

## **CHAPTER III - COHO SALMON ASSESMENT**

### *COLUMBIA RIVER AND OREGON/CALIFORNIA COASTAL COHO*

#### *(OREGON PRODUCTION INDEX AREA)*

The majority of coho harvested in the OPI area originate from stocks produced in rivers located within the OPI area (Leadbetter Point, Washington, to the U.S./Mexico border). These stocks include hatchery and natural production from the Columbia River, Oregon Coast, and northern California, and are divided into the following components: (1) public hatchery (OPIH), (2) Oregon coastal natural (OCN), including river and lake components, (3) Lower Columbia natural (LCN), and (4) natural and hatchery stocks south of Cape Blanco, Oregon, which include the Rogue, Klamath, and Northern California coastal stocks.

A stratified random sampling (SRS) study implemented in 1990 indicated an overestimation of annual OCN spawner escapement, which had previously been based on index surveys. Because the stock composition of the OPI area ocean impacts is based on the proportions of the OPI ocean escapements, a reduction in OCN spawner escapement meant that traditional OCN ocean impacts and abundances were overestimated, while traditional ocean impact and abundance estimates for other OPI area stocks had been underestimated. Starting in 1992, the Council adopted an abundance adjustment procedure for use in assessing fishery impacts. This procedural change, based on improved estimates of OCN spawner escapements, adjusted traditional index abundances of the other OPI area stocks. To achieve targeted exploitation rates and spawner escapement goals, the various OPI area stock abundance index predictions were scaled in the Coho FRAM to reflect the results of the ongoing OCN spawner study and are referred to as SRS abundances. In 1998, after eight years of SRS abundance estimates, the historic OPI data set was rescaled to reflect the revised OCN abundance estimates.

Beginning in 1999, with the availability of a long-term data set in SRS values, all OPI area stock abundances were projected in SRS accounting. Direct comparisons of 2009 abundance forecasts with recent year SRS abundance projections, both preseason and postseason, are reported in Table III-1. All fishery impacts and escapements from the Coho FRAM are reported in SRS values.

Beginning in 2008, a new method was developed to estimate coho abundances for both the natural and hatchery components of the Columbia River and the Oregon coast. The traditional method of stock abundance estimation used only catch data from Leadbetter Point, Washington, to the U.S./Mexico border. This estimation technique was not consistent with the methods used in the Coho FRAM. The Mixed Stock Model (MSM) used for constructing the FRAM base period data was used to estimate the contribution of various coho stocks, including the OPI area stocks, to ocean fisheries and was based on CWTs and associated tag rates. The MSM includes all fisheries that impact a particular stock and therefore should provide a better overall accounting of total harvest and mortality of both Columbia River and Oregon coast coho stocks. The new run size estimates are based on the 1986 – 1997 base period and “backwards” FRAM runs for more recent years. The Oregon Production Index Technical Team (OPITT) decided to use the MSM run reconstruction database for future accounting and predictions. The MSM estimates were refined for use in 2009, with particular attention to the base period reconstruction for OCN coho.

#### **Public Hatchery Coho**

OPI area public hatchery coho smolt production occurs primarily in Columbia River facilities and net pens. Several facilities located in Oregon coastal rivers and in the Klamath River Basin, California, collectively produce fewer coho. OPI area smolt releases since 1960 are reported by geographic area in Appendix B, Table B-1.

### *Predictor Description*

Since 1988, the OPIH stock predictor was a multiple linear regression with the following variables: Columbia River jacks (Jack CR), Oregon coastal and Klamath River Basin jacks (Jack OC), and a correction term for delayed smolts released from Columbia River hatcheries (Jack CR \* [SmD/SmCR]).

The 2008 and 2009 stock prediction differed slightly from that used in previous years. Because of the shorter data set (1986-2007 vs. 1970-2007) and the near-total phase-out of coastal coho salmon hatcheries, the factor for Oregon and California jacks (Jack OC) was not significant in the regression. A simplified model with all OPI Jacks combined in one term (Jack OPI) was used, and all parameters were significant.

The OPIH stock predictor is partitioned into Columbia River early and late stocks based on the proportion of the 2008 jack returns of each stock adjusted for stock specific maturation rates. The coastal hatchery stock is partitioned into northern and southern coastal stock components. The northern OPIH coastal stock is comprised of hatchery production from the central Oregon Coast. The southern OPIH coastal stock is comprised of hatchery production from the Rogue River basin in southern Oregon and the Klamath and Trinity basins in northern California. The 2009 partition was based on the proportion of the smolt releases in 2008.

For the 2009 abundance prediction, the data base includes 1986-2008 recruits and 1985-2007 jack returns (in thousands of fish). The model is:

$$\text{OPIH}(t) = a + b * \text{Jack OPI}(t-1) + c * (\text{Jack CR}(t-1) * [\text{SmD}(t-1)/\text{SmCR}(t-1)])$$

Where:

$$a = 18.601831$$

$$b = 15.590516$$

$$c = 35.286087$$

$$\text{adjusted } r^2 = 0.84$$

The OPIH stock data set and a definition of the above terms are presented in Appendix B, Table B-2.

### *Predictor Performance*

Recent year OPIH stock preseason abundance predictions, partitioned by production area, stock, and as a total, are compared with postseason estimates in Table III-1. The 2008 preseason abundance prediction of 216,1000 OPIH coho was 38 percent of the preliminary postseason estimate of 565,400 coho.

Since 1983, the OPIH predictor has performed well. The years with the highest variations were due principally to high interannual variability in the jack to adult ratios.

### *2009 Stock Status*

Using the appropriate values from Appendix B, Table B-2, the OPIH abundance prediction for 2009 is 1,073,1000 coho, five times higher than the 2008 prediction and 190 percent of the preliminary 2008 postseason estimate.

### **Oregon Coastal Natural Coho**

The OCN stock is composed of natural production north of Cape Blanco, Oregon from river (OCNR) and lake (OCNL) systems, which are predicted independently.

## *Predictor Description*

### **Oregon Coastal Natural Rivers**

From 1988-1993, the abundance of OCNR index coho was predicted using a modified Ricker spawner-recruit model. The predictor related OCNR recruits to the parent brood stock size incorporating an adjustment for ocean survival based on OPI hatchery smolt to jack survival the previous year. Due to a tendency to over-predict abundances, the database in the predictor was shortened from 1970-1991 to 1980-1991 in 1992 and 1993.

Because of concern that the adopted OCNR model did not adequately incorporate environmental variability, an alternative model was used to predict the 1994 and 1995 index abundances. The model used ocean upwelling, sea surface temperatures, and year to predict OCNR index coho abundance. The year term was included in the model to reflect an observed decline in stock productivity.

For 1996-1998, the environmental based model without the year component was used in predicting OCNR stock abundances. In addition, the predictions were in SRS rather than traditional index accounting. The OCNR environmental variables were annual deviation from the mean April-June Bakun upwelling index at 42° N latitude (UpAnom), and annual deviation from the mean January sea surface temperature at Charleston, Oregon (JanAnom).

For 1999-2002, the environmental-based model with the year component included was used to predict OCNR stock abundances.

For 2003-2007, the same environmental-based model without the year component that was used for 1996-1998 was used in predicting OCNR abundance.

In 2008, the OPITT adopted a new abundance time series based on MSM run reconstructions and “backwards” FRAM modeling. This time series starts in 1986, in contrast to the SRS time series, which starts in 1970. There is much less contrast in the environmental variables in the shorter time period than there was in the longer period. In addition, there appears to be a weaker relationship between abundance and the environmental variables in recent years.

