

V. ASSESSMENT OF ABUNDANCE ESTIMATES

California Chinook Estimates

Sacramento River

The preseason estimates of abundance for Sacramento River fall chinook salmon stock were based on recent years' landings and harvest rates with considerations given for brood year natural escapement, hatchery releases, and previous year jack returns. Results comparing projected with actual estimates for ocean chinook salmon fisheries south of Point Delgada and spawning escapement of Sacramento River fall chinook salmon are presented in Tables V-1 and V-2.

The total postseason estimate of combined ocean landings south of Point Delgada and spawning escapement of 1,058,100 was 78 percent greater than the preseason estimate of 595,400. The postseason total ocean landings of 840,700 chinook were 102 percent greater than the preseason estimate of 417,200; the 1986 spawning escapement of 217,400 was 22 percent greater than the preseason projection of 178,200. The troll and recreational harvest estimates for 1986 were 110 percent and 61 percent greater, respectively, than the preseason projections for those fisheries.

Klamath River

The overall area chinook quota of 123,200 for ocean fisheries between Point Delgada and Cape Blanco, in 1986, was based on 1986 stock projections and assumptions about ocean fishery impact rates inside and outside of the Point Delgada to Cape Blanco management area.

Preseason ocean stock abundance projections for Klamath River chinook were 213,000 age three fish and 53,000 age four fish. The preliminary postseason assessment of the actual stock sizes indicates that the age three projection was low by about 245,000 fish (115 percent) while the age four projection was very close to the postseason estimate (Table V-3).

Projections of ocean fishery impact rates were based on assumptions about age-specific harvest rates in outside area fisheries and relative abundance of Klamath River fall chinook within the primary ocean management zone. Preliminary postseason estimates of actual impacts indicate outside area fisheries had a greater impact than expected, while relative abundance of Klamath River chinook within the zone was lower than expected (Table V-3).

The 1986 goals for ocean fisheries approved by the KRSMG were to constrain harvest rates for Klamath River fall chinook to 0.35 for age four fish and 0.25 for age three fish. Preliminary postseason estimates of 1986 ocean harvest rates are 0.44 for age four fish and 0.22 for age three chinook. The major impact areas for age four fish were Fort Bragg, San Francisco, and Coos Bay, harvesting 76 percent of the 1982 brood year coded-wire tags. These also were the major impact areas for age three fish, harvesting 76 percent of the 1983 brood year coded-wire tags.

The 1986 coded-wire tag data indicate the first increase in age four ocean harvest rate for the stock since 1983 (Figure V-1).

Table V-1. Assessment of 1986 preseason stock estimates for California chinook.

Management Area	Key Chinook Stock(s)	Category	Estimate		Error/Deviation (Percent)
			Preseason	Postseason	
South of Pt. Delgada	Sacramento River Fall Run	Ocean Troll Harvest	343,300	721,400	-110
		Ocean Sport Harvest	<u>73,900</u>	<u>119,300</u>	- 61
	Ocean Total	417,200	840,700	-102	
	Spawning Escapements	<u>178,200</u>	<u>217,400</u>	- 22	
	Total	595,400	1,058,100	- 78	
Pt. Delgada-Cape Blanco ^{a/}	Klamath River Fall Run	Ocean Troll Harvest	91,200	96,400	- 6
		Ocean Sport Harvest	<u>32,000</u>	<u>25,600</u>	+20
	Ocean Total	123,200	122,000	+ 1	
	Inriver Escapements	97,200	186,300	- 92	

a/ Ocean fisheries in this zone were managed under quotas.

Table V-2. Expected and actual escapements of selected chinook stocks in 1986 (thousands of fish).^{a/}

Stock	Ocean Escapement			Spawning Escapement	
	Preseason	Postseason	Goal	Postseason	Goal
Sacramento River	178.2	-	-	217.4	122-180
Klamath River	97.2	186.3	115.1 ^{b/}	111.9 ^{c/}	97.5 ^{d/}
Lower River Hatchery Tules	173.9	147.5	90.6	45.8	37.4
Spring Creek Hatchery Tules	16.2	11.3	38.8	3.3	8.2 ^{e/}
Upriver Brights	286.1	316.2	-	113.2 ^{f/}	40.0

a/ Preliminary.

b/ Ocean escapement goal in the framework plan is to meet an average of 68,900 for the period 1983-1986. The harvest rate plan recommended by the KRSMG allows 35 percent of the potential adults from each cohort to escape the fisheries to spawn except that an escapement floor of 35,000 natural spawners is protected in all years. Ocean and inriver users negotiate various harvest rate combinations to determine allowable harvest levels.

c/ Chinook spawning in natural areas.

d/ Long-term framework plan goal for natural spawners.

e/ Hatchery escapement goal. The 1986 management goal was 5,000 adult equivalents.

f/ Escapement above McNary Dam. Liberalized sport fisheries in the Hanford Reach and a limited tribal commercial fishery above Priest Rapids Dam harvested approximately 5,000 and 1,000 adult upriver bright fall chinook, respectively.

