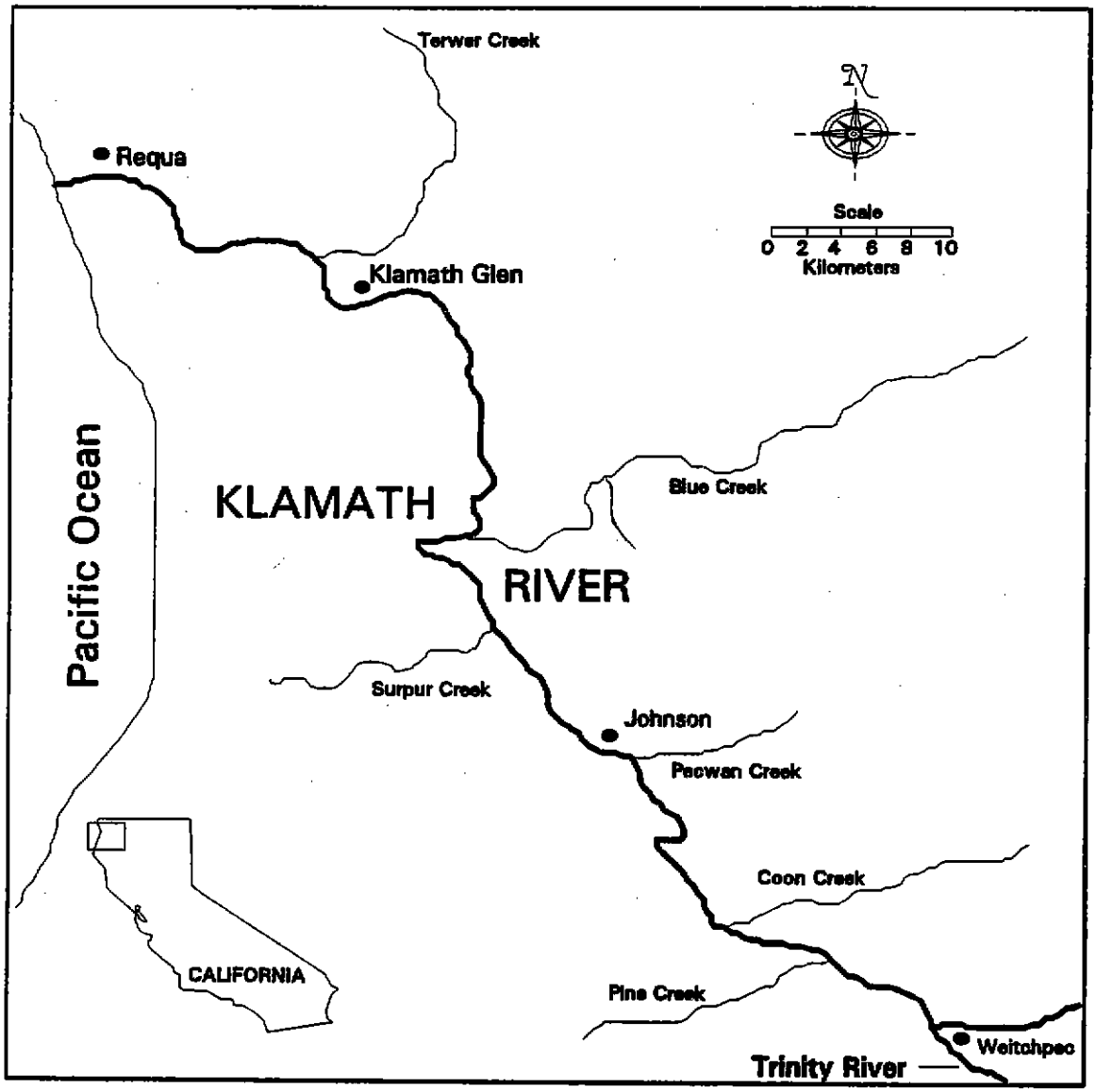
KLAMATH RIVER FISHERIES ASSESSMENT PROGRAM

ANNUAL REPORT 1992

U.S. Fish & Wildlife Service
Coastal California Fishery Resource Office
Arcata, California



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REPORT NO. AFF1-FRO-94-03

James L. Craig
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February 1994

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ACKNOWLEDGEMENTS

The authors wish to express their appreciation to the following persons whose efforts were invaluable in the completion of the 1992 harvest monitoring program and preparation of this report:

Bruce Halstead, Project Leader, for direction and supervision.

Tom Kisanuki, Assistant Project Leader, for direction and supervision.

Pauline Locher, for invaluable program assistance and administrative support.

Nancy Holberg-Caster for program assistance.

Joseph Polos, for technical assistance.

Other members of the CCFRO, Arcata field staff:

Scott Barnett	Jeffrey Chan
David Cook	Frank Erickson
Greg Goldsmith	Scott Kennedy
John Lang	Pete Lara
Steve Nova	Bruce Oppenheim
Virginia Phalen	Thomas Shaw
Margaret Webster	

We also would like to thank the Indian fishers of the Yurok Indian Reservation for their hospitality and cooperation in data collection efforts.

Many thanks to the Bureau of Indian Affairs, Klamath Field Office, for the use of their trailer to accommodate our estuary field crews.

Acknowledgement is extended to members of the Yurok Interim Council for their assistance and cooperation in planning the 1992 fisheries.

Acknowledgement is extended to personnel of the California Department of Fish and Game, Fisheries Department of the Hoopa Valley Business Council, and the U.S. Forest Service for providing data and advice.

Final acknowledgement is extended to the Bureau of Indian Affairs for funding the Klamath River Fisheries Assessment Program, and to the many Bureau personnel who have cooperated with CCFRO, Arcata staff during the 1992 season.

ABSTRACT

During the 1992 spring gill net fishery, an estimated 396 adult spring chinook salmon (Oncorhynchus tshawytscha) were harvested on the Yurok Indian Reservation (YIR). No jack spring chinook were harvested. Age structure of harvested spring chinook was dominated (82%) by age four chinook followed by age three (13%) and age five (5%). A total of six (7%) adipose fin clipped (Ad-clip) and coded-wire-tag (CWT) chinook were observed during mark sampling of the harvest and four tags were recovered representing one spring chinook release group.

During the 1992 fall gill net fishery, an estimated 4,839 adult and 324 jack chinook salmon were harvested on the YIR. Age structure of the harvested fall chinook was dominated (73%) by age four chinook followed by age 3 (14%), age five (9%), and age two (4%). A total of 95 (6%) CWT chinook were observed during mark sampling of the harvest and 81 tags were recovered representing 26 different CWT release groups. Gill net harvest of Klamath basin hatchery chinook (39% Iron Gate Hatchery (IGH), 61% Trinity River Hatchery (TRH)) was similar to that estimated for the Klamath basin inriver run (36% IGH, 64% TRH). An estimated 122 adult and eight jack coho salmon (O. kisutch) were also harvested during the fall gill net fishery.

During the 1992 late fall gill net fishery, an estimated 93 adult fall chinook were harvested on the YIR. Age four (88%) chinook comprised the majority of the sampled harvest followed by age five (12%) chinook. A total of five (17%) Ad-clip CWT chinook were observed during mark sampling of the late fall fishery harvest and three tags were recovered representing one release group.

During 1992 and throughout all gill net fisheries on the YIR, an estimated 115 adult and 28 half pounder steelhead trout (O. mykiss) were harvested. In addition, an estimated 212 adult green sturgeon (Acipenser medirostris) were also harvested. The majority (86%) of sturgeon harvest occurred during the spring fishery.

FORWARD

The Klamath River watershed drains approximately 14,400 square kilometers (km^2) in Oregon and 26,000 km^2 in California. The majority of the watershed in California is within the boundaries of the Six Rivers, Klamath, and Shasta-Trinity national forests. The Hoopa Valley Indian Reservation (HVIR), comprising approximately 583 km^2 in Humboldt and Del Norte counties, borders the lower 26 kilometers (km) of the Trinity River, the largest tributary in the drainage (Figure 1). The Yurok Indian Reservation (YIR), formed in 1983, occupies the lower 68 km of the Klamath River. The most important anadromous salmonid spawning tributaries in the basin include the Trinity River, draining approximately 7,690 km^2, and the Shasta, Scott and Salmon rivers, each draining approximately 2,070 km^2.

Iron Gate Dam on the Klamath River at river kilometer (rkm) 306 and Lewiston Dam on the Trinity River (rkm 179) represent the upper limits of anadromous salmonid migration in these basins, respectively. Iron Gate and Trinity River hatcheries located near the base of each dam, were constructed as mitigation for natural fish production losses resulting from each project.

The Klamath River Basin has historically supported large runs of chinook salmon (Oncorhynchus tshawytscha) and steelhead trout (O. mykiss), which in past years have contributed considerably to subsistence, sport and commercial fisheries in California. Generations of Indians have utilized fishing grounds in the drainage, and their fisheries for salmon, steelhead and sturgeon (Acipenser sp.) have historically provided the mainstay of Indian economy in the area. In past seasons, sport fishing for salmon and steelhead in the drainage has exceeded 200,000 angler days annually.

The U.S. Forest Service (USFS) estimated an annual net economic value of salmon and steelhead fisheries attributable to USFS lands in the Klamath River Basin in excess of $20 million and mean annual net economic values per kilometer of chinook salmon, coho salmon (O. kisutch), and steelhead trout habitat in the basin of $15,600, $1,400 and $2,800, respectively (USFS 1977, USFS 1978).

In 1980, the Department of the Interior (DOI) included the Klamath and Trinity rivers in the National Wild and Scenic Rivers System. Portions of the Klamath and Trinity rivers are also under California state classification as Wild and Scenic Rivers.

Concern about the depletion of anadromous salmonid resources and associated habitat in the basin emerged around the turn of the century and has accelerated in recent decades coincident with expanded logging and fishing operations, dam building activity, road construction and other development. As elsewhere in the Pacific Northwest, chinook, coho salmon, and other anadromous stocks of the Klamath River Basin have experienced the continued effects of drought, habitat degradation and over-exploitation as reflected by the diminished runs of the past few years.

In response to habitat problems resulting form the Trinity River Division Project, Congress enacted P.L. 98-541, the Trinity River Basin Fish and Wildlife Restoration Act on October 24, 1984. This action directs the Secretary of the Interior to restore fish and wildlife populations in the Trinity Basin to levels approximating those which existed immediately before the start of construction on that project. An office administered jointly by the U.S. Bureau of Reclamation (BoR) and the U.S. Fish and Wildlife Service (USFWS) was opened in 1985 in Weaverville, California, to oversee work under P.L. 98-541.

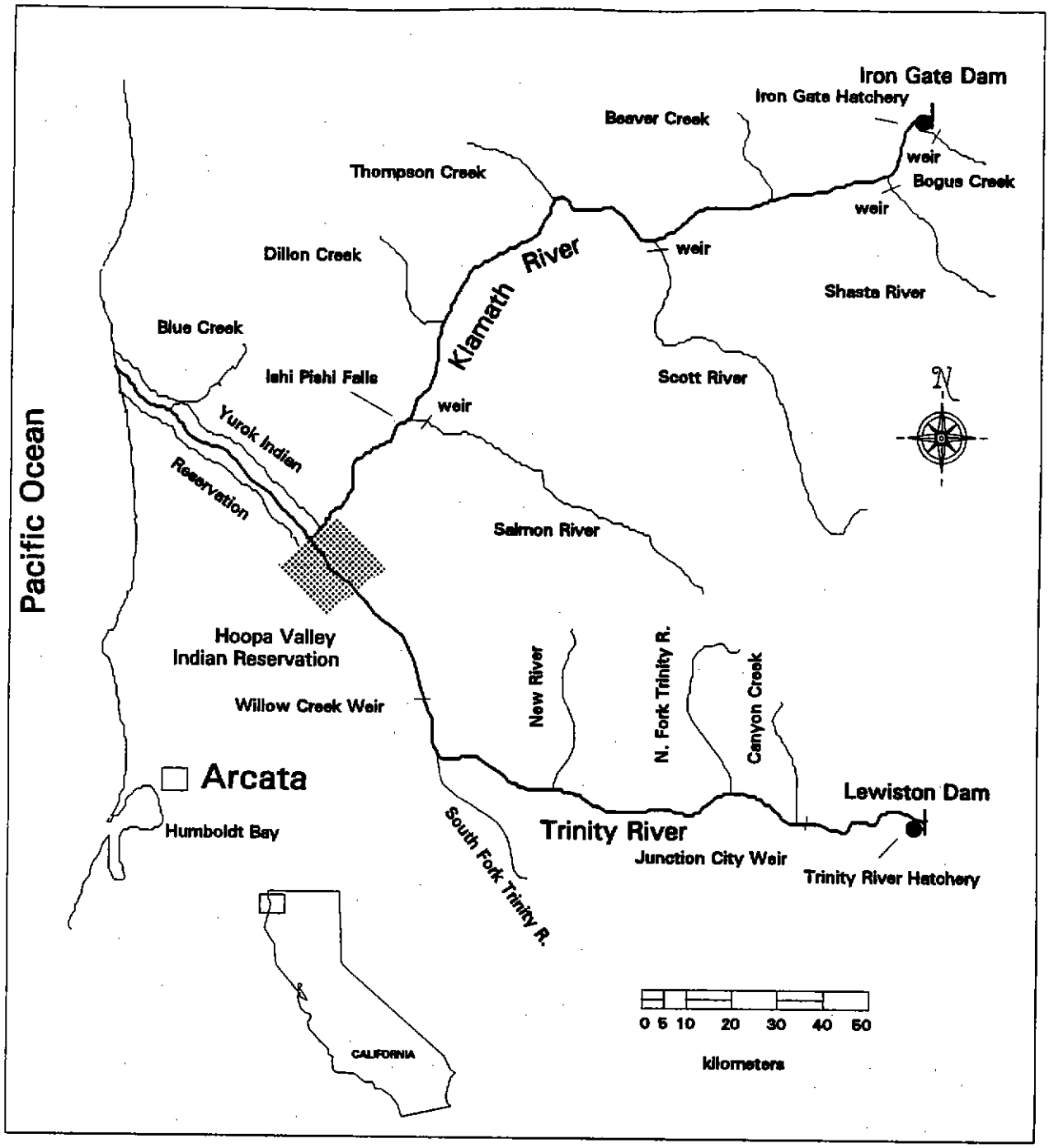

FIGURE 1. Overview map of the Klamath-Trinity River basin accessible to anadromous fish.

In 1985 CH_2M Hill, a consulting firm, completed a document entitled "Klamath River Basin Fisheries Resource Plan", through contract with the Department of the Interior, Bureau of Indian Affairs (BIA) (DOI 1985). This plan details restoration actions for the remainder of the Klamath Basin which are similar to those included in the Trinity River Basin Fish and Wildlife Management Program described below.

Since passage of the Magnuson Fishery Conservation Management Act of 1976 (16 U.S.C. 1801-1882) and the promulgation of the first set of federal fishing regulations governing Indian fishing on the HVIR in 1977, considerable attention has also focused on the fisheries operating on the depressed chinook salmon runs, notably the ocean troll fisheries and the Indian gill net fishery on the Klamath and Trinity Rivers. In 1985, the Klamath River salmon Management Group (KRSMG) was formed to provide recommendations for the management of the combined fisheries harvesting Klamath River chinook stocks. In 1986, the KRSMG provided recommendations concerning allowable levels of harvest for all Klamath stock fisheries.

On October 27, 1986 the Congress enacted P.L. 99-552, the Klamath River Basin Fishery Resources Restoration Act. This action authorized the Secretary of the Interior to restore the anadromous fish populations to optimum levels in both the Klamath and Trinity Rivers through a habitat restoration program and formation of the Klamath River Fishery Management Council (KFMC) which replaced the KRSMG.

The Assistant Secretaries of Indian Affairs, and Fish and Wildlife and Parks, in addressing Departmental resource and Indian Trust responsibilities concerning the Klamath River Basin resource and YIR, have entered into annual fiscal Interagency Agreements providing for fisheries investigation programs focusing on the monitoring and evaluation of chinook salmon runs in the Klamath River, and the monitoring of Indian net harvest levels on the YIR. This is the thirteenth in a series of annual reports covering the Klamath River Fisheries Assessment Program, conducted through CCFRO, Arcata, under the Interagency Agreement for fiscal year 1992. This assessment program, funded by the BIA represents only a portion of the total CCFRO fisheries program which extends beyond the Klamath River Basin. Activities in these other projects are described through other reports.

The Klamath River Fisheries Assessment Program now consists of two major groupings of related activities:

(1) Harvest Monitoring and Evaluation Efforts focus on:

(a) the annual estimation of the Indian net harvest levels on the YIR involving spring and fall run chinook salmon, coho salmon, fall run steelhead trout, and green sturgeon (Acipenser medirostris);

(b) the collection and reading of coded wire tags (CWT) recovered from the net fishery during harvest monitoring activities and use of this data in statistical evaluation of the various tagged release groups through their occurrence in the ocean and in-river net fisheries; and

(c) the annual monitoring of chinook and coho salmon, steelhead trout, and green sturgeon runs to evaluate natural/hatchery composition, to assess length-frequency, age-growth, and length-weight relationships of harvested fish.

(2) Technical Assistance involves:

(a) participation in various technical committees including the

Technical Advisory Team to the KFMC;

(b) the provision of general technical assistance, as requested, to the California Department of Fish and Game (CDFG), BIA, Yurok Tribe, Hoopa Valley Business Council (HVBC) Fisheries Department, other branches of the USFWS, and various other groups and agencies; and

(c) the conduct of various other field studies in the Klamath River Basin as is deemed appropriate.

Methods utilized and results obtained during the 1992 season through these program activities are detailed in sections summarizing data collected on chinook salmon, coho salmon, steelhead trout, and sturgeon.

During 1983 the HVBC Fisheries Department assumed responsibility for harvest monitoring programs covering the Trinity River portion of the HVIR, formerly a part of CCFRO, Arcata responsibilities. It should, therefore, be realized that harvest data presented in this report, unless otherwise noted, are not strictly comparable with harvest data presented in certain previous reports since the area of coverage has changed from that prior to 1983.

NET HARVEST MONITORING PROGRAM

INTRODUCTION

Native American peoples living along the Klamath and Trinity rivers have traditionally fished for chinook salmon (Oncorhynchus tshawytscha), coho salmon (O. kisutch), steelhead trout (O. mykiss), green sturgeon (Acipenser medirostris), white sturgeon (A. transmontanus), and other species using a variety of fishing gear including weirs, dip nets, spears and gill nets. Historically, salmon consumption by these peoples exceeded 907,000 kg (two million pounds) annually (Hoptowit 1980). For historical accounts of the Native American fisheries see Hoptowit (1980), Bearss (1981) and USFWS (1981).

Regulations governing Native American fishing on the HVIR were first promulgated by the Department of the Interior (DOI) in 1977, and CCFRO biologists began monitoring net harvest levels of fall chinook salmon on the Reservation in 1978 (FWS 1981). Considerable progress was made in ascertaining net harvest levels of both spring and fall chinook with the establishment of a monitoring station in the lower Klamath River in 1980. In 1981, operations were expanded to include the upper Klamath and Trinity River portions of the reservation with the opening of a second monitoring station near Pecwan. In 1982, in a cooperative effort with the Hoopa Valley Tribe, a third monitoring station was established in Hoopa. Since 1983, CCFRO biologists have focused monitoring efforts solely on the Klamath River portion of the HVR while responsibility for monitoring harvest levels on the Trinity River portion of the HVR was taken over by the Hoopa Valley Business Council (HVBC) Fisheries Department. In October 1988, Congressional action separated the Klamath River portion of the reservation from the HVR and created the Yurok Indian Reservation (YIR).

