Agendum 10

Ocean Stock Size Projections and Appropriate Harvest Levels for Klamath River Fall Chinook, 1998 Season[1]

by

Klamath River Technical Advisory Team

SUMMARY

Ocean stock size projections for Klamath River fall chinook salmon are 88,000 and 36,800 for age-3 and age-4 fish, respectively. The age-3 projection is approximately 78 percent of the comparative 1997 preseason projection (112,300). The age-4 projection is 85 percent of the comparative 1997 preseason projection (43,100). The preliminary 1997 post-season estimates of age-3 and age-4 Klamath fall chinook were 98,000 and 50,200, respectively. Under the current Pacific Fishery Management Council (PFMC) Framework Plan (Amendment 9), an average of 33 to 34 percent of each cohort, but no less than 35,000 fish for any year, are allowed to escape the fisheries to spawn in natural areas, with the remainder available for harvest.

In the absence of ocean and river fisheries in 1998, the stock strength predictions will produce a 1998 spawning population of 69,600 adult fish, 49,400 of which will spawn in natural areas. Harvest levels (ocean and river combined), under the 1996 allocation regime ("full fishing"), that provide a 33 to 34 percent long term escapement rate would produce a spawning population of 26,900 adult fish, of which 19,100 would spawn in natural areas.

[1] Prepared 24 February 1998.

INTRODUCTION

This report presents ocean stock size projections for Klamath River fall-run chinook in 1998. The current Framework Plan of the PFMC specifies an average escapement rate for Klamath River fall chinook that will spawn in natural areas of between 33 and 34 percent across all broods, but no less than a minimum escapement of 35,000 naturally spawning adult fish. Naturally spawning adult fish are defined as age-3 or older fall chinook spawning outside of the hatchery environment regardless of their origin. Appropriate ocean and river harvest levels of Klamath River fall chinook are determined from the Klamath River Technical Advisory Team's (KRTAT) Harvest Rate Model (HRM) using age-specific stock abundance projections (KRTAT, 1986).

DATA AND ANALYTICAL METHODS

Klamath River fall chinook contribute to ocean and river fisheries primarily as age-3 and age-4 fish and, secondarily, as age-2 and age-5 fish. Stock abundance predictions are developed for all adult age classes (age-3, -4, and -5) in this report.

Age-3 Fish

Regression analysis with the y-intercept forced through zero was used for the age-3 ocean stock size projection. This model best represents biological reality, in that an age-2 river run size of zero will predict an age-3 ocean population of zero. This procedure is consistent with recommendations of the PFMC Salmon Technical Team and the Scientific and Statistical Committee. The regression was based on ocean stock size estimates of age-3 fish during 1982 through 1996 (brood years 1979 through 1993) regressed on river run size estimates of age-2 fish the year before (Table 1 and Figure 1).

Age-3 stock sizes have been projected pre-season since 1985 using similar methods to that described above. In 1997, the age-3 prediction was overestimated by a factor of 1.15 compared to the 1998 post-season estimate (Table 2). This overestimation is similar to that observed for the 1994 season and low relative to most other years. Post-season ocean stock-size estimates for age-3 fish were calculated using cohort reconstruction methods for hatchery and natural components of the stock that accommodate the varying maturity rates between years as described in KRTAT, 1990. Age-3 ocean abundance in 1997 (Table 1) was estimated by applying the average age-3 maturity rate for completed broods (0.38) to the age-3 river run size for 1997.

TABLE 1. Estimated Number of Fall-run Chinook Salmon by Age Entering the Klamath River, 1981-1996, in Thousands of Fish, Including Estimates of Ocean Harvest Rates and Population Sizes.[1]

Return Year	In-river Age Composition				Total	Ocean Harvest Rate By Age		Ocean Population By Age		
	Age 2	Age 3	Age 4	Age 5	Adults	Age 3	Age 4	Age 3	Age 4	Total
1981	28.1	64.0	14.3	1.8	80.1	0.42	0.66	246.6	45.6	292.2
1982	39.4	30.0	33.9	2.6	66.5	0.57	0.65	344.5	106.7	451.2
1983	3.8	35.8	20.7	0.9	57.5	0.28	0.70	103.8	84.9	188.7
1984	8.3	29.6	15.2	2.3	47.1	0.14	0.43	103.0	29.1	132.1
1985	69.4	30.7	32.7	0.9	64.4	0.25	0.29	138.0	46.0	184.0
1986	44.5	167.9	26.9	TR	194.8	0.32	0.52	604.1	56.1	660.2
1987	19.0	120.7	88.0	TR	208.7	0.38	0.53	415.4	192.9	608.4
1988	24.0	136.5	53.5	1.2	191.3	0.39	0.45	612.2	108.7	720.9
1989	9.1	15.2	105.6	3.2	124.0	0.22	0.44	129.7	190.0	319.7
1990	4.4	9.1	26.6	0.2	35.8	0.61	0.61	113.3	68.7	182.0
1991	1.8	14.4	18.1	0.1	32.6	0.10	0.21	43.9	24.8	68.7
1992	13.7	7.3	18.3	1.0	26.7	0.02	0.04	20.8	20.0	40.8
1993	7.6	48.5	8.1	0.6	57.1	0.11	0.11	97.7	10.4	108.1
1994	14.4	35.6	25.0	1.0	61.6	0.05	0.07	69.0	30.3	99.3
1995	22.8	194.1	17.2	2.4	213.7	0.10	0.21	456.2	23.6	479.7
1996	9.5	38.5	136.6	0.3	175.4	0.12	0.16	115.4	172.2	287.6
1997	9.6	34.1	43.2	4.5	81.8	[2]	0.08	98.0	50.2	148.3