Table V-3. Success of 1986 management of Klamath River fall-run chinook.

Area	Age	Preseason	Postseason	Percent of Deviation
<u>STOCK PROJECTION</u>				
Ocean	3	213,000	457,800 ^{a/}	-115
	4	53,000	57,200	- 8
<u>OCEAN HARVEST IMPACTS</u>				
Outside Area (Stock Harvest Rate)	3	12%	18% ^{a/}	- 50
	4	16%	36%	-125
Inside Area (Proportion of All Stocks)	All	28%	18%	+ 36

a/ Subject to revision as the cohort completes its fourth year in 1987.

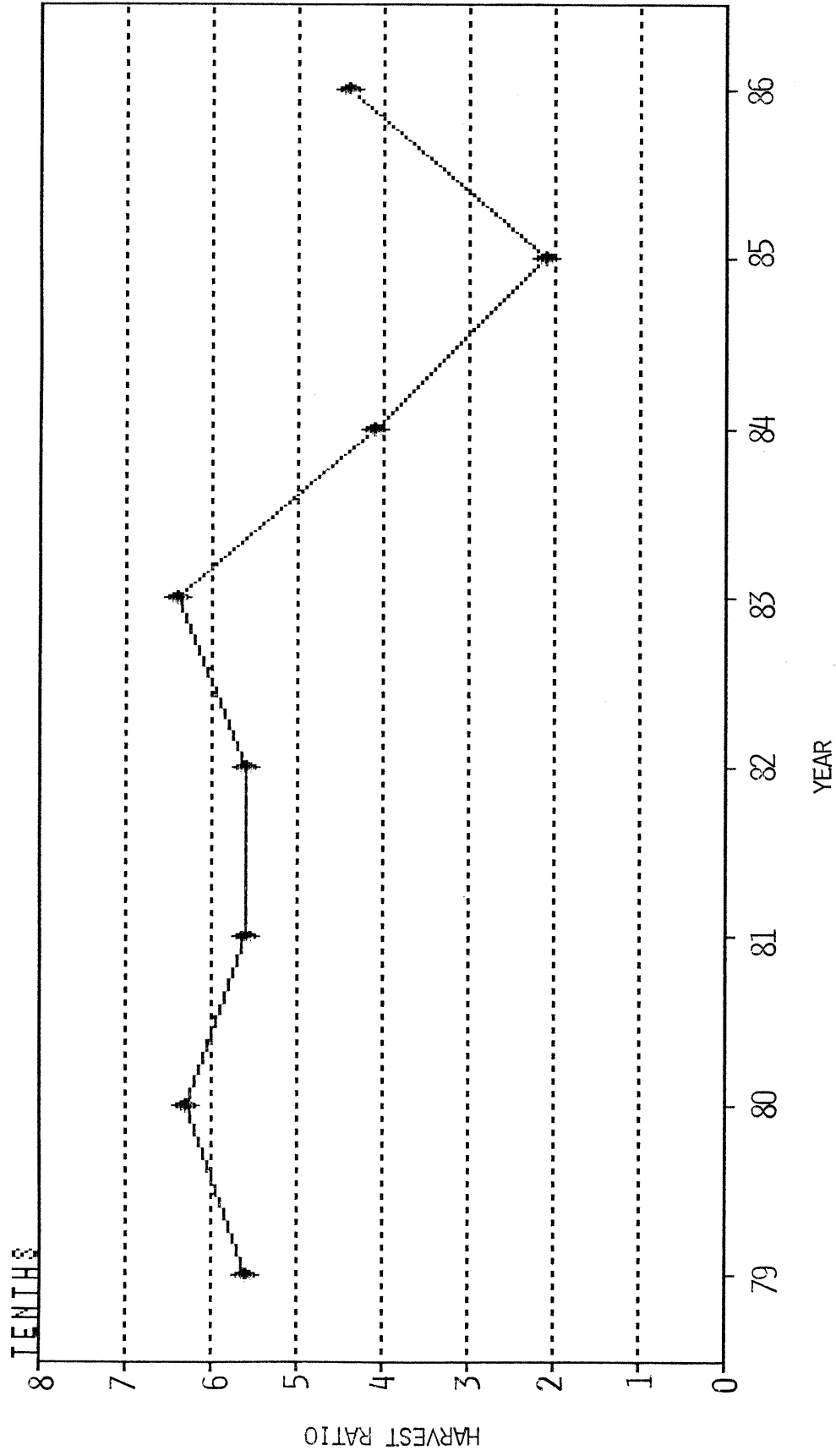


Figure V-1. Ocean harvest rates for age four Klamath River fall chinook, 1979-1986.

