Status of Saint John River, N.B., Atlantic Salmon in 1984 and Forecast of Returns in 1985

by

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Abstract

Estimated total returns to the Saint John River in 1984 were 17,534 1-SW and 17,598 M-SW salmon. Homewater removals of 3,077 1-SW and 3,776 M-SW fish led to an estimated 1984 spawning escapement of 137 percent of the target number of M-SW spawners. The forecast of 1985 homewater returns is 17,443 1-SW fish (9,843 more than the target escapement) and 15,500 M-SW salmon (4,900 fish more than the target escapement and hatchery broodstock requirements). Homing tendencies of the M-SW salmon to 'above' and 'below' Mactaquac origins will result in surpluses to spawning requirements of 4,386 fish 'above' Mactaquac and 514 fish 'below' Mactaquac.

Résumé

On a estimé à 17 534 unibermarins (un hiver en mer) et à 17 598 redibermarins (plusieurs hivers en mer) le nombre de saumons qui sont revenus dans le fleuve Saint-Jean en 1984. Des captures, dans les eaux d'origine, de 3 077 unibermarins et de 3 776 redibermarins ont permis de déterminer que l'effectif de frai atteignait en 1984 environ 137 pour cent du nombre cible établi pour les reproducteurs redibermarins. On prévoit qu'en 1985 les retours dans les eaux d'origine se chiffreront à 17 443 unibermarins (soit 9 843 de plus que l'effectif de frai cible) et à 15 500 redibermarins (soit 4 900 de plus que l'effectif de frai cible et que le stock reproducteur requis pour la pisciculture). Les tendances de retour des redibermarins dans les eaux d'origine en "amont" ou en "aval" du barrage de Mactaquac se traduiront par un surplus de 4 386 poissons en aval et de 514 poissons en amont, par rapport à l'effectif de frai cible.

Introduction

This document is the basis of advice for managing Atlantic salmon stocks of the Saint John River, New Brunswick and, as such, documents data and analyses relevant to both stock status (1984) and forecasts (1985).

Background

Physical attributes of the Saint John River drainage, salmon production area, barriers to migration, fish collection and distribution systems, the role of fish culture operations and the status of the salmon stocks over last twelve or more years have previously been described by Marshall and Penney (MS 1983) and Penney and Marshall (MS 1984).

Forecasts made in 1983 (Penney and Marshall, MS 1984) suggested that total 1984 homewater returns would number approximately 15,700 1-SW and 10,410 M-SW salmon. Surpluses to required spawning escapement, 1984, were to have been approximately 6,500 1-SW and 1,500 M-SW salmon above Mactaquac Dam. A surplus of 1,500 1-SW fish and a deficit of 1,500 M-SW were forecast for the drainage area below Mactaquac. CAFSAC advised (CAFSAC Advisory Document 83/24) managers that for 1984 there would be "1,500 large salmon and 6,000 grilse available for harvest above Mactaquac (including the Indian food fishery at Kingsclear)" and recommended "that there be no harvest of large salmon below Mactaquac".

Homewater fisheries for Saint John River salmon stocks had in past years included the commercial drift, gill and trap net fisheries, the food fisheries by the Indian Band at Kingsclear and sport fisheries of the main stem and tributaries. Management measures in 1984 included a total ban on homewater commercial fisheries (there was a 4-week season in 1983), negotiation of two closed periods - June 25 to July 11 and Aug. 27 to Sept. 12, within the June 1 to Oct. 12 'open' season (Monday and Tuesday closures) of the Kingsclear food fishery (quota remained at 900 'fish') and a prohibition on the retention of M-SW salmon captured in the sport fisheries. The 1984 reduction of open commercial seasons in potentially intercepting fisheries of Newfoundland and Nova Scotia may also have affected homewater returns but potential benefits are not reflected in the existing forecasting models. Record high water levels in June and July and record low water levels in September and October (the Nashwaak and Keswick rivers were closed to angling September 7 to October 5) combined with a 25 percent reduction in sales of angling licenses and an estimated 85 percent reduction in angling effort on the main stem below Mactaquac (Cronin, pers. comm.) also believed to have contributed to a low rate of exploitation in the sport fisheries in 1984.

In general, estimates of total returns, removals, required spawners and returns in 1985 were determined in a manner similar to that of 1984 (Penney and Marshall, MS 1984). However, adjusted proportions of homewater returns to 'above' and 'below' Mactaquac originally derived by Penney and Marshall (op. cit.) were used instead of preliminary sport fish removals and a 13-year mean exploitation rate to estimate returns of wild fish originating below Mactaquac. Also, forecasts of M-SW hatchery returns, 1985, were based on the correlation of M-SW returns on 1-SW returns in the previous year rather than on a 10-year mean return rate.

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Methods

Total River Returns, 1984

Total returns of 1-SW and M-SW salmon of both wild and hatchery origin from both 'above' and 'below' Mactaquac Dam consist of the summation of Mactaquac counts, estimated catches by the Kingsclear Indian Band located between the Mactaquac Dam and Mactaquac Fish Culture Station, estimated angling catches in the mainstem area immediately below the Mactaquac Fish Culture Station, and estimated by-catch and estimated returns to tributaries below Mactaquac Dam.

Mactaquac counts consist of those fish captured at the fish collection facilities at the Mactaquac Dam and head of the smolt migration channel (MC) at the Mactaquac Fish Culture Station.

Kingsclear landings were estimated as the product of the estimated mean exploitation rate of that fishery, 1978-1984, and counts of salmon at Mactaquac Dam (not including migration channel)in 1984. Exploitation rates were derived from the numbers of 1-SW and M-SW tags from fish of hatchery origin which were returned by the Reserve (unadjusted for non-reporting) and the number of tagged hatchery-return fish captured at Mactaquac Dam. These rates were assumed to be the same for wild fish.

Total by-catch for 1984 was assumed to equal the proportion of both hatchery and wild 1984 homewater returns that the wild 1-SW (0.75%) and M-SW (3.24%) salmon by-catch were of the potential total homewater wild return to Mactaquac in 1982 (Penney and Marshall, MS 1984; Table 12). Division of hatchery fish to 'above' or 'below' Mactaquac origins was based on the proportion of smolts released to the respective areas which would contribute to 1-SW and M-SW returns. Division of wild fish to 'above' and 'below' origins was based on the ratio of the total wild fish at Mactaquac + Kingsclear + main river sport fishery to the returns to tributaries below Mactaquac.

