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Ref ID 90867

1997 FALL-RUN CHINOOK SALMON SPAWNING ESCAPEMENT IN THE YUBA RIVER

PREPARED FOR:

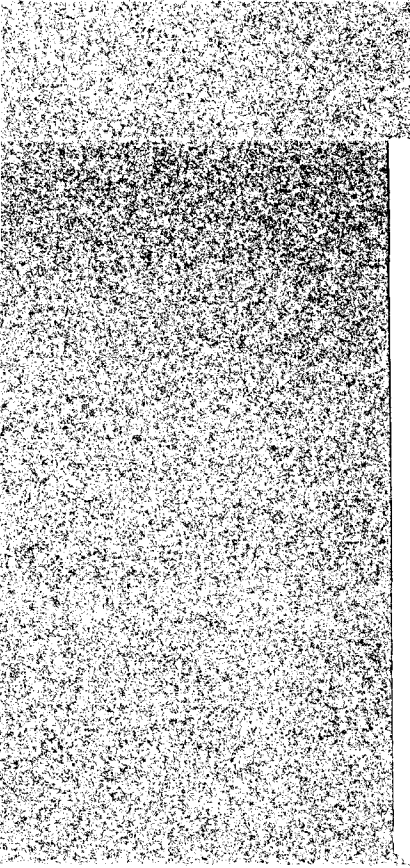
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JUNE 12, 1998



This document should be cited as:

Jones & Stokes Associates, Inc. 1998. 1997 fall-run chinook salmon spawning escapement in the Yuba River. June 12, 1998. (JSA 97-238.) Sacramento, CA. Prepared for the Yuba County Water Agency, Marysville, CA.

INTRODUCTION

From 1953 to 1989, the California Department of Fish and Game (DFG) conducted annual surveys of chinook salmon carcasses on the lower Yuba River to estimate fall-run chinook salmon (*Oncorhynchus tshawytscha*) spawning escapement (i.e., the number of salmon that escape being caught and return to spawn each year). Because of budget and personnel cuts, DFG suspended its surveys of Yuba River salmon carcasses in 1990. In response, Yuba County Water Agency (YCWA) retained Jones & Stokes Associates to conduct the 1991 surveys. In 1992, 1993, and 1994, annual carcass surveys were conducted jointly by DFG and Jones & Stokes Associates. Jones & Stokes Associates conducted carcass surveys from 1995 through 1997; DFG was unable to participate during those years.

This report presents the results of the 1997 surveys. The results of the 1991-1996 surveys were reported in previous documents (Jones & Stokes Associates 1992, 1994, 1995, 1996, 1997).

METHODS

Since the 1970s, DFG has used a modified form of the Schaefer mark-recovery method (Schaefer 1951) to estimate the number of chinook salmon spawning each year in the Yuba River. Weekly carcass surveys were conducted each year during the principal fall chinook salmon spawning season (mid-October through mid-December). During these surveys, field personnel counted fresh and decomposed carcasses, tagged fresh salmon carcasses and returned them to the river, and counted carcasses tagged on previous survey dates. Weekly estimates were computed based on the proportion of tagged carcasses recovered compared to the total number of tagged carcasses at large and the total number of tagged and untagged carcasses observed. Weekly estimates were summed to obtain the total spawning escapement estimate. The sampling methods are described in more detail in previous reports (Jones & Stokes Associates 1992, 1994).

The sampling methods used during the 1997 spawning escapement surveys on the Yuba River were generally consistent with those used by DFG during past surveys. DFG's practice has been to tag only adult (age 3 and older) carcasses and estimate the number of grilse (age 2) by multiplying the adult estimate by the ratio of fresh grilse carcasses to fresh adult carcasses. This assumes that grilse carcasses are recovered at a rate similar to that of adult carcasses. However, by tagging both adults and grilse in recent years, Jones & Stokes Associates found that grilse are often recovered at significantly lower rates than those of adults. Boydston (1994) also made this observation, suggesting that grilse are more easily overlooked and disappear faster from the stream because of their smaller size. To avoid this potential bias, both adults and grilse were tagged in 1997. Independent estimates of adults and grilse were also made for each reach because recovery rates can differ between reaches.

Salmon carcasses were classified as adults if they were greater than 25.5 inches long (fork length [FL]) or grilse if they were less than 25.5 inches long (FL). This cut-off length was determined from length-frequency data collected from spring-run chinook salmon that entered the

Feather River Hatchery in September 1997, and was used to separate adults from grilse during carcass surveys on the Feather River in fall 1997 (Brown pers. comm.).

Weekly carcass surveys were conducted in the Rose Bar reach (Rose Bar to Parks Bar), the Parks Bar reach (Parks Bar to Daguerre Point Dam), and the Daguerre Point reach (Daguerre Point Dam to the Highway 70 bridge in Marysville) (Figure 1) from October 7 to December 4, 1997. These reaches include nearly all of the spawning areas used by chinook salmon in the Yuba River; some fish may spawn between Rose Bar and Englebright Dam, although spawning gravels are relatively scarce in this reach. For many years, DFG did not survey the reach above Parks Bar. Instead, it assumed that 15.5% of the run spawned above Parks Bar; this percentage is the average percentage of total spawning escapement estimated for this reach from 1966-1971 (Konhoff pers. comm.). However, surveys in 1994 and 1996 revealed that 37% of the run spawned in the Rose Bar reach in those years.

