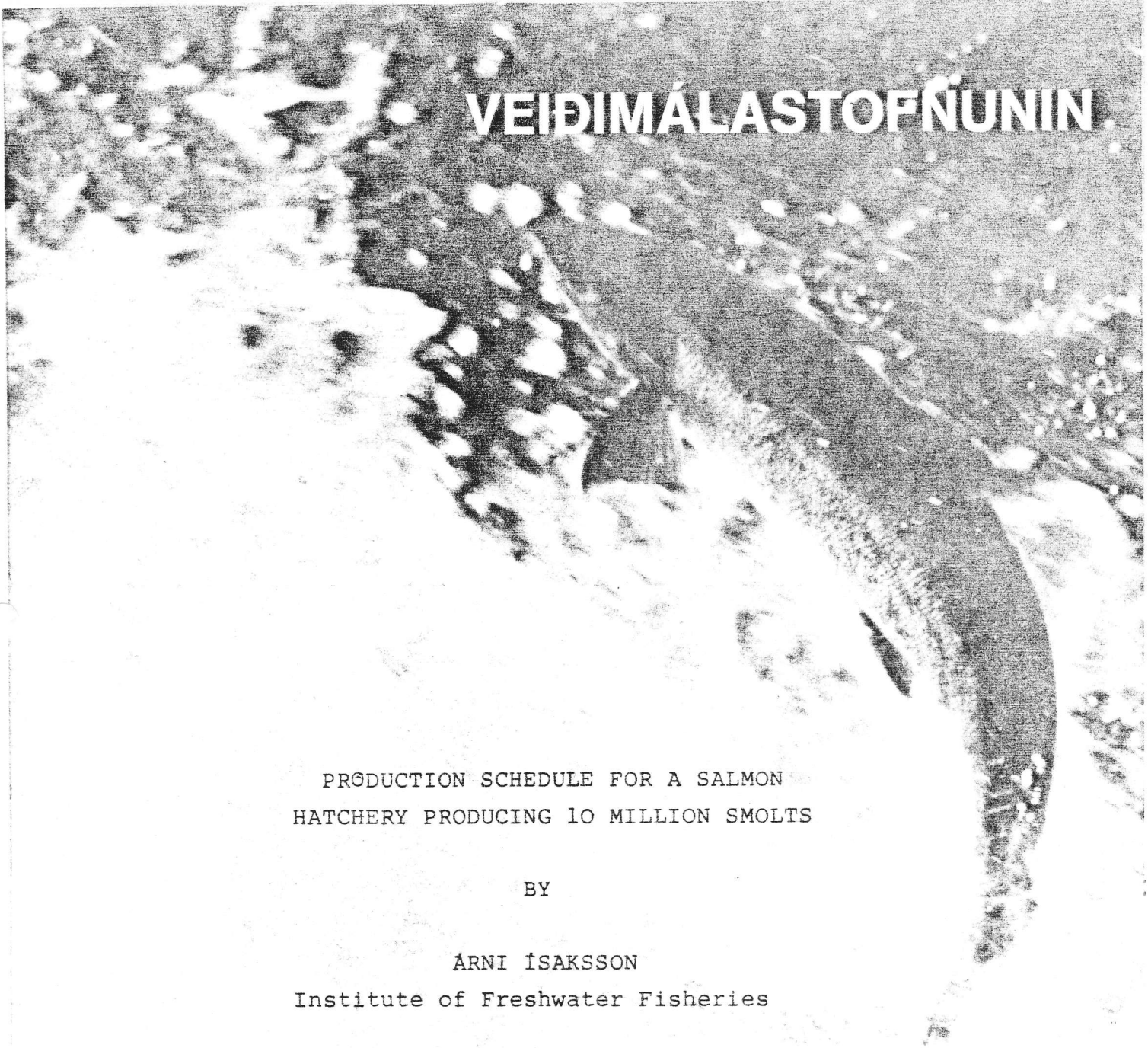
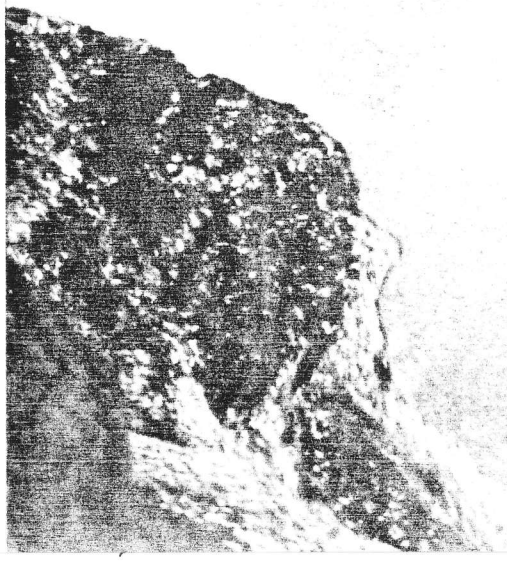