The total angling catch from the main stem 'below' Mactaquac was estimated by personnel of the New Brunswick Dept. Natural Resources (DNR)(Cronin, pers. comm.) Proportions of 1-SW and M-SW fish and hatchery and wild are assumed to be the same as for the sum of the total fish counted at the two Mactaquac facilities and estimated in the Kingsclear fishery through October 15. Ten percent of M-SW reported catch was considered to have been removed from the spawning escapement either because of illegal retention or delayed-release mortality after angling.

Returns of wild salmon to tributaries 'below' Mactaquac in 1984 were based on the estimated numbers of wild fish destined for Mactaquac (including an approximation of those in the by-catch) and a revised proportion of both 1-SW and M-SW salmon originating 'above' and 'below' Mactaquac 1970 to 1983 (Penney and Marshall, MS 1984, Table 12). Hatchery returns to all tributaries 'below' Mactaquac were calculated as the product of the number of smolts released and the return rate for fish of Mactaquac origin returning to Mactaquac + Kingsclear + the main stem sport fishery.

Total River Removals, 1984

Total removals include those fish to the Kingsclear Indian Reserve, mainstem sport fishery, 'above' and 'below' Mactaquac, Tobique, Nashwaak, Hammond and Kennebecasis sport catches and the by-catch fishery. Additional removals include fish captured in the Mactaquac collection facilities and transferred to the Aroostook River or retained at Mactaquac for broodstock, mortalities encountered during collection-handling operations, and some fish sacrificed for analysis. In the absence of angling statistics for the Tobique River, 1984, landings of 1-SW and M-SW were calculated as the product of 0.20 (M-SW) or 0.26 (1-SW)(mean angler exploitation rates based on fish released to the Tobique River or counted through the Tobique fishway and Provincial sport catch statistics 1977 to 1983) and the sum of the number of fish estimated to have ascended the Tobique fishway or were released from the tank truck into the Tobique River at Arthurette through September 15. As with other sport landings in 1984, 10 percent of M-SW catches were considered to have been removed from the spawning escapement. Estimates of hatchery fish were based on the proportions of hatchery/wild salmon available to the fishery.

Angling catches for the main stem 'above' Mactaquac were calculated as the product of the mean exploitation rates of 1979, 1980 and 1982 (0.14 and 0.20 for 1-SW and M-SW respectively based on DNR angling statistics) and the number of fish released at Woodstock through October 1 (end of angling season). Angling catches of 1-SW and M-SW fish in the Nashwaak River were estimated by DNR (Cronin, pers. comm.). Division of 1-SW fish into wild and hatchery components was based on tagged fish of hatchery origin observed in a creel survey. Because hatchery introductions in 1982 were of the same magnitude as 1983, the same proportion was used for M-SW fish in 1984. Catches in the Kennebecasis and Hammond rivers were based on a synthesis of DNR (Pettigrew, pers. comm.) and federal estimates. Hatchery composition of 1-SW and M-SW fish was assumed similar to that of the Nashwaak.

Required Spawners

An accessible salmon-producing substrate of 12,261,000 m^2 'above' Mactaquac and 15,928,000 m^2 'below', an assumed requirement of 2.4 eggs/m^2, a length-fecundity relationship ($\log_e Y_{(eggs)} = 6.06423 + 0.03605X_{(length)}$) applied to M-SW and 1-SW fish 1972-1982 and the 1-SW:M-SW ratios in those years suggest that, on average, approximately 4,400 and 5,700 M-SW fish are required 'above' and 'below' Mactaquac (Marshall and Penney, MS 1983). Because 1-SW fish contribute so few eggs (< 5% female) a management philosophy was proposed that limited 1-SW requirements to that number which provided males for M-SW females unaccompanied by M-SW males, i.e., 3,200 'above' and 4,000 'below' (Marshall and Penney, op. cit).

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Stock Forecasts

a) Wild 1-SW salmon 'above' Mactaquac

The forecast of wild 1-SW returns originating 'above' Mactaquac were derived from a regression of total wild 1-SW fish returning to the Saint John River which were produced 'above' Mactaquac, 1973-1982, on adjusted egg depositions in the Tobique River, 1968-1969 to 1977-1978. Total returns to Mactaquac 1973 to 1981 and adjusted egg depositions to 1976-1977 were previously derived by (Penney and Marshall, MS 1984). Returns of 1-SW fish originating above Mactaquac in 1983 were changed in accordance with a redivision of the by-catch to 'above' and 'below' origins. This change resulted from the delayed availability of DNR 'Fissys' angling data for 1983, utilization of 1984 fry densities in the Nashwaak River to reconstruct spawning escapement for the Nashwaak River (Penney and Marshall, op. cit.), and an exploitation rate for use on the Kennebecasis and Hammond rivers.

Egg depositions for the period 1977-1978 were adjusted in the same manner as Penney and Marshall (MS 1984)using freshwater age composition from 620 wild 1-SW fish sampled at Mactaquac in 1984. Adjustment of the 1980 and 1981 egg depositions, principal contributors to 1-SW returns in 1985, was done with the use of angular-transformed mean proportions for age 2:1's and age 3^{+}:1's in the 1969 to 1979 year-classes.

To make multiplicative effects of environment, competition, variability in recruits, etc. amenable to linear regression analysis, the natural logarithms of the observed values were used (Ricker, 1975). The geometric mean (GM) Y resultant of the logarithmic relationship was converted to an arithmetic mean (AM) by the formula $\log_{10}(AM/GM) = 0.2172\ s^2\ (N-1)/N$, where s is the standard deviation from the regression line of the normally-distributed natural logarithms of the variates (Ricker, 1975, p. 274).

b) Wild M-SW salmon 'above' Mactaquac

The 1985 forecast of M-SW returns to homewaters which originated 'above' Mactaquac was based on the regression of the estimated M-SW returns to Mactaquac 1971-1984 on the estimated numbers of 1-SW fish originating 'above' Mactaquac and returning to Saint John River in the previous year. As in the forecasting of 1-SW salmon, analyses included the use of natural logarithms and conversion of the GM to AM.

c) Wild 1-SW salmon 'below' Mactaquac

The 1985 return to homewaters of 1-SW fish which originated 'below' Mactaquac was estimated from the regression of the estimated numbers of 1-SW fish originating 'below' Mactaquac on the estimated number of 1-SW fish originating 'above' and returning to Mactaquac in the same years, 1970 to 1983. Data from 1984 were excluded from the equation because of the dependence of the 1984 1-SW estimate on the 1970 to 1983 data. Because the data were independent of each other, they were not transformed.