Oregon Coastal Chinook Estimates

Quantitative preseason projections of total run size for either north or south migrating chinook stocks are not made; however, ODFW develops generalized forecasts of a qualitative nature. These generalized forecasts are developed from a variety of population measurements. In 1985, ODFW began development of a comprehensive coastal chinook management plan. It is expected this plan will be completed in late 1987 or early 1988.

ODFW made a preseason inriver run size estimate of 66,000 adults for the Rogue River fall chinook stock in 1986 (see page II-14 of the Council's "Preseason Report I Stock Abundance Analysis for 1986 Ocean Salmon Fisheries," March 1986). A very preliminary postseason estimate by ODFW of inriver run size is not available at this time.

Columbia River Chinook Estimates

Preseason estimates of Columbia River fall chinook inriver abundance are based on relationships between successive age groups within a year class. Historic abundance data used in formulation of these relationships are derived by combining estimates of harvest and escapement and reconstructing the inriver runs originating from both hatchery and natural production sources. Four individual fall chinook stocks are classified according to destination above or below Bonneville Dam and known characteristic differences such as maturity rate, run timing, and ocean distribution. The data base used for inriver abundance estimation includes estimates of the return by age group for the years 1964 to 1985. Catches and escapements of individual stocks are estimated from coded-wire tag recoveries, dam counts based on skin color proportions, and other techniques. Age composition estimates are based on scale reading of fishery and escapement samples. This data base is the source for tables of annual inriver returns presented in Appendix B (Tables B-16 through B-19).

Preliminary estimates of abundance used in analyzing impacts of different regulatory options considered by the Council are presented in Table I-2 of the Council's "Preseason Report I Stock Abundance Analysis for 1986 Ocean Salmon Fisheries." The preseason estimates presented assume a constant, or average, ocean impact. Final preseason expectations of inriver abundance were dependent on adopted regulations and were based on the assumption that ocean fisheries would harvest their full quotas for chinook in the area north of Cape Falcon. No additional ocean escapement was calculated as a result of harvest quotas imposed on the Canadian troll fishery operating off Vancouver Island.

Preseason estimates of ocean escapement are compared with preliminary post-season estimates for critical stocks in Table V-2. For Columbia River tule, LRH, and SCH fall chinook stocks, preliminary postseason estimates are less than preseason estimates. The preseason estimate for the SCH stock (16,200), the stock most critical for determination of allowable harvest in ocean and inriver fisheries in 1986, was 43 percent greater than the postseason estimate (11,300). The preseason estimate for the LRH stock over estimated the inriver return by 18 percent. Considering that the non-treaty troll and recreational fishery chinook quotas for the ocean area north of Cape Falcon were not fully

harvested, the comparison of preseason and postseason estimates presents a conservative view of estimate error for these tule stocks. The preseason estimate for upriver bright fall chinook underestimated the inriver run size by 10 percent.

GSI methods applied to ocean fishery harvest formed a significant part of the preseason impact assessment for these chinook stocks. The allowable harvest of all stocks in 1986 fisheries was based on the expected contribution made by the Columbia River tule stocks which varied by fishery and area. The overall tule stock contribution expected in 1986 fisheries was 58 percent. Samples for GSI analysis were collected from the non-treaty May troll landings for the Columbia River and Grays Harbor catch areas. A preliminary estimate of tule stock contribution is 50 percent compared to preseason expected contribution of about 74 percent for those fisheries and areas. Preliminary GSI stock composition estimates for the May troll fishery indicate an unexpectedly high contribution made to the catch by California stocks. In summary, stock abundance of the most critical chinook stocks contributing to ocean fisheries in 1986 appears to have been over estimated. The impact of ocean fisheries on these stocks was also over estimated because Columbia River tule abundance was less than anticipated, chinook quotas north of Cape Falcon were not fully harvested, and unexpected contributions from other chinook stocks occurred.