[1] Ocean harvest rate and ocean population size for age-3 fish in 1981 and age-4 fish in 1981 and 1982, from CDFG 1989; all others after KRTAT 1990.

[2] Not estimated for incomplete cohort.

Table 2. Comparisons of Pre-and Post-season Ocean Abundance Estimates for Ages 3 and 4 Klamath River Fall Chinook, 1985-1997 Seasons

Year	Age 3 Klamath Fall Chinook			Age 4 Klamath Fall Chinook		
	Preseason Estimate	Postseason Estimate	Pre/Post	Preseason Estimate	Postseason Estimate	Pre/Post
1985	56,500	138,000	0.41	45,500	46,000	0.99
1986	213,000[a]	604,100	0.35	53,000	56,100	0.95
1987	255,900	415,400	0.62	164,900	192,900	0.85
1988	185,400	612,200	0.30	149,100	108,700	1.37
1989	225,300	129,700	1.74	172,400	190,000	0.91
1990	239,500	113,300	2.11	40,100	68,700	0.58
1991	88,100	43,900	2.01	35,700	24,800	1.44
1992	25,000	20,800	1.20	35,800	20,000	1.79
1993	147,200	97,700	1.51	31,300	10,400	2.91
1994	69,000	69,000	1.00	68,900	30,300	2.30
1995	134,500	456,200	0.30	37,600	23,600	1.77
1996	239,900	115,400[b]	2.11	214,800	172,200	1.26
1997	112,300	98,000[b]	1.15	43,100	50,200[b]	0.86

[a] A 75 percent jack count adjustment was applied because most of the jacks were in the Trinity River. Also, the basin jack count was outside the database.

[b] This is a very preliminary estimate as the cohort has not completed its life cycle.

The same regression method used for predicting age-3 fish was used to predict the 1998 age-4 population (see Table 1 for data). The relationship between age-4 ocean abundance estimates and river run size estimates of age-3 fish of the same cohort is shown in Figure 2. An age-4 maturity rate in 1997 (1993 brood) of 0.935 (average 1979-1992 maturation probability from cohort reconstruction) was used to produce a post-season ocean stock size estimate because the cohort is incomplete. The 1997 age-4 predictor was slightly under-estimated relative to the 1997 post-season estimate (Table 2).

Age-5 Fish

The age-5 abundance prediction of 2,600 fish is based on the age-4 river run size estimate for 1997, an age-4 maturation probability of 0.935, and an estimated winter survival rate of 0.80.

Proportion of Adult Spawners Using Natural Areas

The 1998 river run is predicted to be 69,600 in the absence of fishing. Given this scenario, the projected number of adults spawning in natural areas would be 49,400. This projection was derived by applying the five-year average proportion of natural spawners (71 percent) from 1993-1997 to the total spawning population (Table 3). In this period, hatchery practices may have contributed to an artificially high proportion of natural returns in some years. As egg take at the IronGate and Trinity River hatcheries achieved objectives, fish may have been denied volitional entry into the hatchery and counted as "natural" spawners.

The 1997 prediction was 69 percent natural spawners (PFMC, 1997). The post-season estimate of the 1997 natural escapement was 71 percent (CDFG, 1997).

STOCK PROJECTIONS AND APPROPRIATE FISHERY LANDING LEVELS

Ocean abundance projections for Klamath River fall chinook in 1997 are as follows:

Age 3: 88,000 fish
Age 4: 36,800 fish
Age 5: 2,600 fish

These age specific stock-size projections in 1998 would produce 69,600 spawning adults in the fall of 1998 in the absence of fishing, 49,400 of which would spawn in natural areas. Assuming full fishing (33 to 34 percent brood escapement rate) with harvest allocation as in 1996, the spawning escapement would be 26,900 adults, of which 19,100 would spawn in natural areas. This natural escapement would be 55 percent of the escapement floor of 35,000 natural adult spawners.