RESULTS

River Conditions

Figures 2 and 3 present daily average Yuba River discharge and water temperatures during the 1997 chinook salmon spawning season. Yuba River flows below Englebright Dam (Smartville gage) were about 1,300 cubic feet per second (cfs) during the first half of October, 1,000 cfs from mid-October through mid-November, and 1,300 during the remainder of the season. Yuba River flows near Marysville (Marysville gage) averaged about 900 cfs during the first half of October and 600 cfs from mid-October through mid-November and then increased to 1,500 cfs by mid-December. Local storm runoff in early December resulted in a mean daily flow peak of over 3,000 cfs at the Marysville gage on December 7. Mean daily water temperatures at the Marysville gage were around 60°F in early October and declined to below 50°F by mid-December. Water visibility ranged from 1 to 10 feet during the spawning surveys.

Spawning Escapement

An estimated 25,778 chinook salmon (18,975 adults and 6,803 grilse) spawned in the Yuba River in fall 1997 (Table 1). The spreadsheets used to compute the 1997 spawning escapement estimates are presented in Tables A-1 through A-12 in Appendix A.

Spawning Timing

Weekly counts of fresh carcasses provide an approximation of the weekly distribution of spawning activity through the season (Figure 4). Weekly counts of fresh carcasses in the Rose Bar

and Parks Bar reaches indicate that spawning began in early October and reached a peak in late October. Downstream of Daguerre Point Dam, spawning activity had started by mid-October and peaked in early November. Spawning was nearly completed by early December.

Spawning Distribution

An estimated 29% of the run spawned in the Rose Bar reach, 37% of the run spawned in the Parks Bar reach, and 34% spawned in the Daguerre Point reach.

Run Composition

Adult male and female salmon constituted 47% and 53%, respectively, of the fresh adult carcasses observed during the 1997 surveys (Table 1). Grilse salmon constituted 26% of the total number of fresh carcasses. The sex of grilse could not be reliably determined in the field, but typically the majority of grilse are male.

Hatchery Fish

One coded-wire-tagged salmon was recovered from the Yuba River during the 1997 surveys and delivered to DFG for decoding.

Recovery Rates

Weekly recovery rates of tagged adult salmon carcasses (i.e., percent of tagged carcasses that were recovered) averaged 39% in the Rose Bar reach, 47% in the Parks Bar reach, and 38% in the Daguerre Point reach, with an overall recovery rate of 41% for all reaches. The recovery rates of tagged grilse averaged 31% in the Rose Bar reach, 33% in the Parks Bar reach, and 16% in the Daguerre Point reach, with an overall recovery rate of 27% for all reaches.

RECENT TRENDS IN ABUNDANCE

Chinook salmon spawning escapement in the lower Yuba River in 1996 and 1997 was nearly twice the historical average and has increased substantially since 1993 (Table 2 and Figure 5). Annual spawning escapement before and after construction of New Bullards Bar reservoir has ranged from 1,000 fish in 1957 to over 39,000 in 1982 but has consistently averaged about 13,000 fish. The

large spawning escapements in recent years raised the average to about 14,000 fish for the post-New Bullards Bar period (Table 2 and Figure 5).

Preliminary estimates of annual fall-run chinook salmon spawning escapement in the mainstem Sacramento River and its major tributaries (including the Yuba River) in recent years also indicate an overall increase in spawning escapement since the early 1990s (Figure 6). Ocean commercial and sport landings of Central Valley chinook salmon also increased in recent years (Figure 7). Because ocean harvest rates (i.e., the proportion of the total number of salmon that were caught in the ocean) have not changed substantially since the early 1990s and decreased somewhat in 1996 and 1997 (Figure 7), the increase in ocean landings and concurrent increase in spawning escapements in recent years indicates that there has been an overall increase in salmon abundance in the Central Valley since the early 1990s.

CITATIONS

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Personal Communications

Brown, J. Fishery biologist. California Department of Fish and Game, Rancho Cordova, CA. October 1997 - conversation regarding 1997 jack and adult length criteria.

Konnoff, D. L. Fishery biologist. California Department of Fish and Game, Rancho Cordova, CA. January 27, 1988 - memorandum to DFG files regarding 1987 Yuba River chinook salmon spawning stock estimate.

Table 1. 1997 Yuba River Chinook Salmon Spawning Escapement Estimates
by Reach and Age Class

Survey Reach	Adults	Grilse	Total
Rose Bar	6,194	1,231	7,425
Parks Bar	6,949	2,577	9,526
Daguerre	5,832	2,995	8,827
Total	18,975	6,803	25,778

Table 2. Annual Fall-Run Chinook Salmon Spawning Escapement
in the Yuba River during Pre- (1953-1971) and Post- (1972-Present)
New Bullards Bar Reservoir Periods

Year	Pre-Reservoir Escapement	Year	Post-Reservoir Escapement
53	6,000	72	9,258
54	5,000	73	24,119
55	2,000	74	17,809
56	5,000	75	5,641
57	1,000	76	3,779
58	8,000	77	8,722
59	10,000	78	7,416
60	20,000	79	12,430
61	9,000	80	12,406
62	34,000	81	14,025
63	37,000	82	39,367
64	35,000	83	14,256
65	10,000	84	9,965
66	8,000	85	13,066
67	23,500	86	19,406
68	7,000	87	18,510
69	5,230	88	8,501
70	13,830	89	9,837
71	5,650	90	--
		91	14,413
		92	6,361
		93	6,516
		94	10,691
		95	14,561
		96	27,520
		97	25,778
Average	12,906	Average	14,174

-- No carcass surveys conducted.