OPI Area Coho Estimates

The SPDT made an initial evaluation of OPI area coho stock status and fishing impact using procedures that are described in the salmon framework plan, and which achieve the specified OCN coho 1986 rebuilding goal of 170,000 (Table V-4). Under the framework procedure (detailed in the Council's Preseason Report I Stock Abundance Analysis for 1986 Ocean Salmon Fisheries) OPI area public hatchery coho jack returns from the previous year are used to estimate an index of the current year OPI area adult coho abundance.

OPI is not a measure of absolute stock abundance for all adult coho available in the OPI area. It is, rather, primarily a measure of the annual abundance of adult three-year old coho salmon resulting from production in the Columbia River and Oregon coastal public hatcheries and streams although it does include catches from other stocks. The adult index itself is simply the combined number of adult coho that can be accounted for within the Council area south of Leadbetter Point, Washington. Specifically, it is the sum of (1) ocean sport and troll impacts (catch plus hooking mortalities) regardless of stock origin other than from private hatcheries; (2) Oregon coastal public hatchery returns and returns from off-station releases; (3) the Columbia River inriver gillnet catch, Bonneville Dam, and Willamette counts, hatchery returns to the Columbia River below Bonneville Dam; and (4) Klamath River hatchery returns. The index includes coho, which originate north of the OPI area, that are harvested within the OPI area fisheries. The index does not include a portion of OPI area origin coho stocks harvested in areas outside the OPI area. Also, the OCN coho escapement and private hatchery fish are not included in the index value. Accountability of OPI area stocks by the index will vary according to the relative abundance of OPI and non-OPI stocks, the ocean harvest rates and relative abundance of OPI stock components (e.g., OPI area public hatchery versus OCN stocks).

Table V-4. Adult escapement of natural spawning stocks of Oregon coastal coho (thousands of fish). Parentheses indicate rebuilding schedule goals.

Cycle	Year of Adult Return										
	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1	172			129 (172)			183.4 (175)			(200)	
2		108			57 (140)			165.5 ^{a/} (142.8) ^{b/}			(200)
3			73 (175)			200.1 (135)			(200)		

a/ Preliminary spawning estimate as of January 20, 1987 based on peak spawning adults per mile in index streams.

b/ Salmon framework plan rebuilding goal of 170,000 was modified by the Council by OY considerations.

The SPDT calculated the OPI area index to be 1,793,000 adults (Figure V-2), based on the adjusted estimate of hatchery jacks of 103,800 (Table V-5). An OPI escapement of 446,000 fish was required to achieve the Council's existing OCN escapement goal of 170,000, using procedures of the framework plan (Figure V-3). This evaluation suggested an allowable OPI harvest rate of .75 and implied the abundance of the OCN stock to be 680,000 adults (i.e., OCN escapement/1-harvest rate). The relatively large abundance indicated by the OPI estimate contrasted sharply with a realistic expectation for low OCN abundance and indicated that the underlying assumption of framework procedure (proportionality of OCN and OPI hatchery stocks) was invalid for 1986.

The SPDT reviewed a method for directly estimating OCN stock abundance developed by ODFW. The ODFW estimate of 285,600 OCN adults was accepted for use in assessing fishery impacts for the 1986 season.

Impact Assessment and Allowable Harvest

The WDF/NBS catch-regulation analysis model and a derivative microcomputer spreadsheet model were used to assess harvest impacts on OCN and other OPI and non-OPI stocks under regulatory alternatives proposed by the Council. Use of these impact assessment models requires abundance estimates for modeled stocks. Independent estimates of stock abundance are made for OPI and non-OPI stocks (e.g., Washington coastal and Puget Sound).

Major components of the OPI combined stock abundance for 1986 season fishery impact modeling were represented by estimates for the OPI (1,793,000), OCN (including Tenmile Lakes, 302,600), and Oregon coastal private hatchery (285,500) stocks. Individual OPI public hatchery stock components (Oregon coastal, Rogue-Klamath, Columbia River early and late) were estimated on the basis of relative hatchery smolt production.

Preseason Forecast - The SPDT estimated preseason that an OPI area harvest impact of 932,800 coho (ocean harvest, Columbia River Buoy 10 recreational fishery, and ocean troll fishing mortality) would result in an OCN ocean escapement of 142,800 fish.

Postseason Evaluation

The OPI area index of abundance (i.e., the OPI predictor) was estimated to be 2,356,000, 31 percent above the preseason estimate of 1,793,000. Overall, OPI area ocean coho fishery impacts and troll hooking mortality impacts were 996,100 fish, seven percent above the Council's preseason impact of 932,800 fish. Total estimated catch and escapement of coho south of Leadbetter Point was 3,054,200 fish, 37 percent above the preseason estimate of 2,229,800 fish (Table V-6). Both OPI public and private hatchery stocks were larger than predicted preseason.