Beginning in 1984, CCFRO biologists employed a stratified random sampling methodology to assess fall season net harvest levels for chinook salmon, coho salmon, steelhead trout and sturgeon on the Klamath River portion of the HVR in an attempt to improve the accuracy and gauge the precision of the harvest estimates. The techniques employed prior to 1984 yielded point estimates without associated measures of variance. Although they are considered reasonably reliable and accurate, no quantifiable measure of precision can be calculated for estimates made prior to 1984.

Because of the depressed Klamath River fall chinook run predicated for 1992, severe harvest restrictions were instituted on all user groups within and beyond the Klamath Management Zone (KMZ). Restrictions included a complete closure of the commercial ocean troll fishery. The total in-river Indian allocation was set at 4,920 adult fall chinook salmon. Of this number, 3,936 were allocated to the YIR. As this allowable harvest does not meet minimum subsistence needs, no commercial fishing was allowed.

METHODS

Net harvest monitoring data were collected and compiled from three contiguous areas (Estuary, Middle Klamath and Upper Klamath) of the YIR in 1992 (Figure 2). The Estuary encompasses the portion of Klamath River from the mouth to the U.S. Highway 101 bridge (river kilometer (rkm) 0 to 6). The Middle Klamath represents the next 27 rkm of river from the Highway 101 bridge upstream to Surpur Creek (rkm 33). The Upper Klamath Area included the next 37 rkm stretch of river from Surpur Creek to the area near Weitchpec (rkm 70).

Indian fishers were contacted while in their boats, at their riverside camps, or at boat landings in the area. Information obtained included number of fish caught, species identification, mesh size, and number of nets fished, and during the fall fishery in the estuary, the number of hours each net was fished. River surveys, including net counts, were scheduled to coincide with hours when fishers typically checked their nets. Indian fishers not contacted on the river were later interviewed at their residences. When possible, harvested fish were examined for tags, fin clips, and seal and otter bite damage. Snouts were removed from adipose fin clipped (Ad-clip) salmon for subsequent coded wire tag (CWT) recovery and identification. Fish fork lengths (fl) were measured to the nearest centimeter (cm) and scales were removed for age analysis. Sturgeon were also measured to total length (tl). A subsample of all fish were weighed (whole weight) to the nearest pound and these weights were converted to kilograms (kg).

The jack/adult length cutoff for each species of salmonids were determined using the respective length frequency histogram combined with age data from coded wire tags and scale samples. A nadir, or range of low length frequency, is identified on the histogram. Age data from scale analysis and coded wire tag recoveries is examined from sampled fish with lengths within and just beyond the nadir range. The length, above which the number of two year old fish equals the number of three year old fish below said length, is the cutoff.

Due to the nature of the spring, fall, and late fall fisheries, the methods used to estimate harvest were specific to the fishery and are detailed in the appropriate section. During the spring and late fall fisheries, unseen catch data that were believed reliable were included in estimates of catch effort whether or not catches were made during a sample day. This was done to increase catch effort sample size during fisheries that are generally less intensive (fishers fish less and check catch less frequently) and were therefore more difficult to obtain seen catch information. During the more intensively fished fall fishery, sampling effort was increased and estimates of catch effort were generated using seen and unseen reliable catch data for days sampled only.

Typically the estuary receives very high fishing effort during the fall fishery. Because of this high effort and because this effort and harvest can fluctuate with the tidal cycle, sampling was conducted every day the fishery was open and net counts were conducted every two hours during peak fishing times.

Spring Fishery

Under pre-season DOI regulations, the Klamath River portion of the YIR was open to gill net fishing from Monday at 1700 hr to the following Monday at 0900 hr. CCFRO personnel monitored the fishery three to five days a week from April 5 through July 13, 1992. A single crew consisting of a biologist and an Indian technician monitored the fishery from the mouth to Surpur Creek (Estuary and Middle Klamath Areas). A second crew monitored the Upper Klamath Area.

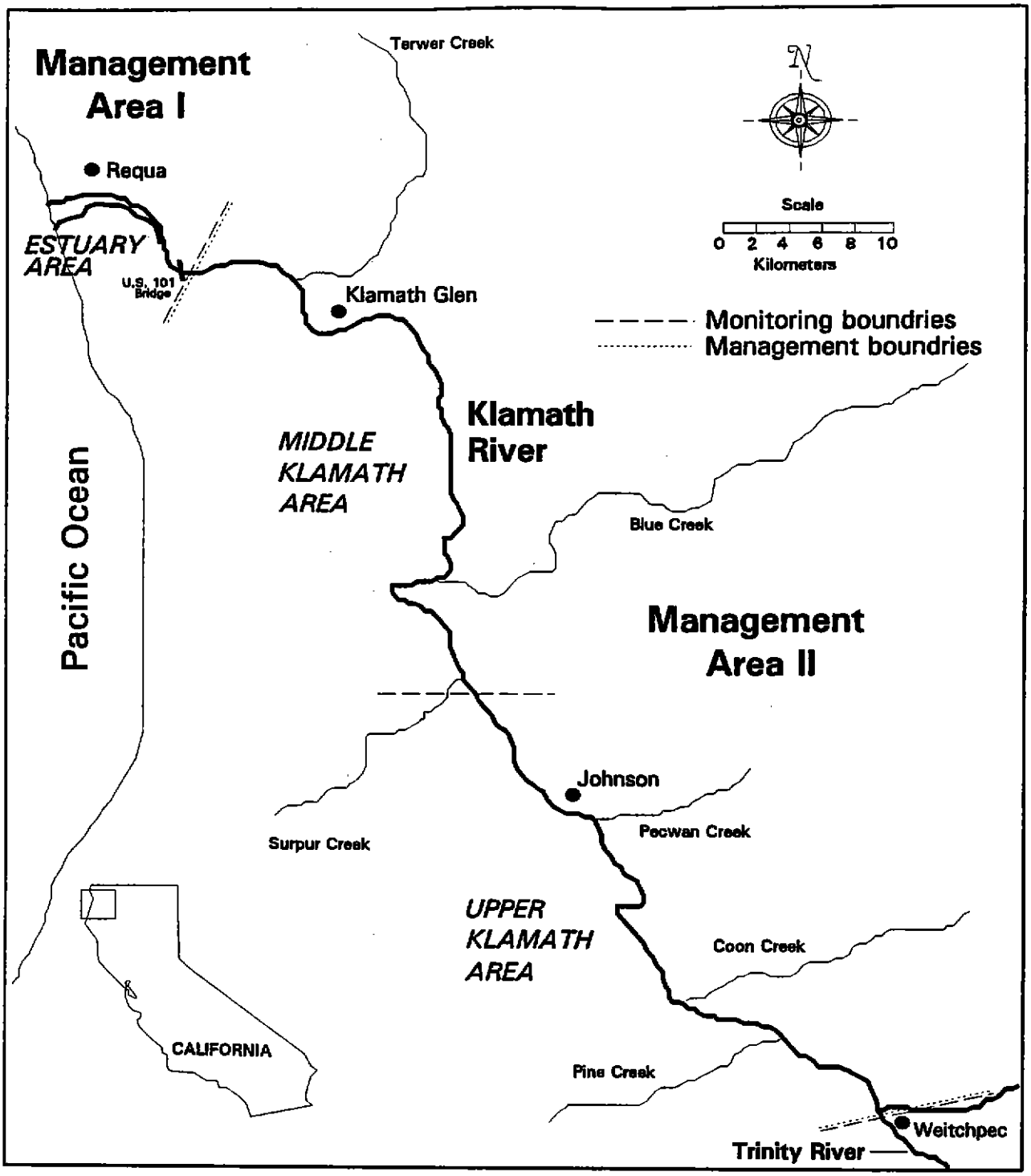

Figure 2. Management and harvest monitoring areas on the Yurok Indian Reservation in 1992.

Procedures used in estimating net harvest for the Klamath monitoring areas during the 1992 spring fishery were similar to those of previous years.

Harvest Estimate, Spring Fishery

a = Number of fishing days available in time period.

s = Number of days sampled in time period.

Y = Daily number of nets fished.

C_s = Catch observed by field crews.

C_u = Reliable unseen catch data reported to field crews.

Y_s = Nets sampled by field crews.

Y_u = Nets accounted for by reliable unseen catch data.

$CPUE_p$ = Catch per unit of effort for the pth period.

$\hat{E}_p$ = Estimated number of nets fished during pth period

$\hat{C}_p$ = Estimated total catch for the pth period.

Estimates for CPUE by species were calculated by monitoring area and time period and data were summed by time period, usually one week, using the following formula: equation (1),

$$CPUE_p = \frac{(\Sigma C_s + \Sigma C_u)}{(\Sigma Y_s + \Sigma Y_u)}$$

Because the harvest was not sampled every day fishing occurred in the monitoring areas, estimation of the number of net fished (effort) during the time period were calculated using the following formula: equuation (2),

$$\hat{E}_p = (\Sigma Y)(a/s)$$

Harvest estimate for the time period were calculated by species and monitoring area using the following formula: equation (3),

$$\hat{C}_p = (\hat{E}_p)(CPUE_p)$$

Harvest estimates were summed by monitoring area and by time period to yield a season harvest estimate.

Statistical analysis of data was limited to the t-test unless otherwise noted. The data were compared at the 95% confidence level.

Fall Fishery

Since 1985, DOI regulations have divided the Hoopa and Yurok reservations into three management zones. Area I encompasses the portion of Klamath River from the mouth to the U.S. Highway 101 bridge (rkm 0 to 6). Area II begins at the U.S. Highway 101 bridge and continues upriver to just upstream of the confluence of the Trinity River (rkm 70). Areas I and II are entirely within the YIR (Figure 2). The Estuary Area is synonymous with Management Area I (rkm 0 to 6). Sampling logistics dictated Management Area II (rkm 6 to 70) be divided (Middle and Upper Klamath). Area III comprises the portion of the

Trinity River within the HVR. These management zones were designed to facilitate distribution of the fall chinook harvest throughout the two reservations. CCFRO biologists monitor the harvest in Management Areas (MA) I and II, while the HVBC Fisheries Department are responsible for estimating the harvest in MA III.

In May and June of 1992, CCFRO biologists met with members of the Yurok Interim Council (YIC) and the Bureau of Indian Affairs (BIA) to discuss pre-season structuring of the fall chinook fishery. Concern over the imbalance of harvest towards Iron Gate Hatchery (IGH) stocks, and presumable Klamath natural stocks, prompted these discussions. Based on CWT recoveries from Ad-clip chinook, IGH stocks are disproportionately harvested to Trinity River Hatchery (TRH) stocks. This imbalance of impacts on the hatchery stocks has been attributed primarily to timing of the fishery and run timing of the two stocks. In general, effort and subsequently harvest have been greater early in the season (August) when IGH stocks are returning to the river. By the time TRH stocks return (September), effort and harvest have usually decreased and/or the fishery had already closed when quotas were attained. In an attempt to equitably distribute the harvest impact between the two hatchery stocks, the following regulations for the Fall Chinook Management Season (July 15 to midnight September 30) were adopted:

> MA I: a quota of 2,322 adult fall chinook (typically, the YIR overall quota is split 60/40 between MA I and MA II, respectively). Fishing permitted from 1900 hour (hr) Friday through 0700 hr Sunday (36 hours) each week until September 5 or until 60% of the MA I quota was met (1,393 adult fish). If the 60% quota is met, the fishery closes. Fishing will resume at 0001 hr September 5, under standard regulations (fishing at all times except Mondays from 0900 hr to 1700 hr) until the remaining 40% of the quota was harvested.
>
> MA II: a quota of 1,614 adult fall chinook. Fishing permitted from 1900 hr Friday through 0700 hr Sunday (36 hours) of each week until September 5 or until 60% of the MA II quota was attained (968 adult fish). Fishing will resume at 0001 hr September 5, under standard regulations until the remaining 40% of the quota was harvested.

The purpose of these regulations, (limiting the net fishery to 36 hours a week from July 17 to September 5), was to reduce overall effort and harvest of the IGH stocks. If the time constraints were insufficient for this purpose, then the 60% quota would effectively minimize harvest of IGH stocks as well. The intended result of these time constraints and sub-quotas would be to increase the relative harvest of TRH stocks yielding more proportionate harvest between IGH and TRH stocks.

Estuary Area

Beginning with the start of the fall fishery on July 17, total net counts were conducted every two hours during evening hours (1900 hr to 0700 hr) and approximately every three hours during the day. The fishery was monitored every day fishing was allowed. Indian fishers were interviewed to obtain information on the number of each fish species caught, the number of nets fished and the number of hours that were fished. From this information, harvest and variance estimates were generated.

Middle Klamath Area

Under pre-season DOI regulations the Middle Klamath Area is part of Management Area II. The fishery was monitored 3 to 5 days per week. To monitor the set net fishery, a total net count was conducted by boat after dark over the entire section of river. At dawn, the crew contacted Indian fishers and sampled the set net harvest.

To monitor the drift net fishery, total net counts were conducted by boat between 2000 hr and 0100 hr when drift netting typically occurs. The harvest was sampled either that evening or the following morning.

Upper Klamath Area

Under pre-season DOI regulations, the Upper Klamath Area was included in Management Area II and was open to fishing the same period as the Middle Klamath Area. A crew monitored the fishery 3 to 5 days per week. The sampling methodologies for set and drift net fisheries were the same as in the Middle Klamath Area.

Fall fishery harvest estimates are comprised of two parts: an estimate or count of total effort and an estimate of average catch per net (or, in the case of the estuary fall fishery, per net hour) for each area and net type. In addition, the estuary fall fishery was stratified by 12 hour period (0700 to 1900 hr, and 1900 to 0700 hr). Independent estimates of harvest in the estuary were made for the day and night time period. Each part of the harvest estimate has an associated variance. These harvest estimates and variances are combined to give an estimated daily harvest and variance. The daily estimates of catch and variance are expanded to total estimates of catch and variance by area, net type and time period.

Harvest Estimate and Associated Variance Calculations, Fall Fishery

Definitions and notations for all equations presented herein are summarized as follows:

a - Number of fishing days available in time period.

s - Number of days sampled in time period.

y - Number of nets sampled during a sample day.

Y - Daily number of nets fished.

Y_i - Estimated net hours (Estuary Area) by day/night period on the ith day.

C_i - Catch per net for the ith day.

$\bar{C}_i$ - Mean catch per net or mean hourly catch (Estuary) for the ith day.

$\hat{C}_i$ - Estimated total catch for the ith day.

$\hat{C}_p$ - Estimated total catch for the pth period.

$\bar{C}_p$ - Mean estimated catch across sample days for the pth period.

$\hat{V}(C_i)$ - Variance of daily catch on the ith day.

$\hat{V}(C_p)$ - Variance of catch across sample days for the pth period.

$\hat{V}(Y_i)$ - Variance of net hours on the ith day (Estuary Area).

$V(\bar{C}_i)$ - Variance of mean hourly catch on the ith day (Estuary Area)

Estuary fall fishery estimates of catch by species were calculated by multiplying mean catch per hour values by the estimated number of net hours: equation (1a),

$$\hat{C}_i = (\hat{Y}_i)(\bar{C}_i)$$

Middle, and Upper Klamath area estimates of catch by species were calculated by multiplying mean catch per net values by the respective total net count: equation (1b),

$$\hat{C}_i = (Y)(\bar{C}_i)$$

The harvest was not sampled every day fishing occurred in the Middle and Upper Klamath areas. Harvest estimates were calculated by time period using the following formula: equation (2),

$$\hat{C}_p = (\Sigma \hat{C}_i)(a/s)$$

The previous estimates were summed to yield the season harvest estimate.

The variance associated with the Estuary harvest estimate were calculated by using the following formula (Goodman 1960): equation (3a),

$$\hat{V}(\hat{C}_i) = (\bar{C}_i)^2[\hat{V}(\hat{Y}_i)] + (\hat{Y}_i)^2[V(\bar{C}_i)] - [\hat{V}(\hat{Y}_i)][V(\bar{C}_i)]$$

The variance associated with daily harvest estimates in the Middle Klamath and Upper Klamath areas were calculated using the following formula (Cochran 1977): equation (3b),

$$\hat{V}(\hat{C}_i) = \frac{(Y-y)}{Y} V(\bar{C}_i) Y^2$$

The variance associated with the catch estimate for a time period were calculated using the following formula (Cochran 1977): equation (4),

$$\hat{V}(\hat{C}_p) = \frac{a(a-s)\Sigma(\hat{C}_i - \bar{C}_i)^2}{s(a-1)} + \frac{a\Sigma[\hat{V}(\hat{C}_i)]}{s}$$

95% confidence interval for harvest estimates were calculated using the following formula: equation (5),

$$95\%\ CI = \hat{C}_p \pm t\sqrt{\frac{\hat{V}(\hat{C}_p)}{a}}$$

Late Fall Fishery

Fall chinook fisheries have been managed by the BIA under authorization of 25 Code of Federal Regulations (CFR) 250.12. Standard 25 CFR 250.9 permits fishing during all times and areas on the YIR except Mondays from 0900 hr to 1700 hr. For the fall chinook fishery, pre-season amendments to Standard 25 CFR are made by the Area Director of the BIA to assure proper management of the fishery resource. These pre-season changes include, but are not limited to, establishing: season dates, in-season time and area closures, and subsistence and/or commercial catch quotas. During 1992, as in recent years,

midnight September 30 marked the end of the fall chinook management period. The fisheries then revert back to standard 25 CFR 250.9 regulations.

By October 5, 1992, the YIR fall chinook quota of 3,936 adult chinook had been exceeded. During October 7, the fall chinook fishery was closed on the YIR under emergency provisions allowed for in standard 25 CFR 250.9. After consultation with CCFRO and the YIC, the Area Director of the BIA reopened the YIR to fishing commencing November 16, except for an area 1/4 mile above and 1/2 mile below Blue Creek (which was to remain closed until after December 31). The extended closure between October 8 and November 16 was to protect the apparently late running fall chinook from further harvest. The closure for the area near Blue Creek was established to provide some measure of protection to the Blue Creek wild stock chinook. However, during the October 8 to November 16 closure, adult chinook were captured in the Klamath River near Blue Creek for broodstock collection.

Personnel from CCFRO monitored the late fall fishery three to four days a week beginning November 16, 1992. A single crew consisting of a biologist and an Indian technician monitored the fishery from the mouth to Surpur Creek (Estuary and Middle Klamath Areas). A second crew monitored the Upper Klamath Area. Monitoring was scheduled to continue through December 13. However, heavy rains increased river flows to the extent that by the afternoon of December 7 no fishing was observed. Crews monitored the river periodically after this time but did not observe any further fishing activity. Estimates of harvest therefore are for the period November 16 through December 6. Late fall harvest estimates were calculated the same as the spring fishery.

RESULTS AND DISCUSSION

Spring Fishery: Chinook

In 1992, an estimated 396 adult spring chinook were harvested on the YIR during the spring net harvest period, April 5 to July 13. This was the third lowest level of spring chinook harvest on the YIR since 1980 (Table 1). The majority of the 1992 harvest (44.4%) occurred during May (Table 2). In 1991, 51.0% of the harvest occurred in July. As in 1991, the majority of the 1992 harvest took place in the Upper Klamath Area (60.3% and 71.7% respectively). Harvest of chinook in the Middle Klamath Area accounted for 24.5% of the 1992 season total while 3.8% of the harvest occurred in the Estuary Area. The difference in harvest levels between the areas can be largely attributed to the total effort each received. During the 1992 spring fishery, total effort was estimated at 2,081 nets (set and drift). Of this total, 1,221 (58.7%) were attributed to the Upper Klamath Area, 608 (29.2%) to the Middle Klamath Area, and 253 (12.1%) to the Estuary Area.

The mean length of adult spring chinook harvested in 1992 was 74.0 cm. (Figure 3) and was not significantly different ($P>0.05$) than the mean fork length of spring chinook harvested each of the previous three years. There were no jack spring chinook harvested in 1992.