Sources: 1953-1966: Hallock n.d..

1967-1989: Mills and Fisher 1994.

1991-1996: Jones & Stokes Associates 1992, 1995, 1996, 1997.

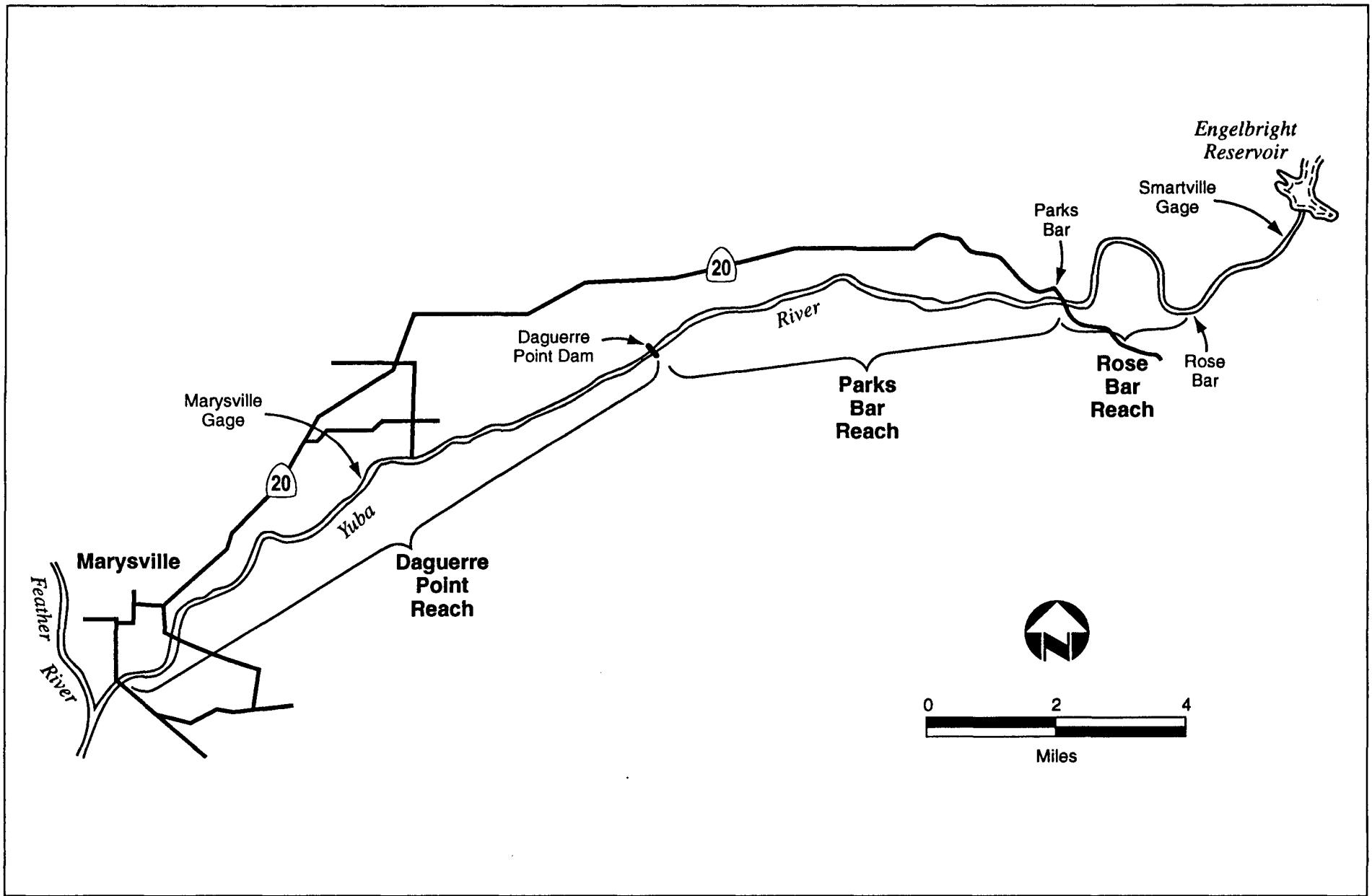


Figure 1
Lower Yuba River Chinook Salmon Spawning
Escapement Survey Reaches

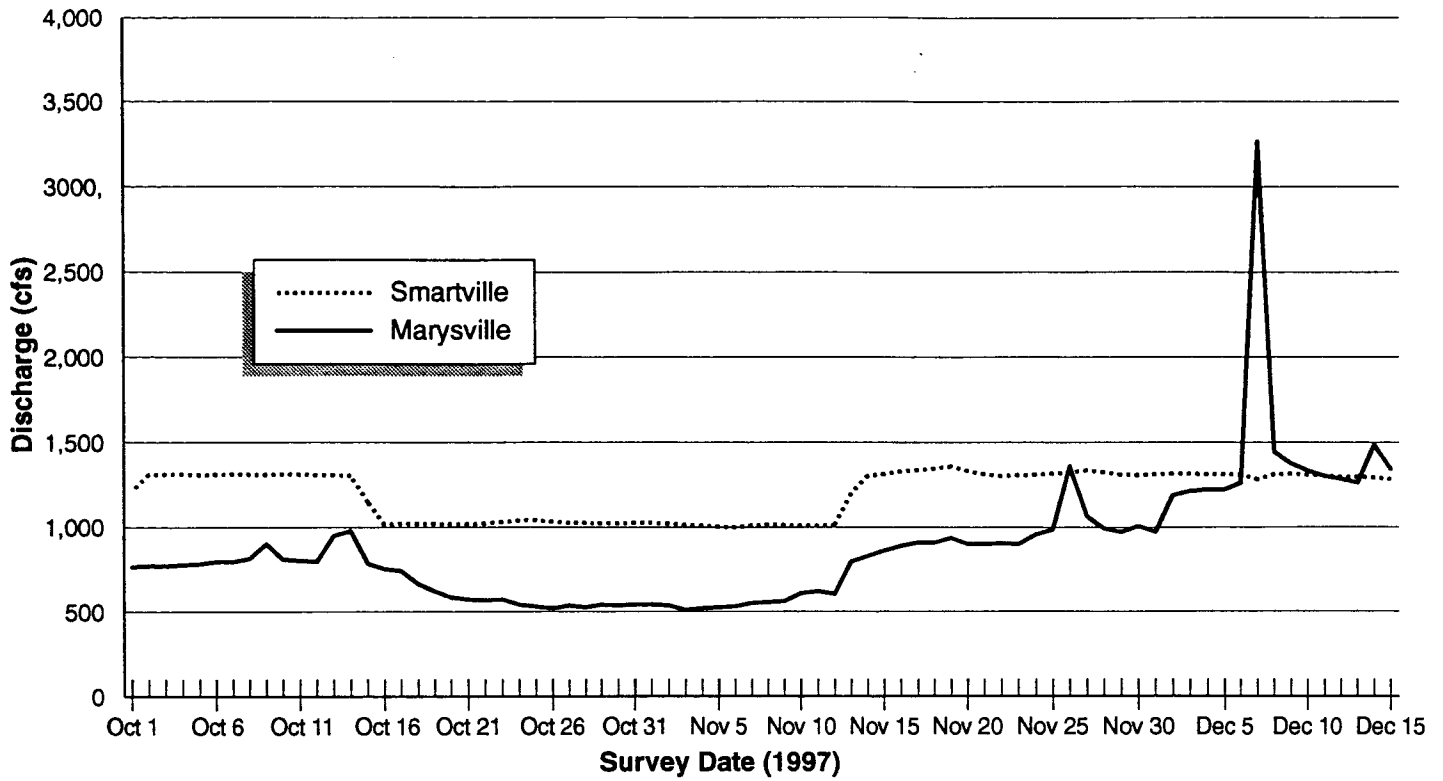


Figure 2
Daily Yuba River Flows Measured at the Smartville and Marysville Gages, October 1 - December 15, 1997