For 2008, several models using the MSM time series were considered. These all tended to predict higher abundances than what would reasonably be expected and none were statistically significant. In the absence of a satisfactory model, the OPITT examined patterns in ocean conditions and hatchery jack returns and determined that the 2007 postseason abundance estimate of 50,000 coho was the most appropriate forecast for 2008.

In 2009 the MSM base period estimates for OCN coho were revised to resolve some of the issues raised in 2008. As the new estimates were not available until the day before the prediction was due there was little time to explore predictive relationships. There were indications that the revised data set was better correlated with environmental data, and new environmental indicators look promising. For this year, however, a variation on the adopted predictor was chosen. The adopted predictor is based on JanAnom and UpAnom in the year of ocean entry. In some years, an additional variable, Year, was added to capture a long-term downward trend in the data that was not represented in the environmental time series. With the recent shift in ocean conditions this linear trend is no longer apparent, but the pattern in residual errors of the predictor matches the regime shifts in 1990 and 2000. Until a more objective index of regime changes can be incorporated in the predictor an index variable called RegInd (Regime Index) was used for the 2009 predictor. This variable flags the cold regimes (1986-1989, 2001 - 2008) with a 0 and

the warm regime (1990 – 2000) with a 1, and by itself explains over 50% of the variability of the time series.

For the 2009 prediction the model used was:

$$\ln(\text{Recruits}(t)) = a + b * \text{UpAnom}(t-1) + c * \text{JanAnom}(t) + d * \text{RegInd}$$

Where:

$$\begin{aligned} a &= 4.926924 \\ b &= 0.004475 \\ c &= -0.175965 \\ d &= -0.948622 \end{aligned}$$

$$\text{adjusted } r^2 = 0.62$$

The OCNR stock data set and a definition of the terms are presented in Appendix B, Table B-4.

### **Oregon Coastal Natural Lakes**

Since 1988, except for 2008, the abundance of OCNL index coho has been predicted using the most recent three-year average adult stock abundance. OCNL coho production occurs from three lake systems (Tennile, Siltcoos, and Tahkenitch). Production from these systems has declined substantially from the levels observed during 1950-1973, but has steadily increased in recent years. Following the same reasoning used for the OCN Rivers predictor in 2008, the OPITT chose to use the 2007 postseason abundance estimate of 10,000 coho for the 2008 preseason prediction instead of using the most recent three-year average.

For 2009, the OPITT chose to use the most recent three-year average adult stock abundance which predicts 20,200 coho.

#### *Predictor Performance*

Recent-year OCN preseason SRS abundance predictions are compared to postseason estimates in Table III-1. Since 2000 the OCN predictor has under estimated abundance except for 2005 and 2007. The 2008 preseason abundance prediction of 60,000 OCN coho was 35 percent of the preliminary postseason estimate of 170,900 coho.

#### *2009 Stock Status*

The 2009 preseason prediction for OCN (river and lake systems combined) is 211,600 coho, 353 percent of the 2008 preseason prediction and 124 percent of the 2008 postseason estimate (Table III-1). The 2009 preseason SRS prediction for OCNR and OCNL components are 191,400 and 20,200 coho, respectively.

### **Private Hatchery Coho**

There have been no Oregon coastal PRIH coho smolt releases since 1990.

### **Salmon Trout Enhancement Hatchery Coho Smolt Program**

#### *Predictor Description*

From 1988 to 2007, preseason abundance predictions for Oregon coastal STEP index coho smolt production facilities were based on the Council-approved procedure, which involved multiplying the average smolt to adult survival rate by the ratio of the current OPI jack survival to the previous year's OPI jack survival.

The 2007 prediction used the observed 2002-2003 brood smolt-to-adult survival rate applied to the 2004 brood smolt production.

### *Predictor Performance*

Recent-year STEP preseason abundance predictions are compared to postseason estimates in Table III-1.

### *2009 Stock Status*

Due to changes with the STEP program, releases were discontinued after the 2004 brood and forecasts were discontinued in 2008 (Table III-1).

## **Lower Columbia River Natural**

### *Predictor Description*

The 2009 prediction for the Clackamas and Sandy Rivers is based on the recent 3-year cohort averages. The forecast for other Oregon lower Columbia natural (LCN) populations are recent cohort averages and averages of recent year abundances. The 2009 adult ocean abundance forecast is 6,100 coho. The 2009 prediction for the Washington LCN coho populations are derived by combining estimates of natural smolt production based on watershed area and a predicted 2006 brood year marine survival rate. The 2009 adult ocean abundance forecast for Washington LCN coho is 26,600 coho.

### *Predictor Performance*

The LCN stock predictor methodology was developed in 2007. The preseason abundance compared to the postseason estimate is presented in Table III-1. The 2008 preseason abundance prediction of 13,400 LCN coho was 49 percent of the preliminary postseason estimate of 27,200 coho.

### *2009 Stock Status*

The 2009 prediction for LCN coho is 32,700 coho (Table III-1). This ocean abundance estimate includes both Oregon and Washington LCN components.

## **Oregon Production Index Area Summary of 2009 Stock Status**

The 2009 combined OPI area stock abundance is predicted to be 1,317,400 coho, which is 477 percent of the 2008 preseason prediction of 276,100 coho and 179 percent of the 2008 preliminary postseason estimate of 736,300 coho. The 2009 OPI area predictions are compared to historical abundances in Table III-2.

## **WASHINGTON COASTAL AND PUGET SOUND COHO STOCKS**

### **Predictor Description and Past Performance**

A variety of preseason abundance estimators currently are employed for Washington coastal and Puget Sound coho stocks (Table I-2). These estimators are used to forecast preseason abundance of adult ocean (age-3) recruits.

The performance of preseason abundance forecasts (adult ocean recruits) cannot be evaluated at this time because postseason run reconstructions for U.S. and Canadian coho production units have not been completed. A comparison of expected preseason and postseason ocean escapements for Washington coastal and Puget Sound stocks in recent years is presented in Tables III-3 and III-4. Postseason estimates of 2008 ocean escapements for some of these stocks are not available at this time. The comparison of preseason and postseason estimates of ocean escapement reflects annual errors in abundance estimates,

deviations in ocean fisheries from preseason expectations, and variations in ocean distributions of stocks as described in the introduction. Fishery impact levels anticipated preseason may be substantially different than those that actually occur.

## **2009 Stock Status**

### *Washington Coastal Coho*

#### **Willapa Bay**

The 2009 Willapa Bay hatchery coho abundance forecast is 59,420 ocean recruits compared to a 2008 preseason forecast of 25,511. The natural coho forecast is 33,544 ocean recruits, compared to a 2008 preseason forecast of 35,063. Both the hatchery and natural forecasts are based on a regression of hatchery or natural jacks vs. terminal adult hatchery or natural returns for the 1994-2004 brood years (1998 excluded as an outlier for the natural forecast).

#### **Grays Harbor**

Preseason abundance forecasts are made for natural fish throughout the system and for hatchery fish returning to three freshwater rearing complexes and three saltwater net-pen sites. The forecasts include fish originating from numerous volunteer production projects. The 2009 abundance forecast for Grays Harbor natural stock coho is 59,226 ocean recruits. The forecast for hatchery stock ocean abundance is 63,485 ocean recruits.

The natural coho forecast consists of an estimate of smolt production in the Humptulips and Chehalis basins multiplied by a smolt to adult survival rate. The smolt production estimate is calculated using the number of smolts per female multiplied by the number of female spawners. The smolt-to-adult survival estimate is 7 percent, which is predicted by a jack/adult return rate model from the WDFW Bingham Creek Research Station.

The hatchery coho forecast consists of an estimate of smolt releases from on- and off-station sites, multiplied by the average return per release for return years 1999-2008 then expanded to ocean recruit abundance based on CWT recoveries.