OCN Coho - A preliminary estimate of OCN spawning escapement (through January 15) is 165,500 adults based on peak counts of adults observed in coastal index streams and expanded coastwide. A preliminary adjustment for private hatchery strays in coastal streams has been included in this estimate. This compares to the preseason expected ocean escapement of 142,800 adults. Total OCN stock

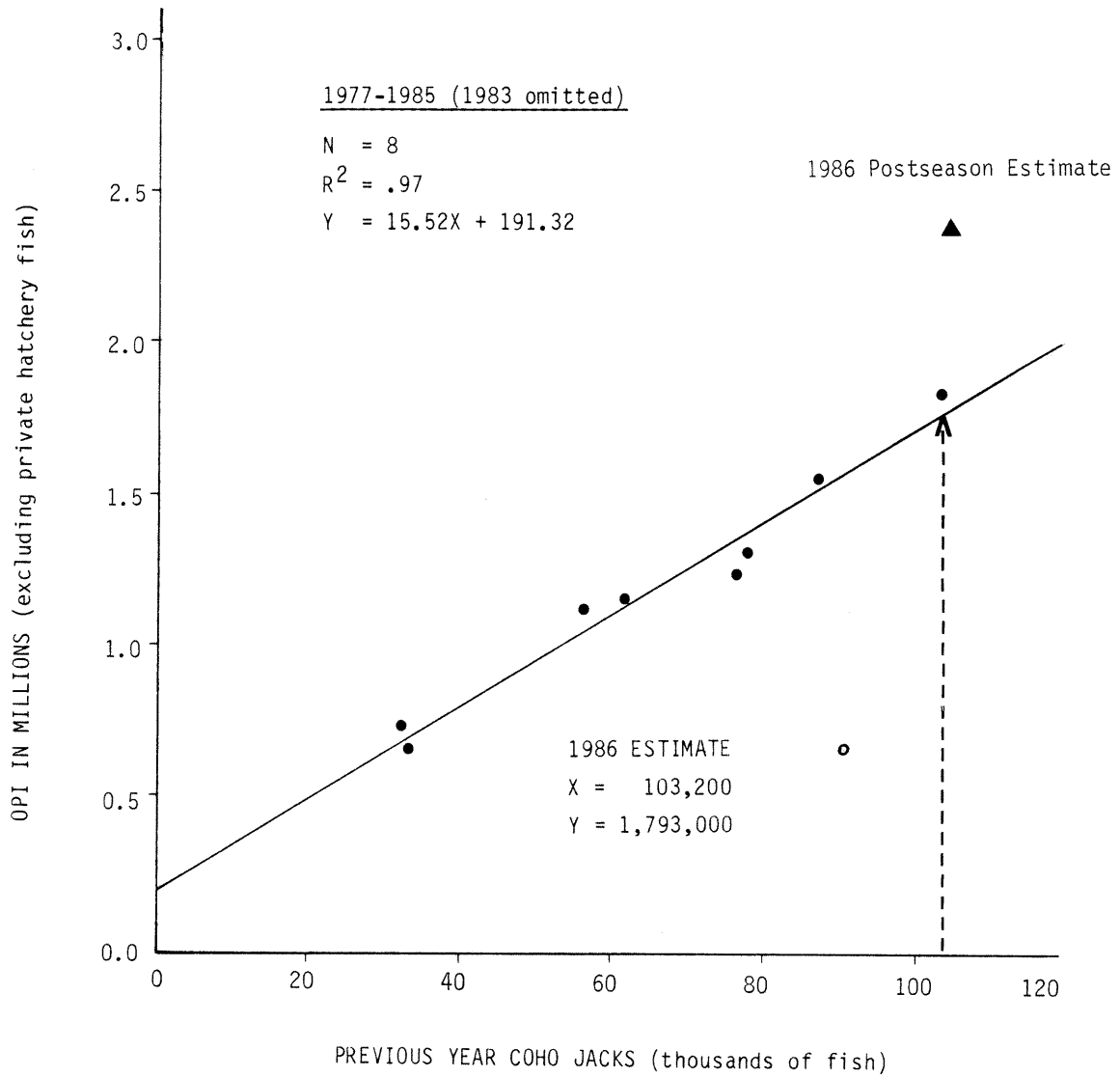


Figure V-2. Relationship of the Oregon production coho index to the Columbia River and Oregon-California coastal coho jack index for the base years 1977-1982 plus 1984-1985. OPI estimate for 1986 is shown by a dashed line.

