A Contrast of Hatchery Steelhead Abundance and Spring chinook SARs for 1990 through 1995.

By
Earl Weber
Columbia River Inter-Tribal Fish Commission
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Introduction

I compared the passage indices for spring/summer chinook (combined hatchery and wild) and hatchery steelhead along with the combined hatchery and wild SARs for spring chinook to determine if there was a relationship between the abundance of hatchery steelhead and the survival of spring/summer chinook. The purpose was to explore the feasibility of reducing the production hatchery steelhead as a means of increasing spring/summer chinook survival to levels consistent with ESA survival and recovery goals.

Methods

Passage indices (PIs) for spring/summer chinook (hatchery and wild combined) and hatchery steelhead were provided by Penelope Sanders, Fish Passage Center, for 1990 through 1995. Alan Byrne, Idaho Fish and Game, provided weekly SAR data for the same years for both wild and hatchery chinook tagged both above and at Lower Granite Dam. The data, from the PTAGIS data base, was pooled to maximize weekly sample sizes. The 1990 – 1995 period was chosen because prior to 1990 hatchery and wild steelhead were not distinguished in samples. In 1996 data plots showed that PIs did not provide the desired contrast early in the year when spring chinook are becoming increasingly abundant while hatchery steelhead are either not present or at least not abundant. 1997 and 1998 are more promising in that regard but cohorts are incomplete.

Correlation coefficients were calculated between hatchery steelhead abundance and spring/summer chinook SARs. In these calculations, and in the accompanying graphics, SARs in weeks in which less than 100 spring/summer chinook were PIT tagged were excluded. Weekly sample sizes appear below.

Year/ Week	1990	1991	1992	1993	1994	1995
04/01/90	7	7	37	0	1	45
04/08/90	291	183	314	10	1	3,564
04/15/90	1682	833	1155	170	607	17,370
04/22/90	1695	2643	909	999	4453	23,781
04/29/90	631	2192	1661	1955	785	35,383
05/06/90	1052	1994	869	1413	2339	19,109
05/13/90	337	895	313	1093	212	4,895
05/20/90	460	799	302	411	84	1,556
05/27/90	564	215	305	238	48	2,576
06/03/90	142	171	255	91	27	1,754
06/10/90	84	149	38	60	19	760
06/17/90	47	132	33	63	38	573
06/24/90	51	121	50	9	8	405
07/01/90	22	49	6	10	2	53
07/08/90	25	39	6	1	19	27
07/15/90	6	29	4	3	11	2
07/22/90	0	21	3	4	4	6
07/29/90	0	2	0	0	0	3
08/05/90	0	1	0	0	2	5
Total	7096	10475	6260	6530	8660	111867

Results

In contrasting annual plots of PIs and SARs for 1990 through 1995 (see attached graphics) no clear relationship between the abundance of hatchery steelhead and spring/summer chinook emerges. Low SARs at the onset of spring/summer chinook annual migrations are probably not due to hatchery steelhead whose migrations typically don't begin for two or three weeks. In some years low abundance of steelhead resulted in slight elevations in chinook SARs early in the migration season but in other years SARs were extremely low despite an apparent near absence of hatchery steelhead. In 1995, the year with by far the most tagged fish, chinook SARs increased as the abundance of hatchery steelhead rose and did not decline until the steelhead abundance dropped.

In half the years (1992, 1993 and 1994) a modest rise in chinook SARs was followed by decreases later on when steelhead abundance increased. But in other half (1990, 1991 and 1995) the chinook SARs increased as hatchery steelhead increased in abundance.

Also, under no conditions in any year did the SARs approach the two percent minimum goal established by PATH over the course of the season, regardless of steelhead abundance.

Correlation coefficients depict a similar situation. Correlation coefficients were weak and evenly divided between positive and negative. Correlation coefficients for each year appear on the graphics.