Scales were collected from 56 of 61 spring chinook sampled. Age structure of the sample was dominated by age 4 chinook (n=46, 82.1%). Age 3 and age 5 chinook accounted for 12.5% and 5.4% of the sample, respectively. There were no age 2 (jacks) chinook sampled. CWT's were recovered from four of the 56 chinook scale sampled. All four were age 4, released in 1989 from TRH as yearlings. Mean fl of age 3 chinook was 68.4, standard deviation (s) = 4.28, significantly less ($P<0.05$) than the mean fl of age 4 chinook 73.0, s = 4.69. Mean fl of age 5 chinook 89.0, s = 4.58, was significantly greater ($P<0.05$) than age 4 chinook.

Bite marks from harbor seals (Phoca vitulina) or sea lions (Zalophus

Table 1. Estimates of spring chinook salmon harvested on the Yurok Indian Reservation for 1980 - 1992[1/].

Year	Jacks	(%)	Adults	(%)	Total
1980	20	(2.0%)	980	(98.0%)	1,000
1981	35	(1.9%)	1,722	(98.1%)	1,757
1982	35	(1.4%)	2,440	(98.6%)	2,475
1983	5	(0.9%)	510	(99.1%)	515
1984	12	(4.6%)	247	(95.4%)	259
1985	45	(4.0%)	1,074	(96.0%)	1,119
1986	14	(2.0%)	692	(98.0%)	706
1987	48	(2.8%)	1,646	(97.2%)	1,694
1988	8	(0.2%)	2,918	(99.8%)	2,926
1989	-	(0.0%)	4,775	(100.0%)	4,775
1990	-	(0.0%)	1,413	(100.0%)	1,413
1991	3	(1.0%)	287	(99.0%)	290
1992	-	(0.0%)	396	(100.0%)	396

1/ Harvest estimates by the U.S. Fish and Wildlife Service using methods described in previous annual reports.

Table 2. Monthly spring chinook harvest estimates on the Yurok Indian Reservation by sample area for 1986-1992.

Year	Month	Estuary	Middle Klamath	Upper Klamath	Total
1986	April	5	54	98	157
	May	6	37	76	119
	June	15	71	169	255
	July	15	5	155	175
	Total	41	167	498	706
1987	April	10	51	18	79
	May	11	115	120	246
	June	250	10	169	429
	July	538	0	402	940
	Total	809	176	709	1694
1988	April	2	20	18	40
	May	251	178	294	723
	June	225	512	227	964
	July	1199	0	0	1199
	Total	1677	710	539	2926
1989	April	123	445	191	759
	May	360	1331	1217	2908
	June	307	232	479	1018
	July	60	17	13	90
	Total	850	2025	1900	4775
1990	April	2	12	18	32
	May	24	32	80	136
	June	80	439	367	886
	July	282	38	39	359
	Total	388	521	504	1413
1991	April	2	8	11	21
	May	0	31	39	70
	June	5	6	40	51
	July	63	0	85	148
	Total	70	45	175	290
1992	April	0	34	49	83
	May	0	47	129	176
	June	10	16	102	128
	July	5	0	4	9
	Total	15	97	284	396

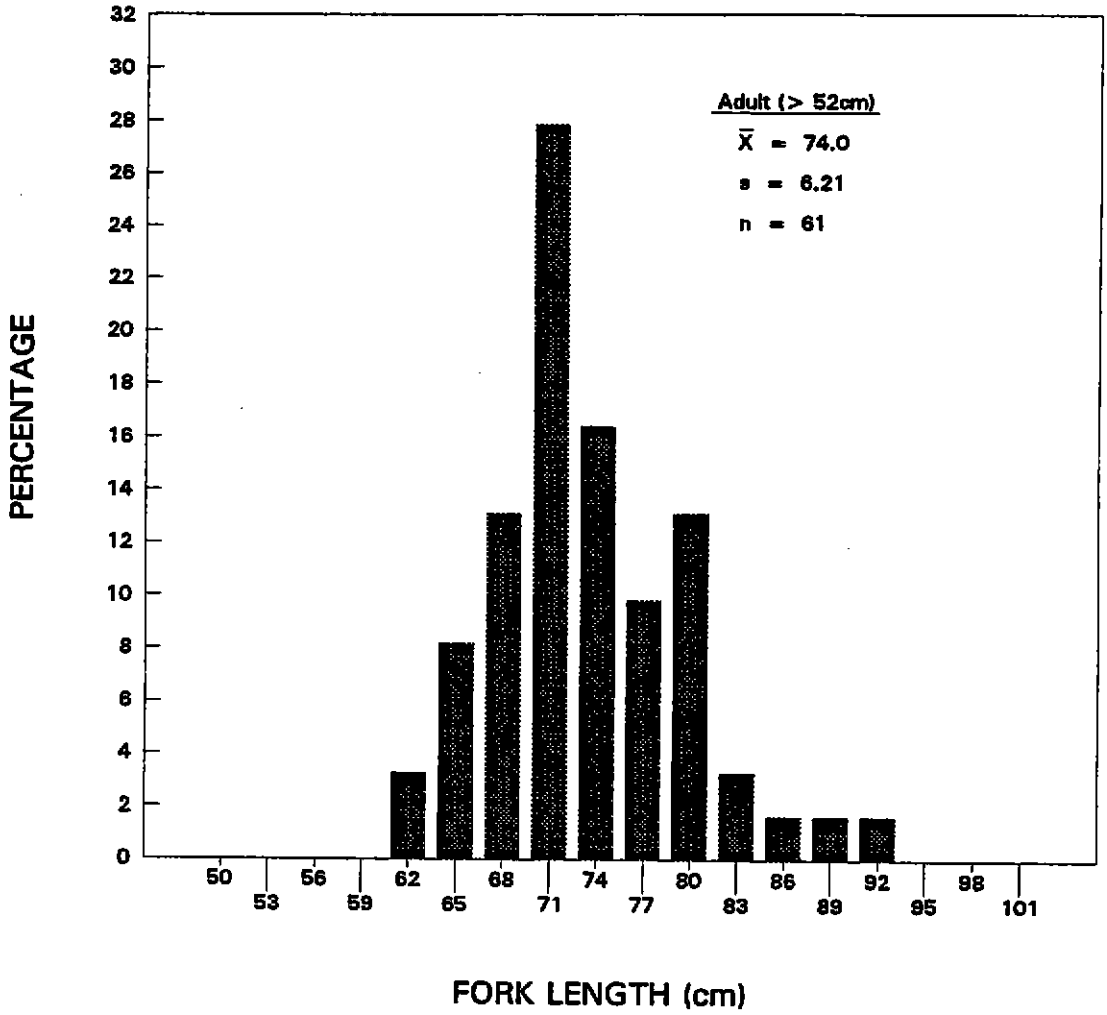

Figure 3. Length frequency distribution of spring chinook salmon harvested on the Yurok Indian Reservation in 1992.

californianus and Eumetopias jubatus) were observed on 13.1% of chinook sampled during the spring fishery. This represents the second highest seal bite rate since 1987 (Table 3). Bites attributed to the river otter (Lutra canadensis) were observed on 11.5% of chinook sampled, the highest rate observed in the last six years of spring chinook fisheries. Percentages of seal bitten fish, and to a lesser extent otter bitten fish, represent minimum values of depredation because they do not account for fish removed from nets by the predators or severely damaged fish that were discarded and not reported as caught.

Ad-clips were observed on six (7.0%) of 86 spring chinook sampled for marks. In 1991, only 0.7% of spring chinook sampled were Ad-clipped, the lowest rate observed for the spring fishery. The mean fl of Ad-clipped spring chinook in 1992 was 71.2 cm (s = 3.70, n = 5).

Table 3. Number and percent of sampled spring chinook with "seal" (seal and sea lion) and river otter bites from all areas of the Yurok Indian Reservation during the 1987 to 1992 spring chinook fisheries.

Year	Number Sampled	Observed Seal Bites	Percent Seal Bites	Observed Otter Bites	Percent Otter Bites
1987	550	24	4.36	13	2.36
1988	630	20	3.17	4	0.63
1989	355	26	7.32	5	1.41
1990	172	25	14.53	2	1.16
1991	67	6	8.96	0	0.00
1992	61	8	13.11	7	11.48

Fall Fishery: Chinook

In 1992, an estimated 4,839 adult fall chinook were harvested on the YIR during the fall net harvest period, July 17 to October 7 (Table 4). Total estimated fall chinook harvest in 1992, including jack-size salmon (< 53cm), was 5,163 (± 1,919) (Table 5). The majority of the total harvest (52.8%) occurred in the Upper Klamath Area, followed by the Estuary Area (24.7%) and Middle Klamath Area (22.4%). By September 29 the adult chinook for MA II had nearly been reached. However, the Fall Chinook Management Season, as authorized by 25 CFR 250.12, would end midnight September 30 and area quotas would then not apply. Therefore, subsistence gill net fishing was allowed to continue under a reservation wide quota. By October 7, 1992 the estimated harvest of adult fall chinook on the YIR in 1992 exceeded the YIR quota and the fishery was closed.

The majority of fall chinook harvest for all areas occurred after September 04 (Table 5) when the fishery began operating under standard regulations (fishing allowed at all times except Mondays from 0900 hr to 1700 hr). Due to varied season structuring between years, including some years of estuary commercial fishing, time period harvest comparisons are tenuous. However, it does appear that river entrance of the fall chinook in 1992 may have been later than previous years (Figure 4). However, peak timing of arrival to both Iron Gate and Trinity River hatcheries were considered within normal bounds (C. Hiser and G. Ramsden, CDFG, personal communication, 1993).

Table 4. The number and percentage (%) of jack and adult fall chinook salmon harvested by the gill and dip net fishery on the Yurok Indian Reservation in 1992.

Area	Jack	(%)	Adult	(%)	Total	(%)
Estuary	124	(9.7%)	1,152	(90.3%)	1,276	(24.7%)
Middle Klamath	52	(4.4%)	1,107	(95.6%)	1,159	(22.4%)
Upper Klamath	148	(5.4%)	2,580	(94.6%)	2,728	(52.8%)
Total All Areas	324	(6.3%)	4,839	(93.7%)	5,163	(100.0%)

In the Estuary Area an estimated 1,152 adult and 124 jack chinook were harvested. Chinook jacks comprised 9.7% of the total estuary harvest. The relatively higher jack percentage in the estuary harvest can largely be attributed to the dip net fishery which is exclusive to this area of the YIR. Of the jacks harvested in the estuary, 87 (70.2%) were captured in dip nets. On several occasions, fishers were also observed releasing jack-sized chinook. This opportunistic fishery also contributed 120 adult chinook to the total estuary harvest. Compared for like period (September 16 to October 6), mean fl (76.1 cm) of dip net captured adult chinook was not significantly different ($P>0.05$) than estuary set net captured adult chinook (83.5 cm). The difference however was significant at the 90% confidence level.

Daily (24 hour period) chinook harvest in the Estuary Area ranged from zero, occurring frequently throughout the fishery to 138 on September 5. The second greatest harvest (124) occurred on September 28. The catch on September 5 was made entirely with set nets. A peak weekly harvest of 336 occurred between September 28 and October 7 (10 days) and was made with both set and dip nets. Set net fishing effort in the estuary ranged from zero to highs of 29 nets on August 28, and 28 nets on September 5. Highest CPUE was on September 19 and 20 (1.77 and 1.25 chinook per set net hour, respectively). Dip netting was first observed near the river mouth on September 10. The peak dip net catch of 61 was made on September 28. Dip netting effort was greatest (four nets) on September 17 and again on October 6.

In the Middle Klamath Area 1,107 adult and 52 jack chinook were harvested. This is the third year in a row that harvest for the Middle Klamath Area was lower than harvest from the other two monitoring areas. Daily set net harvest in the Middle Klamath Area ranged from zero, occurring frequently, to 146 chinook on September 6. Peak single night drift net harvest (9) occurred on October 1. Peak weekly harvest for both set net (495) and drift net (29) captured chinook occurred between September 28 and October 7. Set net fishing effort ranged from zero nets on July 25 and September 27, to 14 nets on September 11. Highest CPUE for set nets was on September 6 (13.3 chinook per net). A peak drift net effort of three nets was observed the evening of September 11 and again on October 1.

In the Upper Klamath Area 2,580 adult and 148 jack chinook were harvested. Daily set net harvest levels in the Upper Klamath Area ranged from zero on many occasions early in the season to 264 chinook on October 2. Peak single

Table 5. Semi-monthly gill net harvest estimates of fall chinook salmon from the three monitoring areas of the Yurok Indian Reservation in 1992.

Time Period	NET HARVEST MONITORING AREA: Estuary	Middle Klamath	Upper Klamath	Semi-Monthly Totals (All Areas)	Cumulative Seasons Total
July 15 - 31	8 [1] 2 [2] 25% [3] 4 [4]	1 0 0% 1	5 5 100% 3	14	14
August 01 - 15	18 4 22% 10	6 3 50% 6	17 8 47% 16	41	55
August 16 - 31	160 52 33% 59	23 0 0% 23	58 49 84% 39	241	296
September 01 - 15	348 27 8% 162	491 191 39% 248	541 269 50% 247	1,380	1,676
September 16 - 30	594 29 5% 380	312 206 66% 71	968 284 29% 209	1,874	3,550
October 01 - 15	148 26 18% 48	326 202 62% 101	1139 562 49% 372	1,613	5,163
Area Season Total	1,276 140 11% 663	1,159 602 52% 450	2,728 1,177 43% 886		5,163 1,919 37% 1,999

1 Harvest estimate.
2 95% Confidence interval.
3 Confidence interval percentage (%)
4 Accounted number of fall chinook

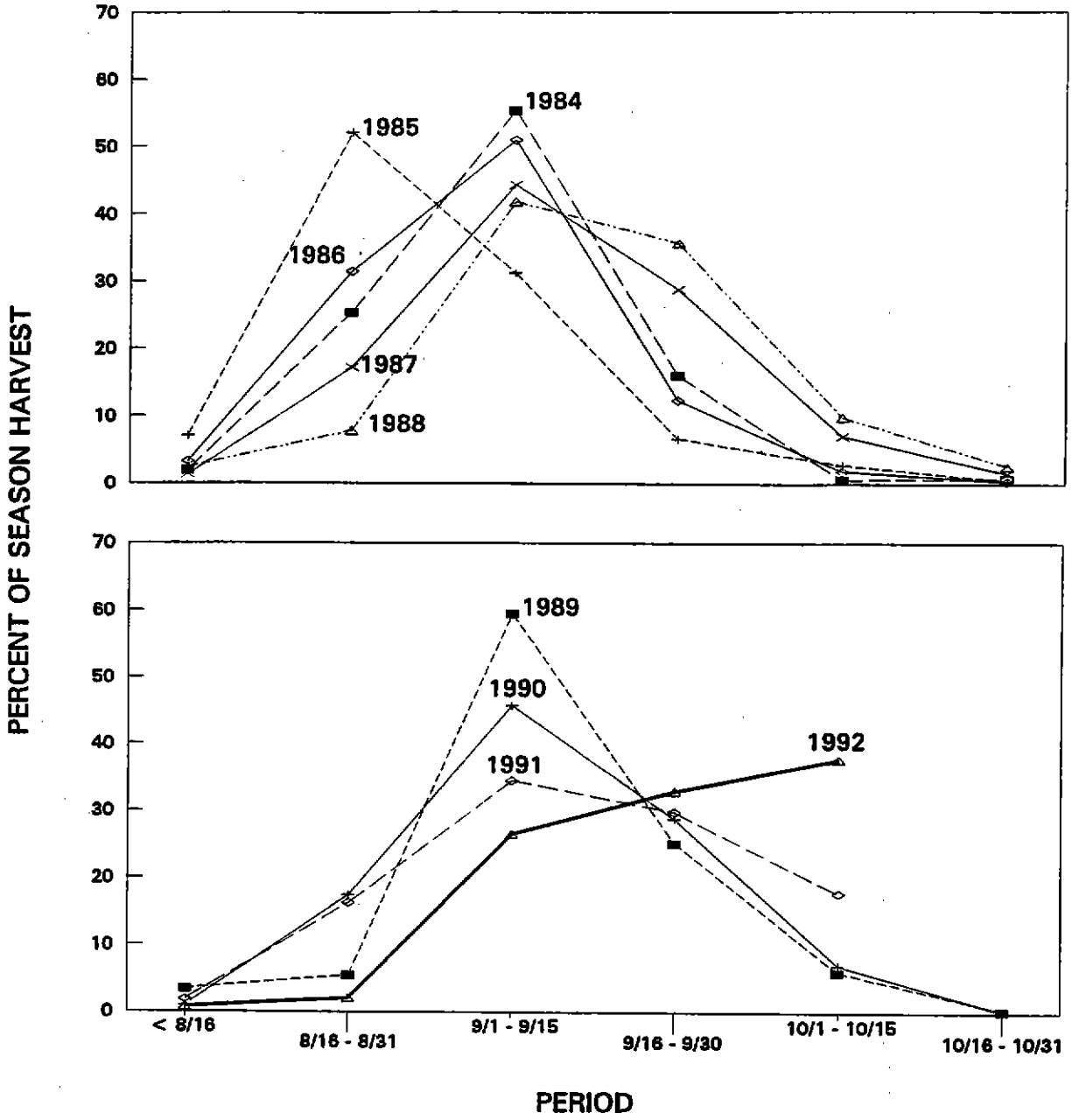

Figure 4. Percent of season harvest of fall chinook salmon by semi-monthly period for Management Area II (Middle and Upper Klamath River), 1984 to 1992.

night drift net harvest (6) occurred on September 4. As with the other two monitoring areas, peak weekly harvest occurred between September 28 and October 7 (1,633). During this ten day period, 1,615 chinook were captured by set nets and 18 by drift nets. Highest CPUE for set nets was on October 1 (13.7 chinook per net). A peak set net count of 35 occurred on October 3. A peak drift net effort of three nets was observed on October 2.

Mean fl (46.3 cm) of chinook jacks was not significantly different ($P>0.05$) than jacks harvested the previous two years but was significantly smaller ($P<0.05$) than jacks harvested in 1989 (Figure 5). Mean fl (80.4 cm) of harvested adults was significantly larger ($P<0.05$) than that of adults harvested in 1990 and 1991, but not significantly different ($P>0.05$) than adults in 1989. Mean lengths were weighted by number harvested within each monitoring area.

Mean fl (82.4 cm) of adults harvested in the Estuary Area was not significantly different ($P>0.05$) than adults (81.7 cm) harvested in the Middle Klamath Area. Mean fl (79.0 cm) of adults harvested in the Upper Klamath Area was significantly less ($P<0.05$) than adults harvested in the Estuary and Middle Klamath areas. In all years since 1981 when this office began comprehensive biological sampling of the YIR gill net fisheries, mean fl of adults harvested in the Estuary Area have been significantly greater ($P<0.05$) than mean fl of adults harvested in the Upper Klamath Area. These findings suggest the influence of gear selectivity towards larger fish. As elsewhere in the fishery, 17.8 to 19.1 cm (7 to 7 1/2 inch) is the most commonly used gill net mesh size. The estuary fishery is the first to contact the chinook run; it is here that the greatest proportion of larger and older fish are likely to be harvested.

Disproportionate harvest of older fish by the gill net fishery is also indicated by comparing age composition of the harvest with that estimated for the overall Klamath River basin fall chinook run. Scales were collected from 824 of 843 chinook measured during the fall chinook gill net fishery. Four-year-old chinook (72.7%) comprised the largest age class of the sample, followed by age 3 (14.1%), age 5 (8.5%), and age 2 (4.7%) (Table 6). In contrast, the age composition of the 1992 Klamath River basin fall chinook run was dominated by age four chinook (45.5%), followed by age two (33.3%), age three (18.6%), and age five (2.5%) (J. Lang, USFWS, personal communication, 1993). Mean fl by age class for fall chinook captured in the gill net fishery was 49.4 cm for age 2, 72.6 cm for age 3, 81.6 cm for age 4, and 89.3 cm for age 5 (Figure 6).