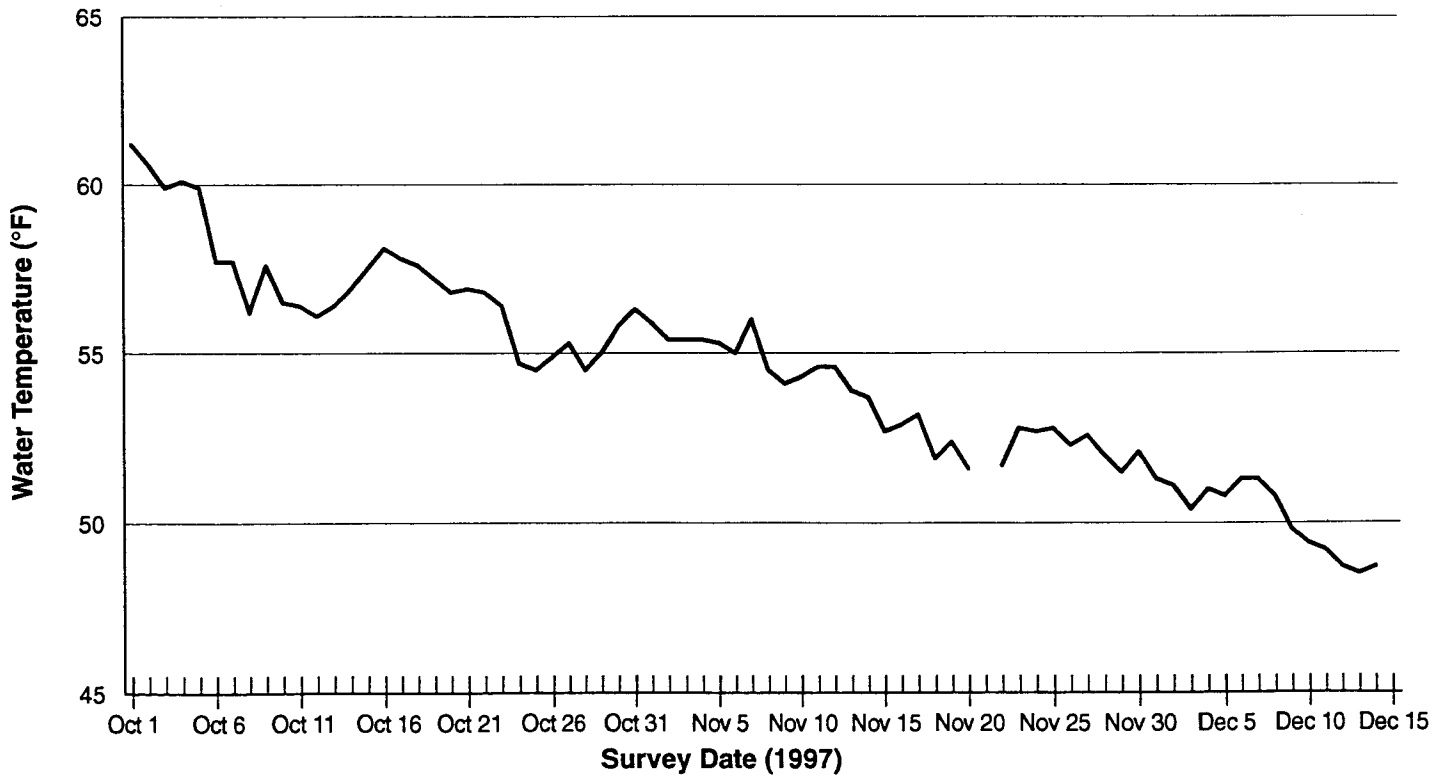


Figure 3
Mean Daily Yuba River Water Temperatures Measured at the Marysville Gage, October 1 - December 15, 1997