Discussion

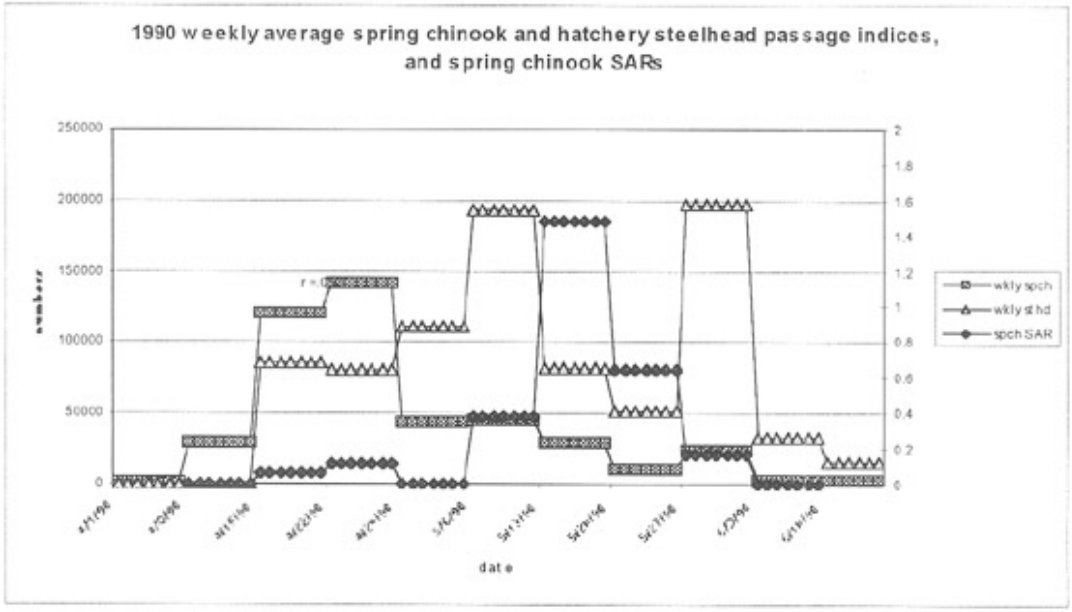
Visual observations provide no relationship between spring/summer chinook survival and hatchery steelhead abundance. There are periods of low steelhead abundance with extremely low chinook SARs as well as periods of relatively high steelhead abundance accompanied by relatively high chinook SARs. Correlation coefficients also indicate that the relationship between hatchery steelhead abundance and spring/summer chinook survival is poor. Correlation coefficients were weak and only half showed the negative relationship that would be expected if hatchery steelhead were the cause of poor chinook survival.

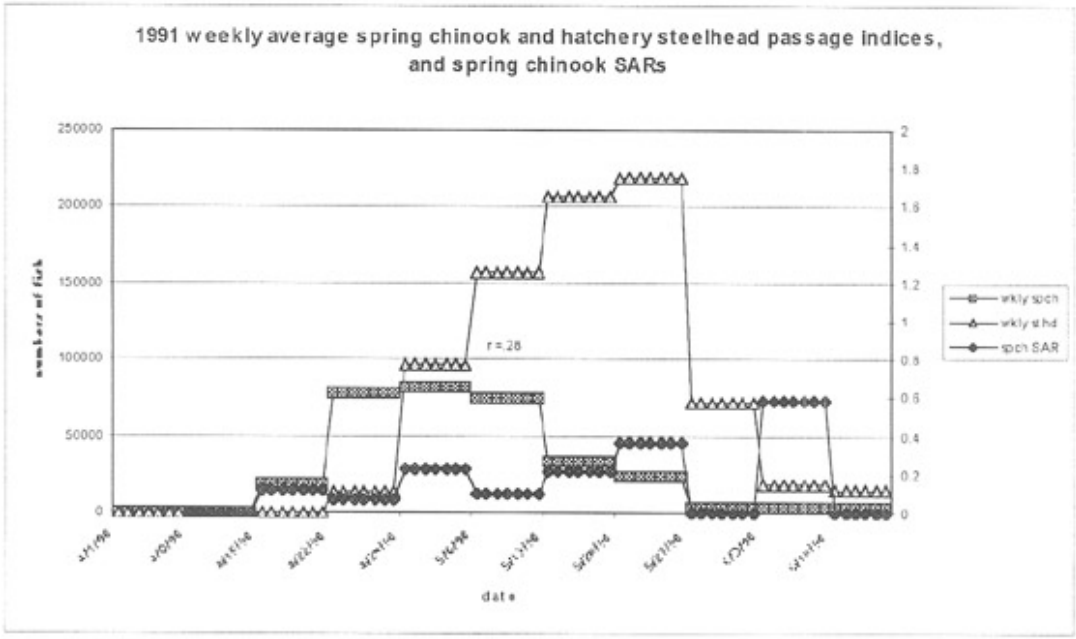
Regardless of steelhead abundance, transported spring/summer chinook survived at low rates. Only in three weeks within the six years did the SARs meet or exceed one percent. Note that these SARs are from Lower Granite Dam only where transport survival is typically the highest. Lower dams such as Lower Monumental and McNary, if added to this type of analysis, have historically show even lower SARs for chinook.