Table V-5. Relationship of Columbia River and Oregon coastal coho jack index to the OPI for coho adults (thousands of fish), 1970-1986.

Year of Adult Production	Jacks ^{a/} of Previous Year			Adult Production Index ^{b/}	
	Columbia ^{c/}	Coastal ^{d/}	Total	Expected ^{e/}	Observed
1970	147.6	18.0	165.6	-	2,794.1
1971	171.7	6.6	178.3	-	3,658.1
1972	98.3	4.1	102.4	-	2,036.5
1973	82.9	5.7	88.6	-	1,994.6
1974	127.8	14.0	141.8	-	3,128.5
1975	72.8	1.2	74.0	-	1,768.2
1976	144.5	32.2	176.7	-	4,113.5
1977	46.1	9.3	55.4	1,034.8	1,122.6
1978	98.4	4.9	103.3	1,803.6	1,850.6
1979	74.6	12.5	87.1	1,543.6	1,567.8
1980	69.2	7.0	76.2	1,368.7	1,254.7
1981	51.9	9.3	61.2	1,127.9	1,170.8
1982	67.6	9.1	76.7	1,376.7	1,312.9
1983	81.4	9.0	90.4	1,593.4	666.7
1984 ^{f/}	32.0	3.3	35.3	676.9	668.1
1985 ^{f/}	23.4	8.8	32.2	615.9	730.3
1986 ^{f/}	89.3	14.5	103.8	1,793.0	2,356.0

a/ Components of jacks are ODFW and WDF hatcheries below Bonneville, Willamette, Winchester, and North Fork dam counts, and Oregon and California coastal hatchery counts.

b/ OPI includes: (1) ocean catches off public Columbia River, Oregon, and California; (2) Oregon and California coastal hatchery returns; (3) Winchester Dam counts; (4) gillnet catches; (5) Bonneville, Willamette, and North Fork dam counts; and (6) hatchery returns to the Columbia River below Bonneville Dam. The OPI has been adjusted to exclude the catch of coho originating from private hatcheries, 1978 to present.

c/ Columbia River jack counts were adjusted to account for the lower jack: adult ratio and higher survival observed for delayed smolt released affecting the 1979-1985 adult production.

d/ Includes estimated returns of jacks and adults to Oregon and California coastal areas from off-station hatchery releases. These estimated returns are based on the percentage of the total smolt releases liberated off-station and the actual return to the hatchery. The basic assumption is that the survival is identical to hatchery releases and the fish return to the liberation site in the same proportion.

e/ Expected values calculated using 1977-1986 data base, but excluding 1983 because of major El Nino influence. Expected OPI values have not yet been updated and a recalculation of the regression relationship made.

f/ Data are preliminary.