Lengths and weights from 245 fall chinook harvested on the YIR in 1992 were used to calculate a length-weight relationship (Figure 7). Mean length and weight of the sampled chinook was 79.6 cm and 7.2 kg, respectively. The formula describing the length-weight relationship is:

$$\text{Weight (kg)} = 10^{(-5.205 + 3.169 \log(\text{fork length}))}, \quad r^2 = 0.95$$

Comparing weights using the respective annual length-weight relationships, a 75 cm chinook returning in 1992 would have weighed 5.5 kg. A 75 cm chinook would have weighed 6.2 kg in 1989, 6.1 kg in 1988, 5.8 kg in 1987, and 5.5 kg in 1986. Length-weight relationships for fall chinook were not analyzed in 1990 and 1991.

Ad-clips were observed on 95 (6.3%) of the 1,498 fall chinook mark sampled in all monitoring areas combined and on 4.4%, 7.4% and 7.3% of the fall chinook mark sampled in the Estuary, Middle Klamath and Upper Klamath Areas, respectively. Mean fl of ad-clipped chinook with recovered tags was 79.3 cm ($s = 7.98$, $n = 76$) for adults and 52.0 cm ($s = 4.58$, $n = 3$) for jacks.

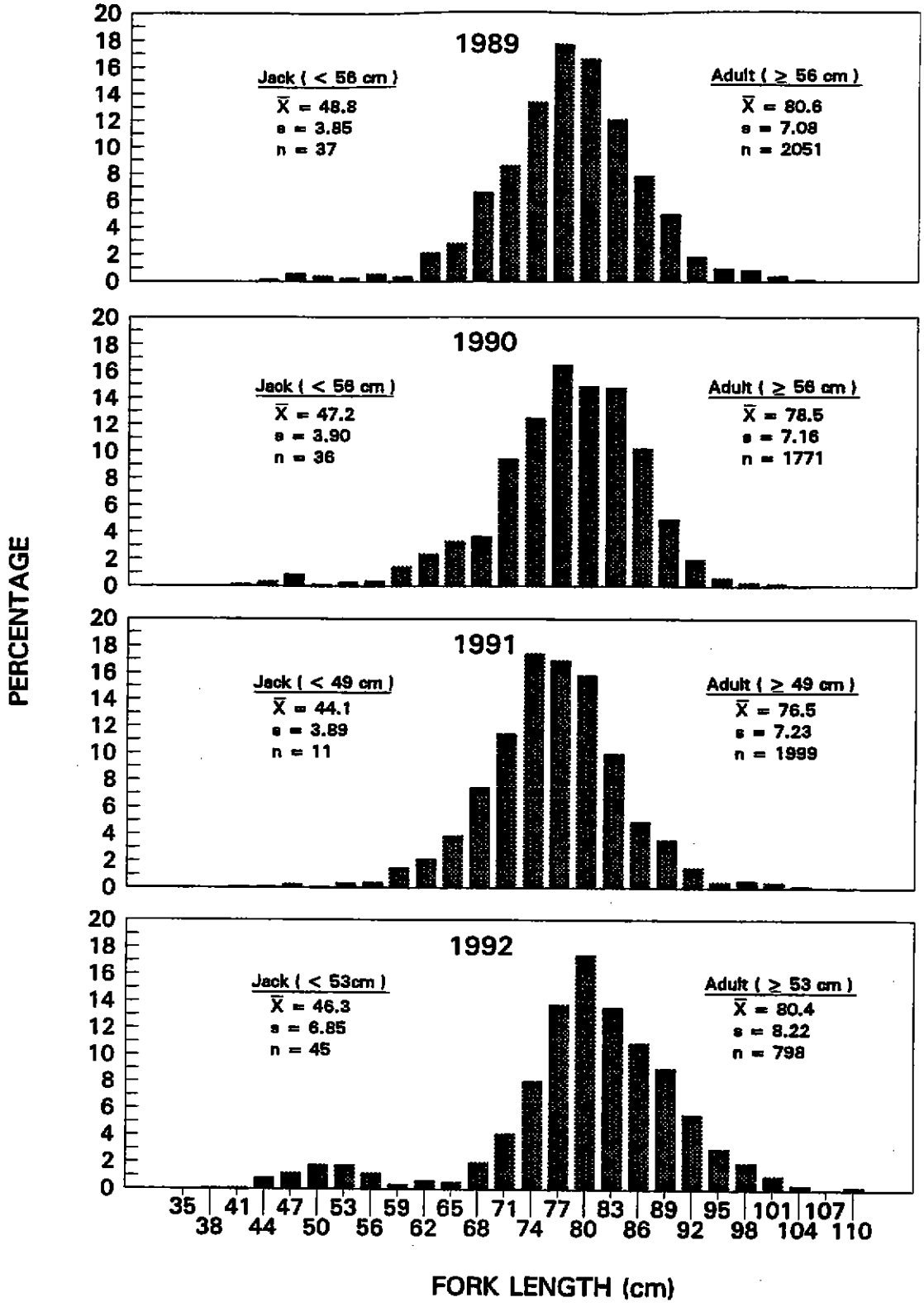

Figure 5. Weighted length frequency distributions of fall chinook salmon on the Yurok Indian Reservation during fall fisheries 1989 - 1992.

Table 6. Age class contribution of chinook salmon harvested by area during the fall fishery on the Yurok Indian Reservation in 1992.

Age	Estuary	Middle Klamath	Upper Klamath	Total
2	2 (0.9%)	11 (5.9%)	26 (6.4%)	39 (4.7%)
3	18 (7.8%)	28 (15.2%)	70 (17.1%)	116 (14.1%)
4	181 (78.4%)	131 (71.2%)	287 (70.2%)	599 (72.7%)
5	30 (13.0%)	14 (7.6%)	26 (6.4%)	70 (8.5%)
Total	231 (100.0%)	184 (100.0%)	409 (100.0%)	824 (100.0%)

Bite marks from seals or sea lions were observed on 3.8% of the chinook salmon sampled in the Estuary Area in 1992 (Table 7). This is a lower percent of depredation than observed in 1990 and 1991. The decrease may be attributed to the reduced fishing time available throughout much of the 1992 fall chinook fishery.

In 1990 and 1991, time constraints on the fall fisheries were far less limiting (USFWS, 1991, 1992a). With reduced fishing time, fishers are inclined to tend nets more closely which reduced the availability of chinook to depredation. This trend may also have been evident during the 1992 fishery. During the initial portion of the 1992 fall fishery (July 17 to September 4), fishing was allowed from 1900 hr Friday to 0700 hr Sunday, a 36 hour period. For these periods, seal bites were observed on 2.8% of chinook examined in the Estuary Area. After September 4 and until the closure on October 7, fishing was allowed at all times during the week except for an eight hour period on Mondays. During this portion of the season, the percent of chinook harvested in the estuary with seal bites increased to 4.2%. It is unknown if there was an increase in the seal and sea lion population late in the summer which would have been a contributing factor. In 1992, for all areas combined, the percent of chinook with seal bites increased from 6.6% during the early portion of the season to 9.6% during the later portion of the season.

Seal bites were observed on 9.2% and 12.2% of the fall chinook sampled in the Middle Klamath and Upper Klamath Areas, respectively. These are the highest values observed for these two areas. Since 1990, the percent of chinook captured in these areas with seal bites have generally increased. While seals are on occasion observed in the up-river areas, the majority of depredation is believed to occur in the Estuary Area. Percentages of seal bitten fish represent minimum values of depredation because they do not account for fish removed from nets by predators or severely damaged fish that were discarded and not reported as being caught.

Bites attributed to the river otter were observed on 1.7% of the fall chinook sampled in the Upper Klamath Area (Table 7). This is the lowest value of otter depredation observed for this area. While otters are present in the

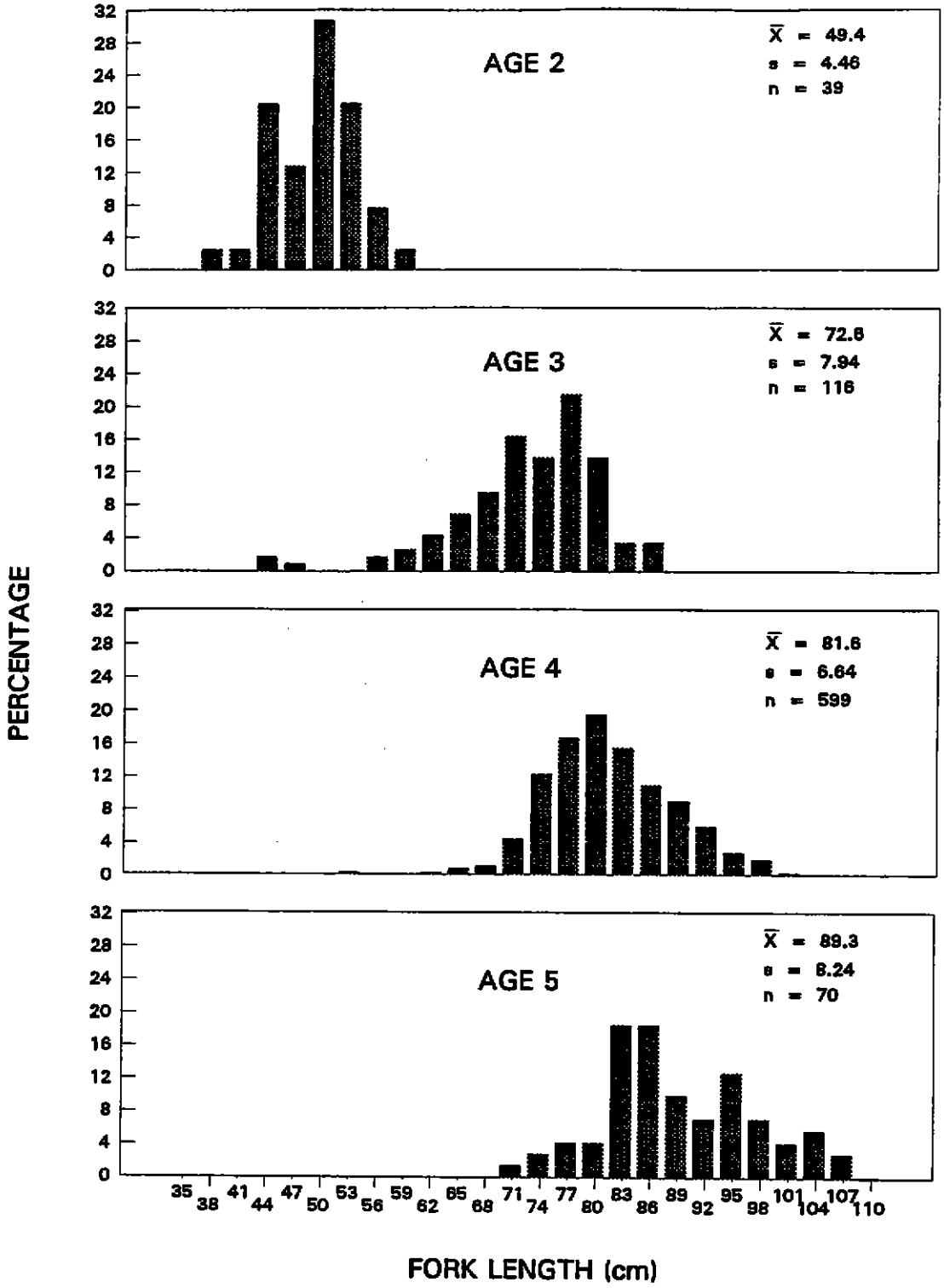

Figure 6. Length distribution by age of chinook salmon sampled during the fall fishery on the Yurok Indian Reservation in 1992.

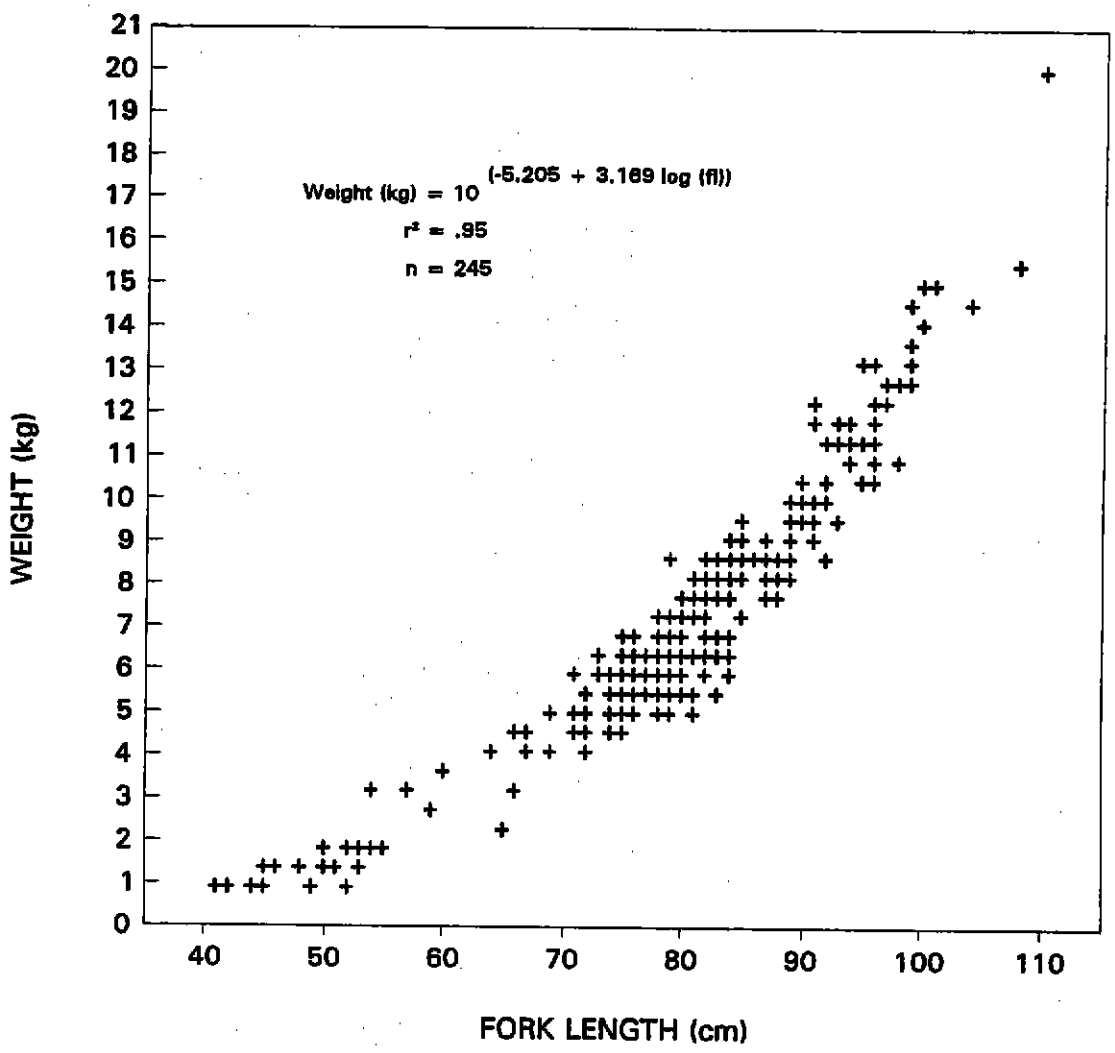

Figure 7. Length weight relationship of chinook salmon sampled during the fall fishery on the Yurok Indian Reservation in 1992.

Table 7. Percent of sampled fall chinook salmon with "seal" (seal and sea lion) and river otter bites from the Estuary, Middle and Upper Klamath monitoring areas for the years 1983-1992.

	Estuary		Middle Klamath		Upper Klamath	
Year	Seal	Otter	Seal	Otter	Seal	Otter
1983	14.2	0.0	-	-	-	-
1984	7.3	0.0	-	3.7	-	4.3
1985	3.2	0.0	-	1.7	-	4.4
1986	5.6	0.0	-	2.4	-	6.3
1987	1.8	0.0	1.0	7.0	1.6	2.5
1988	1.3	0.0	0.6	0.7	2.3	3.5
1989	3.4	0.0	1.5	1.5	3.5	5.8
1990	7.4	0.0	3.2	3.0	5.2	8.5
1991	4.7	0.0	6.1	0.7	4.8	9.9
1992	3.8	0.0	9.2	0.0	12.2	1.7

lower Klamath River, chinook with otter bites were not observed in either the Estuary or Middle Klamath Areas. Although bite marks are usually distinctive, differentiating between minor seal bites and otter bites requires a subjective judgement and it is possible that some mis-identification occurs.

An overview of the general trends in fall chinook harvest and spawning escapement on the Klamath and Trinity rivers is shown on Table 8. The PFMC Fishery Management Plan for Klamath River Fall Chinook calls for a natural spawning escapement floor of 35,000 fish. The floor represents the best assessment of the minimum level of spawning escapement that would not jeopardize future stock productivity. As can be seen in Table 8, the natural adult escapement floor has not been met for the past three years (1990-1992). These low spawning escapements have brought about the concept of spawner "deficit accounting" in which shortfalls in the natural spawning escapement would be "paid back" in the future by allowing additional fish to escape fisheries to spawn. The mechanics of this management tool would be that a shortfall in the adult natural spawning escapement (below the floor) would be added to the natural spawning escapement floor the following year; thereby, creating a new natural escapement floor. Ocean and river harvest would have to be managed to meet this new, increased floor. Evaluation for incorporating deficit accounting into the management of Klamath River fall chinook salmon continues.

Table 8. Fall chinook salmon spawner escapement in the Klamath River Basin for the past eleven years (1982 - 1992).

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Hatchery Escapement											
Iron Gate	10,186	8,885	6,094	22,110	18,557	17,014	6,715	11,690	7,025	4,067	7,313
Trinity River	6,293	5,765	2,932	20,749	19,404	16,387	22,104	11,371	1,719	2,687	3,887
Natural Escapement											
Klamath River Basin	33,174	15,173	12,279	22,827	29,295	32,620	35,813	16,749	8,888	6,232	6,976
Trinity River Basin	17,423	18,137	9,070	38,801	113,007	77,869	55,617	32,478	7,998	5,481	8,999
Angler Harvest											
Klamath River	15,948	2,110	3,163	9,181	14,958	15,249	15,538	7,779	5,303	2,798	4,297
Trinity River	4,875	2,476	1,129	5,596	15,477	10,356	12,076	3,263	350	1,271	690
Indian Harvest											
Yurok Tribe	14,456	11,219	17,815	10,233	20,887	48,267	46,892	42,211	7,249	8,951	4,864
Hoopa Tribe	1,825	1,420	1,310	2,888	5,094	5,244	5,337	3,545	847	1,310	988

Data from California Department of Fish and Game "Klamath River Basin Fall Salmon Spawner Escapement, Inriver Harvest and Run-size Estimates, 1978-1992".

Fall Fishery: Coho

An estimated 122 adult (> 52 cm) and eight jack (≤ 52 cm) coho salmon were harvested in the gill and dip net fisheries on the YIR in 1992 (Table 9). An estimated 32, 76, and 22 coho were harvested in the Estuary, Middle Klamath, and Upper Klamath areas, respectively. A dip net harvest of 30 coho (22 adults and eight jacks) occurred in the Estuary monitoring area.

The 1992 coho salmon harvest on the YIR was lower than harvested yearly over the previous eight years (Table 10). However, due to the shorter net fishery season in 1992 and possible later run timing, harvest may not be indicative of coho run size. Combined returns (n = 3,938) of adult coho salmon to the two large basin hatcheries in 1992 were 59% of the 1982 through 1991 average (n = 6,716) (Bedell 1991, and Hiser 1991).

Peak run timing for coho salmon in the lower Klamath River, as indicated by the net fishery, has been observed from mid September to mid October in past years. In 1992, harvest was greatest during the final days that the fishery was open (October 2 to 7).

