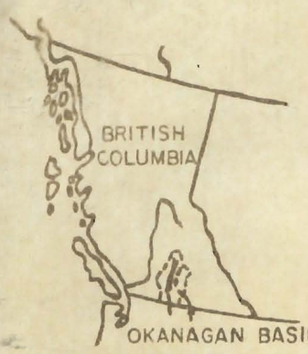

CANADA BRITISH COLUMBIA OKANAGAN BASIN AGREEMENT

OFFICE OF THE STUDY DIRECTOR.
264 WESTMINSTER AVENUE.
PENTICTON. BRITISH COLUMBIA.
P.O. BOX 458.
TELEPHONE (604) 493-0008

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MEMO TO: Mr. A. Murray Thomson

FROM: Gordon D. Koshinsky

cc to: Dr. A.L. Hamilton
Mr. E.H. Vernon
Mr. F. Boyd

I submit herewith estimates of minimum flow requirements for Okanagan tributary streams for the propagation of salmonid fish species endemic to the mainstem lakes.

These estimates are confined to those tributaries which appear to have sufficient water-yield potential to consistently meet fishery requirements if so directed. A general characterization of these tributaries along with a summary of prescribed minimum flows is given in Tables 1 and 2. Flow requirements are outlined in more detail in Table 3. These estimates were made, in consultation with B.C. Fish and Wildlife personnel, on the basis of stream channel and substrate characteristics, along with the observed impact of measured flows on kokanee spawning migrations in 1971.

When assessing and applying the estimates given, the following points should be borne constantly in mind:

(1) The flows recommended are those considered minimal to be consistent with present channel configurations and substrates. If only a fraction of the recommended flows could be guaranteed, it might be possible to accommodate such lesser flows in some tributaries (e.g. Trepanier, Shorts, Trout) through modification of existing channel and substrate characteristics.

(2) It is emphasized that the flows recommended are considered minimal to accommodate spawning and ensure incubation of the resulting eggs. Somewhat higher guaranteed flows would, in most cases, enhance fishery potentials.

(3) It is imperative that flows occur above ground level, i.e. flows are of no avail if they discharge beneath the stream bed.

(4) Guaranteed flows, to be useful for fish propagation must be absolutely without interruption:

a) In space and time during migration of adults and descent of fry.

b) In time, during incubation of eggs.

(5) Some conservation of water could probably be achieved by precise matching of spawning discharge to coincide with the actual onset of spawning migrations. Timing of these runs varies among streams and among years, and may necessitate some trade-off of the September and October flow demands in certain years.

(6) The flows prescribed in Table 2 for incubation, hatching and descent of fry (Nov.-May for kokanee, and June-Dec. for rainbow trout) are predicated to a high yield of fry from deposited eggs. Inability of a particular watershed to consistently deliver flows of the prescribed magnitude should not negate development of the stream for salmonid propagation, provided that available water can be rationed to provide:

a) adequate discharge for access and spawning, along with

b) a constant discharge of some magnitude approaching that recommended in Table 3 during the ensuing developmental and descent periods.

Development of rationing capacity to efficiently utilize available water in high-water years would, of course, enhance the fish-rearing capacity of such streams.

(7) Flows in excess of 2-3 times those prevailing during spawning would be undesirable during incubation because of anticipated scouring of eggs from the gravels.

(8) Provision must be made for an annual spring freshet to remove silt accumulations. Freshet flows of a magnitude exceeding those given in Table 3 may be necessary in practice to attract and provide access to spawning-migrant rainbow trout.

(9) Provision of guaranteed discharge, to be meaningful for fisheries, must be accompanied by:

a) Guaranteed water quality. Most streams at present appear to be suitable in terms of temperature, dissolved oxygen, pH, and toxicants. Some have excessive turbidity.

b) Guaranteed compatible land use. Opportunities for salmonid propagation are curtailed by dyking, channelization, and removal of cover.

c) Guaranteed access, in both directions. This entails:

i) screening of irrigation diversions against downstreaming fry,

ii) modifying minor irrigation dams during spawning runs,

iii) installing, improving and maintaining fishways in major dams and obstructions,

iv) a continuing program of channel clearing (windfalls, log jams, etc.).

(10) In the event that flow requirements could be met for only one or the other species (rainbow trout or kokanee), reference would have to be made to the geographic distribution of total reproductive opportunities, and the nature of the sport-fishing demand.

(11) The schedule of priorities given in Table 2 involves a complex, basically intuitive consideration of several factors, including:

a) Natural potential (including present capability) of the particular stream.

b) Location of the stream in relation to overall distribution of reproductive opportunities for the lake as a whole.

c) Apparent feasibility and costs of meeting requirements under (9) above.

(12) In addition to the major tributaries, a complete assessment of salmonid reproductive opportunities in the Okanagan must consider:

a) The potential of the Okanagan River for propagation of both rainbow trout and kokanee.

b) The potential (as yet unproved) of the shores of the mainstem lakes for propagation of kokanee.

c) The potential of several minor tributaries (Eneas, Lambly, Naswhito, Irish, Deeper, Chute, Naramata, McLean, Inkaneep) to support salmonid reproduction in high-water years. These watersheds appear too small or otherwise unsuitable to warrant intensive management of their salmonid-producing capabilities. However, their probable (albeit intermittent) contribution of rainbow trout should receive consideration in future land use planning.

d) The feasibility of supplementing natural reproduction with hatcheries and spawning channels.

(e) The implications of introducing sport-fish species not dependent on streams for reproduction (e.g. lake trout).