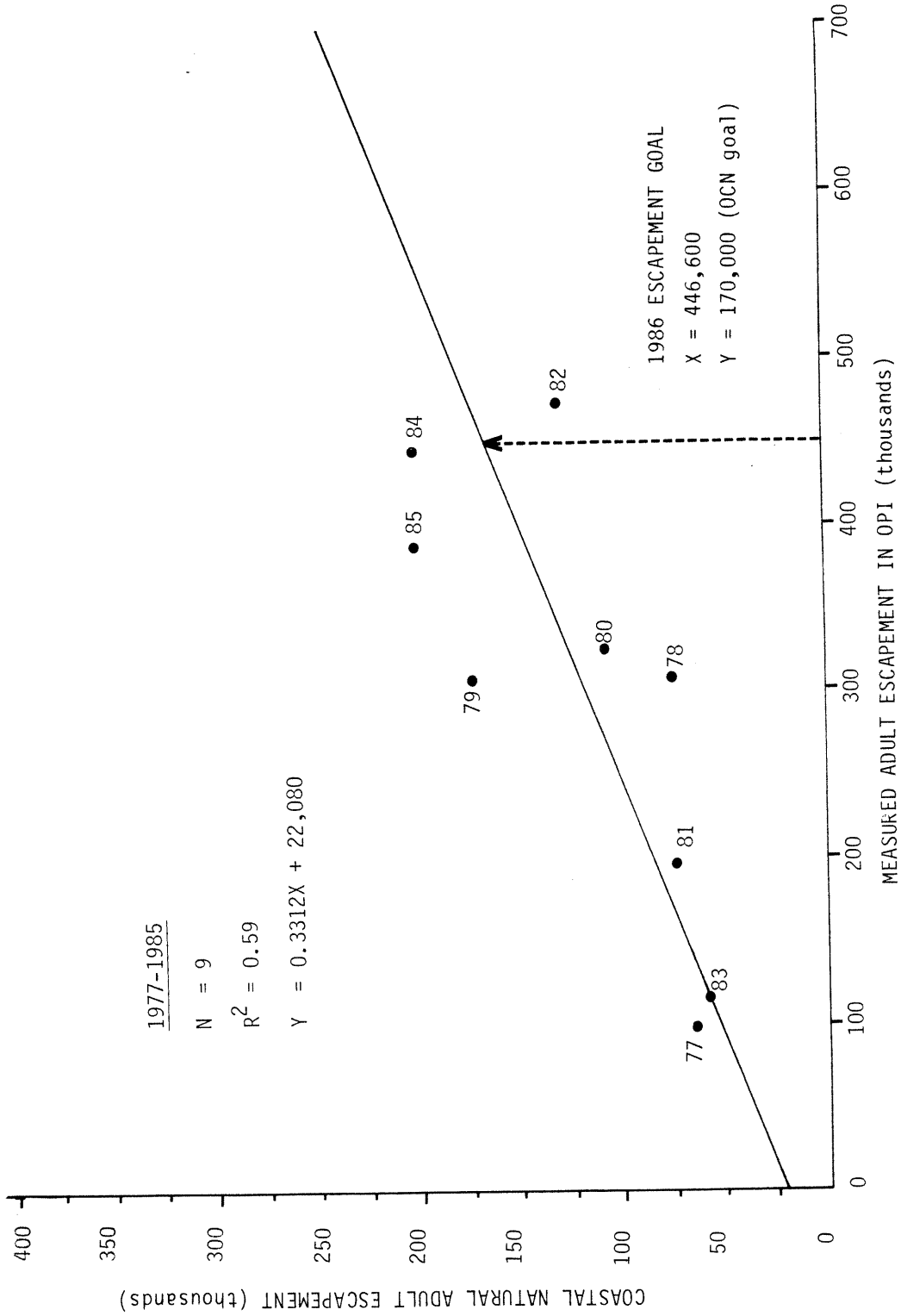


Figure V-3. Relationship between the natural adult coho escapement to Oregon coastal rivers and the measured escapement of adult coho to OPI area, 1977-1985.

Table V-6. OPI area abundance and ocean and Buoy 10 catch and impact estimates for 1986. All postseason data is preliminary.

Estimate	1986	
	Preseason	Postseason
<u>ABUNDANCE</u>		
OPI Area "Index"	1,793.0	2,384.7
Oregon Private Hatcheries		
OPI Ocean Catch	115.6 ^{a/}	88.2 ^{b/}
Stock Abundance	285.5	572.0
OCN		
Stock Size	285.6 ^{a/}	238.5
Spawning Escapement	142.8 ^{c/}	165.5 ^{d/}
OPI Area (All Components)	2,229.8 ^{e/}	3,054.2 ^{f/}
<u>CATCH AND IMPACTS</u>		
Columbia River Ocean Area	213.8	198.6
Columbia River Estuary (Buoy 10)	67.0 ^{g/}	120.4
South of Cape Falcon	652.0 (663.2) ^{h/}	677.3 ^{i/}
All OPI Catch and Impact	932.8 ^{j/} (944.0) ^{h/j/}	996.1 ^{i/j/}

a/ ODFW estimate.

b/ Does not include an additional 39,300 coho estimated (by coded-wire tag analysis) to have contributed to ocean fisheries north of the OPI area and Canada. Total ocean contribution estimated at 127,500.

c/ Expected spawning escapement under the Council-adopted regulations.

d/ ODFW estimate (preliminary) as of January 15, 1987 using peak index counts of adult spawners per mile for standard index streams and adjusted for private hatchery straying.

e/ Combined components of assessment include OPI public hatchery abundance (1,641,700), OCN stock size (285,600), Oregon coastal Tenmile Lakes natural (17,000), and Oregon coastal private hatchery (285,500).

f/ Preliminary OPI area ocean catch and index escapement (2,444,200); OCN coho spawning escapement (165,500); Oregon coastal private hatchery returns (444,500). Does not include Oregon coastal private hatchery estuary recreational harvest and straying in coastal streams, OCN river catch and Tenmile Lake escapement.

g/ As determined by the States of Oregon and Washington and affected treaty Indian tribes.

h/ Includes preseason troll coho hooking mortality estimate of 53,200. Inseason adjusted impact due to lower than expected troll coho impacts south of Cape Falcon.

i/ Includes postseason ODFW estimate of troll hooking mortality for south of Cape Falcon of 57,400.

j/ Includes all ocean harvest and troll hooking mortality impacts and Columbia River estuary (Buoy 10) recreational fishery.

abundance, estimated by applying the 1986 OPI ocean harvest rate to the estimated OCN escapement, is preliminarily estimated at 238,500 (minimal estimate), 16 percent below the preseason estimate of 285,600.