#### **Quinalt River**

The 2009 forecast for Quinalt natural coho is 16,313 ocean recruits, a 6 percent decrease from the 2008 forecast of 17,441. This forecast is based on the mean estimate of recent ocean recruits for 2001 and 2003 through 2007 resulting from the recent Quinalt Department of Fisheries work to re-develop the Quinalt coho run reconstruction estimates.

The Quinalt hatchery coho forecast is 26,210 ocean recruits, a 7 percent increase from the 2008 forecast of 24,540. This return is from a smolt release of 667,406, and is based on a recent 5-year average smolt return rate of 4 percent for the Quinalt National Fish Hatchery.

#### **Queets River**

For 2009, a Queets natural coho forecast was not agreed-to by the co-managers at the time of this report. This forecast and a description of the method used will be provided at a later date.

The 2009 Queets hatchery (Salmon River) coho forecast is 13,537 ocean recruits, an increase of 31 percent compared to the 2008 forecast of 10,334. This forecast is based on a smolt release of 675,159

multiplied by the recent 10 year average Salmon River marine survival rate of 2 percent. Approximately 85 percent of the fish released from the Salmon River facility were marked with an adipose fin clip.

### **Hoh River**

The Hoh River natural coho forecast is 9,496 ocean recruits, an increase of 118 percent compared to the 2008 forecast of 4,349. This forecast is based on estimated smolt production per square mile of watershed from the Clearwater tributary to the Queets River (397 smolts/square mile), multiplied by the size of the Hoh watershed (299 square miles), for a total of 118,703 smolts. The total natural smolt production estimate was then multiplied by an expected survival rate of 8.0 percent. This represents a sharp upswing from last year's survival rate estimate of 3.38 percent, and is the highest value used to forecast marine survival of Hoh River coho in at least the past 16 years, though estimates of the rate were exceeded in actual performance of the stock by brood years 1998 and 1999. The rationale for the 8.0 percent survival rate is a strong return of jacks to coastal areas in 2008, including hatchery jacks to the Sol Duc Hatchery, and the highest natural jack return to the Bingham trap in the Satsop River system in its 30 year database. Ocean conditions have been highly favorable for the coho returning in 2009. The Pacific Decadal Oscillation (PDO) was the third most negative on record, and more localized sea surface temperatures were the coldest in eleven years. The one caution comes from the index of trawl CPUE for coho off the coasts of Washington and Oregon, which indicates only moderate returns of coho (3.6 percent) when regressed against Queets coho survivals. The Bingham Creek jack model indicates an ocean survival of 8.6 percent for that system (Zimmerman, WDFW, 2009). A regression of PDO values against Queets survival points to 11.3 percent (Quinault Tribe, Gilbertson, and Conrad, 2009). Given the ocean trawl results, and the low returns and escapements of the last three years, the 8.0 percent survival rate is a reasonable estimate for the Hoh system natural coho.

No hatchery production is projected for the Hoh system for 2009.

### **Quillayute River**

The Quillayute River summer natural and hatchery coho forecasts for 2009 are 2,233 and 12,921 ocean recruits, respectively. The natural component run size is based on the estimated total summer coho smolt production (27,909) and a projected ocean survival rate of 8.0 percent. This is a higher ocean survival rate than what was used last year (4.0 percent). A high number of jack returns at Bingham Creek and Sol Duc hatcheries indicates improved returns over last year. With the exception of the September trawls off the coasts of Washington and Oregon, which indicated moderate coho populations, ocean ecosystem indicators have projected very favorable conditions for ocean survival. Pacific Decadal Oscillation was the third most negative on record, and sea surface temperature was the coldest in eleven years. The Bingham Creek jack model indicates an ocean survival of 8.6 percent. Given the ocean trawl results, 8.0 percent is a reasonable estimator for the Quillayute system wild coho.

For the hatchery component, an ocean survival rate of 6.0 percent was selected. An examination of the return rates of both hatchery releases and natural smolts indicates that hatchery return rates are 1.5 to 2.0 percent below natural returns. The survival rate of 6.0 percent was multiplied by a release of 215,350 smolts. Approximately 100 percent of the fish were marked with an adipose fin clip. The 2009 forecast abundance of natural summer coho is 50 percent higher than the 2008 forecast, while the hatchery forecast is 67 percent higher than the 2008 forecast level.

The Quillayute River fall natural and hatchery coho forecasts are 19,259 and 39,471 ocean recruits, respectively. The 2009 forecast abundance of natural Quillayute fall coho is 45 percent higher, and the hatchery forecast 67 percent higher, than their respective 2008 forecast levels. The forecast for the natural component is based on the estimated total fall coho smolt production (240,738) multiplied by an

expected marine survival rate of 8.0 percent, which was derived as described for the summer natural returns above. The fall hatchery production forecast was based on the same prediction of marine survival (6.0 percent) used for the summer hatchery coho forecast, multiplied by a release of 657,850 smolts. Approximately 88.3 percent of the hatchery fish were marked with an adipose fin clip.

The basin total coho smolt production estimate (summer and fall stocks) was derived using the 1987, 1988, and 1990 out-migration year average smolt production for the Quillayute system (306,000) multiplied 0.88, which represents the proportion of production from the Clearwater in those years. Smolt production was apportioned according to brood year natural spawning escapements of summer and fall coho to yield the smolt estimates for each natural population.

### **North Washington Coast Independent Tributaries**

Production from several smaller rivers and streams along the North Washington Coast (Waatch River, Sooes River, Ozette River, Goodman Creek, Mosquito Creek, Cedar Creek, Kalaloch Creek, Raft River, Camp Creek, Duck Creek, Moclips River, Joe Creek, Copalis River, Conner Creek), which flow directly into the Pacific Ocean, is forecast as an aggregate. Generally, stock assessment programs on these systems are minimal. The 2009 forecast of natural coho production for these independent streams is 11,130 ocean recruits, based on a prediction of 375 smolts per square mile of watershed drainage, 424 square miles of watershed, and an expected marine survival rate of 7.0 percent. The marine survival projection was derived from jack-to-adult return information collected at the WDFW Bingham Creek research station.

The hatchery forecast of 14,101 ocean recruits is developed from linear regression model estimates of marine survival, predicted by the jack return rate for coho from the Makah National Fish Hatchery. The predicted marine survival of 9.38 percent for the brood year 2006 was multiplied by the 2006 brood year smolt release (200,386) from the Makah National Fish Hatchery. For the 2006 brood year release, 79 percent were marked with an adipose fin clip.

### *Puget Sound*

The 2009 total hatchery and natural coho ocean recruit forecast for the Puget Sound region of 582,462 is 5 percent below the 2008 forecast of 614,517. The hatchery coho forecast of 338,968 is 2 percent above the 2008 forecast of 333,543, and the natural coho forecast of 243,495 is 13 percent below the 2008 forecast of 281,004.

Puget Sound hatchery forecasts for 2009 were generally the product of 2006 brood year (BY) smolt releases from each facility, and a predicted marine survival rate for each program. Marine survival rates were typically based on recent year average survival rates derived from CWT recovery information and/or run reconstructions, and review of relationships between jack returns and adult marine survival rates at selected hatcheries. Forecasts for natural Puget Sound coho stocks were generally derived by measured or predicted smolt production from each major watershed or region, multiplied by stock-specific marine survival rate predictions based on a jack return model from the WDFW Big Beef Creek Research Station in Hood Canal, adult recruits/smolt rate data generated from the WDFW Deschutes River Research Station, and a natural coho CWT tagging program at Baker Lake (Skagit River basin), or other information.