d) Wild M-SW salmon 'below' Mactaquac

The 1985 return to homewaters of M-SW salmon which originated 'below' Mactaquac was based on the 1985 estimate for 'above' Mactaquac and the mean proportion of the total M-SW fish which returned 'below' Mactaquac, 1970-1983.

e) Hatchery 1-SW salmon

Forecasts of hatchery returns in 1985 were derived by applying an average return rate for smolts returning as 1-SW fish, 1975-1984, to the number of smolts released 'above' and 'below' Mactaquac in 1984.

f) Hatchery M-SW salmon

Forecasts of M-SW returns from hatchery-reared smolts released 'above' and 'below' Mactaquac in 1983 were based on the regression of the M-SW returns 1976 to 1984 on 1-SW returns 1975 to 1983. As in previous regressions of data from off-set years, analyses included the use of natural logarithms and conversion of the GM to AM.

Results

Total River Returns, 1984

Estimated homewater returns in 1984 totalled 17,534 1-SW fish (9,548 originating 'above' and 7,986 originating 'below' Mactaquac) and 17,598 M-SW fish (10,523 originating 'above' and 7,075 originating 'below' Mactaquac; Table 1). Hatchery returns comprised 10.8 and 8.7 percent of the total 1-SW and M-SW returns, respectively.

Counts at Mactaquac were 91 percent of the 1-SW and 74 percent of the M-SW fish estimated to have originated 'at' or 'above' Mactaquac (Table 1).

Food fishery landings of 353 1-SW and 2,133 M-SW fish were estimated as the product of the respective 0.0414 and 0.2162 mean exploitation rates for hatchery fish at Kingsclear, 1978-1984 (Table 2), and counts of 7,346 wild and 828 hatchery 1-SW fish and 7,010 wild and 722 hatchery M-SW fish at Mactaquac Dam (exclusive of the migration channel counts).

Total by-catch in 1984 was estimated at 236 1-SW and 886 M-SW fish (Table 1). Mainstem angling yielded an estimated 412 1-SW and 46 M-SW fish. Hatchery composition was assumed to be proportionate to the combined Mactaquac count and Kingsclear catch.

Returns of 7,510 wild 1-SW and 6,587 wild M-SW salmon to tributaries 'below' Mactaquac were based on the 0.48 and 0.41 proportions of 1-SW and M-SW returns respectively originating 'below' Mactaquac, 1970 to 1983 (Table 3). These values reflect the inclusion in 1983 of DNR 'Fissys' estimates of 420 1-SW and 260 M-SW fish angled on the Nashwaak River, an estimated deposition of 7.1 million eggs in the Nashwaak (back-calculated from a mean density of 16.13 fry/100 m^2 in 1984)(Table 4), DNR 'Fissys' estimates of 400 1-SW and 170 M-SW fish taken in the Kennebecasis and Hammond rivers and the use of a 0.22 exploitation rate (Tables 4 and 5).

Releases of 80,535 and 48,706 hatchery smolts 'below' Mactaquac in 1982 and 1983 respectively, and the 1984 return rates of 0.00977 and 0.00606 for smolts released at Mactaquac (Table 6) in the same years suggested respective returns of 476 1-SW fish and 488 M-SW fish below Mactaquac.

Total River Removals, 1984

Total river removals, numbered 3,077 1-SW and 3,776 M-SW fish (Table 7). The totals were predominately comprised of fish originating 'above' Mactaquac. Hatchery fish comprised 16 and 14 percent of of the respective 1-SW and M-SW removals. The estimated angling kill was 2,420 1-SW salmon and 226 M-SW fish. The estimated angling catch on the Nashwaak River was 434 1-SW and 407 M-SW fish. Division into wild (0.824) and hatchery (0.176) components was based on 3 tagged 1-SW hatchery fish (only one-half of the hatchery returns bore tags) in 34 1-SW fish observed during the creel survey. Mactaquac broodstock collections numbered 488 M-SW fish.

Spawning Escapement, 1984

Collation of the total returns (Table 1), total removals (Table 7) and numbers of fish required to meet an egg deposition of 2.4 eggs/m^2 indicates that 163 percent and 116 percent of the required M-SW spawners for 'above' and 'below' Mactaquac, respectively, were attained (Table 8). For 1-SW fish, 224 percent of requirements were met 'above' Mactaquac; 165 percent of requirements were met 'below' Mactaquac.

Stock Forecasts

a) Wild 1-SW salmon above Mactaquac

The 1985 forecast of wild 1-SW fish returning to Mactaquac in the absence of homewater removals was based on the regression of returns to homewaters of 1-SW fish which originated above Mactaquac (Table 3) on estimated Tobique River egg depositions adjusted for smolt age (Table 9).

The adjusted egg depositions used in the 1985 forecast of 1-SW salmon were based on freshwater age of 1-SW fish sampled at Mactaquac, and their expansion to total counts and estimated returns (Table 10). Assignment of the estimated returns to their respective year-classes indicated that the proportion of returning 1-SW fish which smoltified at age 2 has ranged from 0.114 for the 1975 year-class to 0.619 for the 1973 year-class (Table 11). Proportions relevant to the 1985 forecasts were estimated by the 11-year average proportion of 0.351 age 2 and 0.649 age 3^+ smolts (Table 9). The log-transformed equation provided an AM estimate for 1985 of 7,063 1-SW fish (95% C.L. 4,640-10,750) (Table 12).

b) Wild M-SW fish 'above' Mactaquac

Based on the regression $\log_e Y = 4.753 + 0.469 \log_e X$ (n=14, r=0.67, p= 0.008) the 8,136 1-SW returns in 1984 (X) provide a forecast of 8,413 M-SW fish (95% C.L. 6,075-11,659) originating above Mactaquac which will return to homewaters in 1985 (Table 12).

c) Wild 1-SW fish 'below' Mactaquac

Regression of the estimated returns of 1-SW fish 'below' Mactaquac on the number of 1-SW returns 'above' Mactaquac, 1970-1983, (data from Table 3) resulted in the equation Y = 2238.853 + 0.409 X; r=0.67; p = 0.009. Solving 'Y' for an 'X' value of 7,063 1-SW fish to Mactaquac in 1985 yielded an estimate of 5,129 1-SW fish (95% C.L. 4,125-6,135) destined for tributaries 'below' Mactaquac.