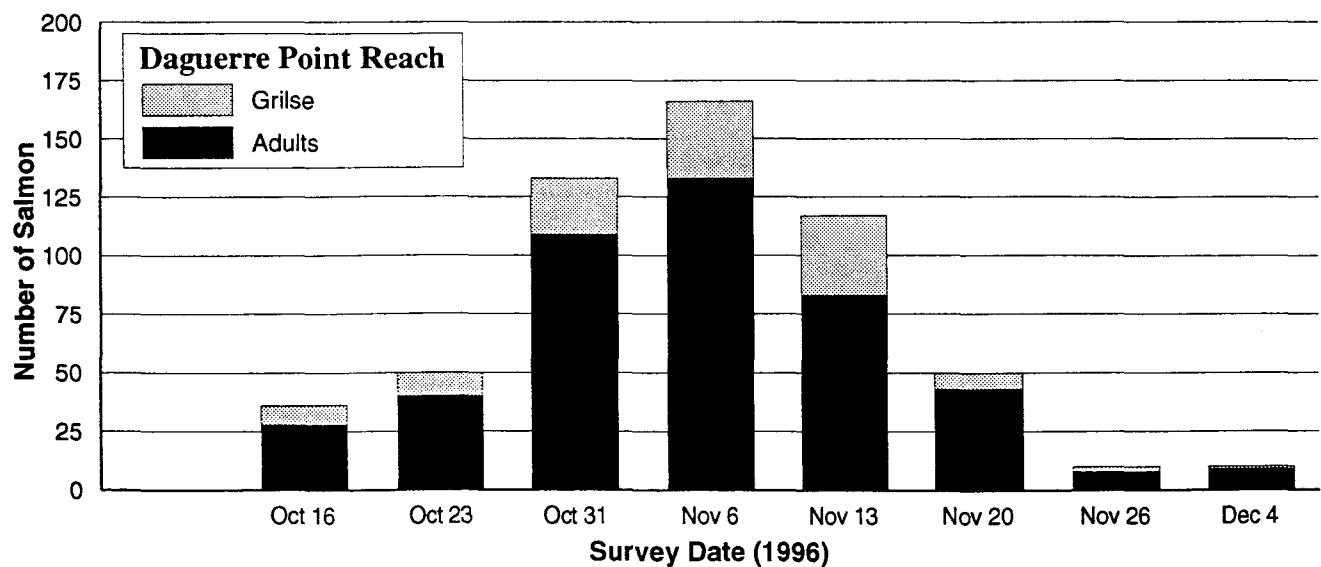
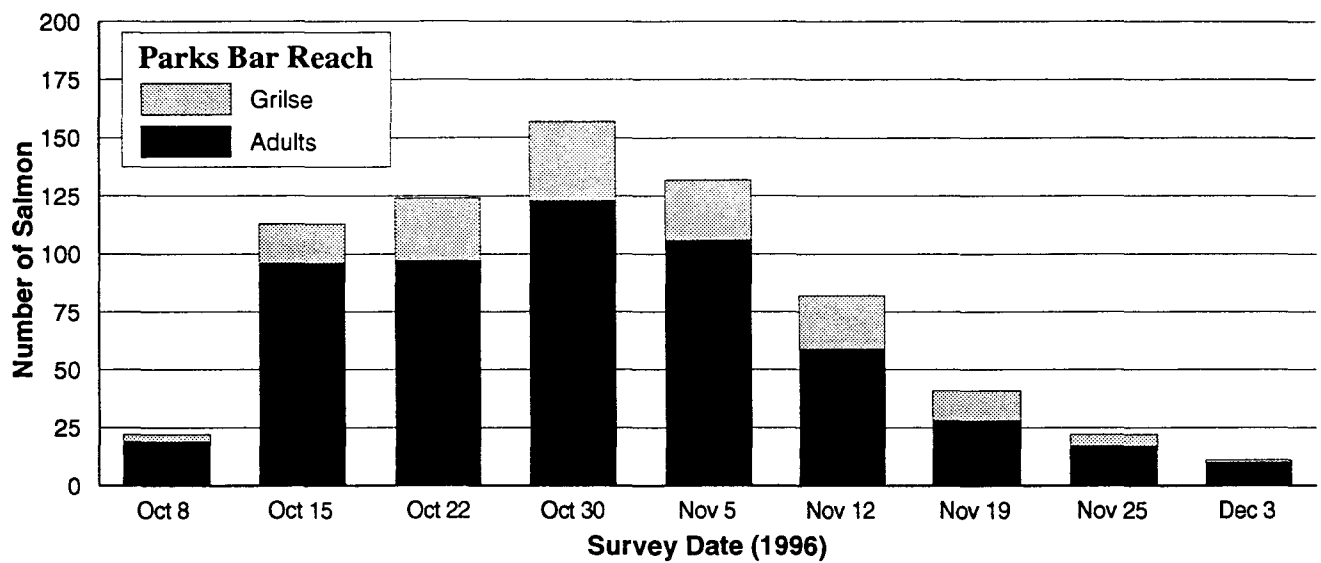