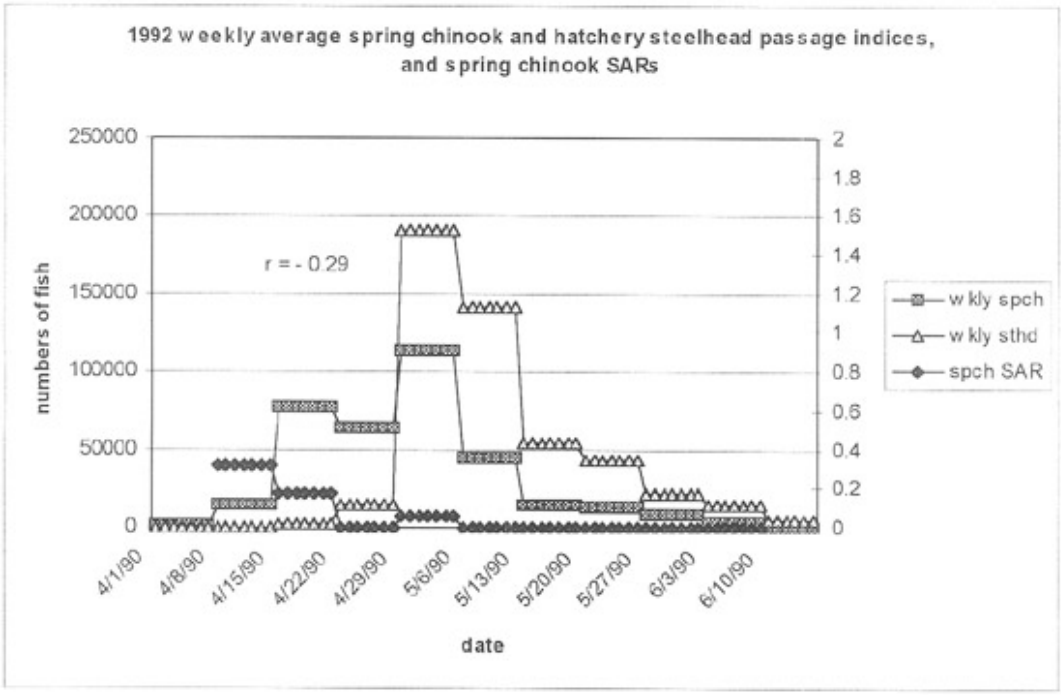
While it is certainly realistic to suspect that hatchery steelhead could consume, injure or at least stress the smaller spring/summer chinook, these results indicate that even the total elimination of the steelhead hatchery program would not result in the restoration of spring/summer chinook to the level of survival (approximately two percent), far less recovery (approximately four percent.) Thus while hatchery steelhead likely contribute to the poor performance of spring/summer chinook, there are clearly other contributing factors and these other factors appear to pose greater limitations to chinook survival and recovery than hatchery steelhead.