d) Wild M-SW fish 'below' Mactaquac

Based on the average 0.413 percent of total Saint John River M-SW production originating below Mactaquac (Table 3) and the 1985 forecast of 8,413 M-SW fish to Mactaquac, the number of wild M-SW fish originating 'below' Mactaquac was estimated at 5,919 (8,413 · (0.413/0.587).

e) Hatchery 1-SW salmon

The average percentage returns of 1-SW salmon to homewaters from smolts released at Mactaquac 1974-1983 was estimated at 2.079 percent (Table 6). The product of the 2.079 percent return rate and the 206,462 smolts released 'at' Mactaquac and 46,126 smolts released 'below' Mactaquac in 1984 resulted in forecasts of 4,292 and 959 1-SW fish returning to respective 'above' and 'below' Mactaquac locations in 1985.

f) Hatchery M-SW salmon

Regression of the estimated M-SW returns 1976 to 1984 on 1-SW returns 1975 to 1983 (Table 6) resulted in the equation $\log_e Y = 2.065 + 0.638 \log_e X$; r = 0.73; p = 0.027, n = 9. Solving 'Y' for an 'X' value of 1,412 1-SW fish to Mactaquac in 1985 yielded an estimate of 873 M-SW fish (95% C.L. 426-1790). The 873 M-SW fish would represent a return rate of 0.00604 (873/144,549), limits of 0.00295 to 0.01238, which when applied to 48,706 smolts released 'below' Mactaquac in 1983 would forecast 295 (143-603) M-SW returns 'below' Mactaquac in 1985.

Forecast Summary

The forecast of total homewater returns (Table 13) to the Saint John River in 1985 is 17,443 1-SW (12,192 of wild and 5,251 of hatchery origin) and 15,500 M-SW fish (14,332 of wild and 1,168 of hatchery origin). For the total Saint John River the forecast returns minus the spawning requirements results in a potential surplus of 9,843 1-SW (120%) and 4,900 M-SW (46%) salmon. Separation to 'above' and 'below' Mactaquac origins indicates a surplus over target escapements of 8,155 1-SW and 4,386 M-SW salmon for the former and a surplus of 1,688 1-SW fish and 514 M-SW salmon for the latter.

Discussion

Total river returns in 1984 of 17,534 1-SW and 17,598 M-SW fish were 12 and 69 percent above forecast returns. Returns of wild 1-SW fish 'above' and 'below' Mactaquac were 23 and 53 percent, respectively, above forecast values.

Returns of wild M-SW fish 'above' and 'below' were 94 and 86 percent above the respective forecast values while hatchery fish were only 45 and 78 percent of forecast values.

The 1984 ban on commercial fishing in Zone 3 and reduction in the 'open' season at Kingsclear suggest that key areas with potential for contributing to discrepancies between M-SW forecasts and returns include previous underestimation of landings in the commercial, by-catch and Indian fisheries. That is, insufficient 'credit' has been accorded due to traditional understatement of the removals by these fisheries. Seasonal reductions in effort in distant commercial fisheries may have also played a role.

In total, 1984 returns of 15,646 wild 1-SW and 16,066 wild M-SW fish are the highest since before 1970 (Table 3). These returns and reduced landings in the sport and commercial fisheries (Table 14) contributed to an estimated escapement of M-SW salmon that was 190 and 137 percent of the respective target escapements 'above' and 'below' Mactaquac.

The 1985 forecast return of 15,500 M-SW salmon exceeds spawning requirements by 4,900 fish (46 percent). Removals of M-SW fish in 1985 equivalent to those of 1984 (21 percent of returns) would result in a spawning escapement of 116 percent of that required.

Literature Cited

Marshall, T.L., and G.H. Penney. MS 1983. Spawning and river escapement requirements for Atlantic salmon of the Saint John River, New Brunswick. CAFSAC Res. Doc. 83/66, 17 p. + app.

Penney, G.H., and T.L. Marshall. MS 1984. Status of Saint John River, N.B., Atlantic salmon in 1983 and forecast of returns in 1984. CAFSAC Res. Doc. 84/47, 34 p.

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Fish. Res. Board Can., Bull. 191:382 p.

Table 1. Estimated total returns of wild and hatchery 1-SW and M-SW salmon originating 'above' and 'below' Mactaquac Dam to the Saint John River, N.B., 1984.

Sea-age	Components	Number of fish: Origin above Mactaquac Wild	Hatch.	Total	Origin below Mactaquac Wild	Hatch.	Total	Total Wild	Hatch.	Total
1-SW										
	Mactaquac counts	7,353	1,304	8,657	-	-	-	7,353	1,304	8,657
	Kingsclear catch	317	36	353	-	-	-	317	36	353
	Angled MS below Mactaquac	351	61	412	-	-	-	351	61	412
	By-catch	115	11	126	106	4	110	221	15	236
	Returns to tribs. below Mactaquac	-	-	-	7,404	472	7,876	7,404	472	7,876
	Totals	8,136	1,412	9,548	7,510	476	7,986	15,646	1,888	17,534
M-SW										
	Mactaquac counts	7,011	806	7,817	-	-	-	7,011	806	7,817
	Kingsclear catch	1,934	199	2,133	-	-	-	1,934	199	2,133
	Angled MS below Mactaquac	41	5	46	-	-	-	41	5	46
	By-catch	493	34	527	343	16	359	836	50	886
	Returns to tribs. below Mactaquac	-	-	-	6,244	472	6,716	6,244	472	6,716
	Totals	9,479	1,044	10,523	6,587	488	7,075	16,066	1,532	17,598

Table 2. Tag recoveries from 1-SW and M-SW salmon of hatchery origin taken at Mactaquac Dam and Kingsclear, 1976-1984.

	1-SW			M-SW		
	No. tag returns		Exploit.	No. tag returns		Exploit.
Year	Mact. Dam	Kingscl.	rate	Mact. Dam	Kingscl.	rate
1976	271	0	0.0	74	0	0.0
1977	252	2	0.0079	109	13	0.1066
1978	109	3	0.0268	94	20	0.1754
1979	300	11	0.0354	71	20	0.2198
1980	838	42	0.0477	197	50	0.2024
1981	185	9	0.0464	126	33	0.2076
1982	92	4	0.0417	54	39	0.4194
1983	51	1	0.0192	20	2	0.0909
1984[1]	44	0	0.0000	58	7	0.1077
1978-1984	1619	70	0.0414	620	171	0.2162

[1]Counts at Mactaquac Dam for entire season; tag returns from Kingsclear not necessarily complete.