### **Strait of Juan de Fuca**

The 2009 forecasts for Strait of Juan de Fuca (SJF) natural and hatchery coho ocean recruits are 20,465 and 7,383, respectively. The natural coho forecast was derived by multiplying the estimated 2006 brood natural smolt production for the region by a predicted ocean marine survival rate developed by two

different models. One of the predictive models was based on a relationship between an index of the Pacific Decadal Oscillation and observed survival rates, and the other a relationship of jack returns to Elwha Hatchery and observed survival rates. The forecasted abundances developed by each model were averaged to produce the final forecast. The hatchery forecasts were based on applying hatchery-specific ocean recruitment rate predictions (1.0 percent for Dungeness, 0.4 percent for Elwha) to the 2006 BY smolt releases for each hatchery. The recruitment rate predictions for the hatchery stocks were based on recent 3-year averages of cohort reconstruction-based recruits/smolt releases in each hatchery production unit.

### **Nooksack-Samish**

The 2009 forecasts for Nooksack-Samish natural and hatchery coho ocean recruits are 7,044 and 25,457 respectively. The natural coho forecast is the product of projected natural smolt production from each stream basin in the region, multiplied by a marine survival rate expectation of 4.6 percent. The natural coho marine survival rate prediction is based on the Big Beef Creek jack-based marine survival prediction, with a 50 percent discount applied to reflect the significantly lower survival rates observed for extreme northern Puget Sound-origin coho in recent years relative to elsewhere in Puget Sound. The hatchery forecasts are based on the 2002-2004 BY average recruits/smolt rate for Kendall Creek Hatchery (1.0 percent), applied to the 2006 BY smolt releases for each facility in the region.

### **Skagit**

The 2009 forecasts for Skagit River natural and hatchery coho ocean recruits are 33,374 and 11,730 (10,695 from in-river hatchery production, 1,035 from Oak Harbor net-pens), respectively. The FMP conservation objective for Skagit natural coho is 30,000 adult spawners. The natural coho forecast is the product of measured smolt production from the Skagit basin multiplied by a marine survival rate expectation of 7.8 percent. The natural coho marine survival rate is based on the average of the 1990-2004 BY (even years only) Skagit natural recruits/smolt rate. The hatchery forecasts are based on an average marine survival rate of the 1990-2004 BY (even years only) Cascade Hatchery CWT-based recruits/smolt rate of 3.5 percent.

### **Stillaguamish**

The 2009 forecast for Stillaguamish River natural coho ocean recruits is 13,400, which is less than the FMP conservation objective of 17,000 natural spawners. The natural coho forecast is based upon the estimated smolt production from the basin for brood year 2006, multiplied by a 9.3 percent marine survival rate expectation based on the Big Beef Creek jack return rate indicator.

### **Snohomish**

The 2009 forecast for Snohomish River natural coho ocean recruits is 67,000, which is less than the FMP conservation objective of 70,000 natural spawners. The Snohomish regional hatchery coho forecast is 53,589; 11,778 for Skykomish River/Wallace River Hatchery facility releases, 38,461 for the Tulalip Bay facility, and 3,350 for the Edmonds net-pen project. The natural coho forecast used the estimated smolt production from the basin for brood year 2006, multiplied by a 9.3 percent marine survival rate expectation based on the Big Beef Creek jack return rate indicator.

### **South Sound**

The 2009 forecasts for South Sound region natural and hatchery coho ocean recruits are 53,606 and 188,766 respectively. The natural coho forecast is the product of projected smolt production from each of the stream basins in the region multiplied by marine survival rate expectation of 9.3 percent for natural coho in the region. The marine survival prediction was based upon the Big Beef Creek jack return rate

indicator, and review of a recent upward trend for the Deschutes River indicator stock, that indicated an improving trend in survival rates for South Sound-origin natural coho. The hatchery coho forecasts are typically based on the 2002-2004 BY average CWT-based recruits/smolt rate for each facility, applied to the 2006 BY smolt releases. The expected survival rates range from 3.8 to 8.8 percent for central Puget Sound hatchery programs north of the Tacoma Narrows, and 1.5 to 3.1 percent for the deep South Sound region, consistent with the observed trend of lower observed survival rates for hatchery coho originating from south of the Tacoma Narrows in the past decade.

### **Hood Canal**

The 2009 forecasts for Hood Canal region natural and hatchery coho ocean recruits are 48,606 and 52,043, respectively. The natural coho forecast is based on a regression of Big Beef Creek jacks versus Hood Canal natural coho run sizes. The hatchery coho forecasts are based on the 1996-2004 BY (1995-2004 BY for the Quilcene Net Pens) average cohort reconstruction-based recruits/smolt rates for each facility, applied to the 2006 BY smolt releases for each facility.

The marine survival rates used for these forecasts were 5.9 percent for George Adams Hatchery, 1.7 percent for Port Gamble Net Pens, 5.4 percent for the Quilcene National Fish Hatchery, and 3.2 percent for the Quilcene Bay Net Pens. A moving average of the most recent 3-year marine survival rate is typically used for forecasting hatchery coho production in this region, but concerns regarding three of the recent years (2001-2003 BY) being higher than what occurred in 2007 resulted in a decision by the co-managers to use a longer-term marine survival average for the 2009 forecasts.

### ***SELECTIVE FISHERY CONSIDERATIONS***

As the region has moved forward with mass marking of hatchery coho salmon stocks, selective fishing options have become an important consideration for fishery managers. Table III-5 summarizes estimates of mass mark rates for coho stocks from Southern British Columbia, Canada to the Oregon Coast, based on preseason abundance forecasts. Agencies have released coho mass marked with adipose clips from the 2006 brood, making these fish available to 2009 fisheries (Table III-6).

### ***EVALUATION OF 2008 REGULATIONS ON 2009 STOCK ABUNDANCE***

Escapements and fishery impacts were estimated using coho FRAM. Abundance forecasts for 2009 were updated for Washington and Oregon stocks, but forecasts for Canadian stocks are unchanged from those employed for 2008 planning. Updated forecasts for Canadian stocks are expected to become available in March 2009. To provide information on the effect of changes in abundance forecasts, the final 2008 pre-season regulatory package for ocean and inside fisheries was applied to 2009 projections of abundance.

### **Oregon Production Index Area**

Ocean fisheries were modeled with 2008 Council regulations and 2008 expectations for non-Council area fisheries. Under this scenario, expected exploitation rates are 2.3 percent on OCN coho and 0.5 percent on Rogue/Klamath hatchery coho. Expected spawner escapement is 206,900 for OCN coho (Tables III-7 and III-8). For Columbia River hatchery coho stocks, the predicted ocean exploitation rate (excluding Buoy 10) is 3.9 percent on the Columbia River early stock and 6.5 percent on the Columbia River late stock. Predicted ocean escapements (after Buoy 10) into the Columbia River in 2009 under this exercise show that under 2008 ocean regulations, Columbia River early and Columbia River late coho are expected to meet hatchery egg take goals (without inside fishing).

Based on parent escapement levels and observed OPI smolt-to-jack survival for 2006 brood OPI smolts, the total allowable OCN coho exploitation rate for 2009 fisheries is no greater than 15 percent under FMP Amendment 13 and no greater than 15 percent under the matrix developed by the OCN work group

(Table III-9; Appendix A, Tables A-2 and A-3). The total allowable Rogue/Klamath hatchery coho marine exploitation rate is 13.0 percent (NMFS ESA consultation standard).