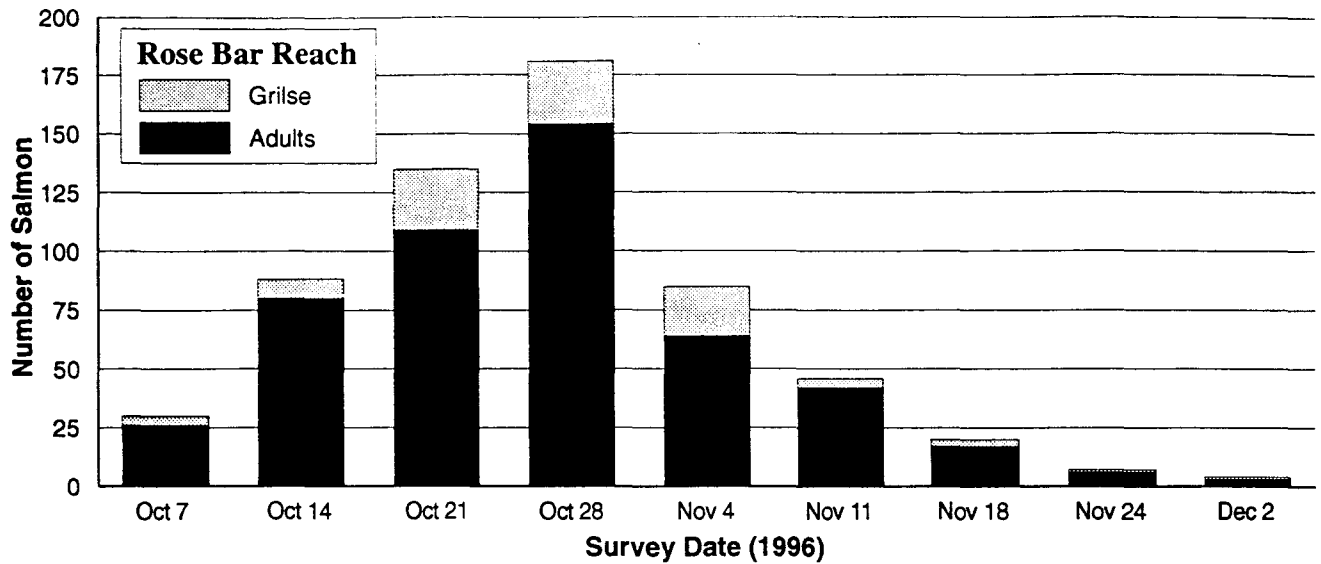
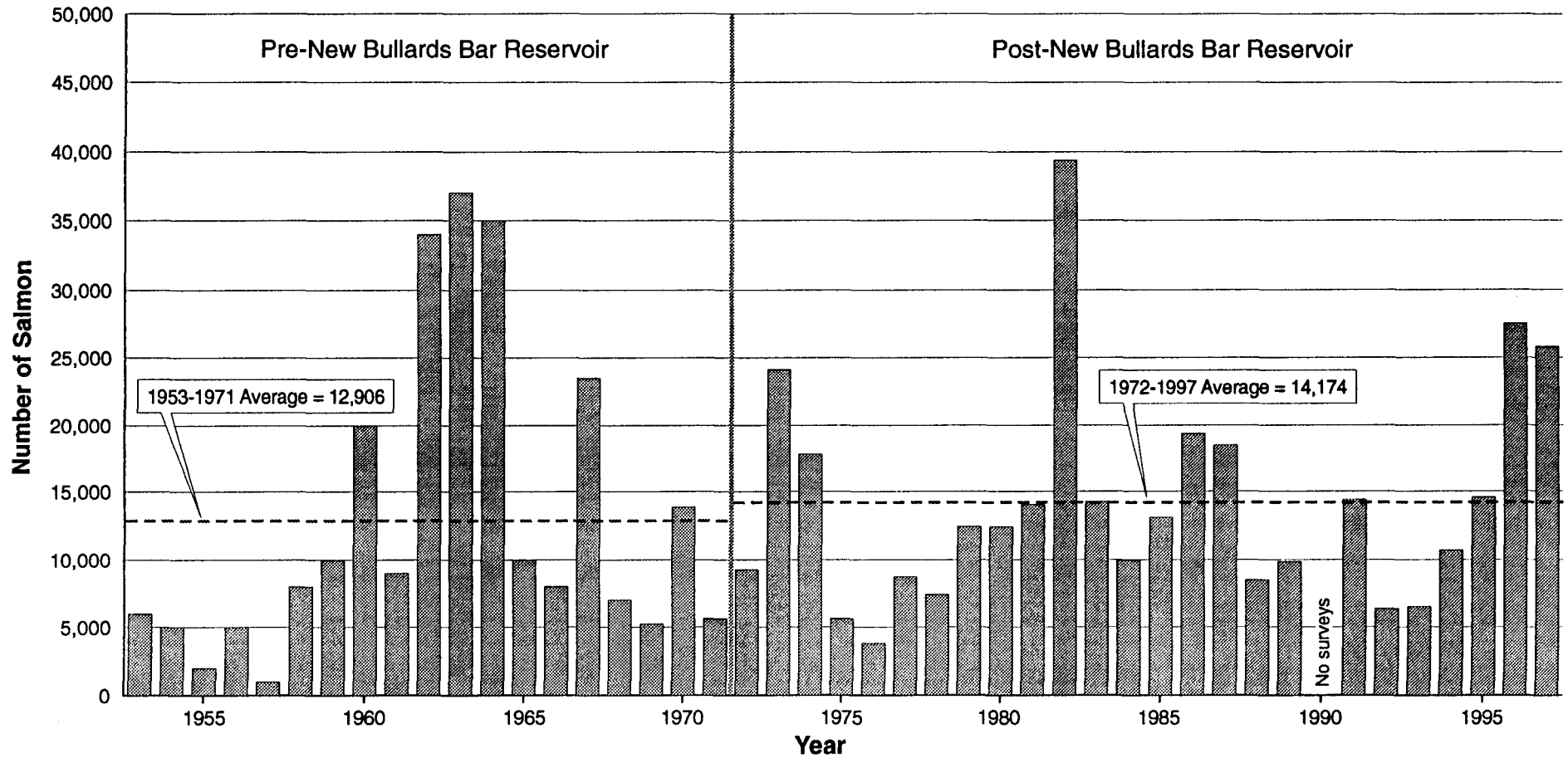