Table 3. Estimated total returns of wild 1-SW and M-SW salmon originating 'above' and 'below' Mactaquac Dam, Saint John River, 1970-1983.

Sea-age	Year	(1) Mact. count	(2) Kings-clear	(3) Angled MS	(4) Trib. Returns BL. Mact.[a]	(5) Comm. fishery Total	(6) Comm. fishery Above	(7) Comm. fishery Below	(8) By-catch Total	(9) By-catch Above[c]	(10) By-catch Below[d]	Total returns (proportions) Above	Below	Total
1-SW														
	1970	2,874		78	2,732	200	105[b]	98[b]	3			3,057	2,830	5,887
	71	1,592		60	3,194	166	57	109	0			1,709	3,303	5,012
	72	784		83	1,420				107	41	66	908	1,486	2,394
	73	1,854		179	2,390				81	37	44	2,070	2,434	4,504
	74	3,389	27	214	4,502				59	26	33	3,656	4,535	8,191
	75	5,725	45	1,052	3,366				54	36	18	6,858	3,384	10,242
	76	6,797	307	1,014	6,456				52	29	23	8,147	6,479	14,626
	77	3,507	28	403	3,670				76	39	37	3,977	3,707	7,684
	78	1,584	43	231	2,912				113	44	69	1,902	2,981	4,883
	79	6,234	228	331	5,081				62	35	27	6,828	5,108	11,936
	80	7,555	378	503	3,790				67	46	21	8,482	3,811	12,293
	81	4,571	222	428	6,221	730	470	260	194	91	103	5,782	6,584	12,366
	82	3,932	171	466	4,338	1,482	352	1,130	79	37	42	4,958	5,510	10,468
	83	3,623	164	207	3,989	1,091	283	808	68	32	36	4,309	4,833	9,142
Mean												4,475 (.52)	4,070 (.48)	8,545 (1.00)
M-SW	1970	2,449		59	2,935	6,934	3,204[b]	3,749[b]	19			5,712	6,684	12,396
	71	2,235		89	1,060	3,473	2,391	1,082	0			4,715	2,142	6,857
	72	4,831		62	2,277				9	6	3	4,899	2,280	7,179
	73	2,367		91	4,350				165	60	105	2,518	4,455	6,973
	74	4,775	569	459	3,575				13	8	5	5,811	3,580	9,391
	75	6,200	739	446	2,758				77	56	21	7,441	2,779	10,220
	76	5,511	1,646	950	3,528				101	70	31	8,177	3,559	11,736
	77	7,247	864	1,489	6,217				184	112	72	9,712	6,289	16,001
	78	3,034	645	263	3,559				151	79	72	4,021	3,630	7,651
	79	1,993	561	152	1,240				70	48	22	2,754	1,262	4,016
	80	8,157	2,069	533	5,037				244	165	79	10,924	5,116	16,040
	81	2,441	639	282	2,857	4,983	2,291	2,692	669	338	331	5,991	5,880	11,871
	82	2,262	1,626	592	2,989	2,440	359	2,081	332	162	170	5,001	5,240	10,241
	83	1,712	512	98	2,363	2,651	986	1,665	309	139	170	3,447	4,198	7,645
Mean												5,794 (.59)	4,078 (.41)	9,873 (1.00)

[a]Reference Table 5.

[b]Values include by-catch.

[c]Columns (1+2+3+6)/columns (1+3+3+6+4+7) x Col. 8, where the 1970 and 1971 commercial and by-catch are combined and treated as by-catch without commercial landings.

[d]Below = (Total-Above).

Table 4. Parameters and derivation of total returns of salmon and angling exploitation rates for the Nashwaak River, 1970-1983.

Year	Sea-age	Eggs/♀[a]	Prop. ♀	Prop. pop'n[b]	Eggs/fish[c]	Egg prop's	Total eggs[d] (1,000's)	No. ♀'s[e]	No. ♂ + ♀'s[f]	No. angled	Total returns	Exploit. rate
1970	1-SW	3,592	.23	.487	402	.118	1,226.6	341	1,484	811	2,295	.35
	M-SW	6,828	.86	.513	3,012	.882	9,167.9	1,343	1,561	854	2,415	.35
1971	1-SW	3,389	.23	.781	609	.323	1,448.2	427	1,858	733	2,591	.28
	M-SW	6,778	.86	.219	1,277	.677	3,035.7	448	521	205	726	.28
1972[g]	1-SW		.32							581	1,205	.48
	M-SW		.83							926	1,890	.49
1973[g]	1-SW		.20							408	1,447	.28
	M-SW		.86							923	3,456	.27
1974	1-SW	3,238	.16	.533	276	.074	1,049.1	324	2,025	495	2,520	.20
	M-SW	8,182	.90	.467	3,439	.926	13,127.9	1,604	1,783	433	2,216	.20
1975	1-SW	3,238	.23[h]	.587	437	.138	1,290.7	399	1,733	663	2,396	.28
	M-SW	7,677	.86[h]	.413	2,727	.862	8,061.9	1,050	1,221	467	1,688	.28
1976	1-SW	3,692	.23	.650	552	.198	1,666.0	451	1,962	1,746	3,708	.47
	M-SW	7,441	.86	.350	2,240	.802	6,748.3	907	1,055	941	1,996	.47
1977	1-SW	3,492	.23	.479	385	.102	1,012.9	290	1,261	1,096	2,357	.46
	M-SW	7,551	.86	.521	3,383	.898	8,917.4	1,181	1,373	1,190	2,563	.46
1978	1-SW	3,676	.23	.469	397	.100	1,574.7	428	1,862	451	2,313	.20
	M-SW	7,775	.86	.531	3,551	.900	14,172.6	1,823	2,120	511	2,631	.19
1979	1-SW	3,368	.23	.813	630	.328	1,443.1			960	2,823	.35[i]
	M-SW	8,018	.86	.187	1,289	.672	2,956.6			221	650	.35[i]
1980	1-SW	3,891	.23	.483	432	.114	1,252.5	322	1,400	1,107	2,507	.44
	M-SW	7,548	.86	.517	3,356	.886	9,734.5	1,290	1,500	1,183	2,683	.44
1981	1-SW	3,233	.23	.685	509	.201	1,986.1	614	2,671	1,085	3,756	.29
	M-SW	7,455	.86	.315	2,020	.799	7,894.8	1,059	1,231	498	1,729	.29
1982	1-SW	4,084	.23	.617	580	.192	1,098.8	269	1,170	1,278	2,448 (2,164)[j]	.52
	M-SW	7,390	.86	.383	2,434	.808	4,624.3	626	728	792	1,520	.52
1983	1-SW	3,512[k]	.23	.618	499	.166	1,186.9	338	1,470	420	1,890 (1,750)[j]	.22
	M-SW	7,609[k]	.86	.382	2,500	.834	5,963.3	783	910	260	1,170 (1,127)[j]	.22