Mean fl of adult coho salmon harvested in 1992 was 65.5 cm (s = 6.39, n = 29) and 45.4 (s = 3.26, n=7) for coho jack salmon (Figure 8). Mean fl of adult coho salmon in 1992 was not significantly different (P>0.05) than that of adult coho harvested in 1991 and 1990 (fl = 66.5, s = 5.23, n = 79, and fl = 65.7, s = 5.81, n = 87, respectively) but was significantly smaller (P<0.05) than that of adult coho harvested in 1989 (fl = 69.0, s = 3.74, n = 166).

Table 9. Estimated coho salmon harvested by the gill and dip net fisheries on the Yurok Indian Reservation during 1992.

Method[1/]	Monitoring Area: Estuary	Middle Klamath	Upper Klamath	Total
Gill Net				
Adult	2	76	22	100
Jack	0	0	0	0
Total	2	76	22	100
Dip Net				
Adult	22	0	0	22
Jack	8	0	0	8
Total	30	0	0	30
Combined				
Adult	24	76	22	122
Jack	8	0	0	8
Total	32	76	22	130

1/ Coho salmon were captured by two methods in 1992, gill and dip net.

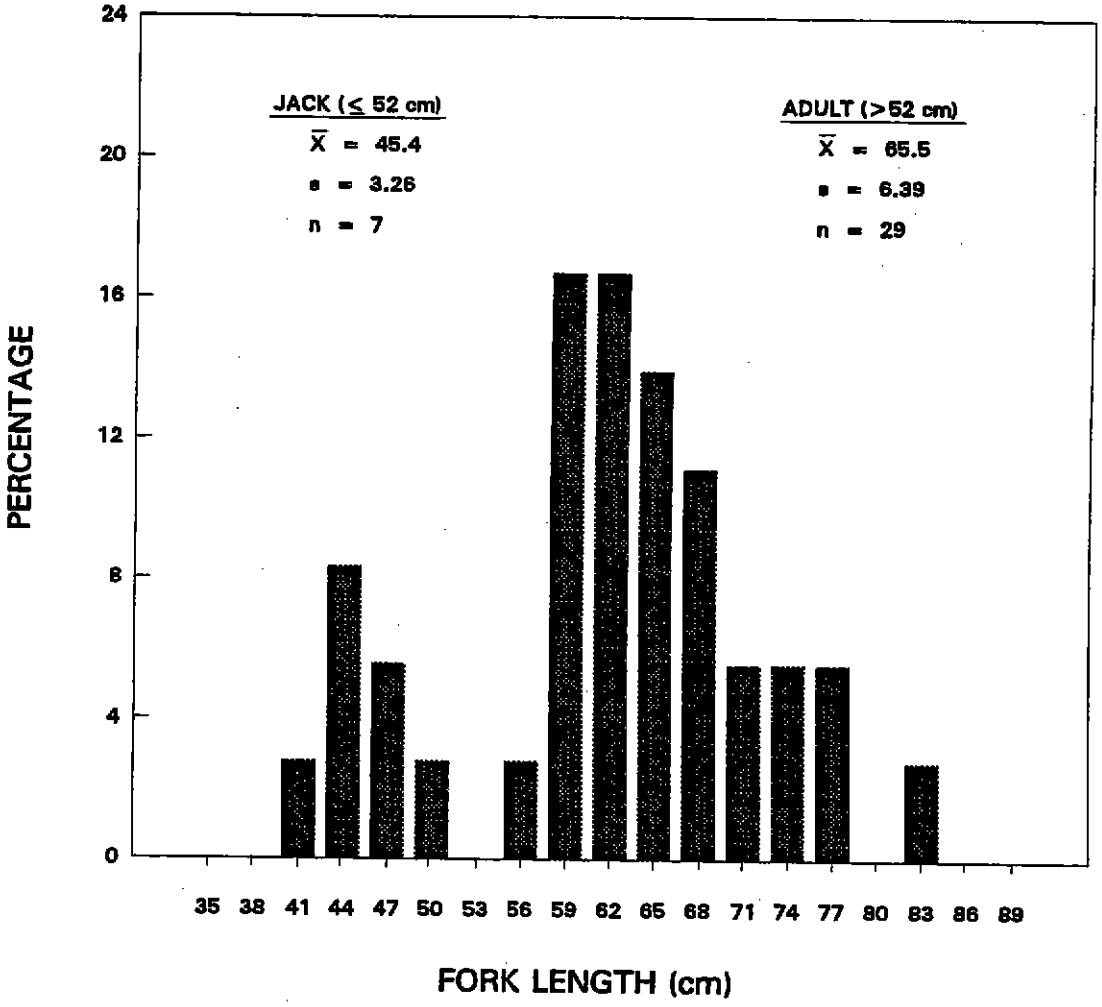

Figure 8. Length frequency distribution of coho salmon harvested on the Yurok Indian Reservation in 1992.

Scale samples were collected from 16 coho sampled during the fishery. All samples were identified as age three including samples from coho with fork lengths of 41 and 44 cm.

Ad-clips were observed on nine (20.0%) of 45 adult and jack coho salmon examined in 1992. Ad-clips were observed on eight (20.0%) of 40 adult coho examined. Snouts were collected from six adult and one jack coho salmon. Tags were recovered from each snout collected.

Table 10. Estimates of coho salmon harvested on the Yurok Indian Reservation from 1984 to 1992[1/].

Year	Ending Date[2/]	Jacks	(%)	Adults	(%)	Total
1984	10/31	39	(9.8%)	360	(90.2%)	399
1985	10/31	49	(2.5%)	1894	(97.5%)	1943
1986	10/31	9	(5.2%)	163	(94.8%)	172
1987	10/31	31	(3.3%)	904	(96.7%)	935
1988	10/31	15	(2.6%)	573	(97.4%)	988
1989	10/22	14	(2.7%)	511	(97.3%)	525
1990	10/25	5	(1.3%)	377	(98.7%)	382
1991	10/08	0	(0.0%)	391	(100.0%)	391
1992	10/07	8	(6.2%)	122	(93.8%)	130

1/ Harvest estimates by the U.S. Fish and Wildlife Service using methods described in previous annual reports.

2/ Represents final monitoring and/or harvest estimate date for the upper Klamath area. The upper Klamath area is typically the last area to be monitored in each season.

Late Fall Fishery: Chinook

Previous to 1991, the monitoring of chinook harvest had been restricted to the spring and fall fisheries. Chinook arriving after the fall fishery, typically referred to as "late fall chinook", have historically been harvested but the fishery was not monitored and harvest was unknown. Monitoring of fall fisheries usually ended in September for the Estuary Area and during October for the Middle and Upper Klamath areas. Beginning in 1991, CCFRO initiated harvest monitoring of the late fall fishery. In 1991, an estimated 21 adult chinook were harvested during the late fall fishery (October 30 to December 13) (USFWS 1993a). An additional 96 chinook were caught in 1991 for broodstock by the Yurok Accelerated Stocking Program (USFWS 1992b)

In 1992, an estimated 93 adult chinook were harvested on the YIR during the late fall period (November 16 through December 6). An estimated 78 adult chinook were harvested in the Upper Klamath Area and an additional seven adult chinook were harvested in the Middle Klamath Area (Table 11). All chinook harvested in the Upper and Middle Klamath Area were captured with set nets. In the Estuary Area, six adult chinook were captured by dip net and two by set net. There were no jack chinook captured during the late fall fishery on the YIR. Estimated set net effort (89.7%) was greatest in the Upper Klamath Area (Table 11). Catch effort and estimated harvest in the Upper Klamath Area were highest the first week of the late fall fishery and declined thereafter. This suggest that chinook may have been fairly abundant in November, and presumably October as well, and indicates that the extended fall season closure was warranted. An additional 112 adult chinook were caught in 1992 after the October 7 fall fishery closure for broodstock by the Yurok Accelerated Stocking Program (USFWS 1993b).

Mean fl (91.5, s = 8.34, n = 27) of chinook harvested during the late fall fishery was significantly greater ($P<0.05$) than mean fl (80.4) of adult chinook harvested during the fall fishery. Scale samples were collected from

Table 11. Estimated weekly adult chinook harvest and effort (number of nets) by area and net type during the late fall fishery on the Yurok Indian Reservation in 1992.

		Estuary		Middle Klamath		Upper Klamath	
Date	Net Type:	Set	Dip	Set	Drift	Set	Drift
Nov 16-22	Harvest	2	2	0	0	53	0
	Effort	7	4	11	0	32	3
Nov 23-29	Harvest	0	0	7	0	13	0
	Effort	0	16	9	5	23	0
Nov 30-	Harvest	0	4	0	0	12	0
Dec 06	Effort	2	14	7	0	39	0
Total	Harvest	2	6	7	0	78	0
	Effort	9	34	27	5	94	3

24 of the 27 chinook measured. Age four chinook (87.5%) comprised the majority of the sample followed by age five chinook (12.5%). There were no age two or age three fish in the sample.

Ad-clips were observed on five (16.7%) of 30 chinook sampled for marks during the late fall fishery. An additional Ad-clip chinook was captured during the fishery but was released (dark fish). The mean fl of Ad-clipped chinook was 85.6 cm (s = 9.26, n = 5).

CODED WIRE TAG INVESTIGATIONS

INTRODUCTION

The use of coded wire tags on Pacific salmon enables hatchery managers to evaluate the success or failure of various rearing and release strategies. CWT recovery information allows fishery harvest managers to assess the contribution of different stocks to ocean and inriver fisheries. It is also valuable in determining the extent that hatchery stocks utilize natural areas for spawning.

There are three sources of CWT chinook from within the Klamath River basin:

1) Two large hatcheries are operated within the Klamath River basin. IGH is located at the base of Iron Gate Dam (rkm 249) on the Klamath River and TRH is located at the base of Lewiston Dam (rkm 178) on the Trinity River. During most years CWT's are applied to a portion of each chinook release group.

2) A few small scale facilities along both the Klamath and Trinity Rivers rear fall chinook for supplementation or bioenhancement purposes. These supplementation and enhancement and/or interim artificial programs (IAP) normally also CWT a portion of their production.

3) California Department of Fish and Game (CDFG) and USFWS are involved in tagging operations of natural stocks from the mainstem Trinity River and from the larger tributaries within the Klamath Basin. This program was initiated by CDFG in 1983. The goal of the program is to provide information on natural stocks of chinook salmon.

While conducting net harvest monitoring operations on the YIR in 1992, CCFRO biologists collected snouts from Ad-clipped chinook and coho. This information is used to assess the contribution of hatchery and natural stocks to the gill net fishery.

METHODS

Methods of acquiring CWT samples during net harvest monitoring activities were previously described in this report. Coded wire tags from the field samples were recovered from salmon snouts with the aid of a magnetic field detector. Tags were then decoded with the aid of a Reichert 580 dissecting scope, Hitachi CCTV camera and Koyo video monitor. If a tag was not detected, the snout was dissolved in a potassium hydroxide solution. A magnet was then stirred through the resultant slurry to recover tags that did not activate the magnetic field detector.

Recovery data for each CWT group were expanded to estimate contribution to the net harvest by time and area. The expansion adjusts for that portion of the harvest not sampled, the non-recovery of snouts from observed Ad-clipped fish and tags lost during dissection. The expanded tag factor varies with each sampling area, and period, and is the product of three ratios:

(1) Sampling Ratio = $\frac{\text{Estimated Net Harvest}}{\text{Number of Fish Examined for Ad-Clips}}$

(2) Head Recovery Ratio = $\frac{\text{Number of Ad-Clipped Fish Observed}}{\text{Number of Heads Recovered}}$

(3) Lost Tag Ratio = $\frac{\text{Number of Heads with Tags}}{\text{Number of Tags Decoded}}$

Contribution rates of individual CWT groups to the net fishery were calculated and expressed as a percentage:

(4) Contribution Rate (%) = $\frac{\text{Estimated CWT Harvest}}{\text{Number of Tagged Fish Released}} \times 100$

The contribution rate compensates for unequal release-size bias and allows for comparison of different release strategies. Statistical analysis of data was limited to the t-test unless otherwise noted. The data were compared at the 95% confidence level.

RESULTS AND DISCUSSION

Spring Fishery: Chinook

A total of 86 (21.7%) of the estimated 396 chinook salmon harvested during the 1992 spring fishery (April 5 - July 13) on the YIR were examined for Ad-clips (Table 12). Of the six Ad-clipped chinook observed, five (83.3%) snouts were collected and four CWTs were recovered. One snout did not contain a CWT.

Table 12. Chinook mark sample data collected during the 1992 spring fishery on the Yurok Indian Reservation.

	Monitoring Area			
	Estuary	Middle Klamath	Upper Klamath	Total
Estimated Harvest	15	97	284	396
Mark Sampled	1	11	74	86
Observed Ad-Clips	0	1	5	6
Collected Snouts	0	0	5	5
Tags Recovered	0	0	4	4
No Tags	0	0	1	1

An estimated 17 CWT chinook salmon were harvested during the spring fishery in 1992 (Table 13). A single tag code was recovered which represented a 1988 brood year (BY), spring chinook yearling release from TRH. An estimated four chinook that were Ad-clipped but did not contain a CWT were also harvested.

Length statistics for 1992, by code and area of capture are presented in Table 14.

Scale samples were taken on the five Ad-clip chinook with snouts collected. All five were identified as age four. The contribution rate of age three and four fingerling and yearling releases of spring chinook to the net fishery has decreased substantially over the past three completed BY (1986 to 1988) (Table 15).

Table 13. Actual and expanded coded wire tag recoveries for chinook salmon from the spring fishery on the Yurok Indian Reservation in 1992.

Tag Code	Brood Year	Race	Hatchery of Origin[1]	Release Type[2]	Actual	Expanded
06-61-48	1988	Spring	TRH	Y	4	16.96
Total					4	16.96
Ad - No Tag					1	4.23
Total					5	21.19

[1] TRH - Trinity River Hatchery [2] Y - Yearling - October/November Release

Table 14. Length data of chinook coded wire tag groups harvested during the spring fishery on the Yurok Indian Reservation in 1992.

Tag Code	Brood Year	Race	Hatchery of Origin[1]	Release Type[2]	Estuary	Middle Klamath	Upper Klamath	All Areas
06-61-48	1988	Spring	TRH	Y	----[3]	----	71.7	71.7
					----[4]	----	4.5	4.5
					0 [5]	0	3	3
					----[6]	----	67	67
					----[7]	----	76	76
Ad-No Tag					----	----	73.0	73.0
					----	----	----	----
					0	0	1	1
					----	----	73	73
					----	----	73	73

[1] TRH - Trinity River Hatchery
[2] Y - Yearling
[3] Mean Fork Length (cm)
[4] Standard Deviation (cm)
[5] Sample Size
[6] Minimum Size (cm)
[7] Maximum Size (cm)

Table 15. Contribution rate of coded wire tag (CWT) age 3 and 4 spring chinook for brood years 1980 – 1988 to the gill net fishery on the Yurok Indian Reservation.

Tag Code	Brood Year	Hatchery of Origin[1]	Release Type[2]	Number Harvested[3] 3 Yr	4Yr	Total	Number Released Tagged[4]	Contribution Rate[5]
06–61–39	1980	TRH	Y	10	39	49	34601	0.142
06–61–35	1981	TRH	F	0	0	0	182635	0.000
06–61–37	1981	TRH	Y	9	73	82	98637	0.083
06–61–38	1982	TRH	Y	76	50	126	96461	0.131
06–61–41	1982	TRH	F	6	12	18	146194	0.012
06–61–40	1983	TRH	Y	96	224	320	90293	0.354
06–61–43	1984	TRH	Y	207	230	437	98568	0.443
06–61–42	1985	TRH	F	47	62	109	192487	0.057
06–61–44	1985	TRH	Y	83	543	626	101091	0.619
06–61–45	1986	TRH	F	3	0	3	197113	0.002
06–61–46	1986	TRH	Y	23	64	87	101030	0.086
06–61–47	1987	AMBP	F	9	0	9	185718	0.005
06–61–48	1988	TRH	Y	0	17	17	98820	0.017
06–61–49	1988	TRH	F	3	0	3	181698	0.002

[1] TRH – Trinity River Hatchery
AMBP – Ambrose Ponds, TRH stock

[2] Y – Yearling, October/November Release
F – Fingerling, spring release

[3] Estimated number of coded wire tagged spring chinook

[4] From Pacific States Marine Fisheries Commission CWT release data (PSMFC 1991)

[5] Contribution rate = (estimated number harvested/number released tagged) X 100

Fall Fishery: Chinook

A total of 1,498 (29.0%) of the estimated 5,163 chinook salmon harvested during the 1992 fall fishery (July 17 - October 7) on the YIR were examined for adipose fin clips (Table 16). Of the 95 Ad-clipped chinook observed, 89 (93.7%) snouts were collected and 81 CWTs recovered. Eight (9.0%) of the snouts did not contain a CWT.

An estimated 284 CWT chinook salmon were harvested during the fall fishery in 1992 (Table 17). An additional 35 chinook that were Ad-clipped but did not contain a CWT were estimated to have been harvested.

Twenty six different tag codes were recovered representing: three fingerling and two yearling fall chinook groups from IGH; seven groups of fall chinook of IGH origin released as yearlings at off-site facilities; one fingerling and four yearling fall chinook groups from TRH; one fingerling and one yearling fall chinook groups of TRH origin released at off-site facilities; one fingerling and two yearling spring chinook groups from TRH; one yearling fall chinook group from the Hoopa Valley Business Council's (HVBC) hatchery; one yearling fall chinook natural stock group from Horse Linto Creek; one fingerling fall chinook natural stock group from the upper Trinity River; and one fingerling fall chinook natural stock group from Blue Creek. A single release of TRH yearling fall chinook (tag code 06-56-32, BY 1988) accounted for 32.0% of the total expanded CWT's recovered.

Fall chinook originating from TRH (on-site and off-site releases combined) accounted for 52.7% of the estimated 284 CWT chinook harvested on the YIR in 1992, while fall chinook originating from IGH (on-site and off-site releases combined) comprised 37.6% (Table 16). Previous to the 1992 fishery (1982 to 1991), IGH stock CWT chinook have comprised the majority of the gill net fishery expanded CWT recoveries. Natural stock CWT fall chinook from Horse Linto Creek accounted for 5.5% of the estimated harvest of tagged chinook and Blue Creek fall chinook natural stocks comprised 1.7%. Spring chinook stock

Table 16. Chinook mark sample data collected during the 1992 fall chinook fishery on the Yurok Indian Reservation.

	Monitoring Area			
	Estuary	Middle Klamath	Upper Klamath	Total
Estimated Harvest	1276	1159	2728	5163
Mark Sampled	517	390	591	1498
Observed Ad-Clips	23	29	43	95
Collected Snouts	21	27	41	89
Tags Recovered	17	24	40	81
No Tags	4	3	1	8

Table 17. Actual and expanded coded wire tag recoveries for chinook salmon from the 1992 fall fishery on the Yurok Indian Reservation (# = actual number, Exp = expanded number).