PRODUCTION SCHEDULE FOR A SALMON HATCHERY PRODUCING 10 MILLION SMOLTS

BY

ÁRNI ÍSAKSSON
Institute of Freshwater Fisheries



Reykjavík 1980

Production schedule for a salmon hatchery producing 10 million smolts

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1. Indtroduction

In a previous report a theoretical production schedule for a hatchery producing 10 millions smolts was presented. It has been deemed necessary to revise that schedule based on actual figures from the Kollafjörður Experimental Fish Farm. After studying those figures it became quite clear that such a production scheme would not harmonize with the availability of hot water from the R.D.H.S and would in fact create small peaks in midwinter which possibly could not be met by the energy supply at that time.

By studying the Kollafjörður data it became equally obvious that the rearing program has by no means obtained maximum growth rate, partly due to calorie shortage and possibly also from crowded conditions. Since a salmon hatchery at Straumsvík is entirely dependent on calories from the R.D.H.S. it was decided to present two types of data in this report. Firstly actual production data for the Kollafjörður hatchery and secondly a shifted production schedule for the Straumsvík hatchery which could logically be obtained by optimizing temperature and space at the time when calories are abundant. I would expect these figures to be critically reviewed and compared to growth rates of Pacific salmon. Some Canadian literature on Atlantic salmon indicates that the assumed growth rates are modest (Goff and Forsyth 1979).

II. Production schedules.

The production figures for the Kollafjörður Experimental Fish Farm are presented in table 1. The table shows that over 60% of the total smolt production is in cold water by the end of the year. A comparable figure for the hatchery at Straumsvík will have to be close to 100%. Rearing temperatures at Kollafjörður must be considered modest and much below those that give optimum growth. This is especially true for the latter part of the year from August through September. This is due to the fact that hot water at the station is limited and temperatures can not be kept up during cold periods and when there are great quantities of fish.

It may stand out in the table that the flows of cold water into outdoor ponds are twice as high as those deemed necessary by temperature. This is done to get a more rapid turnover of water in the 60 m^2 outdoor ponds. The water quantity in these ponds is about 36 m^3. Water flows of 5 l/sec result in a complete turnover every 2 hours. Due to this rapid turnover the ponds never freeze over even during heavy frost. The same turnover rate may not be necessary at Straumsvík because the cold water source will be stable at 4°C whereas Kollafjörður water may get cooled down to 2°C.

The production schedule for the salmon hatchery at Straumsvík is shown in table 2. The growth rates in the table are fairly comparable to Kollafjörður through July but are assumed to be much higher for the rest of the year due to higher rearing temperatures. Rearing temperatures of 15°C are applied from May through October but are reduced to 10°C in early November to comply with R.D.H.S. hot water supply. These high temperatures result in high calorie demand during the months from August through October, at a time when calories are easily available.

It is unfortunate that increased temperature calls for increased water flows and possibly lower fish densities. There seems to be no possibility that water use in excess of 2000 l/sec can be avoided. The greatest demand of heated water is in late August when the average weight of the fish is 15 grams. At that size the parr can tolerate considerable salinities, probably up to 10‰. Shortage of freshwater at that time could therefore be compensated for by the pumping of seawater or brackish freshwater from borholes. This water could easily be used to supplement freshwater for the remainder of the year. Another alternative to meet freshwater shortage might be to reuse some of the freshwater at least once after thorough filtration. This would save calories from R.D.H.S and also some pumping cost.

Hatchery survival rates are based on the Kollafjörður data and are fairly consistent with those presented in an earlier report.