Lower Columbia River natural (LCN) coho were listed as Endangered under the Oregon state ESA in 1999 and have been managed under a state Recovery Plan harvest rate matrix since 2001. LCN coho were listed as threatened under the Federal ESA in 2005. From 2001 through 2005, Oregon coast hatchery stocks were used as a surrogate in FRAM; in 2006 and 2007, unmarked Columbia River hatchery stocks were used as a surrogate in FRAM. In 2008, NMFS allowed a 8.0 percent exploitation rate in marine area and mainstem Columbia River fisheries combined. The 8.0 percent exploitation rate was split by managers to allow less than one-third for inriver fisheries and greater than two-thirds for all marine fisheries. Under 2008 fishery regulations and 2009 abundances the exploitation rate is predicted to be 2.0 percent for marine fisheries (excluding the Buoy 10 fishery) using combined unmarked Columbia River hatchery stocks as the proxy. There has been no guidance from NMFS so far on the allowable exploitation rate on LCN coho in 2009.

### **North of the Oregon Production Index Area**

Ocean escapement expectations in relation to management goals for selected naturally-spawning coho stocks, given 2009 preseason abundance forecasts and 2008 preseason projections for fishing patterns, are presented in Table III-7. The 2009 forecasts for Canadian coho stocks are not available, but are assumed to be at 2008 levels for this analysis. More detailed fishery management goals for Council area coho stocks are listed in Appendix A, Table A-1.

Under 2008 regulations, 2009 ocean escapements for natural coho stocks north of the OPI index area are expected to be at levels that would permit attainment of FMP escapement goals for all U.S. stocks except Skagit, Stillaguamish, and Snohomish coho. In addition, all annual management objectives for stocks subject to the PSC agreement would be met. The exploitation rate by U.S. fisheries south of the Canadian border on Interior Fraser coho is projected to be 5.3 percent, well within the anticipated 10.0 percent allowable exploitation rate under the 2002 PST Coho Agreement. The Council area fisheries portion is 1.6 percent.

Coho bycatch during Puget Sound fisheries directed at chum and sockeye salmon will also be a consideration for preseason planning.

TABLE III-1. Preliminary 1996-2009 preseason and postseason coho stock Stratified Random Sampling abundance estimates for Oregon production index area stocks in thousands of fish. (Page 1 of 2)

Stock	Year	Preseason	Postseason <sup>al</sup>	Preseason/Postseason <sup>al</sup>
<b>Oregon Production Index Area Hatchery Total</b>	1996	309.2	182.6	1.69
	1997	376.1	215.3	1.75
	1998	118.4	203.6	0.58
	1999	559.2	319.6	1.75
	2000	671.4	677.1	0.99
	2001	1,707.6	1,395.5	1.22
	2002	361.7	660.1	0.55
	2003	863.1	952.5	0.91
	2004	623.9	634.6	0.98
	2005	389.9	443.1	0.88
	2006	398.8	440.6	0.91
	2007	593.6	476.5	1.25
	2008	216.1	565.4	0.38
2009	1,073.1	-	-	
Columbia River Early	1996	142.2	98.0	1.45
	1997	206.9	129.8	1.59
	1998	63.8	126.4	0.50
	1999	325.5	174.9	1.86
	2000	326.3	378.0	0.86
	2001	1,036.5	815.9	1.27
	2002	161.6	324.7	0.50
	2003	440.0	645.7	0.68
	2004	313.6	389.0	0.81
	2005	284.6	282.7	1.01
	2006	245.8	251.4	0.98
	2007	424.9	291.0	1.46
	2008	110.3	333.9	0.33
2009	672.7	-	-	
Columbia River Late	1996	114.4	30.8	3.71
	1997	86.5	53.7	1.61
	1998	24.9	47.3	0.53
	1999	140.9	120.7	1.17
	2000	278.0	260.1	1.07
	2001	491.8	488.3	1.01
	2002	143.5	271.8	0.53
	2003	377.9	248.0	1.52
	2004	274.7	203.0	1.35
	2005	78.0	111.6	0.70
	2006	113.8	156.3	0.73
	2007	139.5	171.0	0.82
	2008	86.4	207.6	0.42
2009	369.7	-	-	
Oregon Coastal North of Cape Blanco	1996	38.5	28.0	1.38
	1997	60.4	19.0	3.18
	1998	21.6	19.7	1.10
	1999	59.4	14.4	4.13
	2000	48.5	23.4	2.07
	2001	127.3	46.9	2.71
	2002	36.6	41.6	0.88
	2003	29.3	34.5	0.85
	2004	16.6	21.7	0.77
	2005	11.5	10.7	1.07
	2006	8.6	7.9	1.09
	2007	7.0	1.3	5.38
	2008	1.7	7.1	0.24
2009	7.3	-	-	

TABLE III-1. Preliminary 1996-2009 preseason and postseason coho stock Stratified Random Sampling abundance estimates for Oregon production index area stocks in thousands of fish. (Page 2 of 2)

Stock	Year	Preseason	Postseason <sup>a/</sup>	Preseason/Postseason <sup>a/</sup>
<b>Oregon and California Coastal South of Cape Blanco</b>				
	1996	14.2	25.8	0.55
	1997	22.3	12.8	1.74
	1998	8.1	10.2	0.79
	1999	33.4	9.6	3.48
	2000	18.6	15.6	1.19
	2001	52.0	46.0	1.13
	2002	20.0	22.0	0.91
	2003	15.9	24.3	0.65
	2004	19.0	29.9	0.64
	2005	15.8	38.1	0.41
	2006	30.6	25.0	1.22
	2007	22.2	13.2	1.68
	2008	17.7	16.8	1.05
	2009	23.4	-	-
<b>Lower Columbia River Natural</b>				
	2007	21.5	19.4	1.11
	2008	13.4	27.2	0.49
	2009	32.7	-	-
<b>Oregon Coastal Natural (Rivers and Lakes)</b>				
	1996	63.2	86.1	0.73
	1997	86.4	27.8	3.11
	1998	47.2	29.2	1.62
	1999	60.7	51.9	1.17
	2000	55.9	69.0	0.81
	2001	50.1	163.2	0.31
	2002	71.8	304.5	0.24
	2003	117.9	278.8	0.42
	2004	150.9	197.0	0.77
	2005	152.0	150.1	1.01
	2006	60.8	116.4	0.52
	2007	255.4	60.0	4.26
	2008	60.0	170.9	0.35
	2009	211.6	-	-
<b>Salmon Trout Enhancement Program<sup>b/</sup></b>				
	1996	0.4	1.2	0.33
	1997	1.3	0.3	4.33
	1998	0.2	0.3	0.67
	1999	0.7	0.4	1.75
	2000	0.6	0.5	1.20
	2001	1.0	1.4	0.71
	2002	0.6	3.0	0.20
	2003	3.6	3.6	1.00
	2004	3.1	1.0	3.10
	2005	1.0	0.4	2.50
	2006	0.6	0.1	6.00
	2007	0.2	0.0	-
	2008	-	-	-
	2009	-	-	-

a/ Postseason estimates are based on preliminary data, and not all stocks have been updated with final estimates.

b/ Program was discontinued in 2005.

