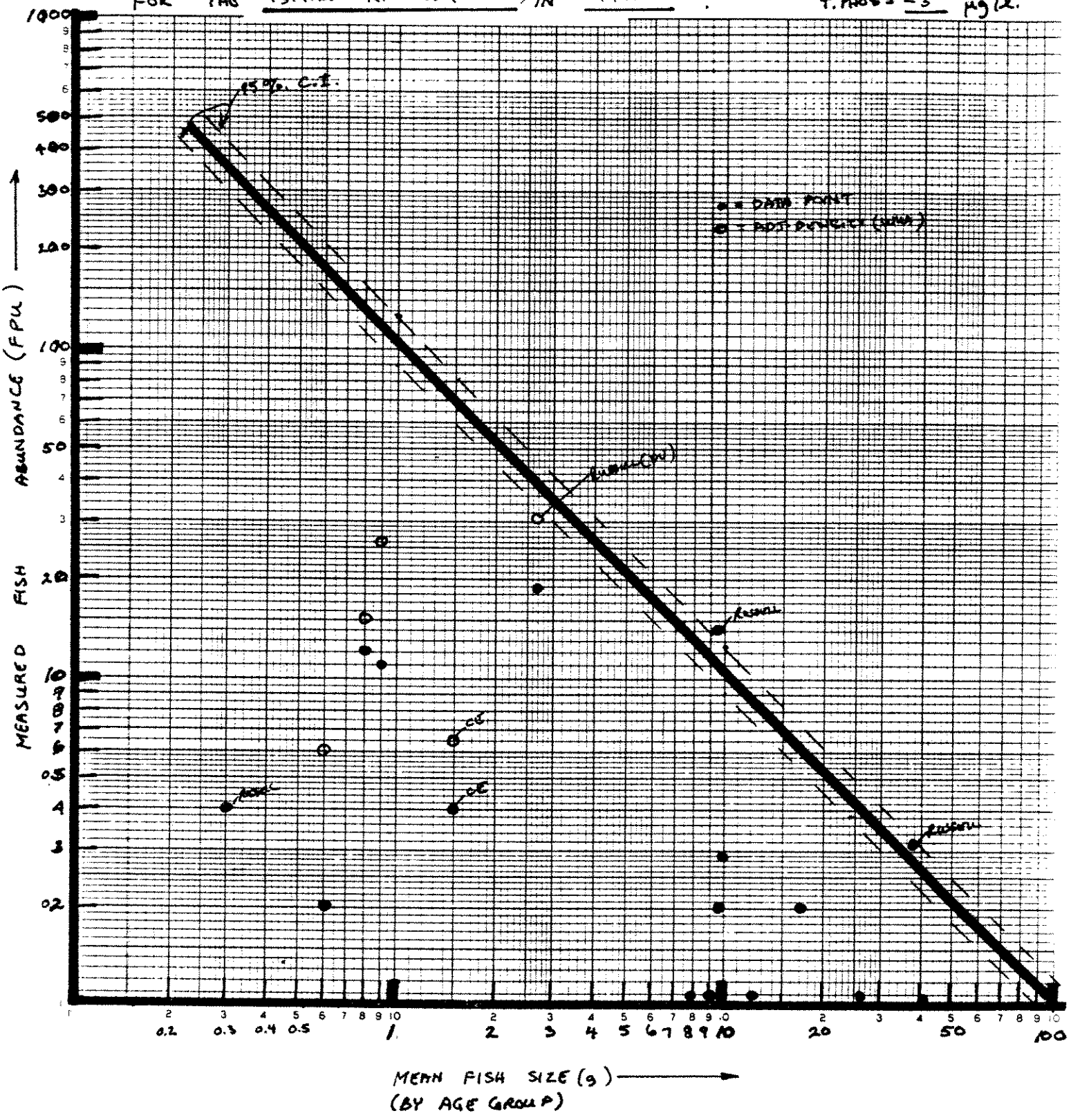

Full Logarithmic, 3 × 3 Cycles

EFFECTS OF SEDIMENT RELEASES ON SALMONID FISH PRODUCTION

Definition of Sediment:

Sediment is considered to be inorganic, undissolved material which includes the particle size classes commonly referred to as fine pebbles (2-4 mm.), sand (0.062-2 mm.), silt (0.004-0.062 mm.) and clay (<0.004 mm.).