[a]Values for wild fish at Mactaquac.
[b]From Prov. angling.
[c]Product of first 3 columns.
[d]Egg prop.'s x eggs
[e]Eggs/eggs per ♀.
[f]No. ♀'s/prop. ♀.
[g]Derived from fence data.
[h]Mean of fence and Westfield data.
[i]12-year mean of arcsin transformed data (exclusive of 1983).
[j]Wild fish only (Hatchery fish were calculated by applying rates for the 1981 and 1982 smolt classes returning to Mactaquac + Kingsclear + MS sport fishery (from Table 16) of 0.0139 for 1-SW in 1982 and 0.0021 for M-SW in 1983 and 0.0078 for 1-SW in 1983 to respective releases of 20,400 and 18,000 smolts to the Nashwaak River in 1981 and 1982.
[k]Eleven-year mean at Mactaquac.

Table 5. Estimated returns of 1-SW and M-SW salmon to tributaries[a] below Mactaquac Dam, Saint John River, 1970-1983 (Penney and Marshall, MS 1984).

Sea-age	Year	No. of wild salmon				
		Nashwaak	Nashwaak x 0.16	Kennebecasis and Hammond	Kennebecasis and Hammond x 0.49	Total
1-SW	1970	2,295	368	46	23	2,732
	1971	2,591	415	126	62	3,194
	1972	1,205	193	15	7	1,420
	1973	1,447	232	477	234	2,390
	1974	2,520	403	1,060	519	4,502
	1975	2,396	383	394	193	3,366
	1976	3,708	593	1,446	709	6,456
	1977	2,357	377	628	308	3,670
	1978	2,313	370	154	75	2,912
	1979	2,823	452	1,212	594	5,081
	1980	2,507	401	592	290	3,790
	1981	3,756	601	1,251	613	6,221
	1982	2,164	346	1,227[b]	601	4,338
	1983[c]	1,750	280	1,314[b]	645	3,989
M-SW	1970	2,451	392	62	30	2,935
	1971	726	116	146	72	1,060
	1972	1,890	302	57	28	2,277
	1973	3,456	553	229	112	4,350
	1974	2,216	355	674	330	3,575
	1975	1,688	270	537	263	2,758
	1976	1,996	319	814	399	3,528
	1977	2,563	410	2,177	1,067	6,217
	1978	2,631	421	340	167	3,559
	1979	650	104	326	160	1,240
	1980	2,683	429	1,292	633	5,037
	1981	1,729	277	571	280	2,857
	1982	1,520	243	823	403	2,989
	1983[c]	1,127	180	709[b]	347	2,363

[a]where Nashwaak represents 31.0 percent and Hammond + Kennebecasis equals 42.9 percent of production area below Mactaquac Dam.

[b]wild fish only (hatchery fish removed as per footnote j, Table 4, where hatchery smolt releases to Kennebecasis + Hammond were 24,518 in 1981 and 24,714 in 1982).

[c]based on DNR 'Fissys' estimate and exploitation rate of 0.22.

Table 6. Estimated total returns to the Saint John River from hatchery-reared smolts released at Mactaquac, 1974-1984.

Year of Release (i)	Number of smolts	Prop. 1-yr smolt	Year of Return	Number of returns: Mactaquac MC	Mactaquac Dam	Kingscl.	Angled MS	By-catch	Comm-ercial	Total	% Return
			i+1								
1974	337,281	0.00		1,771	3,564	28	977	34		6,374	1.890
75	324,186	0.06		2,863	4,831	219	1,129	32		9,074	2.799
76	297,350	0.14		1,645	4,533	36	708	70		6,992	2.351
77	293,132	0.26		777	1,779	49	369	70		3,044	1.038
78	196,196	0.16		799	2,722	100	186	20		3,827	1.951
79	244,012	0.09		3,072	6,687	335	640	59		10,793	4.423
80	232,258	0.12		921	2,861	139	350	74	385	4,730	2.037
81	189,090	0.08		828	1,464	64	267	21	202	2,846	1.505
82	172,231	0.06		374	857	39	69	11	95	1,445	0.839
83	144,549	0.22		476	828	36	61	11	0	1,412	0.977
84	206,462	0.28									
1974-1983	2,430,285									50,537	2.079[a]
1974	337,281		i+2	310	1,313	392	267	20		2,302	0.683
75	324,186			341	1,727	206	417	34		2,725	0.841
76	297,350			223	1,728	368	165	50		2,534	0.852
77	293,132			145	747	210	65	21		1,188	0.405
78	196,196			302	1,992	506	146	46		2,992	1.525
79	244,012			126	963	252	125	147	999	2,612	1.070
80	232,258			88	640	462	181	50	110	1,531	0.659
81	189,090			44	255	76	17	23	166	581	0.307
82	172,231			84	722	199	5	34	0	1,044	0.606
83	144,549										
84	206,462										
1974-1982	2,285,736									17,509	0.766[a]

[a]unweighted.

Table 7. Estimated homewater removals of 1-SW and M-SW salmon originating 'above' and 'below' Mactaquac Dam on the Saint John River, N.B., 1984.