TABLE III-2. Oregon production index (OPI) area coho harvest impacts, spawning, abundance, and exploitation rate estimates by SRS accounting in thousands of fish.<sup>a/</sup>

Year or Avg.	Oregon and California Coastal Returns							Ocean	OCN Exploitation
	Ocean Fisheries <sup>b/</sup>		Hatcheries and			Columbia River	Exploitation Rate	Rate Based on	
	Troll	Sport	Freshwater Harvest <sup>c/</sup>	OCN Spawners	Private Hatcheries	Returns	Abundance	Postseason	
1970-1975	1,629.6	558.4	45.8	55.2	-	460.4	2,749.3	0.80	-
1976-1980	1,253.6	555.0	31.2	31.1	26.1	263.3	2,155.1	0.83	-
1981	830.9	339.9	34.1	32.6	117.8	170.2	1,555.0	0.81	-
1982	737.2	300.4	37.1	76.2	184.7	440.1	1,763.4	0.62	-
1983	428.5	275.0	18.2	22.8	133.9	95.3	1,070.0	0.80	-
1984	94.7	174.2	51.2	74.5	115.4	414.6	881.5	0.32	-
1985	164.8	280.4	45.4	73.9	332.0	356.3	1,373.4	0.44	-
1986	638.9	320.6	79.3	70.0	453.7	1,497.6	3,026.7	0.34	-
1987	468.2	296.2	45.1	30.1	119.3	307.3	1,377.9	0.60	-
1988	844.7	297.2	61.1	56.8	116.1	639.4	1,989.2	0.57	-
1989	645.1	425.5	61.1	46.4	46.9	660.1	1,871.2	0.57	-
1990	275.9	357.1	28.7	24.3	35.6	196.1	1,128.5	0.69	-
1991	448.4	469.9	77.8	38.6	35.1	935.1	1,823.2	0.45	-
1992	67.4	256.5	51.0	44.4	-	214.3	610.0	0.51	-
1993	13.1	140.8	38.6	55.7	-	113.9	342.1	0.42	-
1994	2.7	3.0	28.1	49.6	-	168.9	250.5	0.02	0.07
1995	5.4	43.5	37.5	57.7	-	74.1	215.9	0.22	0.12
1996	7.0	31.8	45.7	78.6	-	113.0	297.3	0.14	0.08
1997	5.5	22.4	26.9	31.7	-	148.1	204.6	0.12	0.12
1998	3.5	12.8	29.4	34.3	-	168.4	265.2	0.06	0.08
1999	3.6	36.5	22.6	50.6	-	274.1	414.0	0.10	0.07
2000	25.2	74.6	33.3	81.1	-	547.6	901.0	0.13	0.07
2001	37.5	216.8	75.7	184.8	-	1,108.3	1,438.6	0.16	0.07
2002	14.9	118.7	54.0	268.4	-	499.9	990.5	0.14	0.12
2003	28.8	252.4	45.0	235.3	-	677.3	1,183.6	0.23	0.14
2004	26.2	159.4	38.1	199.9	-	442.5	826.8	0.22	0.15
2005	10.5	58.2	42.5	164.1	-	487.1	592.1	0.12	0.11
2006	4.5	47.5	29.3	132.8	-	386.4	557.1	0.09	0.06
2007	26.6	128.5	10.9	71.3	-	333.4	536.5	0.28	0.11
2008 <sup>e/</sup>	0.6	26.4	14.9	165.7	-	471.7	736.3	0.04	0.03

a/ The OPI area includes ocean and inside harvest impacts and escapement to streams and lakes south of Leadbetter Point, Washington.

b/ Includes estimated nonretention mortality: troll fishery-hook-and-release mortality for 1982-2005 and drop-off mortality for all years; sport fishery-hook-and-release mortality for 1994-2005 and drop-off mortality for all years.

c/ Includes returns from Salmon-Trout Enhancement Program (STEP) smolt releases.

d/ Ocean fishery impacts on private hatchery stock and returns to private hatcheries are excluded in calculating the OPI area stock aggregate ocean exploitation rate index.

e/ Preliminary.

TABLE III-3. Preseason and postseason estimates of ocean escapements for selected Washington coastal adult natural coho stocks in thousands of fish.

Year	Preseason			Postseason			Preseason			Postseason			Preseason			Postseason								
	Forecast	Return	Pre/Postseason	Forecast	Return	Pre/Postseason	Forecast	Return	Pre/Postseason	Forecast	Return	Pre/Postseason	Forecast	Return	Pre/Postseason	Forecast	Return	Pre/Postseason						
	<b>Quillayute River Fall</b>						<b>Hoh River</b>						<b>Queets River</b>						<b>Grays Harbor<sup>a/</sup></b>					
1984	7.0	11.0	0.64	2.7	7.7	0.35	5.2	9.7	0.54	28.7	103.8	0.28												
1985	19.2	15.8	1.22	6.6	5.2	1.27	11.3	6.0	1.88	56.4	25.1	2.25												
1986	6.1	17.1	0.36	3.9	6.4	0.61	5.2	5.8	0.90	51.6	33.3	1.55												
1987	11.7	23.8	0.49	5.5	7.2	0.76	9.0	8.9	1.01	103.3	55.7	1.85												
1988	10.4	9.1	1.14	2.0	2.6	0.77	4.7	4.5	1.04	26.4	58.0	0.46												
1989	14.5	11.1	1.31	5.7	5.4	1.06	6.2	5.4	1.15	43.0	60.9	0.71												
1990	15.2	9.5	1.60	5.1	4.5	1.13	5.9	7.1	0.83	48.3	57.3	0.84												
1991	8.8	10.6	0.83	3.4	5.4	0.63	7.9	8.6	0.92	138.0	108.7	1.27												
1992	12.5	13.6	0.92	4.9	5.0	0.98	5.6	7.0	0.80	48.4	40.9	1.18												
1993	7.6	4.7	1.62	4.8	1.9	2.53	6.5	5.4	1.20	84.7	37.3	2.27												
1994	7.0	6.4	1.09	3.0	1.4	2.14	3.6	1.2	3.00	31.3	11.8	2.65												
1995	8.5	14.3	0.59	4.4	5.4	0.81	7.2	7.3	0.99	64.4	58.9	1.09												
1996	9.2	14.6	0.63	3.0	5.8	0.52	5.4	10.7	0.50	82.7	82.4	1.00												
1997	5.1	5.0	1.02	1.6	1.4	1.14	2.4	2.0	1.20	14.8	18.9	0.78												
1998	7.4	17.0	0.44	3.2	5.2	0.62	4.5	4.6	0.98	27.1	41.2	0.66												
1999	12.8	19.5	0.66	2.8	6.3	0.44	3.7	5.0	0.74	50.3	38.9	1.29												
2000	8.2	17.7	0.46	3.3	8.8	0.38	2.5	8.3	0.30	44.2	40.8	1.08												
2001	20.6	36.7	0.56	7.6	14.8	0.51	10.6	27.8	0.38	46.6	73.5	0.63												
2002	18.5	34.7	0.53	6.9	11.2	0.62	10.2	16.1	0.63	50.3	117.2	0.43												
2003	21.2	25.2	0.84	10.4	8.1	1.28	19.6	11.2	1.75	52.3	107.9	0.48												
2004	17.7	25.1	0.71	6.6	6.3	1.05	14.7	11.1	1.32	101.1	93.1	1.09												
2005	16.1	22.1	0.73	6.4	8.2	0.78	14.1	9.8	1.44	78.5	45.1	1.74												
2006	13.0	12.2	1.07	5.6	2.3	2.43	7.1	6.5	1.09	60.3	14.5	4.16												
2007	10.8	10.9	0.99	5.4	5.1	1.06	13.6	6.0	2.27	59.4	24.3	2.44												
2008 <sup>b/</sup>	10.5	12.7	0.83	4.3	4.0	1.08	10.2	NA	NA	42.7	NA	NA												

a/ The source for postseason return estimates is Washington Department of Fish and Wildlife.

b/ Postseason returns are preliminary.