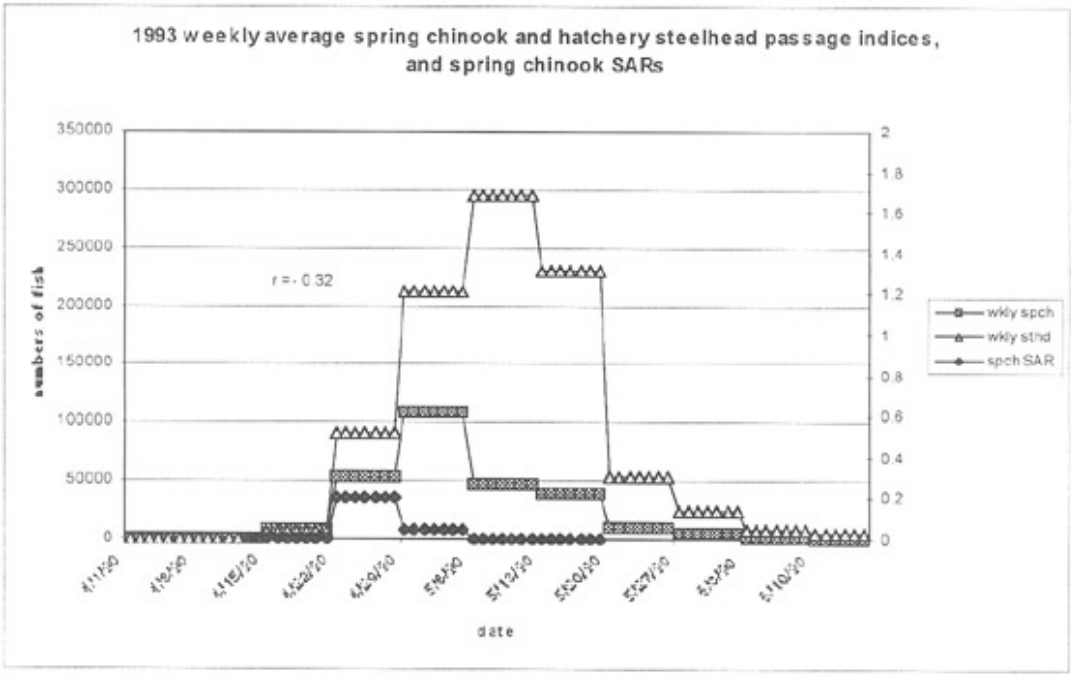
Finally, to the extent that hatchery steelhead lower chinook survival, they do so only within the context of the transportation program. In light of the evidence presented herein, the benefits of reducing or eliminating hatchery steelhead would not be anywhere near those required for survival or recovery of Snake River spring/summer chinook. At the same time, such actions would have the potential to severely inhibit the survival and recovery of Snake River steelhead.

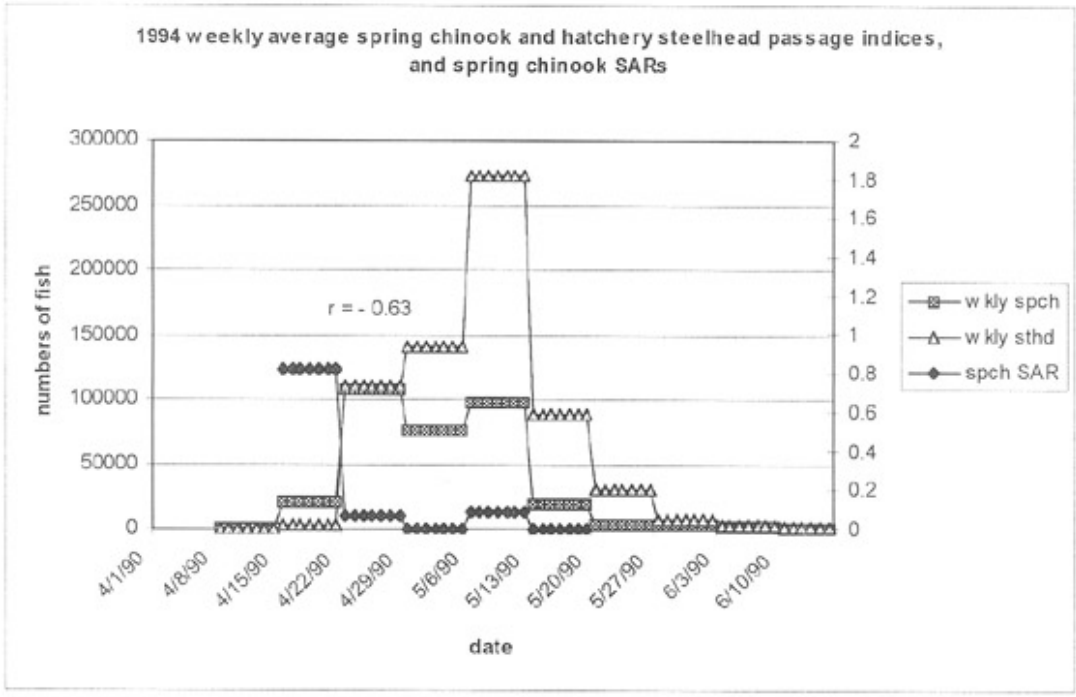
First set of graphics: spring chinook SARs versus numbers of hatchery steelhead and spring chinook, 1990 through 1995.