Figure 4
Weekly Counts of Fresh Salmon Carcasses
by Survey Reach, 1997



SOURCES:

1953-1966: Hallock (n.d.)

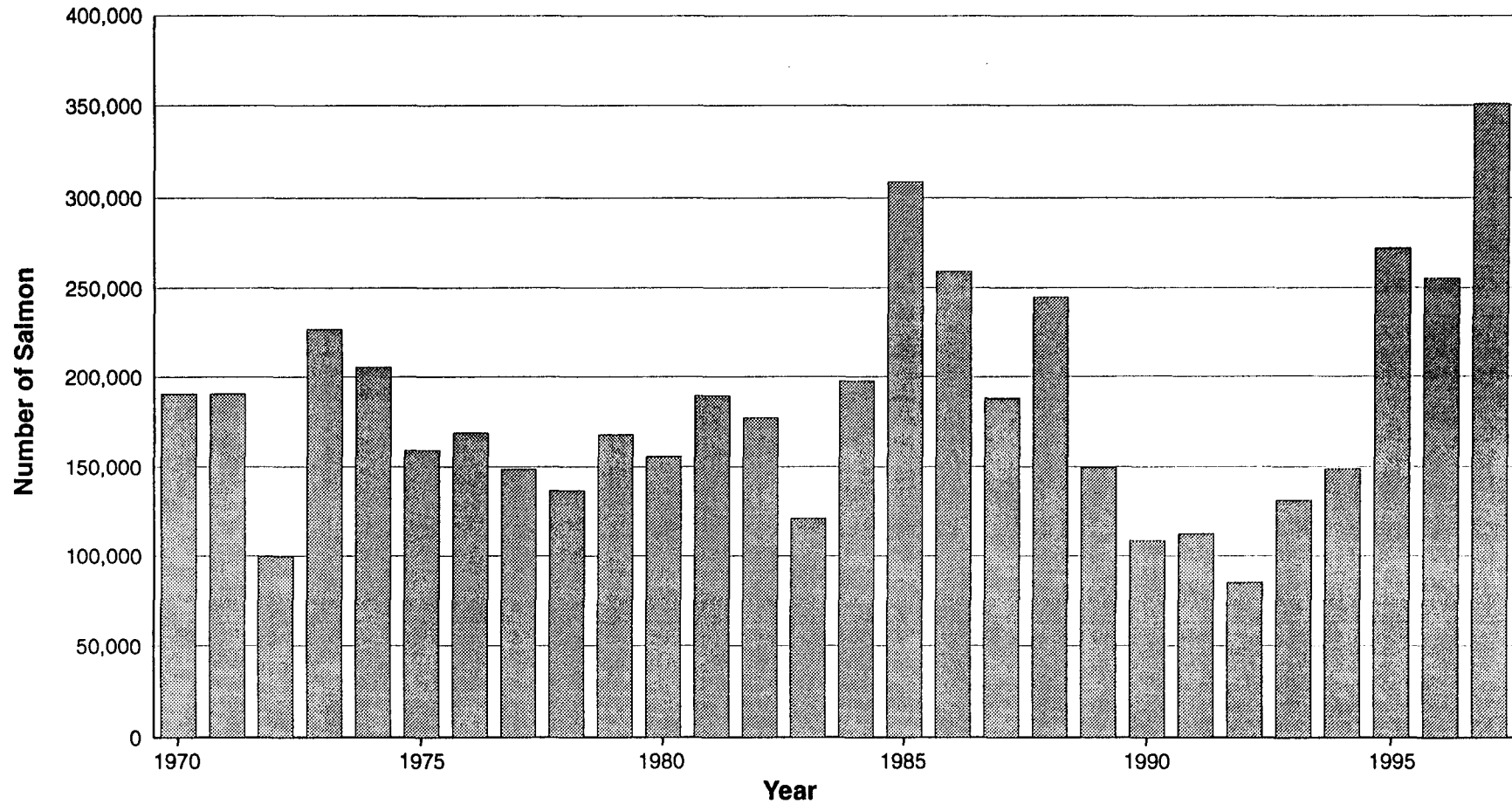
1967-1989: Mills and Fisher (1994)

1991-1995: Jones & Stokes Associates (1992, 1994, 1995, 1996, 1997).