Gordon D. Koshinsky

Gordon D. Koshinsky,
Research Scientist,
Fisheries Research Board of Canada.

GDK:RM

TABLE 1. General characterization of salmonid spawning opportunities in major Okanagan tributary streams.

Stream	Estimated relative spawning potential sq. yards [a,b]	Est. No. kokanee spawners 1971	Range of obs. discharge during 1971 kokanee spawning period, cfs	Remarks
Trout	8,000-	0	6.6-51.0	Extensive capital works required. Silt problem.
Peachland	1,000	36,000	2.5-11.8	Physical improvements being undertaken.
Trepanier	5,000-	10,000	1.8- 5.2	Sub-optimal substrate increases flow requirement.
Powers	12,000-	7,000	2.4- 5.7	Some excellent habitat.
Shorts	11,000	+	0.7- 1.6	Good potential. Sub-channel discharge.
Whiteman	4,000	1,000	3.2- 5.3	Considerable potential.
Equesis	35,000	28,000	8.2-12.4	Indian reserve. Fishway required. confirmed?
Deep	?	-	5.5- 8.1	Needs more assessment.
BX upper	3,000	-	0.9- 5.3	Needs more assessment.
Vernon, upper	11,000	+	4.3- 6.0	Substrate badly silted. Control needed on Ellison Lake.
Vernon, lower	4,000	1,000+	7.3-10.3	Much cultural interference.
Coldstream	19,000	60,000	7.8-10.5	Good habitat.
Kelowna	16,000-	0	8.3-10.2	Restoration costs and implications prohibitive.
Mission	57,000±	380,000	13.7-62.2	Require modifications to Smith-Alphonse fishway.
Penticton	3,000-	+	2.4-14.0	Restoration costs and implications prohibitive.
Shingle	7,000	0	0.0- 3.9	Indian reserve. Dyking problem at mouth.

[a] Based on Galbraith, D.M. and G.D. Taylor, 1970. Fish habitat survey Okanagan tributary streams, 1969. Rep. B.C. Fish Wildl. Br. 210p.

[b] (-) indicates full potential can only be realized through massive effort and expenditure in addition to regulating discharge.

TABLE 2. Suggested minimum flow requirements for salmonid spawning in major Okanagan tributary streams.

Stream	Suggested min. discharge, cfs: Spawning run	Suggested min. discharge, cfs: Incubation	Where discharge required, mouth to -	Order of priority
Trout	15	10	Mile 1.3 (start of canyon)	2
Peachland	4.5-5	2.5-3	Mile 0.8 (impassible falls)	2
Trepanier	8-10	6-8	Mile 0.8 (natural obstruction)	4
Powers	5	4	Mile 0.4 (small falls)	3
Shorts	8-10	6-8	Mile 0.8 (impassible falls)	3
Whiteman	5	3-4	Mile 3.0 (falls?)	3
Equesis	8-10	6-8	Mile 8	2
Deep	7-8	6	Mile 15?	4
BX upper	4	2.5	Mile 6	4
Vernon, upper	8-10	7-8	Mile 3 (Ellison Lake)	3
Vernon, lower	10	8	Mile 6 (Kalamalka Lake)	4
Coldstream	8	6-7	Mile 3.2 (Coldstream Ranch)	2
Kelowna	5	4	Mile 10	-
Mission	40-45	30-35	Mile 12 (Falls)	1
Penticton	-	-	-	-
Shingle	7-8	4	Mile 7	3

TABLE 3. Summary of estimated minimum water requirements[a], acre-feet by whole months, to support reproduction of rainbow trout and kokanee from the mainstem in Okanagan tributary streams.

	Trout	Peach-land	Trep-anier	Powers	Shorts	White-man	Equesis	Deep	BX upper	Vernon upper	Vernon lower	Cold-stream	Kelowna	Mission	Shingle
A. KOKANEE															
Jan.	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
Feb.	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
Mar.	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
Apr.	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
May	600+	150+	360+	240+	360+	180+	360+	360+	150+	420+	480+	360+	240+	1800+	240+
Sept.	500	270	300	300	300	240	300	300	150	300	480	-	240	2400	300
Oct.	900	270	480	300	480	300	480	420	240	480	600	480	300	2400	420
Nov.	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
Dec.	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
Total	5600	1590	3300	2280	3300	1800	3300	3240	1440	3720	4440	3000	2220	17,400	2400
B. RAINBOW															
Apr.	400	150	300	150	300	150	300	240	120	300	300	240	150	1400	240
May	900+	300+	600+	300+	600+	300+	600+	480+	240+	600+	600+	480+	300+	2700+	480+
June	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
July	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
Aug.	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
Sept.	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
Oct.	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
Nov.	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
Dec.	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
Total	5500	1500	3420	2130	3420	1710	3420	3240	1410	3840	4260	3240	2130	16,700	2400
A + B KOKANEE + RAINBOW															
Jan.	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
Feb.	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
Mar.	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
Apr.	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
May	900+	300+	600+	300+	600+	300+	600+	480+	240+	600+	600+	480+	300+	2700+	480+
June	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
July	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
Aug.	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
Sept.	600	270	360	300	360	180	360	360	150	420	480	360	240	2400	300
Oct.	900	270	480	300	480	300	480	420	240	480	600	480	300	2400	420
Nov.	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
Dec.	600	150	360	240	360	180	360	360	150	420	480	360	240	1800	240
Total	7800	2190	4680	3060	4680	2400	4680	4500	1980	5280	6000	4560	3000	23,700	3360

[a]Based on minimum ranges of recommended discharge from Table 2.