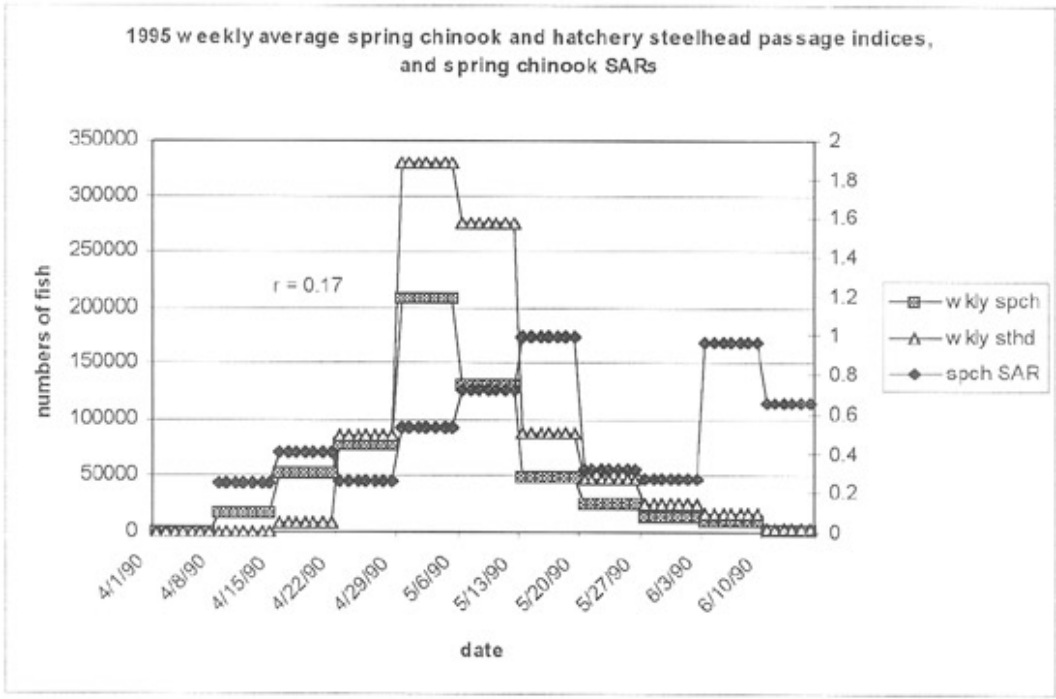




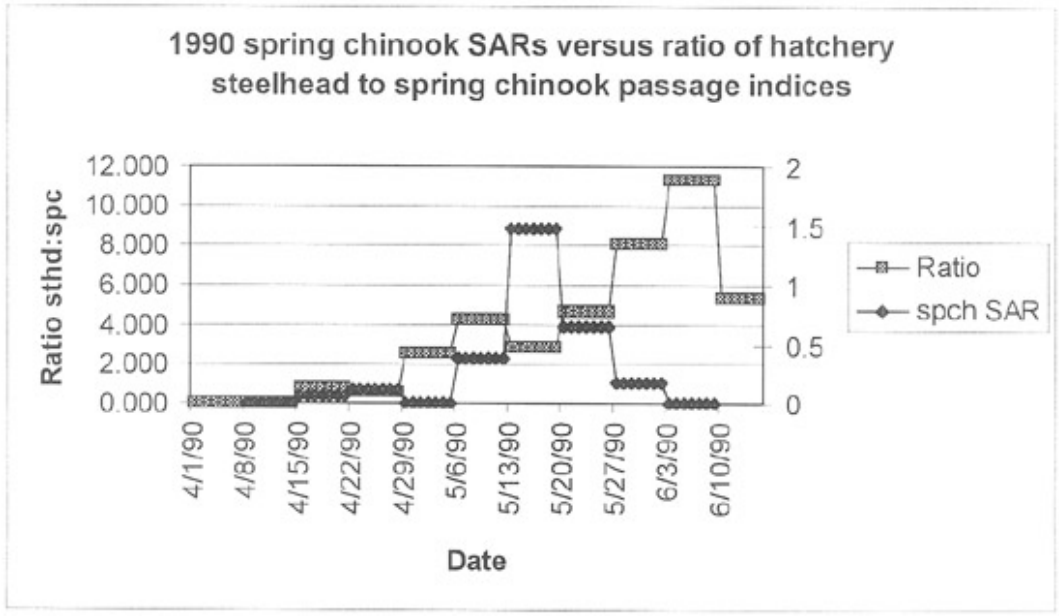

1992 weekly average spring chinook and hatchery steelhead passage indices, and spring chinook SARs
numbers of fish
250000
200000
150000
100000
50000
0
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
r = - 0.29
4/1/90
4/8/90
4/15/90
4/22/90
4/29/90
5/6/90
5/13/90
5/20/90
5/27/90
6/3/90
6/10/90
date
wkly spch
wkly sthd
spch SAR