Tag Code	Brood Year	Race	Origin[1]	Release Type[2]	ESTUARY		MIDKLAM		UPKLAM		TOTAL	
					#	Exp	#	Exp	#	Exp	#	Exp
05-01-01-01-06	1988	Fall	USFWS[3]	F	0	0.00	1	4.83	0	0.00	1	4.83
06-01-02-01-02	1988	Fall	IGH	F	2	6.76	0	0.00	1	1.63	3	8.39
06-01-02-01-05	1990	Fall	IGH	F	0	0.00	0	0.00	1	8.04	1	8.04
06-01-02-01-06	1990	Fall	IGH	F	0	0.00	0	0.00	1	3.44	1	3.44
06-01-04-01-03	1990	Spring	TRH	F	0	0.00	1	1.00	0	0.00	1	1.00
06-28-07	1988	Fall	IGH[4]	Y	1	3.16	0	0.00	5	19.99	6	23.15
06-28-08	1988	Fall	IGH[5]	Y	0	0.00	2	6.33	2	7.93	4	14.26
06-28-09	1988	Fall	IGH[5]	Y	0	0.00	2	3.02	2	3.26	4	6.28
06-28-10	1988	Fall	IGH[6]	Y	3	6.71	0	0.00	1	1.63	4	8.34
06-28-11	1988	Fall	IGH[7]	Y	1	1.51	1	1.51	0	0.00	2	3.02
06-28-14	1988	Fall	IGH[8]	Y	0	0.00	1	1.51	3	9.51	4	11.02
06-28-15	1988	Fall	IGH[8]	Y	0	0.00	2	4.90	2	3.26	4	8.16
06-29-24	1988	Fall	HLCR[9]	Y	3	9.48	0	0.00	1	6.25	4	15.73
06-52-09	1989	LFall	HVBC[10]	Y	0	0.00	1	1.51	0	0.00	1	1.51
06-55-22	1988	Fall	TRH	Y	0	0.00	0	0.00	1	8.04	1	8.04
06-55-23	1988	Fall	TRH	Y	0	0.00	2	3.02	2	9.67	4	12.69
06-56-31	1987	Fall	TRH[11]	Y	0	0.00	2	3.02	1	8.04	3	11.06
06-56-32	1988	Fall	TRH	Y	6	19.58	6	24.18	8	47.14	20	90.90
06-56-33	1987	Fall	TRH[11]	F	0	0.00	0	0.00	1	8.04	1	8.04
06-56-34	1989	Fall	TRH	Y	0	0.00	1	4.82	1	8.04	2	12.86
06-56-35	1988	Fall	TRH	F	0	0.00	0	0.00	1	6.25	1	6.25
06-56-39	1989	Spring	TRH	Y	0	0.00	0	0.00	1	1.68	1	1.68
06-59-37	1987	Fall	IGH	Y	0	0.00	1	1.51	0	0.00	1	1.51
06-59-62	1988	Fall	IGH	Y	0	0.00	1	1.51	2	9.69	3	11.20
06-61-48	1988	Spring	TRH	Y	0	0.00	0	0.00	1	1.35	1	1.35
B6-13-06	1988	Fall	TRNSAP[12]	F	0	0.00	0	0.00	1	1.63	1	1.63
TOTAL TAGS					16	47.20	24	62.67	39	174.51	79	284.38
NO TAG					5	14.59	3	14.46	1	6.25	9	35.30
TOTAL					21	61.79	27	77.13	40	180.76	88	319.68

[1] HVBC – Hoopa Valley Business Council
IGH – Iron Gate Hatchery
TRH – Trinity River Hatchery
TRNSAP – Trinity River Natural Stocks Assessment Program
USFWS – U.S. Fish and Wildlife Service, Blue Creek stock, wild
HLCR – Horse Linto Creek stock, wild

[2] F (Fingerling) – April to June release
Y (Yearling) – Late September to December release

[3] Blue Creek Stock (Wild) – Klamath River

[4] IGH Stock – reared & released at Indian Creek – Klamath River

[5] IGH Stock – reared & released at Bluff Creek – Klamath River

[6] IGH Stock – reared & released at Elk Creek – Klamath River

[7] IGH Stock – reared & released at Grider Creek – Klamath River

[8] IGH Stock – reared & released at Red Cap Creek – Klamath River

[9] Horse Linto Creek Stock (Wild) – Trinity River

[10] Trinity River Stock – reared at Supply Creek, released at Red Rock – Trinity River

[11] TRH Stock – reared & released at Ambrose Pond – Trinity River

[12] Trinity River Stock (Wild) – captured, tagged & released at Junction City – Trinity River

Table 18. Origin and recovery area of expanded coded wire tags (percent of recovered tags in parentheses) harvested by the gill net fishery on the Yurok Indian Reservation in 1992.

Hatchery of Origin	Monitoring Area: Estuary	Middle Klamath	Upper Klamath	Total
IGH[1/]	6.76 (14.3)	3.02 (4.8)	23.07 (13.2)	32.85 (11.6)
IGH[2/]	3.16 (6.7)	0.00 (0.0)	19.99 (11.5)	23.15 (8.1)
IGH[3/]	0.00 (0.0)	9.35 (14.9)	11.19 (6.4)	20.54 (7.2)
IGH[4/]	0.00 (0.0)	6.41 (10.2)	12.77 (7.3)	19.18 (6.7)
IGH[5/]	6.71 (14.2)	0.00 (0.0)	1.63 (0.9)	8.34 (2.9)
IGH[6/]	1.51 (2.1)	1.51 (2.4)	0.00 (0.0)	3.02 (1.1)
TRH[7/]	19.58 (41.5)	32.02 (51.1)	79.14 (45.3)	130.74 (45.9)
TRH[8/]	0.00 (0.0)	3.02 (4.8)	16.08 (9.2)	19.10 (6.7)
TRH[9/]	0.00 (0.0)	1.00 (1.6)	3.03 (1.7)	4.03 (1.4)
HVBC[10/]	0.00 (0.0)	1.51 (2.4)	0.00 (0.0)	1.51 (0.5)
USFS[11/]	9.48 (20.1)	0.00 (0.0)	6.25 (3.6)	15.73 (5.5)
HLCR[12/]	0.00 (0.0)	4.83 (7.7)	0.00 (0.0)	4.83 (1.7)
TRNSAP[13/]	0.00 (0.0)	0.00 (0.0)	1.63 (0.9)	1.63 (0.6)
Total	47.20	62.67	174.51	284.38
No Tags	14.54	14.46	6.25	35.30
Total	61.79	77.13	180.76	319.68

1/ Iron Gate Hatchery (IGH) fall stock reared and released at hatchery
2/ IGH fall stock reared and released at Indian Creek
3/ IGH fall stock reared and released at Bluff Creek
4/ IGH fall stock reared and released at Red Cap Creek
5/ IGH fall stock reared and released at Elk Creek
6/ IGH fall stock reared and released at Grider Creek
7/ Trinity River Hatchery (TRH) fall stock reared and released at hatchery
8/ TRH fall stock reared and released at Ambrose Ponds
9/ TRH spring stock reared and released at hatchery
10/ Hoopa Valley Business Council Hatchery Supply Creek stock
11/ HLCR - Horse Linto Creek wild stock
12/ USFWS - Blue Creek Wild Stock
12/ Trinity River Wild Stock - captured, tagged and released at Junction City

from TRH accounted for 1.4% the estimated harvest of tagged chinook. Other tag groups of fall chinook (Trinity River natural stocks, and HVBC stocks) made up the remaining 1.1% of the harvest of CWT chinook.

Contribution rates of CWT groups were examined with regard to release type and site of release (Table 19). Juvenile CWT chinook groups released onsite as yearlings at both IGH and TRH continue to demonstrate higher contribution rates to the gill net fishery than those released onsite as fingerlings. The contribution rate for 1988 BY, IGH yearling fall chinook released onsite was 0.014%, 3.5 times greater than the fingerling release (0.004%). The difference was more pronounced with the 1987 BY releases in which yearling fall chinook released onsite (0.123%) had a contribution rate 41 times greater than the fingerling release (0.003%). The contribution rate for 1988 BY, TRH yearling fall chinook released onsite was 0.129%, 16 times greater than the fingerling release (0.008%).

Chinook released offsite also have contribution rates greater then those released onsite. There were five offsite rearing and yearling release operations using 1988 BY IGH stock (Indian Creek, Bluff Creek, Elk Creek, Grider Creek, and Red Cap Creek). Their percent contribution rates (0.187, 0.093, 0.047, 0.033, and 0.109, respectively) were substantially greater than the IGH onsite yearling release (0.014). There were no offsite releases from TRH for the 1988 BY.

Each CWT group has an inherent expansion factor (≥ 1.0) which is based on the tagging rate for that tag group (total fish released/number tagged). Expansion factors assume no differential mortality between tagged and non tagged fish of similar release group. These expansion factors are applied to the expanded CWT recoveries by tag group for each inriver recovery type (net fishery, sport fishery, hatchery returns, spawning ground surveys) yielding an estimate of the total contribution by tag group to the particular fishery (Table 20). Hatchery contribution to the gill net fishery is compared to that of the inriver run to determine the proportionality of the harvest. As noted in previous annual reports (USFWS 1988, USFWS 1989, USFWS 1991, and USFWS 1992a), the gill net fishery has disproportionately harvested IGH stocks and presumably Klamath natural stocks (assuming similar run timing) in relation to TRH stocks. Difference in run timing (IGH stocks enter the river predominately in late July and August while TRH stocks enter approximately mid-August and September), timing of the estuary net fishery including intensively fished commercial fisheries, and selectivity of gill nets are believed to effect the disproportionate harvest.

Contribution to the 1992 inriver run from Klamath basin hatcheries was estimated to be 14,351 fall chinook (Klamath River Technical Advisory Team, Klamath River Fall Chinook Cohort Reconstruction, (KRTAT, KRFCCR), 1992). Of these, 35.6% were determined to be IGH stocks and 64.4% TRH stocks. Contribution to the 1992 YIR gill net fishery from Klamath basin hatcheries was estimated to be 2,100 fall chinook. Of these, 38.6% were determined to be IGH stocks and 61.4% TRH stocks (Table 20) reflecting more proportionate harvest than previous years. Although compounded by the apparent late run timing of the inriver run, it is suggested that the time constraints promulgated for the early portion of the season (July 15 to September 5) effectively reduced gill net harvest impacts on IGH stocks.

Total contribution to the 1992 gill net fishery from chinook CWT groups was estimated to be 2,152 (jacks and adults). Of tag groups contributing, the single largest (n = 993) was a 1988 BY, TRH yearling release (tag code 6-56-32) (Table 20). This single tag group is estimated to have comprised 20.5% of the total YIR gill net harvest of adult fall chinook (4,839).

The next largest contributor (n = 290) of adult chinook to the net fishery was a 1988 BY, IGH onsite fingerling release (tag codes 6-1-2-1-1 and 6-1-2-1-2).

Table 19. Contribution rates of coded wire tag (CWT) age 3 and 4 chinook to the net fisheries on the Yurok Indian Reservation for brood years 1987 to 1989.

Tag Code[1]	Brood Year	Race	Hatchery of Origin[2]	Release Type	NUMBER HARVESTED[3] 3 Yr	4Yr	Total	Number Released Tagged[4]	Contribution Rate[5]
06-29-22	1987	Fall	HLCR	Y	0	22	22	24720	0.089
06-52-07	1987	L Fall	MLCR	Y	0	29	29	39097	0.074
06-52-08	1987	L Fall	SPCR	Y	5	16	21	8352	0.251
06-56-31	1987	Fall	AMBP	Y	9	62	71	92300	0.077
06-56-33	1987	Fall	AMBP	F	0	15	15	172980	0.009
06-59-36	1987	Fall	IGH	Y	6	58	64	57600	0.111
06-59-37	1987	Fall	IGH	Y	9	45	54	38400	0.141
combined					15	103	118	96000	0.123
B6-02-01	1987	Fall	IGH	F	0	4	4	157380	0.003
B6-09-05	1987	Fall	BGCR	F	0	2	2	24671	0.008
06-28-07	1988	Fall	INCR	Y	11	23	34	18158	0.187
06-28-08	1988	Fall	BLCR	Y	5	14	19	17766	0.107
06-28-09	1988	Fall	BLCR	Y	6	6	12	15671	0.077
combined					11	20	31	33437	0.093
06-28-10	1988	Fall	ELCR	Y	2	8	10	21265	0.047
06-28-11	1988	Fall	GRCR	Y	8	3	11	16708	0.066
06-28-12	1988	Fall	GRCR	Y	0	0	0	16477	0.000
combined					8	3	11	33185	0.033
06-28-14	1988	Fall	RCCR	Y	8	11	19	17773	0.107
06-28-15	1988	Fall	RCCR	Y	7	8	15	13512	0.111
combined					15	19	34	31285	0.109
06-29-23	1988	Fall	HLCR	F	2	0	2	22855	0.009
06-29-24	1988	Fall	HLCR	Y	5	16	21	20282	0.104
06-55-22	1988	Fall	TRH	Y	2	8	10	22234	0.045
06-55-23	1988	Fall	TRH	Y	5	13	18	24131	0.075
06-56-32	1988	Fall	TRH	Y	35	91	126	97569	0.129
06-56-35	1988	Fall	TRH	F	9	6	15	194197	0.008
06-59-62	1988	Fall	IGH	Y	3	11	14	98283	0.014
06-61-48	1988	Spring	TRH	Y	0	1	1	98820	0.001
B6-13-06	1988	Fall	TRWILD	F	0	2	2	15703	0.013
05-01-01-01-06	1988	Fall	USFWS	F	0	5	5	10074	0.050
06-01-02-01-01	1988	Fall	IGH	F	0	0	0	111299	0.000
06-01-02-01-02	1988	Fall	IGH	F	0	8	8	88629	0.009
combined					0	8	8	197928	0.004
06-01-08-01-01	1988	Fall	BGCR	F	2	0	2	35008	0.006
06-52-09	1989	L Fall	SPCR	Y	2	–	2	7336	0.027
06-56-34	1989	Fall	TRH	Y	13	–	13	97810	0.013
06-56-39	1989	Spring	TRH	Y	2	–	2	102555	0.002

[1] Tag codes from the same release were also combined.

[2]
- HLCR – Horse Linto Creek stock, wild
- MLCR – Hoopa Valley Tribe, Mill Creek
- SPCR – Hoopa Valley Tribe, Supply Creek
- AMBP – Ambrose Ponds, TRH stock
- IGH – Iron Gate Hatchery
- BGCR – Bogus Creek stock, wild
- INCR – Indian Creek, IGH stock
- BLCR – Bluff Creek, IGH stock
- ELCR – Elk Creek, IGH stock
- GRCR – Grider Creek, IGH stock
- RCCR – Red Cap Creek, IGH stock
- TRH – Trinity River Hatchery
- TRWILD – Trinity River stock, wild
- USFWS – Blue Creek Stock, wild

[3] Estimated number of CWT fall chinook

[4] From Pacific States Marine Fisheries Commission coded wire tag release data (PSMFC 1991).

[5] Contribution rate = (estimated number harvested/number released tagged) X 100

Table 20. Actual and expanded coded wire tag (CWT) recoveries, expansion factors, and contribution of chinook CWT release groups to the 1992 fall fishery on the Yurok Indian Reservation.

Tag Code[a]	Brood Year	Race	Origin[1]	Release Type[2]	CWT Recoveries[3] Actual	CWT Recoveries[3] Expanded	Expansion Factor[4]	Contribution[5]
05-01-01-01-06	1988	Fall	USFWS[6]	F	1	4.83	1.172	5.66
06-01-02-01-05	1990	Fall	IGH	F	1	8.04		
06-01-02-01-06	1990	Fall	IGH	F	1	3.44		
06-63-26	1990	Fall	IGH	F	0	0.00		
combined						11.48	27.573	316.54
06-01-04-01-03	1990	Spring	TRH	F	1	1.00	9.342	9.34
06-28-07	1988	Fall	IGH[7]	Y	6	23.15	1.118	25.88
06-28-08	1988	Fall	IGH[8]	Y	4	14.26		
06-28-09	1988	Fall	IGH[8]	Y	4	6.28		
combined						20.54	2.331	47.88
06-28-10	1988	Fall	IGH[9]	Y	4	8.34	1.111	9.27
06-28-11	1988	Fall	IGH[10]	Y	2	3.02		
06-28-12	1988	Fall	IGH[10]	Y	0	0.00		
combined						3.02	1.136	3.43
06-28-14	1988	Fall	IGH[11]	Y	4	11.02		
06-28-15	1988	Fall	IGH[11]	Y	4	8.16		
combined						19.18	1.250	23.98
06-01-02-01-01	1988	Fall	IGH	F	0	0.00		
06-01-02-01-02	1988	Fall	IGH	F	3	8.39		
combined						8.39	34.615	290.42
06-29-24	1988	Fall	HLCR[12]	Y	4	15.73	1.227	19.30
06-52-09	1989	LFall	HVBC[13]	Y	1	1.51	1.193	1.80
06-55-22	1988	Fall	TRH	Y	1	8.04	1.007	8.10
06-55-23	1988	Fall	TRH	Y	4	12.69	1.017	12.91
06-56-31	1987	Fall	TRH[14]	Y	3	11.06	1.010	11.17
06-56-32	1988	Fall	TRH	Y	20	90.90	10.926	993.17
06-56-33	1987	Fall	TRH[14]	F	1	8.04	13.587	109.24
06-56-34	1989	Fall	TRH	Y	2	12.86	4.892	62.91
06-56-35	1988	Fall	TRH	F	1	6.25	14.532	90.83
06-56-39	1989	Spring	TRH	Y	1	1.68	3.402	5.72
06-59-37	1987	Fall	IGH	Y	1	1.51	1.039	1.57
06-59-62	1988	Fall	IGH	Y	3	11.20	8.260	92.51
06-61-48	1988	Spring	TRH	Y	1	1.35	6.158	8.31
B6-13-06	1988	Fall	TRNSAP[15]	F	1	1.63	1.251	2.04
Total					79	284.38		2151.96

[a] Tag codes from the same release were combined

[1] HVBC – Hoopa Valley Business Council
IGH – Iron Gate Hatchery
TRH – Trinity River Hatchery
TRNSAP – Trinity River Natural Stocks Assessment Program
USFWS – U.S. Fish and Wildlife Service

[2] F (Fingerling) – April to June release
Y (Yearling) – Late September to December release

[3] Actual and expanded CWT recoveries

[4] Expansion factor = (# tagged + # shed tags + # untagged fish) / # tagged fish

[5] Contribution = Expanded CWT from YIR * Expansion factor

[6] Blue Creek Stock (Wild) – Klamath River

[7] IGH Stock – reared & released at Indian Creek – Klamath River

[8] IGH Stock – reared & released at Bluff Creek – Klamath River

[9] IGH Stock – reared & released at Elk Creek – Klamath River

[10] IGH Stock – reared & released at Grider Creek – Klamath River

[11] IGH Stock – reared & released at Red Cap Creek – Klamath River

[12] Horse Linto Creek Stock (Wild) – Trinity River

[13] Trinity River Stock – reared at Supply Creek, released at Red Rock – Trinity River

[14] TRH Stock – reared & released at Ambrose Pond – Trinity River

[15] Trinity River Stock (Wild) – captured, tagged & released at Junction City – Trinity River

A 1990 BY, IGH onsite fingerling release (tag codes 6-1-2-1-5 and 6-1-2-1-6) also contributed 317 jack chinook to the gill net fishery representing 97.8% of the estimated total jack chinook harvest (324). Although the actual and expanded gill net harvest recoveries for these two release groups were low (Table 17), as was their CWT contribution rate (Table 19), their expansion factors were relatively high (due to the low tagging rate) thus yielding substantial contribution to the fishery with relatively few tags recovered. The IGH component of the 1992 inriver run, not including offsite release groups, was in fact dominated by BY 1990 (n = 2,820, 61.2%) and BY 1988 (n = 1,501, 32.6%) fall chinook (KRTAT, KRFCCR, 1992).

The age composition of the CWT chinook harvested on the YIR during the fall fishery in 1992 was 4.4% age 2, 5.7% age 3, 82.7% age 4, and 7.2% age 5 (Table 21). Age composition of the Klamath basin inriver run based on both scale samples and CWT recoveries indicated a stronger two and three year old component than determined for the YIR net fishery (Table 21). This discrepancy in age composition between the net fishery and the inriver run is typical and supports the assertion that gill nets disproportionately harvest the larger and older fish of the inriver run. As noted in previous years, Klamath basin age composition data again indicate that the Klamath River age 4 component (79.2%) of the 1992 adult return (hatchery and natural spawners) was stronger than the Trinity River age 4 component (59.7%) and conversely, the Trinity River age 3 component (38.0%) was greater than that of the Klamath River (18.1%) (J. Lang, USFWS, personal communication, 1993). This difference in age composition between the two river basins, combined with the propensity of the net fishery to select for larger/older fish, substantiates the venerability of Klamath River basin stocks to the net fishery. Length statistics of chinook by CWT code and area of capture are presented in Table 22.