**TABLE III-4. Preseason and postseason estimates of ocean escapements for selected Puget Sound adult natural coho stocks in thousands of fish. (Page 1 of 1)**

Year	Skagit River <sup>a/</sup>			Stilliguamish River <sup>a/</sup>			Hood Canal <sup>b/</sup>		
	Preseason Forecast	Postseason Return	Pre/Postseason	Preseason Forecast	Postseason Return	Pre/Postseason	Preseason Forecast	Postseason Return	Pre/Postseason
1984	29.6	37.2	0.80	NA	26.9	NA	NA	57.5	NA
1985	26.1	31.3	0.83	NA	34.4	NA	NA	38.5	NA
1986	43.5	73.4	0.59	37.0	49.9	0.74	NA	82.2	NA
1987	33.0	41.2	0.80	29.7	46.3	0.64	NA	71.7	NA
1988	29.6	29.9	0.99	24.5	35.4	0.69	18.2	15.5	1.2
1989	31.2	27.6	1.13	24.5	13.5	1.81	36.8	25.5	1.4
1990	37.6	25.9	1.45	30.8	34.1	0.90	43.9	14.2	3.1
1991	40.8	11.8	3.46	32.9	11.3	2.91	17.6	15.3	1.2
1992	35.7	9.5	3.76	18.7	18.0	1.04	10.1	19.9	0.5
1993	28.1	14.5	1.94	24.5	10.6	2.31	39.5	16.7	2.4
1994	17.9	30.5	0.59	10.2	30.3	0.34	13.5	57.0	0.2
1995	30.0	16.2	1.85	32.7	20.4	1.60	19.3	41.1	0.5
1996	26.7	8.6	3.07	29.8	10.1	2.44	15.4	53.6	0.4
1997	34.2	40.4	0.85	15.7	14.1	1.14	38.1	109.2	0.4
1998	41.1	83.2	0.48	37.7	31.2	1.23	87.3	132.1	0.7
1999	53.4	34.1	1.44	27.3	7.5	3.64	45.2	17.6	2.4
2000	24.7	74.7	0.35	15.0	31.2	0.46	50.4	41.2	1.2
2001	46.9	105.0	0.41	18.1	80.6	0.22	40.6	123.8	0.4
2002	79.9	67.7	1.31	14.5	30.5	0.48	25.6	79.6	0.3
2003	97.9	87.9	1.12	27.7	49.8	0.56	25.8	201.6	0.1
2004	130.9	166.7	0.76	26.6	66.0	0.40	79.7	223.8	0.4
2005	48.4	50.7	1.39	41.8	29.9	1.62	79.6	57.6	2.1
2006	106.6	18.9	5.65	45.0	23.6	1.91	59.4	37.8	1.6
2007 <sup>c/</sup>	26.8	66.2	0.40	69.2	38.7	1.79	42.4	88.3	0.5
2008 <sup>c/</sup>	61.4	NA	-	31.0	NA	-	30.4	NA	-

a/ Post-season numbers for 1996-to-present represent terminal run sizes. Pre-season values for 2001 forward are for April age-3 ocean runsize before fishing.

b/ Post-season numbers for 1996-to-present represent ocean age-3 runsizes. Pre-season values for 2001 forward are for April age-3 ocean runsize before fishing.

c/ Preliminary.

TABLE III-5. Mass marking of 2006 brood coho available to 2009 Council fisheries. The mark used is an adipose fin clip.

Region	Ocean Recruits		Percent Mass
	Natural	Hatchery	Marked
<b>PUGET SOUND STOCKS:</b>			
Nooksack-Samish and 7/7A Independent	7,044	25,457	69.4%
Skagit	33,374	11,730	23.4%
Stillaguamish	13,400	0	0.0%
Snohomish	67,000	53,589	34.5%
South Puget Sound Normal	53,606	185,366	71.2%
South Puget Sound Delayed	0	3,400	93.0%
Hood Canal	50,856	49,793	44.4%
Strait of Juan de Fuca and Area 9	21,240	6,608	22.2%
Puget Sound Total	246,520	335,943	51.3%
<b>WASHINGTON COASTAL STOCKS:</b>			
North Coast Independent Tributaries	11,130	14,101	44.4%
Quillayute Summer	2,233	12,921	85.3%
Quillayute Fall	19,259	39,471	59.4%
Hoh	9,496	0	0.0%
Queets	0	13,537	NA
Quinault	16,313	26,210	49.4%
Grays Harbor	59,226	63,485	46.2%
Willapa Bay	33,544	59,420	61.0%
Washington Coastal Total	151,201	229,145	53.9%
<b>COLUMBIA RIVER STOCKS:</b>			
Columbia River Early	15,407	641,886	81.0% <sup>a/</sup>
Columbia River Late	17,295	335,110	82.0% <sup>a/</sup>
Columbia River Total	32,702	976,996	81.4% <sup>a/</sup>
<b>OREGON COASTAL</b>	211,600	30,700	5.5%
<b>SOUTHERN BRITISH COLUMBIA STOCKS<sup>b/</sup>:</b>			
Georgia Strait Mainland	12,853	12,778	43.6%
Georgia Strait Vancouver Island	30,829	4,768	8.4%
Johnstone Strait	16,403	3,563	11.2%
Southwest Vancouver Island	36,739	6,187	9.7%
Northwest Vancouver Island	23,407	1,017	1.0%
Lower Fraser River	14,476	64,537	67.0%
Interior Fraser River	13,980	1,325	0.0%
Southern British Columbia Total	148,687	94,175	29.5%

a/ Columbia River estimate of percent mass marked do not include natural production.

b/ For this assessment, the percent mass marked was assumed to be the same as in 2008.

TABLE III-6. Projected coho mark rates for 2009 fisheries under base period fishing patterns (percent marked).

Area	Fishery	June	July	August	Sept
Canada					
Johnstone Strait	Recreational	-	15%	12%	-
West Coast Vancouver Island	Recreational	35%	16%	11%	11%
North Georgia Strait	Recreational	30%	30%	29%	23%
South Georgia Strait	Recreational	36%	36%	30%	32%
Juan de Fuca Strait	Recreational	39%	42%	43%	39%
Johnstone Strait	Troll	35%	26%	21%	25%
NW Vancouver Island	Troll	25%	24%	26%	33%
SW Vancouver Island	Troll	45%	40%	44%	46%
Georgia Strait	Troll	38%	38%	38%	33%
Puget Sound					
Strait of Juan de Fuca (Area 5)	Recreational	57%	50%	50%	50%
Strait of Juan de Fuca (Area 6)	Recreational	55%	47%	49%	48%
San Juan Island (Area 7)	Recreational	48%	41%	40%	31%
North Puget Sound (Areas 6 & 7A)	Net	-	34%	35%	33%
Council Area					
Neah Bay (Area 4/4B)	Recreational	48%	55%	53%	59%
LaPush (Area 3)	Recreational	68%	62%	67%	42%
Westport (Area 2)	Recreational	69%	69%	69%	67%
Columbia River (Area 1)	Recreational	76%	74%	74%	75%
Tillamook	Recreational	71%	68%	65%	51%
Newport	Recreational	68%	66%	64%	49%
Coos Bay	Recreational	62%	59%	47%	31%
Brookings	Recreational	55%	43%	38%	12%
Neah Bay (Area 4/4B)	Troll	56%	52%	56%	61%
LaPush (Area 3)	Troll	60%	62%	59%	63%
Westport (Area 2)	Troll	57%	62%	68%	66%
Columbia River (Area 1)	Troll	72%	70%	69%	75%
Tillamook	Troll	68%	67%	69%	65%
Newport	Troll	66%	66%	64%	62%
Coos Bay	Troll	61%	60%	53%	39%
Brookings	Troll	51%	51%	54%	70%
Columbia River					
Buoy 10	Recreational	-	-	-	78%

TABLE III-7. Estimated ocean escapements for critical natural and Columbia River hatchery coho stocks (thousands of fish) based on preliminary 2009 pre-season abundance forecasts and 2008 Council regulations.<sup>a/</sup>