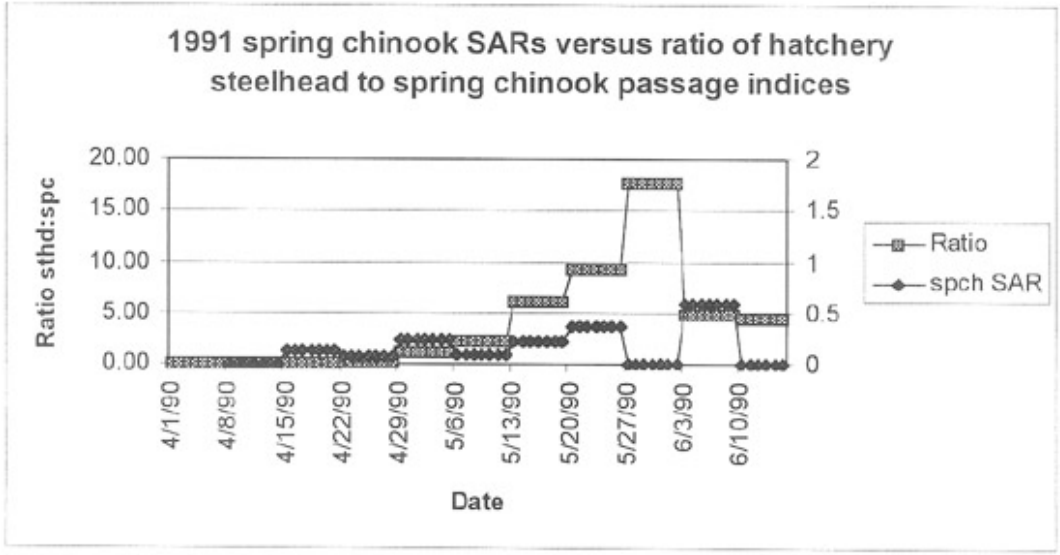

1993 weekly average spring chinook and hatchery steelhead passage indices, and spring chinook SARs
numbers of fish
350000
300000
250000
200000
150000
100000
50000
0
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
r = - 0.32
date
wkly spch
wkly sthd
spch SAR

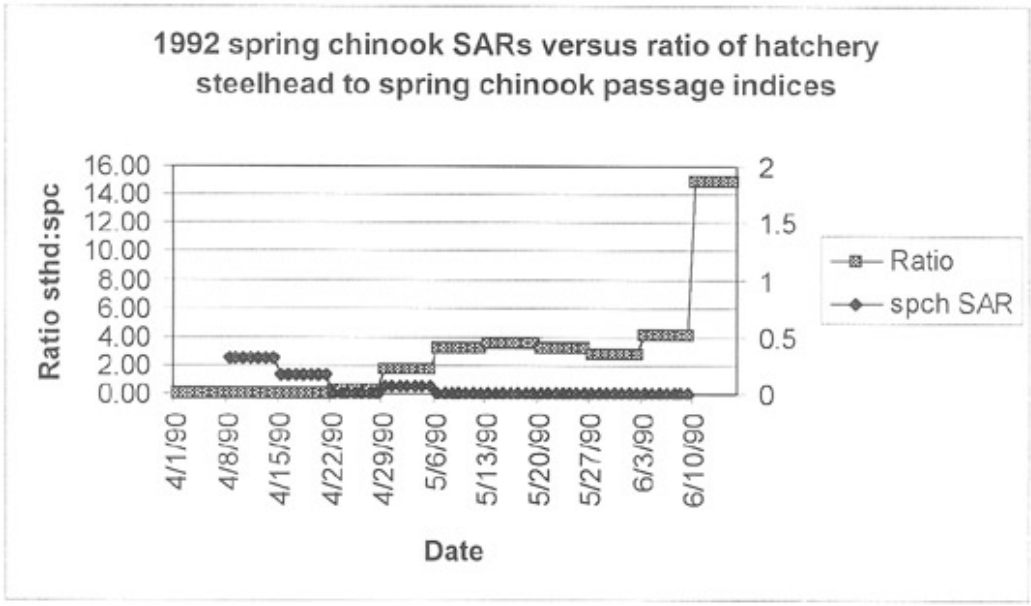

1994 weekly average spring chinook and hatchery steelhead passage indices, and spring chinook SARs
numbers of fish
300000
250000
200000
150000
100000
50000
0
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
r = - 0.63
wkly spch
wkly sthd
spch SAR
4/1/90
4/8/90
4/15/90
4/22/90
4/29/90
5/6/90
5/13/90
5/20/90
5/27/90
6/3/90
6/10/90
date