Table 21. Percent age composition of the chinook gill net harvest on the Yurok Indian Reservation during the 1992 fall fishery and for the Klamath basin inriver run.

Age:	Two	Three	Four	Five
Estuary[1/]	0.0	0.0	100.0	0.0
Middle Klamath[1/]	1.6	10.1	81.1	7.2
Upper Klamath[1/]	6.6	5.6	78.6	9.2
All Areas[1/]	4.4	5.7	82.7	7.2
All Areas[2/]	4.7	14.1	72.7	8.5
Inriver Run[3/]	20.9	16.4	60.7	2.0
Inriver Run[4/]	33.3	18.6	45.5	2.5

[1/] Based on coded wire tags [2/] Based on scale analysis
[3/] Based on coded wire tags (KRTAT, KRFCCR, 1992)
[4/] Based on scale analysis (J. Lang, USFWS, personal communication, 1993)

Table 22. Length data of chinook coded wire tag groups harvested during the fall fishery on the Yurok Indian Reservation (YIR) in 1992.

Tag Code	Brood Year	Race[1]	Hatchery of Origin[2]	Release Type[3]	Reservation Monitoring Area: Estuary	Middle Klamath	Upper Klamath	All Areas
06-28-07	88	Fall	IGH[4]	Y	76.0[14]	----	81.4	80.5
					----[15]	----	5.9	5.7
					1 [16]	0	5	6
					76 [17]	----	77	76
					76 [18]	----	91	91
06-28-08	88	Fall	IGH[5]	Y	----	81.5	77.5	79.5
					----	5.0	6.4	5.2
					0	2	2	4
					----	78	73	73
					----	85	82	85
06-28-09	88	Fall	IGH[5]	Y	----	90.0	78.0	84.0
					----	11.3	1.4	3.8
					0	2	2	6
					----	82	77	72
					----	98	79	81
06-28-10	88	Fall	IGH[6]	Y	77.7	----	75.0	77.0
					5.1	----	----	4.4
					3	0	1	4
					72	----	75	72
					82	----	75	82
06-28-11	88	Fall	IGH[7]	Y	74.0	92.0	----	83.0
					----	----	----	12.7
					1	1	0	2
					74	92	----	74
					74	92	----	92
06-28-14	88	Fall	IGH[8]	Y	----	92.0	77.7	81.3
					----	----	3.5	7.7
					0	1	3	4
					----	92	74	74
					----	92	81	92
06-28-15	88	Fall	IGH[8]	Y	----	70.0	78.5	74.3
					----	7.1	10.6	8.9
					0	2	2	4
					----	65	71	65
					----	75	86	86
06-29-24	88	Fall	HLCR[9]	Y	92.0	----	76.0	88.0
					6.9	----	----	9.8
					3	0	1	4
					84	----	76	76
					96	----	76	96

Table 22. (Continued) Length data of chinook coded wire tag groups harvested during the fall fishery on the YIR in 1992.

Tag Code	Brood Year	Race[1]	Hatchery of Origin[2]	Release Type[3]	Reservation Monitoring Area: Estuary	Middle Klamath	Upper Klamath	All Areas
06-52-09	89	L Fall	HVBC[10]	Y	----	66.0	----	66.0
					----	----	----	----
					0	1	0	1
					----	66	----	66
					----	66	----	66
06-55-22	88	Fall	TRH	Y	----	----	74.0	74.0
					----	----	----	----
					0	0	1	1
					----	----	74	74
					----	----	74	74
06-55-23	88	Fall	IGH	Y	----	79.0	79.5	79.3
					----	1.4	5.0	3.0
					0	2	2	4
					----	78	76	76
					----	80	83	83
06-56-31	87	Fall	TRH[11]	Y	----	83.0	75.0	80.3
					----	1.4	----	4.7
					0	2	1	3
					----	82	75	75
					----	84	75	84
06-56-32	88	Fall	TRH	Y	83.7	82.3	76.6	80.5
					4.3	9.8	5.2	7.1
					6	6	8	20
					77	72	69	69
					89	97	87	97
06-56-33	87	Fall	TRH[11]	F	----	----	91.0	91.0
					----	----	----	----
					0	0	1	1
					----	----	91	91
					----	----	91	91
06-56-34	89	Fall	TRH	Y	----	65.0	70.0	67.5
					----	----	----	3.5
					0	1	1	2
					----	65	70	65
					----	65	70	70
06-56-35	88	Fall	TRH	F	----	----	81.0	81.0
					----	----	----	----
					0	0	1	1
					----	----	81	81
					----	----	81	81

Table 22. (Continued) Length data of chinook coded wire tag groups harvested during the fall fishery on the YIR in 1992.

Tag Code	Brood Year	Race[1]	Hatchery of Origin[2]	Release Type[3]	Reservation Monitoring Area: Estuary	Middle Klamath	Upper Klamath	All Areas
06-56-39	89	Spring	TRH	Y	----	----	72.0	72.0
					----	----	----	----
					0	0	1	1
					----	----	72	72
					----	----	72	72
06-59-37	87	Fall	IGH	Y	----	81.0	----	81.0
					----	----	----	----
					0	1	0	1
					----	81	----	81
					----	81	----	81
06-59-62	88	Fall	IGH	Y	----	74.0	75.5	75.0
					----	----	2.1	----
					0	1	2	3
					----	74	74	74
					----	74	77	77
06-61-48	88	Spring	TRH	Y	----	----	66.0	66.0
					----	----	----	----
					0	0	1	1
					----	----	66	66
					----	----	66	66
B6-13-06	88	Fall	TRNSAP[12]	F	----	----	85.0	85.0
					----	----	----	----
					0	0	1	1
					----	----	85	85
					----	----	85	85
05-01-01-01-06	88	Fall	USFWS[13]	F	----	78.0	----	78.0
					----	----	----	----
					0	1	0	1
					----	78	----	78
					----	78	----	78
06-01-02-01-02	88	Fall	IGH	F	69.5	----	78.0	72.3
					23.3	----	----	17.2
					2	0	1	3
					53	----	78	53
					86	----	78	86
06-01-02-01-05	90	Fall	IGH	F	----	----	57.0	57.0
					----	----	----	----
					0	0	1	1
					----	----	57	57
					----	----	57	57

Table 22. (Continued) Length data of chinook coded wire tag groups harvested during the fall fishery on the YIR in 1992.

Tag Code	Brood Year	Race[1]	Hatchery of Origin[2]	Release Type[3]	Reservation Monitoring Area: Estuary	Middle Klamath	Upper Klamath	All Areas
06-01-02-01-06	90	Fall	IGH	F	----	----	51.0	51.0
					----	----	----	----
					0	0	1	1
					----	----	51	51
					----	----	51	51
06-01-04-01-03	90	Spring	TRH	F	----	48.0	----	48.0
					----	----	----	----
					0	1	0	1
					----	48	----	48
					----	48	----	48
No Tags					77.6	67.3	64.5	71.9
					4.7	23.4	27.6	15.9
					5	3	2	10
					73	50	45	45
					84	94	84	94

1 L Fall - Late Fall Run
2 HVBC - Hoopa Valley Business Council
IGH - Iron Gate Hatchery
TRH - Trinity River Hatchery
TRNSAP - Trinity River Natural Stocks Assessment Program
USFWS - U.S. Fish and Wildlife Service
3 F - Fingerling
Y - Yearling
4 IGH Stock - reared & released at Indian Creek - Klamath River
5 IGH Stock - reared & released at Bluff Creek - Klamath River
6 IGH Stock - reared & released at Elk Creek - Klamath River
7 IGH Stock - reared & released at Grider Creek - Klamath River
8 IGH Stock - reared & released at Red Cap Creek - Klamath River
9 Horse Linto Creek Stock (Wild) - Trinity River
10 Trinity River Stock - reared at Supply Creek, released at Red Rock - Trinity River
11 TRH Stock - reared & released at Ambrose Pond - Trinity River
12 Trinity River Stock (wild) - captured, tagged & released at Junction City - Trinity River
13 Blue Creek Stock (wild) - Klamath River
14 Mean Fork Length (cm)
15 Standard Deviation (cm)
16 Sample Size
17 Minimum Size (cm)
18 Maximum Size (cm)

Fall Fishery: Coho

Ad-clips were observed on nine (19.6%) of the 46 coho salmon examined in 1992 with seven snouts recovered (Table 23). Six of the 1993 CWT recoveries were from a single release group identified with two tag codes (06-63-20 and 06-63-23) and one recovery was made for release group 06-56-57. Ad-clips were observed on only four (2.2%) of the 186 coho examined in 1991.

Assuming the majority of adult coho return at age three, the increase in the Ad-clip rate in 1992 may be attributed to the higher tagging rate and greater relative number of CWT's applied to the 1989 BY. For the 1988 BY, only 46,030 (7.2%) of the 641,984 coho released from basin hatcheries were Ad-clipped and CWT. For the 1989 BY, the number of coho tagged increased to 93,495 representing 11.0% of the total release.

Table 23. Coho salmon mark sample data collected during the 1992 fall fishery on the Yurok Indian Reservation.

	Monitoring Area			
	Estuary	Middle Klamath	Upper Klamath	Total
Estimated Harvest	32	76	22	130
Mark Sampled	21	19	6	46
Observed Ad-Clips	2	6	1	9
Collected Snouts	2	4	1	7
Tags Recovered	2	4	1	7
No Tags	0	0	0	0

An estimated 29 CWT coho salmon were harvested during 1992 (Table 24). The single release group identified by two tag codes (06-63-20 and 06-63-23) represented a 1989 BY, yearling plus release from IGH. This release group is estimated to have composed 28 of the 29 CWT coho harvested. The remaining CWT recovery (06-56-57) represented a 1990 BY, yearling plus release from TRH.

Multiplying the expanded coho CWT recoveries by the respective CWT expansion factor yields an estimated hatchery contribution of 156 (148 adults, eight jacks) coho salmon to the fall fishery on the YIR (Table 25). However, the estimated hatchery contribution to the fishery exceeds the estimated total harvest for coho salmon (122 adults, eight jacks). There are several possible causes for this apparent discrepancy. Contribution estimates assume no differential mortality between marked (Ad-CWT) and unmarked fish. If mortality rates of marked fish were greater than that of non marked fish then the assumption of non differential mortality would be violated and result in an over estimation of the hatchery component of the harvest. Additionally, the mark sample group (46) was small which could promote errors when calculating the expanded CWT recoveries for the net fishery. The data

Table 24. Actual and expanded coded wire tag recoveries for coho salmon from the 1992 fall fishery on the Yurok Indian Reservation (# = actual number, Exp = expanded number).

Tag Code	Brood Year	Origin[1]	Type[2]	Estuary #	Estuary Exp	Middle Klamath #	Middle Klamath Exp	Upper Klamath #	Upper Klamath Exp	Total #	Total Exp
06-56-57	1990	TRH	Y+	1	1.00	0	0.00	0	0.00	1	1.00
06-63-20	1989	IGH	Y+	1	1.61	3	16.20	1	4.50	5	22.31
06-63-23	1989	IGH	Y+	0	0.00	1	5.40	0	0.00	1	5.40
Total Tags				2	2.61	4	21.60	1	4.50	7	28.71
No Tag				0	0.00	0	0.00	0	0.00	0	0.00
Total				2	2.61	4	21.60	1	4.50	7	28.71

[1] TRH - Trinity River Hatchery IGH - Iron Gate Hatchery
[2] Y+ (Yearling plus) - February to March release

Table 25. Actual and expanded coded wire tag (CWT) recoveries, expansion factors, and contribution of coho salmon CWT release groups to the 1992 fall fishery on the Yurok Indian Reservation.

Tag Code[1]	Brood Year	Origin[2]	Release Type[3]	CWT Recoveries Actual	CWT Recoveries Expanded	Expansion Factor[4]	Contribution[5]
06-56-57	1990	TRH	Y+	1	1.00	8.415	8.42
06-63-20	1989	IGH	Y+	5	22.31		
06-63-23	1989	IGH	Y+	1	5.40		
combined					27.71	5.338	147.92
Total				7	28.71		156.34

[1] Tag codes from the same release were combined
[2] IGH - Iron Gate Hatchery, TRH - Trinity River Hatchery
[3] Y+ - (Yearling Plus) February to March Release
[4] Expansion Factor = (#tagged + #tags shed + #untagged) / (#tagged)
[5] Contribution = Expanded CWT from YIR fishery * Expansion Factor

suggest however that the majority of coho harvested were of hatchery origin.

Length statistics for CWT coho captured in 1992 are presented in Table 26 by code and area of capture.

Table 26. Length data of coho salmon coded wire tag groups harvested during the fall fishery on the Yurok Indian Reservation in 1992.

Tag Code	Brood Year	Race	Hatchery of Origin[1]	Release Type[2]	Estuary	Middle Klamath	Upper Klamath	All Areas
06-56-57	1990	Coho	TRH	Y+	45.0[3]	----	----	45.0
					----[4]	----	----	----
					0 [5]	0	0	1
					----[6]	----	----	45.0
					----[7]	----	----	45.0
06-63-20	1989	Coho	IGH	Y+	73.0	63.0	71.7	70.2
					----	----	11.1	8.8
					1	1	3	5
					73.0	63.0	60.0	60.0
					73.0	63.0	82.0	82.0
06-63-23	1989	Coho	IGH	Y+	76.0	----	----	76.0
					----	----	----	----
					1	0	0	1
					76.0	----	----	76.0
					76.0	----	----	76.0

[1] TRH - Trinity River Hatchery
[2] Y - Yearling
[3] Mean Fork Length (cm)
[4] Standard Deviation (cm)
[5] Sample Size
[6] Minimum Size (cm)
[7] Maximum Size (cm)

Late Fall Fishery: Chinook

Ad-clips were observed on five (16.7%) of 30 chinook examined during the 1992 late fall fishery (November 16 to December 6) with four snouts recovered (Table 27). Three CWT were recovered from a single release group (06-29-24). One snout did not contain a tag. The single CWT group recovered represented chinook raised and released from the Horse Linto Creek Bioenhancement Facility. This facility was established in 1985 with the goal to increase the number of natural spawning fall chinook salmon in the Klamath-Trinity basin using technologies developed on Horse Linto Creek (J. Boberg, USFS, personal communication, 1993). The combined efforts of interim artificial propagation using the locally adapted stock and extensive watershed rehabilitation have apparently yielded successful results.

Based on the sampling rate during the late fall fishery, an estimated 16 CWT chinook were harvested (Table 28). Of these tagged chinook, 12 were attributed to the 1988 BY Horse Linto Creek stock. During the fall fishery (July 17 to October 7) an additional 16 CWT chinook were credited to the

Table 27. Chinook mark sample data collected during the 1992 late fall fishery on the Yurok Indian Reservation.

	Monitoring Area			
	Estuary	Middle Klamath	Upper Klamath	Total
Estimated Harvest	8	7	78	93
Mark Sampled	1	1	28	30
Observed Ad-Clips	0	0	5	5
Collected Snouts	0	0	4	4
Tags Recovered	0	0	3	3
No Tags	0	0	1	1

same release group. Combining recoveries for both the fall and late fall fisheries yields an estimated 28 CWT chinook from this tag group, the second most numerous tag group recovered in 1992.

Based on the tagging rate expansion factor (1.227) for tag code 06-29-24 (Table 29), Horse Linto Creek chinook from this release group comprised an estimated 14.0% of the late fall chinook harvest.

Table 28. Actual and expanded coded wire tag recoveries for chinook from the 1992 late fall fishery on the Yurok Indian Reservation.

				All Monitoring Areas Combined	
Tag Code	Brood Year	Origin[1]	Type[2]	Number	Expanded
06-29-24	1988	HLCR	Y	3	11.63
Total Tags				3	11.63
No Tag				1	3.88
Total				4	15.51

[1] HLCR - Horse Linto Creek stock (Wild) - Trinity River
[2] Y (Yearling) - October 22, 1989 release

Table 29. Actual and expanded coded wire tag (CWT) recoveries, expansion factors, and contribution of chinook CWT release groups to the 1992 late fall fishery on the Yurok Indian Reservation (YIR).

Tag Code	Brood Year	Origin[1]	Release Type[2]	CWT Recoveries Actual	CWT Recoveries Expanded	Expansion Factor[3]	Contribution[4]
06-29-24	1988	HLCR	Y	3	11.63	1.227	12.86
Total				3	11.63		12.86

[1] HLCR - Horse Linto Creek (Wild)
[2] Y - (Yearling) - October 22, 1989 release
[3] Expansion Factor = (#tagged + #tags shed + #untagged) / (#tagged)
[4] Contribution = Expanded CWT from YIR fishery * Expansion Factor

Length data for CWT chinook harvested during the late fall fishery are presented in Table 29. Mean length for the Horse Linto Creek chinook (tag code 06-29-24) captured during the fall and late fall fisheries was 86.4 cm (s = 7.41, n = 7). Mean length of these tagged chinook was greater than mean length of any other tagged group (sample size > 1) during 1992.

Table 30. Length data of chinook coded wire tag groups harvested during the late fall fishery on the Yurok Indian Reservation in 1992.

Tag Code	Brood Year	Race	Hatchery of Origin[1]	Release Type[2]	All Monitoring Areas
06-29-24	1988	Fall	HLCR	Y	84.3 [3] 3.05[4] 3 [5] 81 [6] 87 [7]
No Tag					75.0 ---- 1 ---- ----

[1] HLCR - Horse Linto Creek (Wild)
[2] Y - Yearling
[3] Mean Fork Length (cm)
[4] Standard Deviation (cm)
[5] Sample Size
[6] Minimum Size (cm)
[7] Maximum Size (cm)

OTHER SPECIES

INTRODUCTION

Along with chinook and coho salmon, other species of fish such as steelhead and sturgeon are harvested during the spring, fall, and late fall fisheries. These species are all important to Indian fishers on the YIR. However, relatively little is known regarding their life histories, limiting factors, and population status within the Klamath basin. This information is needed to insure proper management and long-term utilization of these species.

METHODS

Methods used to estimate the net fisheries harvest of steelhead and sturgeon are the same as described previously in this report for chinook with the exception of establishing the adult/"jack" cutoff lengths. The cutoff length for both steelhead and sturgeon were determined by length frequency analysis (did not incorporate age data from scale or fin ray analysis).

RESULTS AND DISCUSSION

Steelhead

An estimated 115 adult (> 42 cm) and 28 "half-pounder" (≤ 42 cm) steelhead were harvested on the YIR in 1992 (Table 31). The majority (76.2%) of steelhead harvest occurred in the upper Klamath monitoring area and during the fall season (67.1%). Harvest in the middle Klamath and estuary monitoring areas were equal at 11.9% of total harvest each.

The 1992 steelhead harvest during the fall fishery was lower than estimated for any fall fishery over the previous eight years (Table 32).

Table 31. Estimated number of steelhead harvested on the Yurok Indian Reservation in 1992.

	Monitoring Area							
Fishery	Estuary		Middle Klamath		Upper Klamath		Total	(%)
Spring	0		0		41		41	(28.7%)
Fall	17		17		62		96	(67.1%)
Late Fall	0		0		6		6	(4.2%)
Totals	17	(11.9%)	17	(11.9%)	109	(76.2%)	143	(100.0%)

Table 32. Estimated number of steelhead harvested on the Yurok Indian Reservation during fall chinook fisheries from 1984 to 1992[1/].