According to the table, all the fish will be of smolt size and in outdoor ponds by 31st of December. In practice there often seems to be a fraction of the fish which grows very slowly, almost stunted. It may be bad business not to be able to give these fish extra calories in January and February to bring them to the smolt size. Any great demands for hot water at that time would be turned down by the R.D.H.S. The question thus arises whether an alternative source of calories such as by oil should be included in the facilities, to be able to boost the production during critical periods.

For clarification the monthly water flows and energy requirements are graphically depicted in figures 1 and 2. Figure 2 shows that there is a gradual increase in water flows from January through June. Release of all the smolts in June results in a drastic reduction in early July but during the months in July and August there is a great increase in water requirements due to rapid growth of the fish and high temperatures.

Gradual grading of fish into cold water along with lowered rearing temperatures results in reduced water requirements in November and December.

From figure 2 one can see that calorie requirements are relatively high (5000 kcal/sec) from July 1 till the end of the year. The very high energy requirements are in August, September and October, approaching 20.000 kcal/sec.

III Concluding remarks

In the previous discussion it has been attempted to put the production of salmon smolts at Straumsvik into a realistic perspective in spite of restraints imposed by available water and calories. It should be pointed out that better growth rates are obtained at low fish densities although exact relationships are poorly known. It may therefore not be advisable to cut down the space of the fish to the extent that desirable growth rates may suffer. That may, however, ultimately be a managerial decision when production has started, resulting in a reduced output of smolts from an original plan.

Table 1. Rearing program at the Kollafjörður Experimental Fish Farm based on the 1978 brood year.

	INTENSIVE REARING												
Month	Jan 1	Feb 1	March 1	April 1	May 1	June 1	July 1	August 1	Sept 1	Oct.1	Nov 1	Dec	March 1
Mean weight (g)	-	0,1	0,2	0,4	0,8	1,6	3,2	6,4	13,0	10,0	10,0	10,0	10,0
Max weight (g)					0,8			9,0					
No of fish		284000	270000	213000	125000	116000	110000	110000	110000	90000	70000	44000	14000
Total weight (kg)		28	54	85	100	185	352	704	1430	900	700	440	140
Flow per kg (1/min)		1,5	1,5	1,5	1,5	1,5	1,0	0,6	0,5	0,5	0,5	0,5	
Water quant (1/sec)		0,7	1,35	2,1	2,5	4,6	5,9	7,0	11,9	7,5	5,8	3,7	
Rearing temp	10,0	11,4	12,3	12,1	12,5	11,2	11,5	9,6	10,2	10,1	8,6	8,5	
	COLD WATER REARING									60% of smolts in cold water			
Mean weight(g)										25,0	26,0	25,0	18,0
No of fish										20000	20000	26000	30000
Total no of fish										20000	40000	66000	96000
Total weight(kg)										500	1040	1650	2190
Water quant (1/sec)										5	10	15	20
Rearing Temp. °C										2-4	2-4	2-4	2-4

Table 2. Production schedule for a ' mon hatchery producing 10 million smolts.

-INTENSIVE REARING-

	100% weight gain per month									50% weight gain per month				20% weight gain per month					
Month	Jan 1	Feb 1	Marz 1	April 1	May 1	June 1	July 1	August 1	August 31	Sept 1	Sept 31	Oct 1	Oct 31	Nov 1	Nov 30	Dec 1	Dec 31	Jan 1	Feb 1
Mean weight (grams)	-	0,1	0,2	0,4	0,8	1,6	3,5	8,0	15,0	12,0	18,0	15,0	22,0	22,0	26,0	25,0	30,0	0	0,1
No of fish x 10^6		20	18	16	11	11	10,5	10	10	8	8	6	6	4	4	2	2	0	20
Total weight kg		2000	3600	6400	8800	17600	36750	80000	150000	96000	144000	90000	132000	88000	104000	50000	60000	0	2000
Flow per kg (l/min)		1,5	1,5	1,5	1,5	1,5	1,0	1,0	0,8	0,8	0,8	0,8	0,8	0,6	0,6	0,6	0,6	0	1,5
Water quant l/sec		50	90	160	220	440	610	1335	2000	1280	1920	1200	1760	880	1040	500	600	0	50
Rearing temp °C		12	12	12	15	15	15	15	15	15	15	15	15	10	10	10	10	0	12
Kcal required		400	720	1280	2420	4840	6710	14685	22000	14080	21120	13200	19360	5280	6240	3000	3600	0	400