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Figure 5
Annual Fall-Run Chinook Salmon Spawning Escapement in the Lower Yuba River during Pre- (1953-1971) and Post- (1972-1997) New Bullards Bar Reservoir Periods

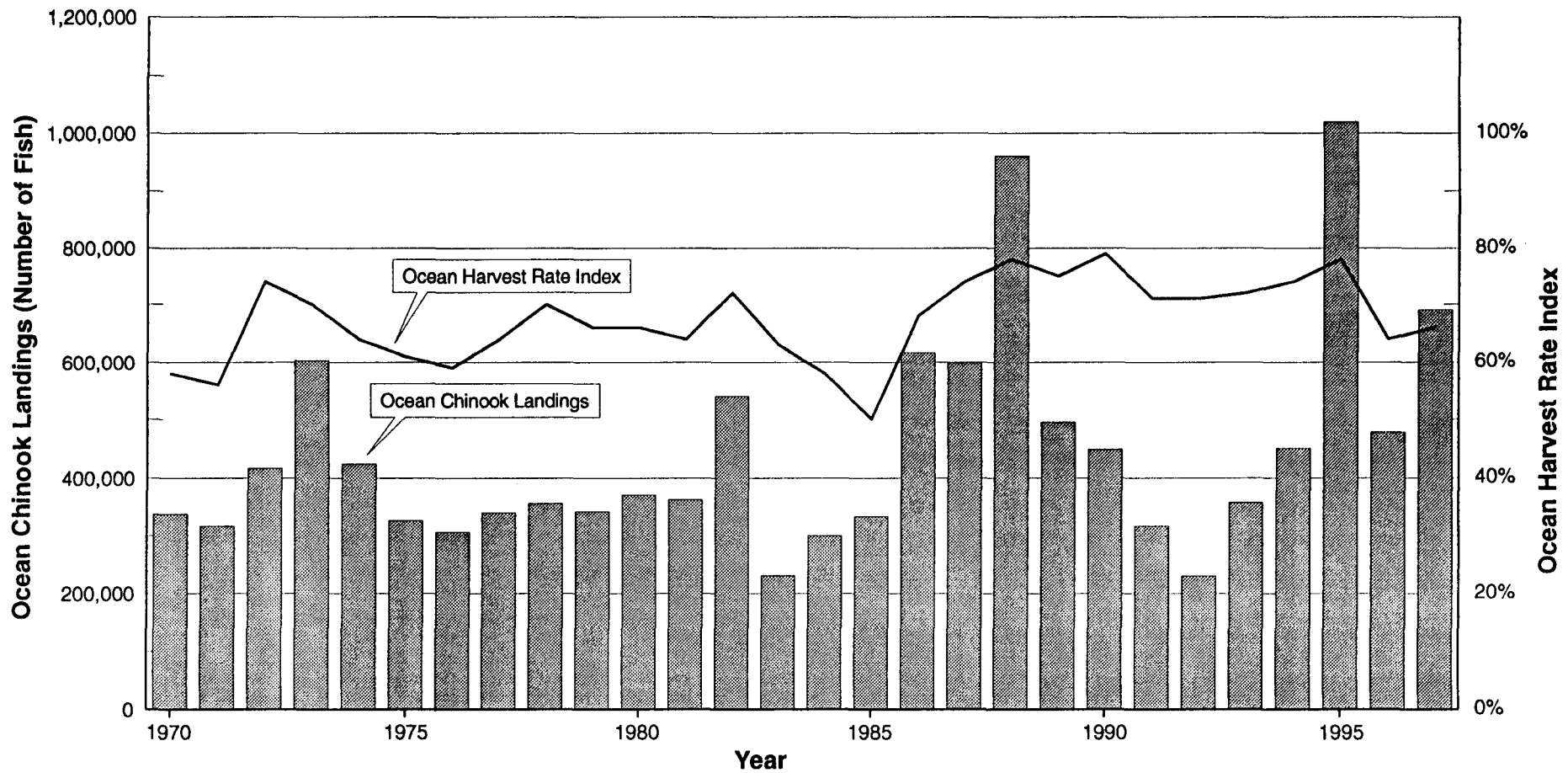


SOURCE:
Pacific Fishery Management Council (1998)



Jones & Stokes Associates, Inc.

Figure 6
Annual Hatchery and Natural Spawning Escapement
of Central Valley Fall-Run Chinook Salmon



SOURCE:
Pacific Fishery Management Council (1998)



Jones & Stokes Associates, Inc.

Figure 7
Annual Ocean Landings of Central Valley Chinook Salmon
(Total Commercial and Sport Landings South of Point Arena)
and Ocean Harvest Rate Index

**Appendix A. Weekly Recovery Data and Population
Estimates of Chinook Salmon, 1997**