Private Hatchery - The postseason estimate of private hatchery contribution to west coast ocean fisheries of 127,500 was 10 percent greater than the preseason expectation of 115,600. An estimated 39,300 private hatchery coho were caught in ocean fisheries north of the OPI area, including Canadian fisheries. The postseason estimate of total Oregon private hatchery adult stock size, 572,000, is 100 percent greater than the preseason expected abundance, 285,000. A preliminary estimate of 6.7 percent survival (excluding strays to coastal rivers and Oregon coastal estuary recreational catches) represents a considerable increase over survival estimated for previous years of from 0.9 to 3.3 percent.

A comparison of preseason and postseason abundance estimates for major stocks of the OPI area are compared in Tables V-6 and V-7.

Washington Coastal and Puget Sound Coho Estimates

A variety of preseason abundance estimators are currently employed for Washington coastal and Puget Sound coho stocks (1986 Council Preseason Report II, Table I-3). For natural stocks, estimates are derived by: (1) parent spawner abundance expanded by average recruit per spawner, (2) the relationship between return of jacks and adults, and (3) summer stream flows. For hatchery stocks, predictions involve: (1) coded-wire tag based survival rates and (2) average adult return per smolt released.

Assessment of predictor performance for 1986, at this time, is difficult because of the preliminary, or unavailable, status of run-size information for many important stocks. Preseason estimates of ocean escapement for critical natural stocks are compared to available preliminary postseason estimates in Table V-8. Postseason estimates of ocean escapement for critical Washington coastal natural stocks, Quillayute fall, Hoh, and Queets, are all greater than preseason expectations. Quillayute fall coho escapement was more than twice the expected amount; Hoh coho escapement was 60 percent greater than the preseason expectation; Queets coho escapement was 21 percent greater than the preseason expectation. The SPDT intends to address performance of these and other predictors in a more complete manner when estimates are available.

Table V-7. Comparison of preseason projection and actual ocean contribution and return of Oregon private hatchery adult coho (thousands of fish), 1981-1986.

Year	Preseason Estimate			Postseason Estimate			Deviation of Projected from Actual Total Production	
	OPI Ocean Harvest ^{a/}	Return to Facility	Total Production	OPI Ocean Harvest ^{a/}	Non-OPI Ocean Harvest ^{e/}	Return to Facility ^{b/}		Total Production ^{e/}
1981	140.0	67.4	207.4	142.0		111.3	253.3	+ 22%
1982	193.3	180.6	373.9	122.1		176.9	299.0	- 20%
1983	103.0	103.0	206.0	110.3		133.1	243.4	+ 18%
1984	16.0	68.0	84.0 ^{c/}	35.0		114.9	149.9	+ 78%
1985	23.7	73.1	96.8	54.9 ^{d/}	20.5	309.7	385.1	+298%
1986 ^{f/}	115.6	169.9	285.5	88.2	39.3	444.5	572.0 ^{e/}	+100%

a/ Estimates based on coded-wire tag recoveries.

b/ In 1985 adult coho estimates were recalculated using biological jacks determined from scale samples rather than length frequency.

c/ Adjusted downward 29 percent for El Nino impact.

d/ In addition, an estimated 20,500 coho were harvested in 1985 north of Leadbetter Pt., including Canada.

e/ Includes the estimated ocean harvest north of Leadbetter Pt., including Canada, estimated from coded-wire tags. Total production does not include estuary sport harvest in Coos and Yaquina bays and private hatchery strays in coastal streams. These catches have not yet been calculated for earlier years.

f/ Preliminary estimates January 29, 1987.

Table V-8. Preseason expected and preliminary postseason estimates of escapement for critical coho stocks originating north of Cape Falcon in 1986 (thousands of fish).

Stock	Ocean Escapement		Spawning Escapement	
	Preseason	Postseason	Postseason	Goal
Skagit	43.5	NA	NA	30.0
Stillagamish	37.0	NA	NA	17.0
Quillayute Fall	6.1	15.9	10.6	6.3-15.8
Hoh	3.9	6.3	4.3	2.0-5.0
Queets	5.2	6.3	5.3	5.8-14.5
Grays Harbor	51.6	NA	NA	35.4