Stock	Ocean Escapement Estimates Under 2008 Regulations <sup>b/</sup>		2009 Spawning Escapement Goal <sup>c/</sup>
	2009 Preseason Abundance	2008 Preseason Abundance	
<b>Natural Coho Stocks</b>			
Skagit	27.5	49.1	30.0 <sup>d/</sup>
Stillaguamish	10.5	24.0	17.0 <sup>d/</sup>
Snohomish	53.7	69.2	70.0 <sup>d/</sup>
Hood Canal	39.1	18.6	21.5 <sup>d/</sup>
Strait of Juan de Fuca	19.1	21.3	12.8 <sup>d/</sup>
Quillayute Fall	18.5	9.5	6.3 - 15.8
Hoh	8.8	3.4	2.0 - 5.0
Queets	NA	7.4	5.8 - 14.5
Grays Harbor	56.8	36.8	35.4
LCN	31.7(2.3%)	13.4 (34.7%)	Exploitation Rate ≤8.0%
OCN	206.9 (2.3%)	35.0 (42.7%)	Exploitation Rate ≤8.0%
R/K	NA (0.5%)	NA (18.2%)	Exploitation Rate ≤13.0%
<b>Hatchery Coho Stocks</b>			
Columbia Early	636.6	23.7	18.6
Columbia Late	342.1	18.2	11.9

a/ Quota levels include harvest and hooking mortality estimates used in planning the Council's 2008 ocean fisheries and a coho catch for the Canadian troll fishery off the West Coast of Vancouver Island (WCVI).

b/ 2008 pre-season regulations include the following coho quota fisheries: Treaty Indian troll - 20,000 non-selective; non-Indian troll - 4,000 selective; recreational north of Cape Falcon - 20,350 selective plus a 4,000 quota for the Area 4B fishery; recreational Cape Falcon to OR/CA border - 9,000 selective; Ocean escapement is generally the estimated number of coho escaping ocean fisheries and entering freshwater. For Puget Sound stocks, ocean escapement is the estimated number of coho entering Area 4B which are available for U.S. net fisheries in Puget Sound and spawning escapement after impacts associated with the Canadian and Puget Sound troll and recreational fisheries have been deducted. For the OCN coho stock, this value represents the estimated spawner escapement in SRS accounting. For Columbia River hatchery and LCN stocks, ocean escapement represents the number of coho before the Buoy 10 fishery; the LCN exploitation rate shown is the total ocean fisheries exploitation rate, which had an ER forecast of 13.3% and an ESA limit of 20% including in mainstem Columbia River fisheries.

c/ Goals represent Salmon FMP conservation objectives, ESA consultation standards, or hatchery escapement needs. Spawning escapement goals are not directly comparable to ocean escapement because the latter occur before inside fisheries.

d/ Annual management goals may be determined by the state and tribal co-managers during the pre-season planning process, and expressed in terms of total mortality exploitation rate constraints.

TABLE III-8. Comparison of Lower Columbia natural (LCN), Oregon coastal natural (OCN), and Rogue/Klamath (RK) coho projected harvest mortality and exploitation rates by fishery under Council-adopted 2008 regulations and preliminary 2009 preseason abundance estimates.

Fishery	Projected Harvest Mortality and Exploitation Rate					
	LCN		OCN		RK	
	Number	Percent	Number	Percent	Number	Percent
<b>SOUTHEAST ALASKA</b>	0	0.0%	0	0.0%	0	0.0%
<b>BRITISH COLUMBIA</b>	35	0.1%	567	0.3%	23	0.1%
<b>PUGET SOUND/STRAITS</b>	49	0.2%	164	0.1%	0	0.0%
<b>NORTH OF CAPE FALCON</b>						
Recreational	216	0.7%	220	0.1%	2	0.0%
Treaty Indian Troll	263	0.8%	410	0.2%	0	0.0%
Non-Indian Troll	88	0.3%	149	0.1%	0	0.0%
<b>SOUTH OF CAPE FALCON</b>						
Recreational:	65	0.2%				
Cape Falcon to Humbug Mt.			611	0.3%	8	0.0%
Humbug Mt. to Horse Mt. (KMZ)			83	0.0%	16	0.1%
Fort Bragg			0	0.0%	0	0.0%
South of Pt. Arena			0	0.0%	0	0.0%
Troll:	0	0.0%				
Cape Falcon to Humbug Mt.			0	0.0%	0	0.0%
Humbug Mt. to Horse Mt. (KMZ)			0	0.0%	0	0.0%
Fort Bragg			0	0.0%	0	0.0%
South of Pt. Arena			0	0.0%	0	0.0%
<b>BUOY 10</b>	29	0.1%	13	0.0%	0	0.0%
<b>ESTUARY/FRESHWATER</b>	NA	NA	2,626	1.2%	46	0.3%
<b>TOTAL</b>	745	2.3%	4,843	2.3%	95	0.5%

TABLE III-9. Maximum allowable fishery impact rate for OCN coho under Amendment 13 matrix (Appendix A, Table A-2) and the OCN work group matrix (Appendix A, Table A-3) based on parent escapement levels by stock component and marine survival category.<sup>a/</sup>

Fishery Year (t)	Estimated OCN Coho Spawners by Stock Component					Hatchery Jack Survival Rate (t-1)	Amendment 13 Matrix			OCN Work Group Matrix <sup>b/</sup>		
	Parent Spawner Year (t-3)	Northern	North-Central	South-Central	Southern		Marine Survival Category	Parental Spawner Category	Maximum Allowable Impacts	Marine Survival Category	Parental Spawner Category	Maximum Allowable Impacts
1998	1995	3,900	13,600	36,500	3,800	0.04%	Low	Very Low	≤10-13%	Extremely Low	Very Low	≤8%
1999	1996	3,300	18,100	52,600	4,600	0.10%	Med	Very Low	≤15%	Low	Critical	0-8%
2000	1997	2,100	2,800	18,400	8,300	0.12%	Med	Very Low	≤15%	Low	Critical	0-8%
2001	1998	2,600	3,300	25,900	2,300	0.27%	Med	Very Low	≤15%	Medium	Critical	0-8%
2002	1999	8,900	11,800	28,300	1,400	0.09%	Med	Low	≤15%	Low	Low	≤15%
2003	2000	17,900	14,300	36,500	11,000	0.20%	Med	Low	≤15%	Med	Low	≤15%
2004	2001	33,500	25,200	112,000	12,200	0.14%	Med	Low	≤15%	Med	Low	≤15%
2005	2002	52,500	104,000	104,100	7,800	0.11%	Med	High	≤20%	Low	High	≤15%
2006	2003	59,600	68,900	99,800	6,800	0.12%	Med	High	≤20%	Low	High	≤15%
2007	2004	33,100	40,400	96,400	24,500	0.17%	Med	Med	≤20%	Med	Med	≤20%
2008	2005	16,500	51,400	86,300	10,000	0.07%	Low	High	≤15%	Extremely Low	High	≤8%
2009	2006	24,100	21,200	82,400	3,900	0.27%	Med	Low	≤15%	Med	Low	≤15%
2010	2007	17,500	12,300	36,000	5,200	-	-	Low	-	-	Low	-
2011	2008	27,700	57,900	79,100	400	-	-	High	-	-	High	-

a/ Under the NMFS ESA consultation standards, the southern stock component is managed for a total allowable Marine Exploitation rate of 13%, as represented by Rogue/Klamath hatchery stocks, which is separate from these OCN coho impact rates.

b/ Developed by the OCN work group as a result of the 2000 Review of Amendment 13.