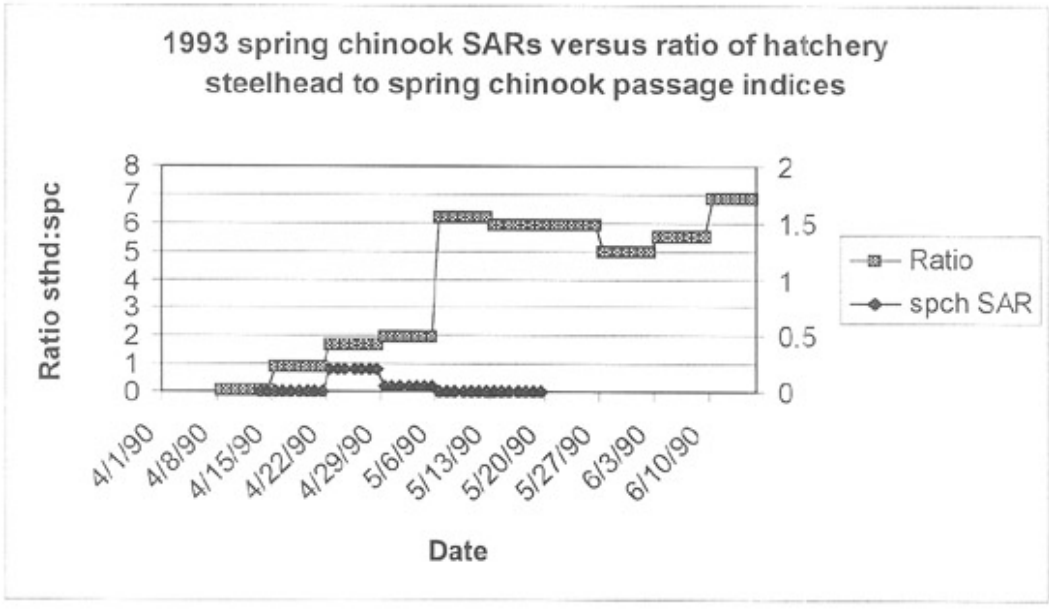

1995 weekly average spring chinook and hatchery steelhead passage indices, and spring chinook SARs
numbers of fish
350000
300000
250000
200000
150000
100000
50000
0
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
r = 0.17
wkly spch
wkly sthd
spch SAR
4/1/90
4/8/90
4/15/90
4/22/90
4/29/90
5/6/90
5/13/90
5/20/90
5/27/90
6/3/90
6/10/90
date

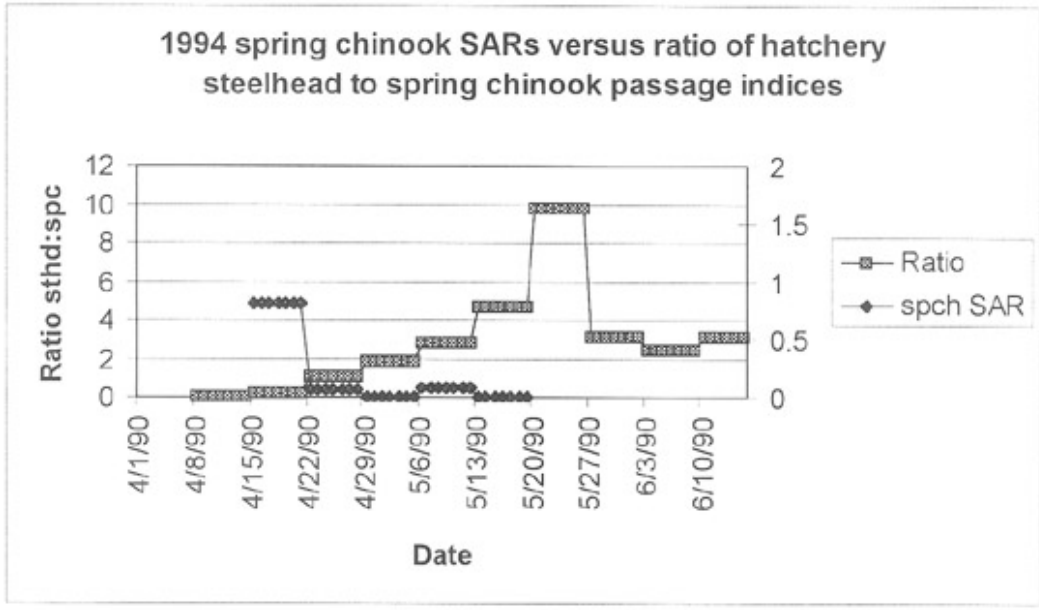
Second set of graphics: spring chinook SARs versus the ratio of hatchery steelhead to spring chinook, 1990 through 1995.