Sea-age	Components	Number of fish: Origin above Mactaquac Wild	Hatch.	Total	Origin below Mactaquac Wild	Hatch.	Total	Total Wild	Hatch.	Total
1-SW										
	Kingsclear Indians	317	36	353	-	-	-	317	36	353
	Angled									
	Tobique River	907	168	1,075	-	-	-	907	168	1,075
	Mainstem above Mact.	292	45	337	-	-	-	292	45	337
	Mainstem below Mact.	351	61	412	-	-	-	351	61	412
	Nashwaak River	-	-	-	357	77	434	357	77	434
	Hammond River	-	-	-	22	5	27	22	5	27
	Kennebecasis River				111	24	135	111	24	135
	Trucked to Aroostook R.	0	58	58	-	-	-	0	58	58
	Hatchery broodfish	-	-	-	1	0	1	1	0	1
	Mortalities, etc.	0	9	9	-	-	-	0	9	9
	By-catch	115	11	126	106	4	110	221	15	236
	Totals	1,982	388	2,370	597	110	707	2,579	498	3,077
M-SW										
	Kingsclear Indians	1,934	199	2,133	-	-	-	1,934	199	2,133
	Angled[a]									
	Tobique River	96	7	103	-	-	-	96	7	103
	Mainstem above Mact.	17	1	18	-	-	-	17	1	18
	Mainstem below Mact.	41	5	46	-	-	-	41	5	46
	Nashwaak River	-	-	-	34	7	41	34	7	41
	Hammond River	-	-	-	4	0	4	4	0	4
	Kennebecasis River	-	-	-	12	2	14	12	2	14
	Trucked to Aroostook R.	0	29	29	-	-	-	0	29	29
	Hatchery broodfish	261	202	463	21	4	25	282	206	488
	Mortalities, etc.	6	8	14	-	-	-	6	8	14
	By-catch	493	34	527	343	16	359	836	50	886
	Totals	2,848	485	3,333	414	29	443	3,262	514	3,776

[a]10 percent of angled M-SW fish assumed to be lost from spawning escapement.

Table 8. Estimated homewater returns, removals and spawning escapement of 1-SW and M-SW salmon originating 'above' and 'below' Mactaquac Dam, Saint John River, 1984.

Sea-age	Category	Numbers of fish: Origin above Mactaquac Wild	Origin above Mactaquac Hatch.	Origin below Mactaquac Wild	Origin below Mactaquac Hatch.	Total Wild	Total Hatch.	Total Both
1-SW								
	Homewater returns	8,136	1,412	7,510	476	15,646	1,888	17,534
	Homewater removals	1,982	388	597	110	2,579	498	3,077
	Spawners	6,154	1,024	6,913	366	13,067	1,390	14,457
	Target spawners	3,200		4,400				7,600
	Percentage of target spawners	224		165				190
M-SW								
	Homewater returns	9,479	1,044	6,587	488	16,066	1,532	17,598
	Homewater removals	2,848	485	414	29	3,262	514	3,776
	Spawners	6,631	559	6,173	459	12,804	1,018	13,822
	Target spawners	4,400[a]		5,700				10,100[a]
	Percentage of target spawners	163		116				137

[a]Excludes 500 broodfish required at Mactaquac FCS.

Table 9. Numbers of eggs/100 m^2 deposited in the Tobique River, 1968-1981, and derivation of weighted numbers of eggs contributing to annual returns of wild 1-SW fish at Mactaquac, 1973-1982 and 1985 (for explanation see Penney and Marshall (MS 1984)).

Tobique egg deposition		Proportion of age at smoltification[a]		Eggs/100 m^2 contributing to 1-SW fish		Total wt'd egg contrib/100 m^2 to 1-SW fish @ Mact. (yr)
Year	Eggs/100 m^2	Age 2	Age 3^+	Yr i	Yr i+1	
1968	5.7	.207				
			.793		4.55	
1969	43.6	.445		19.40		23.95 (1973)
			.555		24.20	
1970	60.9	.269		16.38		40.58 (1974)
			.731		44.52	
1971	71.2	.419		29.83		74.35 (1975)
			.581		41.37	
1972	130.8	.619		80.96		122.33 (1976)
			.381		49.84	
1973	86.5	.411		35.55		85.39 (1977)
			.589		50.95	
1974	269.4	.114		30.71		81.66 (1978)
			.886		238.69	
1975	368.2	.361		132.92		371.61 (1979)
			.639		235.28	
1976	245.4	.388		95.22		330.50 (1980)
			.612		150.18	
1977	309.2	.306		94.62		244.80 (1981)
			.694		214.58	
1978	193.2	.386		74.58		289.16 (1982)
			.614		118.62	
1979	112.3					
1980	362.1					
			.649[b]		235.00	
1981	118.7	.351[b]		41.66		276.66 (1985)

[a]derived from Tables 11 and 12.

[b]mean (n=11) calculated with angular transformation.

Table 10. Freshwater age and numbers of 1-SW fish (A) counted at Mactaquac fish passage facilities, Saint John River, 1972-1984, and (B) that would have returned to Mactaquac had they not been exploited within the river, 1972-1984

Freshwater-age	Numbers of 1-SW fish												
	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983[a]	1984
A													
2	110	1,413	1,593	1,941	3,962	922	391	3,166	2,214	1,280	794	2,348	4,140
3	596	404	1,762	3,727	2,658	2,545	1,160	2,974	4,986	2,861	2,902	1,264	3,132
4	78	37	34	57	177	39	33	94	355	430	236	11	81
Total	784	1,854	3,389	5,725	6,797	3,506	1,584	6,234	7,555	4,571	3,932	3,623	7,353
B													
2	127	1,578	1,718	2,325	4,749	1,046	469	3,468	2,486	1,619	1,001	2,793	4,581
3	690	451	1,901	4,465	3,186	2,887	1,393	3,257	5,598	3,619	3,659	1,503	3,466
4	91	41	37	68	212	44	40	103	398	544	298	13	89
Total	908	2,070	3,656	6,858	8,147	3,977	1,902	6,828	8,482	5,782	4,958	4,309	8,136

[a]changed from Penney and Marshall (MS 1984, Table 13) based on re-reading scale samples.

Table 11. Numbers of wild 1-SW salmon and proportion of age 2:1's of the total that would have returned to Mactaquac for the 1969-1979 year-classes (numbers of 1-SW fish from Table 10).

Year class (i)	Numbers at age of 1-SW returns to Mactaquac				Prop. 2:1's of total
	2:1 (i+3)	3:1 (i+4)	4:1 (i+5)	Total	
1968		690	41		
1969	127	451	37	615	.207
1970	1,578	1,901	68	3,547	.445
1971	1,718	4,465	212	6,395	.269
1972	2,325	3,186	44	5,555	.419
1973	4,749	2,887	40	7,676	.619
1974	1,046	1,393	103	2,542	.411*
1975	469	3,257	398	4,124	.114*
1976	3,468	5,598	544	9,610	.361
1977	2,486	3,619	298	6,403	.388
1978	1,619	3,659	13	5,291	.306
1979	1,001	1,503	89	2,593	.386
1980	2,793	3,466			
1981	4,581				

*influenced by 1977 smolt-class with its reduced survival.