1. Effects on Salmonid Food Chains

1. Algae on substrate is scoured or blanketed by sediment.
2. Turbidity reduces light penetration and photosynthesis.
3. Insect feeding apparatus is affected by sediment.
4. Insect habitat is clogged or filled with sediment.
5. Detritus on stream bottom is covered with sediment.
6. Benthic algal, phytoplankton and aquatic insect production is reduced.
7. Sediments contaminated with chemicals may be discharged to watercourses and subsequently contaminants are desorbed or deposited in contaminant sinks.

1970 - Gammon - 40 mg/l reduced insect production 25%, 120 mg/l - 60%
1977 - Slaney - 75 mg/l caused 65% reduction in insect production
1985 - Lloyd - 5 NTU increase reduced productivity by 13%
- 25 NTU increase reduced productivity by 50%

2. Effects on Fish (direct)

1. Gill damage - abrasion of epithelial cells.
2. Feeding efficiency reduced.

1974 - Langer - 20,000 mg/l caused mortality of trout
1977 - Noggle - 16,000 mg/l caused mortality of chinook in 4 days. Plasma glucose increased 33%
1977 - Noggle - 55% feeding efficiency @ 100 mg/l for coho 10% efficiency @ 250 mg/l

3. Effects on Fish (Indirect)

1. Reduced permeability of gravel and egg to fry survival.
2. Emergence of fry obstructed by fines.

1965 - Cooper - permeability of gravel function of gravel size (percent fines)
1966 - Koski - 5% increase in sediment caused 20% decrease in egg to fry survival
1969 - Hall and Lantz - fines reduced emergence of fry.
- fine debris blanket reduced subsurface oxygen levels

...2

4. Effects on Fish Habitat

1. Reduction in winter rearing habitat by infilling of gravel/cobble and pools.
2. Avoidance of fine substrate in favour of coarse substrate.

1964 - Saunders/Smith - 70% reduction in brook trout after filling of coarse substrate with fines
1974 - Bustard/Naver - sediment filled coho overwinter habitat.
1977 - Bjornn - fewer fish remained in stream channel after addition of fine sediment.

Sediment Limits Used in British Columbia

Sediment Standards Generally Accepted for Freshwater:

1) < 25 mg/l - no harmful effect.
2) 25 - 80 mg/l - good to moderate conditions.
3) 80 - 400 mg/l - unlikely to support a productive fisheries resource.
4) > 400 mg/l - poor at best.

Sediment releases can be classified as: (1) long term continuous, (2) regular periodic or (3) single short term.

(1) The following standards are applied to long term continuous (permitted or approved) releases of suspended solids:

MOE - Pollution Control Objectives for Mining, Smelting and Related Industries:

25 - 75 mg/l.(variances may be allowed during periods of excess runoff).

DFO - Metal Mining Liquid Effluent Regulations:

Total suspended matter - Maximum Monthly mean - 25 mg/l
- Maximum conc. composite sample - 37.5 mg/l
- Maximum conc. in a grab sample - 50 mg/l

...3

(2) The following is an example of standards applied to regular periodic releases of suspended solids:

Placer Mining - Red code streams (spawning/rearing) - No discharge.
- Yellow code streams (migration) - 25-75 mg/l
- Green code streams (no fish) - 25-75 mg/l

Recent placer mining practices in BC have had complete recycle on all operations (no discharge) although operators are free to apply for a waste management permit to discharge 25 - 75 mg/l suspended solids.

Cewe/Allard Gravel Washing (Coquitlam River) - 75 mg/l (above background measured upstream of all operations)

(3) The following is an example of standards applied to single short term releases of suspended solids:

Approval from BC Environment, Water Management Branch, for "work in and about a watercourse" is generally required before commencing work. A referral of the application is usually made to DFO for review and comment. Site specific approvals (e.g. pipeline crossing, rip-rap, stream diversion, etc.) are given by DFO with timing of work, duration of work and/or specific method/design constraints. No limits on suspended sediment are usually given, although best practicable technology must be used to minimize disturbance. For example, pipeline crossings must use the fluming or dam and pump method rather than an open cut. Recent advances in technology have permitted horizontal drilling under stream channels (BC Tel Light Guide System) resulting in no disturbance to the stream channel.