Year	Monitor Date[2/]	Half Pounder	(%)	Adults	(%)	Total
1984	10/31	110	(18.9%)	472	(81.1%)	582
1985	10/31	46	(16.5%)	232	(83.5%)	278
1986	10/31	53	(25.0%)	159	(75.0%)	212
1987	10/31	30	(11.1%)	240	(88.9%)	270
1988	10/31	36	(9.0%)	363	(91.0%)	399
1989	10/22	8	(3.7%)	211	(96.3%)	219
1990	10/25	6	(2.8%)	209	(97.2%)	215
1991	10/08	67	(14.7%)	388	(85.3%)	455
1992	10/07	28	(29.2%)	68	(70.8%)	96

1/ Harvest estimates by the U.S. Fish and Wildlife Service using methods described in previous annual reports.

2/ Represents final monitoring and/or harvest estimate date for the upper Klamath area. The upper Klamath area is typically the last area to be monitored in each season.

Combined returns (n = 677) of adult steelhead to the two large basin hatcheries in 1992 were only 19% of the 1982 through 1991 average (n = 3,483) (Hiser 1993, and Ramsden 1993).

Mean fl of adult and half-pounder steelhead sampled during the 1992 fishery was 62.4 cm and 35.2 cm respectively (Figure 9). Mean fl of adult steelhead harvested in 1992 was not significantly different (P>0.05) than the mean fl of adult steelhead harvested the previous three years.

Fin clips were observed on 5 of the 24 (21%) steelhead trout examined for marks in 1992 (Table 33). Three steelhead were adipose fin clipped only and two steelhead were adipose and left ventral fin clipped (ADLV). The ADLV steelhead were 1990 BY, TRH stock released in the spring of 1991. Steelhead released from IGH since 1987 have not been marked. The presence of Ad-clip only steelhead was noted during 1991 juvenile outmigration studies on the Trinity River. However, the Ad-clip only rate for steelhead during the outmigration studies was extremely low (0.9%) (USFWS, 1993c). That a relatively greater number of adult steelhead examined in 1992 were Ad-clipped only suggest regeneration of the ventral fin clip may be occurring. Hatcheries outside the Klamath basin utilize Adipose only fin clips for marking all or a portion of their production and some straying of these non-basin stocks may be occurring.

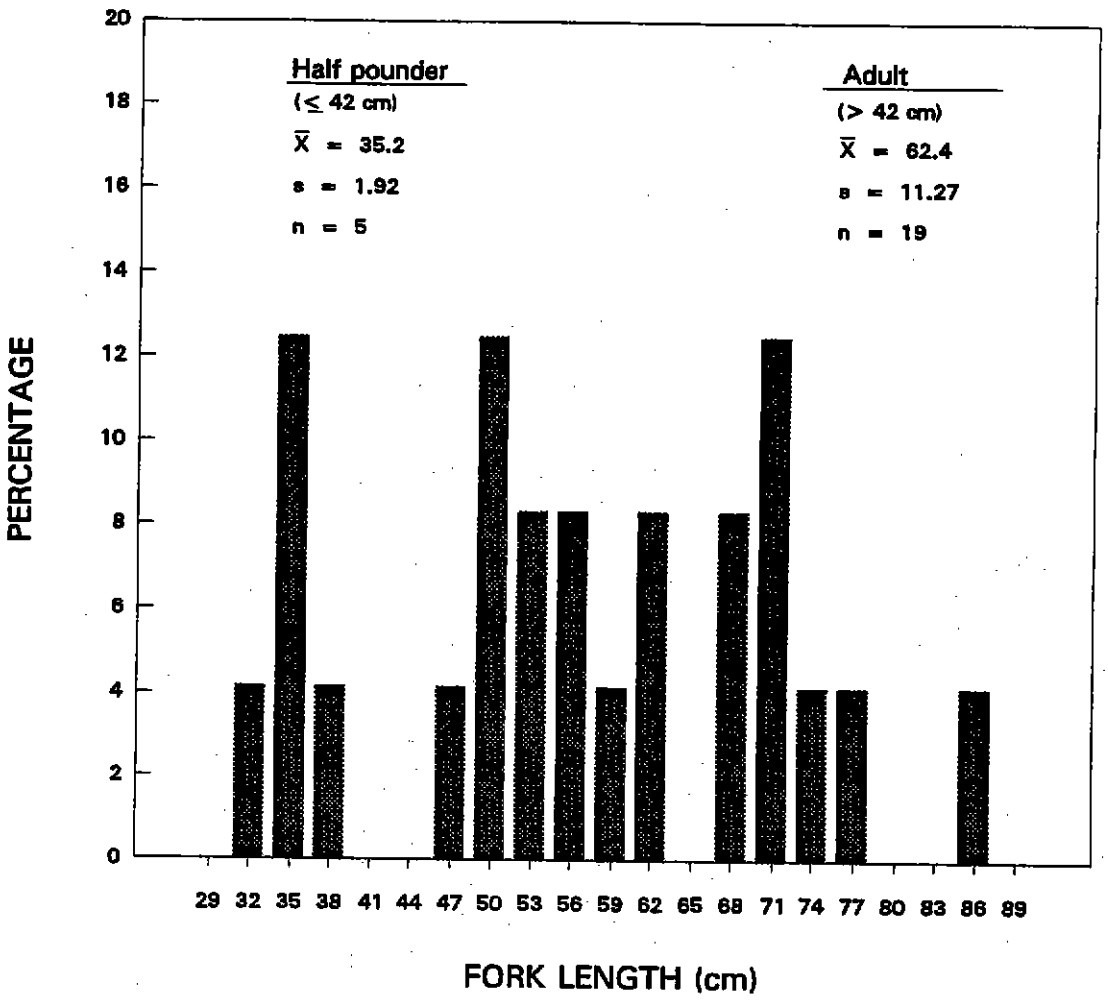

Figure 9. Length frequency distribution of steelhead harvested on the Yurok Indian Reservation in 1992.

Table 33. Fin clipped steelhead harvested in the fall gill net fishery on the Yurok Indian Reservation in 1992.

Fin clip	Length Range (cm)	Mean Length (cm)	Release Year	Release Type	Brood Year	Sample Size
Adipose Only	56 - 72	62.0	unknown	unknown	unknown	3
Adipose + Left Ventral	49 - 63	56.0	1991	Yearling	1990	2

Green sturgeon

An estimated 212 adult (≥ 130 cm) green sturgeon were harvested during the gill net fishery on the YIR in 1992 (Table 34). Only green sturgeon and only adults were observed during monitoring efforts in 1992. The majority (85.8%) of green sturgeon were harvested during the spring fishery (April 05 - July 16) with approximately half of the total harvest occurring in April and May. An estimated 30 (14.2%) green sturgeon were harvested during the fall fishery (July 17 - October 7). All sturgeon sampled during the fall fishery were in post-spawn condition. The majority (62.3%) of green sturgeon harvest in 1992 occurred in the upper Klamath monitoring area.

The 1992 harvest of adult green sturgeon is 71% of the 1982 to 1991 average harvest (297) (Table 35).

A total of 35 adult green sturgeon were measured in 1992, ranging from 134 cm to 238 cm tl with a mean of 178.3 cm (Figure 10). The mean tl of adult green sturgeon sampled in 1992 was not significantly different ($P>0.05$) than the yearly mean tl of adult green sturgeon sampled in any previous year of monitoring (Table 36). In 1992, as observed in previous years, male green sturgeon (62%) comprised the majority of the sampled harvest and tended to be smaller than the female green sturgeon. The mean tl of 21 male green sturgeon (173.8, $s = 21.42$, range 134 - 210 cm) sampled in 1992 was not significantly different ($P>0.05$) than the mean tl (189.1, $s = 26.78$, range 148 - 238 cm) of the 13 females sampled in 1992.

A total of 25 pectoral ray sections were collected from sampled green sturgeon in 1992. These samples, and pectoral ray sections collected in previous years of harvest monitoring, are being used for a green sturgeon age analysis study. The study, a cooperative project between USFWS, CCFRO and the USFS Redwood Science Laboratory, and funded by the Klamath River Basin Task Force, is anticipated to have a report completed by October 1994. Age analysis of green sturgeon was conducted by USFWS, CCFRO, in 1982, using pectoral ray sections collected during 1979-1982 net harvest monitoring activities (USFWS 1983).

Table 34. Estimates of adult green sturgeon harvest by week and area on the Yurok Indian Reservation during 1992.

Time Period[1]	Monitoring Area: Estuary	Middle Klamath	Upper Klamath	Total All Areas	Cumulative Total
3/30-4/05	0	0	5	5	5
4/06-4/12	0	0	0	0	5
4/13-4/19	6	16	0	22	27
4/20-4/26	0	0	14	14	41
4/27-5/03	0	23	14	37	78
5/04-5/10	0	8	15	23	101
5/11-5/17	0	3	17	20	121
5/18-5/24	0	5	18	23	144
5/25-5/31	0	8	6	14	158
6/01-6/07	0	0	2	2	160
6/08-6/14	0	1	0	1	161
6/15-6/21	0	0	0	0	161
6/22-6/28	6	0	13	19	180
6/29-7/05	0	0	2	2	182
7/06-7/12	0	0	0	0	182
Spring Total	12	64	106	182	182
7/17-7/18	1	0	0	1	183
7/24-7/25	0	0	0	0	183
7/31-8/01	0	0	0	0	183
8/07-8/08	0	0	0	0	183
8/14-8/15	0	0	0	0	183
8/21-8/22	3	0	0	3	186
8/28-8/29	0	0	25	25	211
9/04-9/06	0	0	0	0	211
9/07-9/13	0	0	1	1	212
9/14-9/20	0	0	0	0	212
9/21-9/27	0	0	0	0	212
9/28-10/7	0	0	0	0	212
Fall Total	4	0	26	30	212
1992 Total	16	64	132	212	212

[1] Time periods vary in length due to seasonal restrictions on the number of days fishing is allowed.

Table 35. Estimated harvest of green and white sturgeon on the Klamath River portion of the Yurok Indian Reservation for the years 1980 to 1992.

	Green Sturgeon			White Sturgeon		
Year	Juvenile	Adult	Total	Juvenile	Adult	Total
1980	30	300	330	10	3	13
1981	25	710	735	10	5	15
1982	53	327	380	10	5	15
1983	89	401	490	10	0	10
1984	21	389	410	2	0	2
1985	31	320	351	2	1	3
1986	53	368	421	0	0	0
1987	33	138	171	0	0	0
1988	5	207	222	0	5	5
1989	0	268	268	0	34	34
1990	3	239	242	0	0	0
1991	3	309	312	0	2	2
1992	0	212	212	0	0	0

Table 36. Length data of adult green sturgeon sampled on the Klamath River from 1980 to 1992[1/].

Year	Mean Total Length (cm)	Standard Deviation	Sample Size	Range (cm) Minimum - Maximum
1980	173.0	15.25	90	148 - 211
1981	176.3	17.62	157	138 - 232
1982	170.7	18.78	82	130 - 216
1983	170.9	13.64	45	145 - 208
1984	175.0	16.29	65	140 - 214
1985	174.8	17.44	34	130 - 208
1986	169.2	20.99	21	134 - 210
1987	176.9	23.71	21	143 - 260
1988	178.8	23.20	16	139 - 218
1989	169.5	20.05	20	136 - 196
1990	178.4	20.71	51	129 - 217
1991	179.9	19.76	63	130 - 222
1992	178.3	23.94	35	134 - 238

[1/]Length data presented for years 1980 to 1985 include sturgeon sampled during gill net, beach seine, and hook and line monitoring. Data from 1986 to present are for sturgeon sampled during gill net monitoring only.

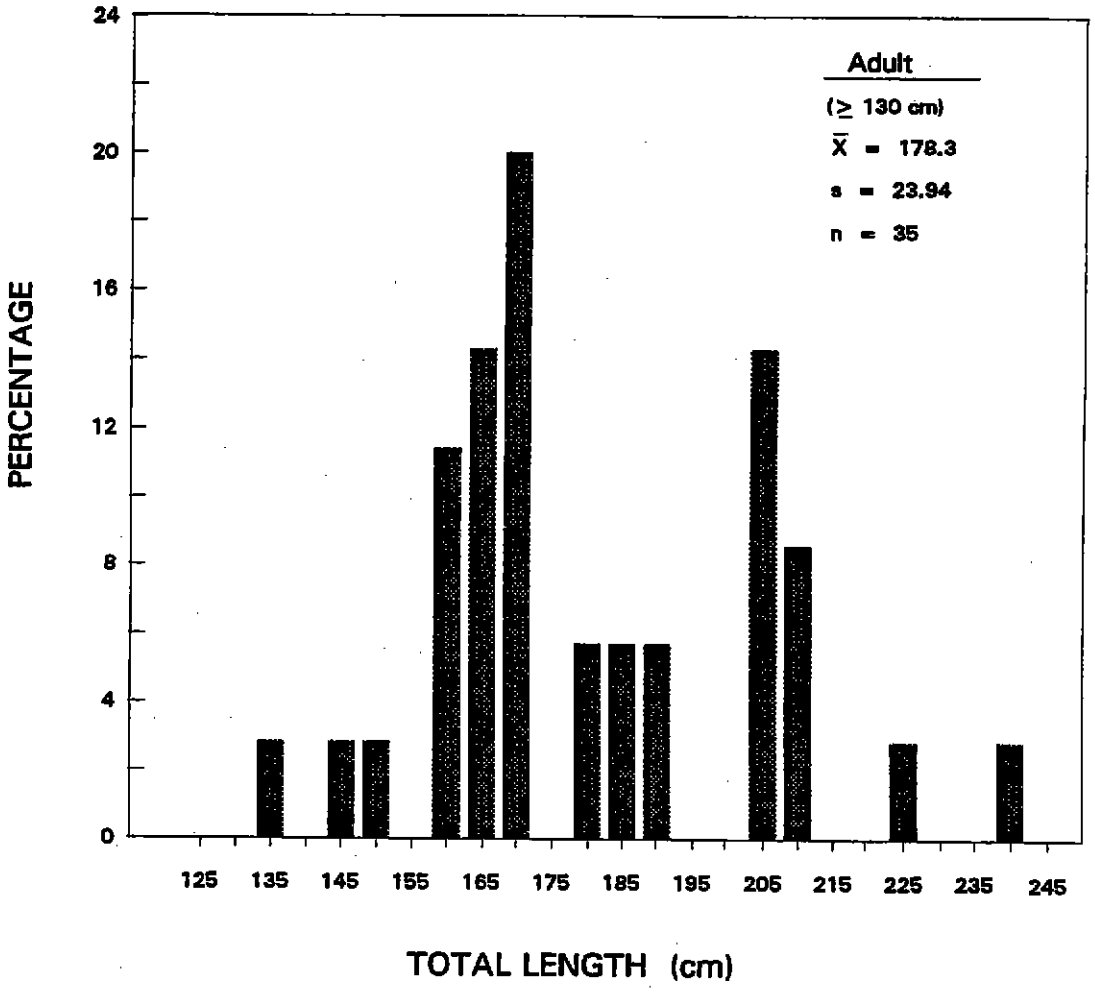

Figure 10. Length frequency distribution of green sturgeon harvested on the Yurok Indian Reservation in 1992.

HARVEST OVERVIEW AND RECOMMENDATIONS

Spring Chinook

The Klamath River native spring chinook population has undergone a 95% reduction from historical population levels, due to dams, irrigation diversions, mining, timber harvest practices, and floods (Nehlsen et al. 1991). In 1991, the Klamath River native spring chinook were listed by the American Fisheries Society as a population at a ***high risk of extinction***.

Little is known about spring chinook ocean and inriver migrations and contributions to ocean and inriver fisheries. The deficiency is due primarily to the inability to identify (via external mark and CWT) natural from unmarked hatchery fish. For the Trinity sub-basin, weir counts and marked hatchery spring chinook are used as the only available comparative indicator of natural population trends. There is no such indicator on the Klamath River as Iron Gate Hatchery does not propagate spring chinook and there are no mainstem weirs. While population surveys of key spawning grounds have become more comprehensive recently there is still a lack of information needed to effectively manage the fishery. Efforts are currently underway to develop a spring chinook management group that would help address these deficiencies.

However, since it is acknowledged that natural stock spring chinook populations are seriously depressed **it is recommended that time restrictions be implemented for the lower Klamath River spring chinook fishery** to reduce effort and consequent harvest. **Time restrictions should be a minimum of three days a week throughout spring fisheries until such time that natural stocks have recovered sufficiently to allow greater harvest** or that impacts can be directed more toward hatchery stocks. If it can be determined that natural escapement in any particular year is critically low then time closures should be more restrictive or the fishery closed completely.

Fall Chinook

Since the signing of the Klamath River Salmon Long-Term Harvest Sharing Agreement in 1986, a substantial portion of the allowable harvest of Klamath River fall chinook was shifted from ocean user groups to inriver user groups. With the greater inriver allocation, management of the lower Klamath River Indian gill net fisheries became an increasingly important component of overall management actions directed to restore the chinook resource to sustainable levels. The primary concerns to lower Klamath River harvest managers have been the net fisheries imbalanced harvest of Klamath and Trinity sub-basin stocks and the disproportionate impacts on older (four and five year old) chinook. In accordance with the role of technical advisor to the BIA and as stewards of the fisheries resources in the Klamath basin, the Fish and Wildlife Service has made recommendations that would strive to achieve more balanced harvest between the sub-basin stocks and age classes of fall chinook salmon. Until 1992, these recommendations had not been realized.

Since the 1987 fishery, recommendations have consistently specified the need for early season (August) time closures and/or in-season sub-quotas. Such measures, if implemented, would attempt to proportionately balance harvest impacts between the two sub-basins by spreading harvest into September to take advantage of Trinity River Hatchery and presumably Trinity natural stocks and lessen impacts on Iron Gate Hatchery and presumably natural stocks from the Klamath sub-basin. However, the only constraints on fishing time for the 1988 to 1990 fall chinook fisheries were daytime (0700 - 1900 hour) closures. These daytime restrictions were instituted more to minimize conflicts with sport fishermen than minimize harvest of the early season run. Time closures were even less limiting during the 1991 fall chinook fishery. Finally, in

1992, pre-season discussions between the BIA, CCFRO, and members of the YIC resulted in the first effort to reduce early season harvest through significant time restrictions (see Methods: Fall Fishery). As reported in the Coded Wire Tag Investigations section of this report, the lower Klamath River fall chinook net fishery impacted the hatchery chinook (39% IGH, 61% TRH) in proportion similar to the estimated hatchery contribution (36% IGH, 64% TRH) for the inriver run.

Although apparently successful in its first year, similar early season time restrictions combined with sub-quotas should be implemented for future lower Klamath River fall chinook net fisheries. Additionally, if pre-season projections of inriver run size could be refined to the point of estimating the sub-basin component to the inriver run, then the time closures and in-season sub-quotas for the net fishery could also be adjusted accordingly to yield more precise balancing of sub-basin impacts.

Mesh size restriction, first recommended for the Estuary Area commercial fisheries but advocated for Reservation wide use, has been discussed but remains very unpopular with fishers. Institution of a six 1/2 inch mesh size would help to balance the harvest of age three and older chinook (USFWS, 1989a).

Nets fished in the estuary should be attended at all times. By constantly tending the nets, the loss of salmon to seal and sea lion depredation would be reduced.

Openings of Management Areas should be concurrent to prevent major effort shifts.

Green Sturgeon

Net fisheries on the Hoopa Valley and Yurok Indian Reservations are presently providing the only practical means to evaluate Klamath River sturgeon population trends. Harvest of green sturgeon by Indian fishers on the YIR has been relatively steady, averaging just under 300 adult fish a year since 1982. At this time regulations specific to the sturgeon fishery do not appear to be warranted. A measure of conservation will occur by default if time restrictions are implemented for the spring chinook fishery.

As relatively little is known about the Klamath River green sturgeon, studies should be initiated to determine the green sturgeons biological and ecological requirements, early life history, distribution and abundance.

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