-COLD WATER REARING-

Mean weight (grams)	27	27	27	27	27	27		-	-	27	27	27	27	27	27	27	27	27	27
No of fish x 10^6	10	10	10	10	10	10		-	-	2	2	4	4	6	6	8	8	10	10
Total weight kg	270000	270000	270000	270000	270000	270000		-	-	54000	54000	108000	108000	162000	162000	216000	216000	270000	270000
Flow per kg (l/min)	0,2	0,2	0,2	0,2	0,2	0,2		-	-	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Water quant l/sec	900	900	900	900	900	900		-	-	180	180	360	360	540	540	720	720	900	900
Rearing temp °C	4	4	4	4	4	4		-	-	4	4	4	4	4	4	4	4	4	4
Total water quantity	900	950	990	1060	1120	1340	610	1335	2000	1460	2100	1560	2120	1420	1580	1220	1320	900	950

RELEASE

Figure 1. Total water flows required for the rearing of 10 million smolts.

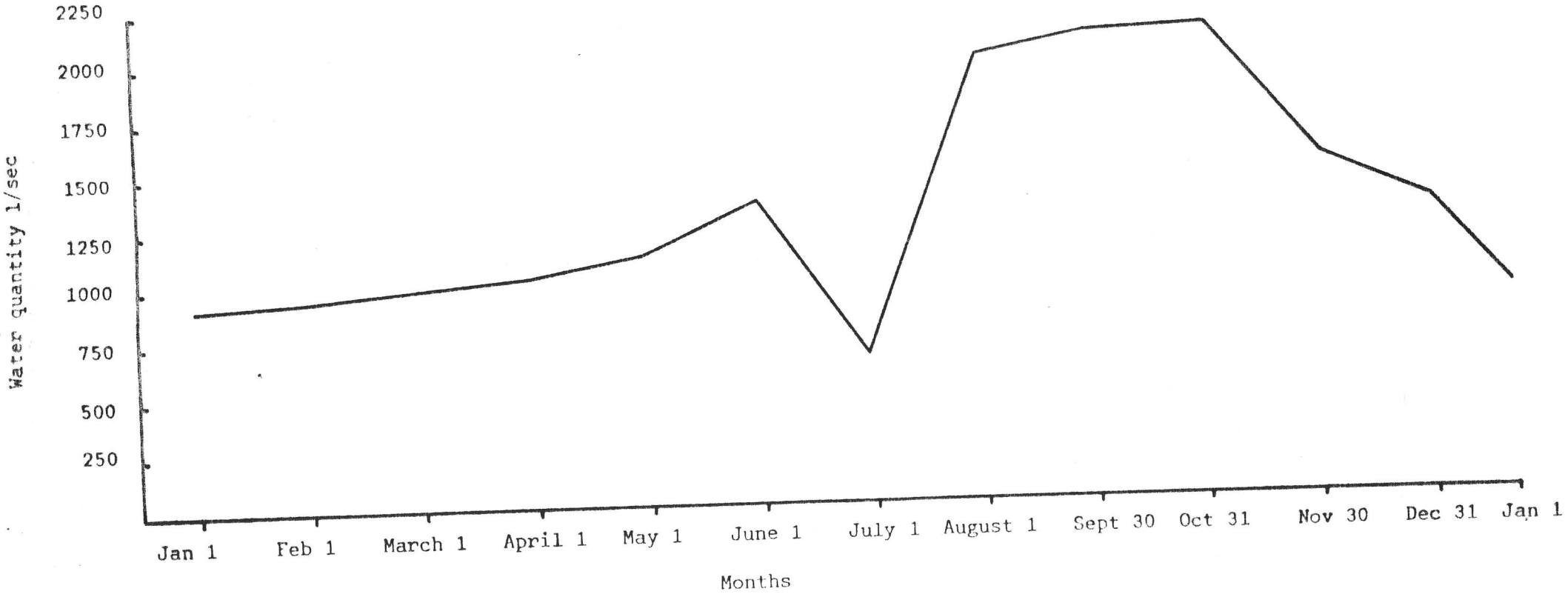

Figure 2. Energy requirement for the production of 10 million salmon smolts.