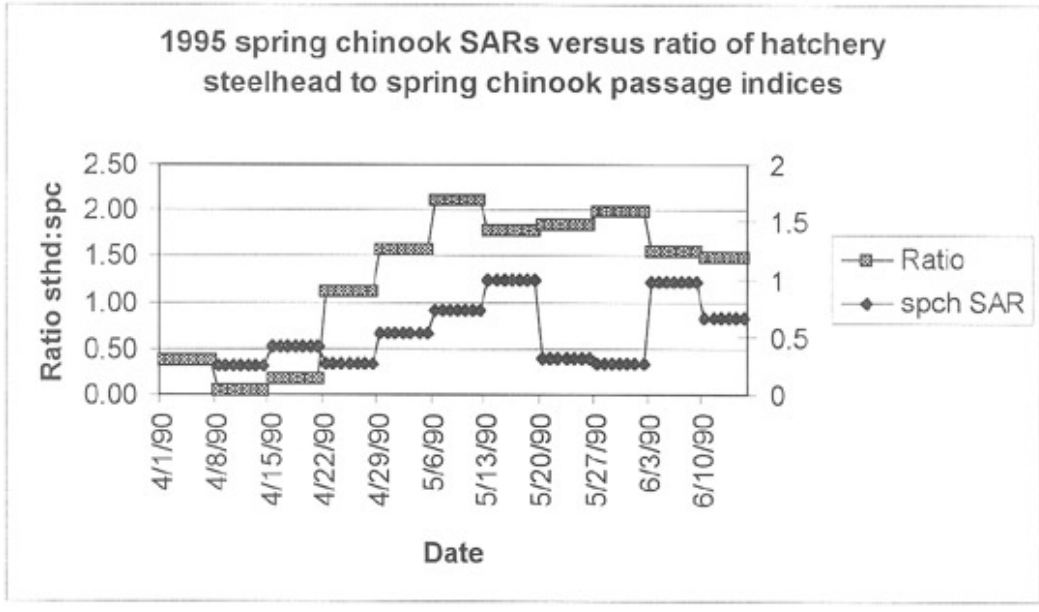





1992 spring chinook SARs versus ratio of hatchery steelhead to spring chinook passage indices
Ratio sthd:spc
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
2
1.5
1
0.5
0
4/1/90
4/8/90
4/15/90
4/22/90
4/29/90
5/6/90
5/13/90
5/20/90
5/27/90
6/3/90
6/10/90
Date
Ratio
spch SAR


1993 spring chinook SARs versus ratio of hatchery steelhead to spring chinook passage indices
Ratio sthd:spc
8
7
6
5
4
3
2
1
0
2
1.5
1
0.5
0
4/1/90
4/8/90
4/15/90
4/22/90
4/29/90
5/6/90
5/13/90
5/20/90
5/27/90
6/3/90
6/10/90
Date
Ratio
spch SAR


1994 spring chinook SARs versus ratio of hatchery steelhead to spring chinook passage indices
Ratio sthd:spc
12
10
8
6
4
2
0
2
1.5
1
0.5
0
4/1/90
4/8/90
4/15/90
4/22/90
4/29/90
5/6/90
5/13/90
5/20/90
5/27/90
6/3/90
6/10/90
Date
Ratio
spch SAR


1995 spring chinook SARs versus ratio of hatchery steelhead to spring chinook passage indices
Ratio sthd:spc
2.50
2.00
1.50
1.00
0.50
0.00
2
1.5
1
0.5
0
4/1/90
4/8/90
4/15/90
4/22/90
4/29/90
5/6/90
5/13/90
5/20/90
5/27/90
6/3/90
6/10/90
Date
Ratio
spch SAR