

Some conclusions from sockeye smolt experiments at Main Bay Hatchery (1987 through 1990; adult returns through 1993):

by

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Main Bay Hatchery is located Prince William Sound. It is a large facility by Alaska Standards, with a consistent supply of IHN-free water; and subsequently the potential to produce a large number of sockeye salmon smolts, perhaps as many as 20 million. We felt the risk associated with sockeye culture at Main Bay was acceptable if three key elements were stressed in the culture practices: 1. an IHN-free water supply; 2. appropriate isolation; and, 3. rigorous disinfection at appropriate points in the process.

In 1987 Main Bay began producing sockeye smolts. Eggs, sac fry and emergent fry were kept isolated in single-incubator lots until the fry had been feeding for at least three months, after which time we felt vertically transmitted virus was not significant risk to the fish. The rearing fry were then mixed with other lots of fish in raceways and reared until the following spring when production scale experiment to determine the most efficient way to produce adult sockeye salmon. The parameters evaluated were; release of smolts directly from freshwater or release after rearing for at least two weeks in seawater; differing rearing densities in raceways; size of smolts at release; and, time of release. The results from the final adult return numbers in 1993 are preliminary.

It appears that each manipulation had significant consequences.

1. Freshwater vs seawater rearing prior to release. It appears that sockeye need not be reared to achieve maximum survivals from smolt to adult. Smolt released at 10g directly from freshwater in 1989 had a greater survival rate to adult (17.8% vs 16.6%) than 9.9g smolt released from net pens in seawater.

2. Smolt size and survival to adult. Sockeye smolts above 8g do not necessarily have a greater chance of surviving to adult. Smolts released at 8g in 1989 had a greater survival rate to adult than smolts released at 15.1g (16.5% vs 15.7%).

■The **age of an adult sockeye** is strongly related to the size of a smolt. About 50% of the 8g smolts returned as 2-ocean adults, where greater than 80% of smolts larger than 14g returned as 2-ocean adults. There was a strong correlation in a simple linear regression between smolt size and age at maturity.

3. Rearing density and survival to adult. It is probable that rearing density is related to adult survival, though this experiment was somewhat influenced by the time of release of each of the treatment groups. The greatest survivals were achieved at the lowest rearing density (maximum density reached in the lowest density raceway was 33kg/m³).

■Though the greatest survival came from the smolt reared in the least dense rearing environment, **the greatest adult production for a single raceway was from the smolt group reared at the highest rearing density** (maximum density attained during rearing was 88kg/m³).

■A higher % of the returning adults were 1-ocean "jacks" from the groups of smolt reared at higher densities.

4. Time of release. Survival to adult is greatly influenced by time of release within a fairly small time window. We found that time of release had the strongest influence on survival among the parameters that we measured. As little time as a week, between the release of two groups of similar smolts, may make a substantial difference in survival to adult.

■The optimal release time in 1990 was the last several days in May and the first several days in June.

■The later smolt releases in 1990 tended to produce fewer 1-ocean "jacks".

■The later smolt releases in 1990 tended to produce relatively more 3-ocean adults.

Yearling Sockeye Smolt Main Bay

Treatments:

1986 brood; 1988 release; 330,025 smolts:

1. Moist feed, released from freshwater, 110,900 smolts;
2. Moist feed, released from seawater, 40,270 smolts;
3. Dry feed, released from freshwater, 77,082 smolts; and,
4. Dry feed, released from seawater, 101,773 smolts.

1987 brood; 1989 release; 3,576,600 smolts:

1. Size at release, smaller (7-9g), 1,209,517 smolts;
2. Size at release, larger (14-18g), 617 smolts;
3. Released from freshwater, 948,027 smolts; and,
4. Released from seawater, 1,148,287 smolts.

1988 brood; 1990 release; 2,616,498 smolts:

1. Rearing densities @ 1,000,000; 800,000; 600,000; and 400,000 smolts per raceway, and
2. Release timing, smolts released on 15 May, 22 May, 29 May, and 5 June.

**1987 Brood; Total Return from Smolts
Released from Freshwater or Seawater Rearing**

Treatment	Smolts released	1-ocean "jacks" (%)	2-ocean adults (%)	3-ocean adults (%)	Total return (%)
Released freshwater (@10.0g)	949,000	278 (0.0)	98,591 (10.4)	70,334 (7.4)	169,203 (17.8)
Released seawater (@9.9g)	1,150,000	2,323 (0.2)	113,459 (9.9)	74,871 (6.5)	190,653 (16.6)

**1987 Brood; Total Return from Smolts
Released at Two Different Sizes (7-9g and 14-18g)**

Treatment	Smolts released	1-ocean "jacks" (%)	2-ocean adults (%)	3-ocean adults (%)	Total return (%)
"Smaller" smolts (@ 7-9g)	1,210,000	2,300 (0.2)	100,053 (8.3)	97,343 (8.0)	199,696 (16.5)
"Larger" smolts (@14-18g)	618,000	0 (0.0)	82,098 (13.3)	15,096 (2.4)	97,194 (15.7)

**1988 Brood: Return from Smolts
Released after Rearing at Different Densities**

Treatment (peak den.)	Smolts released (date @ wt)	1-ocean "jacks" (%)	2-ocean adults (%)	3-ocean adults (%)	Total 2's & 3's (%)	Total return (%)
1,000,000 (88kg/m³)	848,544 (5/26 @ 15.0g)	25,907 (3.1)	98,130 (11.6)	21,565 (2.5)	119,695 (14.1)	145,602 (17.2)
800,000 (67kg/m³)	642,752 (5/24 @ 13.4g)	12,746 (2.0)	103,576 (16.1)	10,341 (1.6)	113,917 (17.7)	126,663 (19.7)
600,000 (48kg/m³)	461,915 (5/28 @ 17.0g)	12,109 (2.6)	64,138 (13.9)	5,595 (1.2)	69,733 (15.1)	81,842 (17.7)
400,000 (33kg/m³)	317,793 (6/6 @ 16.9g)	6,043 (1.9)	54,618 (17.2)	16,140 (5.1)	70,758 (22.3)	76,801 (24.2)

**1988 Brood: Return from Smolts
Released on Different Dates**

Treatment release date	Smolts released (@ wt)	1-ocean "jacks" (%)	2-ocean adults (%)	3-ocean adults (%)	Total 2's & 3's (%)	Total return (%)
15 May	90,775 (@13.5g)	1,745 (1.9)	11,670 (12.9)	1,706 (1.9)	13,376 (14.8)	15,121 (16.7)
22 May	76,935 (@15.6g)	2,083 (2.7)	13,475 (17.5)	891 (1.2)	14,366[*] (18.7)	16,449 (21.4)
29 May	96,027 (@16.1g)	1,185 (1.2)	18,745 (19.5)	3,805 (4.0)	22,530 (23.5)	23,735 (24.7)
5 June	87,147 (@16.5g)	287 (0.3)	16,770 (19.2)	3,652 (4.2)	20,422 (23.4)	20,709 (23.8)

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