Table 12. Adjusted Tobique River egg deposition[a]/100 m^2 in year i and year i+1 recruiting to total wild 1-SW and M-SW salmon which would have returned to Mactaquac in the absence of homewater removals in year i+5 and i+6 respectively, resultant M-SW:1-SW salmon ratios, and forecast numbers of 1-SW and M-SW fish to Mactaquac in the absence of homewater removals in 1985.

Year i-i+1 (1)	Eggs/100 m^2 (2)	Total 1-SW i+5 (3)	Total M-SW i+6 (4)	M-SW/ 1-SW (5)
1965-66		3,057	4,715	1.54
1966-67		1,709	4,899	2.87
1967-68		908	2,518	2.77
1968-69	23.95	2,070	5,811	2.81
1969-70	40.58	3,656	7,441	2.04
1970-71	74.35	6,858	8,177	1.19
1971-72	122.34	8,147	9,712	1.19
1972-73	85.39	3,977	4,021	1.01
1973-74	81.66	1,902	2,754	1.45
1974-75	371.61	6,828	10,924	1.60
1975-76	330.50	8,482	5,991	0.71
1976-77	244.80	5,782	5,001	0.86
1977-78	289.16	4,958	3,447	0.69
1978-79		4,309	9,479	2.20
1979-80		8,136	8,413[c]	
1980-81	276.66	7,063[b]		

[a]See Tables 10, 11 and 12 for weighting procedure and update of Penney and Marshall (MS 1984).

[b]Based on regression of 1-SW returns to Mactaquac, 1973-1982, (col. 3) on adjusted egg deposition in Tobique River, 1968-1969 to 1977-1978, (col. 2):

$$\log_e Y = 6.605 + 0.388 \log_e X;\ n=10,\ r=0.68,\ p= 0.031$$

$$\hat{Y}_{1985} = 7,063(AM);\ 95\%\ C.L. = 4,640 \text{ to } 10,750$$

[c]Based on regression of MSW returns to Mactaquac 1971-1984, (col. 4) on 1-SW returns to Mactaquac 1970-1983, (col. 3):

$$\log_e Y = 4.753 + 0.469 \log_e X;\ n=14,\ r=0.67,\ p= 0.008$$

$$\hat{Y}_{1985} = 8,413(AM);\ 95\%\ C.L. = 6,075 \text{ to } 11,659$$

Table 13. Summary of the 1985 forecast for the Saint John River, New Brunswick (95% C.L. are shown in parentheses).

Requirement	1-SW			M-SW		
	Wild	Hatch.	Total	Wild	Hatch.	Total
Above Mactaquac	7,063 (4,640-10,750)	4,292	11,355	8,413 (6,075-11,659)	873 (426-1,790)	9,286
Target escpm.			3,200			4,400 + 500[1]
Surplus			+ 8,155			+ 4,386
Below Mactaquac	5,129 (4,125-6,135)	959	6,088	5,919	295 (143-603)	6,214
Target escpm.			4,400			5,700
Surplus			+ 1,688			+ 514
Total	12,192	5,251	17,443	14,332	1,168	15,500
Target escpm.			7,600			10,100 + 500[1]
Surplus			+ 9,843			+ 4,900

[1]Broodfish for Mactaquac Fish Culture Station.

Table 14. Commercial (inc. by-catch), sport (DNR bright fish) and Native (Kingsclear estimated from tags) landings of 1-SW and M-SW salmon on the Saint John River, 1949-1984. (Numbers of fish x 10^3.)

	Commercial			Sport			Native			
Year	1-SW	M-SW	Total	1-SW	M-SW	Total	1-SW	M-SW	Total	G.T.
1949	1.5	16.1	17.6							
1950	1.1	12.4	13.5							
1951	1.6	17.9	19.5							
1952	1.1	12.1	13.2							
1953	1.6	14.9	16.5							
1954	0.9	9.5	10.4							
1955	0.8	5.5	6.3							
1956	0.6	4.9	5.5							
1957	0.8	6.9	7.7							
1958	1.2	13.8	15.0							
1959	2.1	14.3	16.4							
1960	1.0	10.6	11.6							
1961	0.8	9.5	10.3							
1962	0.5	5.5	6.0							
1963	0.6	4.2	4.8							
1964	0.9	9.4	10.3							
1965	1.5	17.8	19.3							
1966	1.5	18.9	20.4							
1967	0.7	9.4	10.1							
1968	0.7	7.3	8.0							
1969	0.3	2.5	2.8	1.5	0.6	2.1				4.9
1970	0.4	5.4	5.8	1.3	1.3	2.6				8.4
1971	0.3	2.6	2.9	1.2	0.7	1.9				4.8
1972	0.1	<.1	0.1	0.9	1.6	2.5				2.6
1973	0.1	0.2	0.3	1.3	1.5	2.8				3.1
1974	0.1	<.1	0.1	2.0	2.5	4.5	<.1	0.6	0.6	5.2
1975	0.1	0.1	0.2	2.5	1.7	4.2	0.1	0.7	0.8	5.2
1976	0.1	0.1	0.2	4.7	2.8	7.5	0.5	2.0	2.5	10.2
1977	0.1	0.2	0.3	4.3	4.4	8.7	0.1	1.1	1.2	10.2
1978	0.2	0.2	0.4	1.7	2.2	3.9	0.1	1.0	1.1	5.4
1979	0.1	0.1	0.2	3.3	0.8	4.1	0.3	0.8	1.1	5.4
1980	0.1	0.3	0.4	4.7	5.4	10.1	0.8	2.6	3.4	13.9
1981	1.4	6.8	8.2	4.1	2.0	6.1	0.4	0.9	1.3	15.6
1982	1.8	2.9	4.7	3.4	2.0	5.4	0.2	2.1	2.3	12.4
1983	1.3	3.1	4.4	2.5	1.1	3.6	0.2	0.6	0.8	8.8
1984[a]	0.2	0.9	1.1	2.4	0.2	2.6	0.4	2.1	2.5	6.2

[a]preliminary; also includes 10% of sport-caught M-SW releases.