FIGURE 1. AGE 2 ON 3 KLAMATH FALL CHINOOK

1979 - 1993 BROOD YEARS

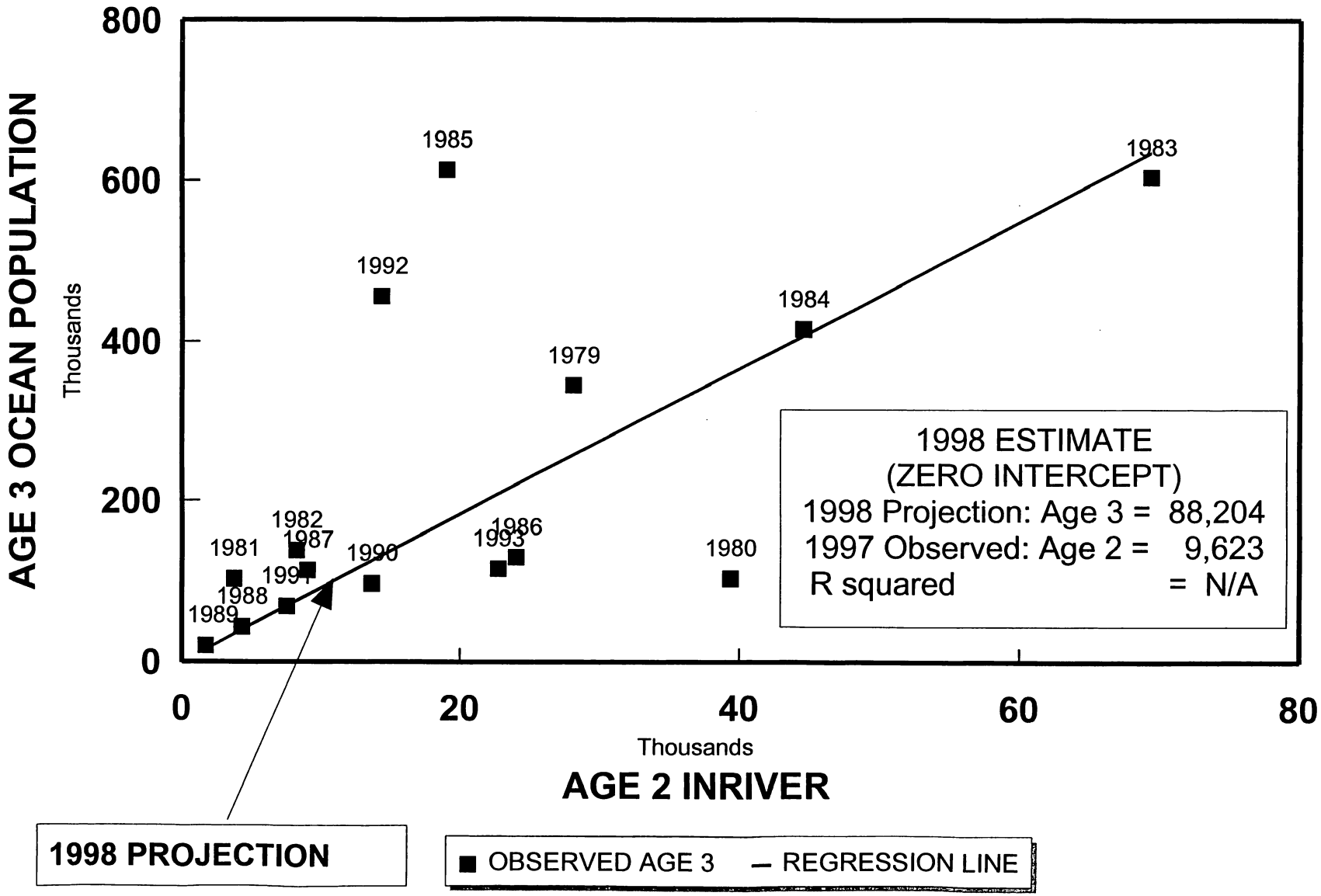

FIGURE 2. AGE 3 ON 4 KLAMATH FALL CHINOOK

1979 - 1993 BROOD YEARS

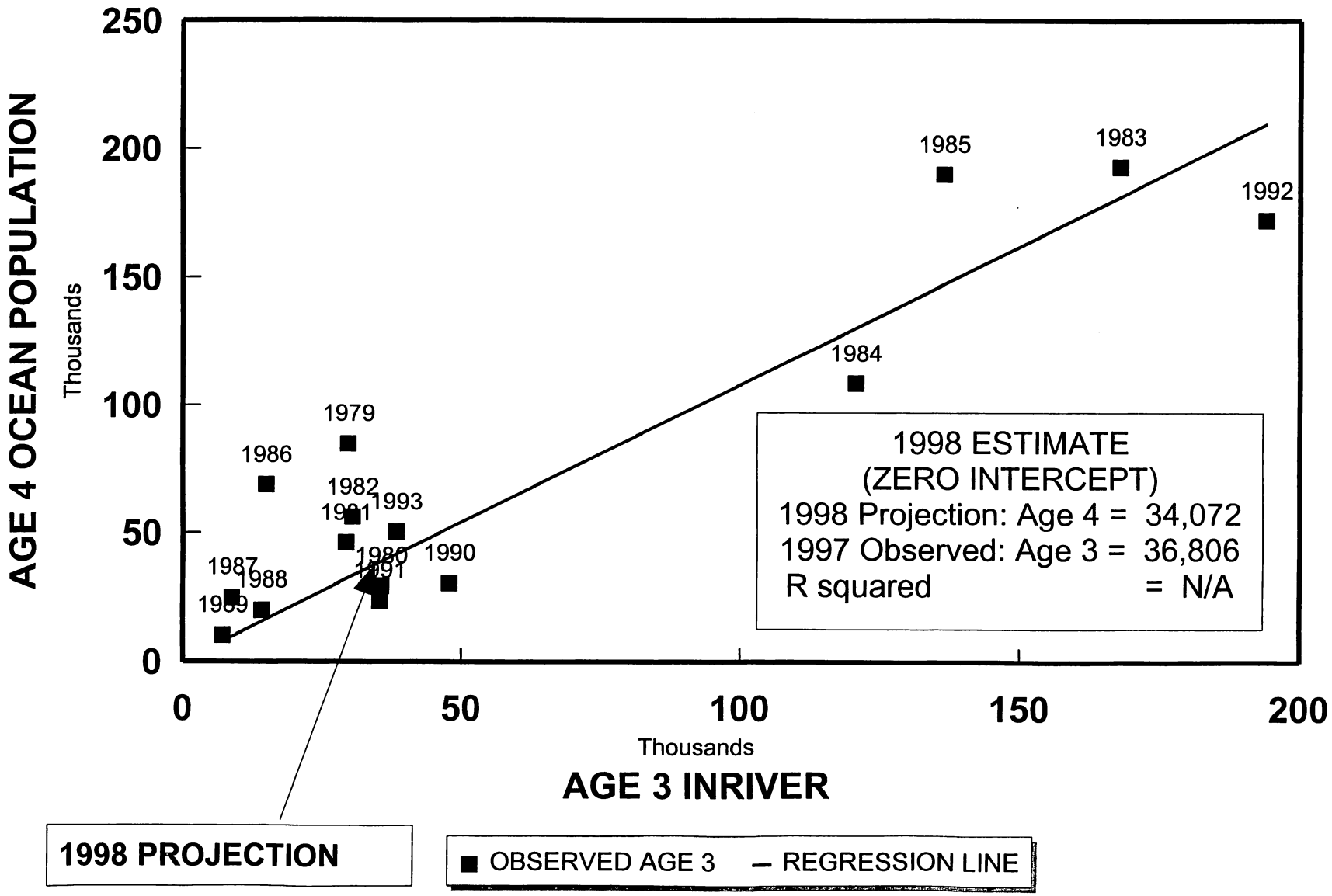

Table 3. Distribution of Natural and Hatchery Adult Fall Chinook Spawners in the Klamath Basin, 1985-1997.

Year	Hatchery	Natural	Percent Natural
1985	22,500	25,700	53%
1986	32,900	113,400	78%
1987	29,100	101,700	78%
1988	33,500	79,400	70%
1989	22,000	43,900	67%
1990	8,100	15,600	66%
1991	6,500	11,600	64%
1992	7,400	12,000	62%
1993	21,600	21,900	50%
1994	14,700	32,300	69%
1995	28,900	161,800	85%
1996	20,030	81,000	80%
1997	18,655	45,945	71%
1993 – 97 Un-weighted Average			71%

Ocean landings of Klamath River fall chinook in 1997 late season (September-November) ocean fisheries totaled 650 summer fishery equivalents, consisting of 266 age-4 fish and 384 age-5 fish (Table 4). In previous years, these landings have been subtracted from the ocean allocation in the coming year.

TABLE 4. Calculations of September-November, 1997, Ocean Fishery Landings of Klamath River Fall Chinook

Brood Year (Age Class)	Number Ocean CWT's	Summer Equivalent CWT's	River CWTs	Total River Run	Brood Year CWT Expansion Factor	Ocean Landings
1995 (3)	0	0	111	9,623	86.69	0
1994 (4)	11	9	1,129	34,072	30.18	266
1993 (5)	9	7	809	43,171	53.36	384
					Total 1997 Fall Ocean Landings	650

REFERENCES

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