# SALMON FISHERY UPDATE

Situation: The only ocean salmon fisheries open in November are the California recreational fisheries between Horse Mountain and Point Arena (scheduled to close November 16) and between Point Arena and Pigeon Point (scheduled to close November 9).

A summary of the management events for the 2003 salmon season (updated through October15) is contained in Attachment 1. Through October 15, there have been four inseason management conferences to adjust fisheries. The first conference closed the commercial troll fishery north of Cape Falcon effective June 6. The second conference allowed fishing seven days per week in the recreational fishery between Cape Falcon and the Queets River effective July 25. The third conference call ended retention of coho in the Cape Falcon to Humbug Mt. recreational fishery effective August 19. The fourth conference call transferred 5,000 chinook from the recreational fishery north of Cape Falcon to the commercial fishery north of Cape Falcon.

Mr. Dell Simmons, Chair of the Salmon Technical Team (STT), will provide detailed effort and harvest data for salmon fisheries through October 15 in his report to the Council (Exhibit E.1.a, Supplemental STT Report).

**Council Task:**

**1. Discuss issues relevant to inseason management of salmon fisheries.**

Reference Materials:

1. Exhibit E.1, Attachment 1: Table E.1-1. Sequence of Events in Ocean Salmon Fishery Management through October 15, 2003.
2. Exhibit E.1.a, Supplemental STT Report: Status Report of the 2003 Ocean Salmon Fisheries off Washington, Oregon, and California.

Agenda Order:

a. Salmon Technical Team Report — Dell Simmons
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. Council Discussion

PFMC
10/20/03

Exhibit E.2
Situation Summary
November 2003

# INSEASON CONSIDERATION OF SCHEDULED 2004 COMMERCIAL AND RECREATIONAL OPENINGS SOUTH OF CAPE FALCON

Situation: The 2003 Federal Regulations for West Coast Salmon Fisheries specify that for the 2004 non-Indian commercial salmon fisheries between Cape Falcon and the Oregon/California border and for the recreational salmon fishery between Cape Falcon and Humbug Mt., the season will open March 15, and the openings could be modified following review at the November 2003 Council meeting. As of the time this exhibit was prepared, Council staff is unaware of any proposals to change the opening date.

**Council Action:**

1. **If appropriate, recommend modifications to the opening date(s) for Oregon commercial and recreational fisheries south of Cape Falcon.**

Reference Materials:

1. None.

Agenda Order:

a. Agendum Overview — Chuck Tracy
b. Agency and Tribal Reports and Comments
c. Reports and Comments of Advisory Bodies
d. Public Comment
e. **Council Action**: Recommend Maintaining or Modifying the March 15, 2004 Opening Date for Commercial and Recreational Fisheries South of Cape Falcon

PFMC
10/20/03

# PACIFIC FISHERY MANAGEMENT COUNCIL SCHEDULE AND PROCESS FOR DEVELOPING 2004 OCEAN SALMON FISHERY MANAGEMENT MEASURES

| | |
|---|---|
| Nov. 3-7, 2003 | The Council and advisory entities meet th the Hilton Del Mar, Del Mar, California to, (1) consider any changes to methodologies used in the development of abundance projections or regulatory options and (2) adopt the management process and schedule for 2004 ocean salmon fisheries. |
| Jan. 20-23, 2004 | The Salmon Technical Team (STT) and Council staff economist meet in Portland, Oregon to draft *Review of 2003 Ocean Salmon Fisheries*. This report summarizes seasons, quotas, harvest, escapement, socioeconomic statistics, achievement of management goals, and impacts on species listed under the Endangered Species Act. (February 6 print date, mailed to the Council February 26, and available to the public March 2.) |
| Feb. 17-20 | STT meets in Portland, Oregon to complete *Preseason Report I Stock Abundance Analysis for 2004 Ocean Salmon Fisheries*. This report provides key salmon stock abundance estimates and precision, harvest and escapement estimates, when recent regulatory regimes are projected on 2003 abundance, and other pertinent information to aid development of management options. (February 24 print date, mailed to the Council February 26, and available to the public March 2.) |
| Feb. 26 through March 7 | State and tribal agencies hold constituent meetings to review preseason abundance projections and range of probable fishery options. The Klamath Fishery Management Council completes recommendations for ocean management options affecting Klamath River fall chinook. |
| March 2 | Council reports summarizing the 2003 salmon season and salmon stock abundance projections for 2004 are available to the public from the Council office. |
| March 8-12 | Council and advisory entities meet at the Sheraton Tacoma Hotel, Tacoma, Washington to adopt 2004 regulatory options for public review. The Council adopts preliminary options on March 9, tentative options for STT analysis on March 10, and final options for public review on March 12. |
| March 15 though April 4 | Management agencies, tribes, and public develop their final recommendations for the regulatory options. North of Cape Falcon Forum meetings are tentatively scheduled for March 18-19 (Portland area) and April 1-2 (Seattle area). Council staff completes a preliminary draft *Environmental Assessment for the Proposed 2004 Management Measures for the Ocean Salmon Fishery Managed under the Pacific Coast Salmon Plan.* |
| March 23 | Council staff distributes *Preseason Report II: Analysis of Proposed Regulatory Options for 2004 Ocean Salmon Fisheries* to the public. The report includes the public hearing schedule, comment instructions, option highlights, and tables summarizing the biological and economic impacts of the proposed management options. |

| | |
|---|---|
| March 29 and 30 | Sites and dates of public hearings to review the Council's proposed regulatory options are: Westport, Washington (March 29); North Bend, Oregon (March 29); and Eureka, California (March 30). Comments on the options will also be taken during the Council meeting on April 6 in Sacramento, California. |
| April 5-9 | Council and advisory entities meet to adopt final regulatory measures at the Red Lion Hotel Sacramento, Sacramento, California. The *Preseason Report II: Analysis of Proposed Regulatory Options for 2004 Ocean Salmon Fisheries*, the preliminary *Environmental Assessment for the Proposed 2004 Management Measures for the Ocean Salmon Fishery Managed under the Pacific Coast Salmon Plan*, and information developed at the Council meeting is considered during the course of the week. The Council will tentatively adopt final regulatory measures for analysis by the STT on April 6. Final adoption of recommendations to National Marine Fisheries Service (NMFS) are scheduled to be completed on April 8. |
| April 10-14 | The STT completes *Preseason Report III Analysis of Council-Adopted Regulatory Measures for 2004 Ocean Salmon Fisheries.* |
| April 15-23 | Council staff completes final *Environmental Assessment for the Proposed 2004 Management Measures for the Ocean Salmon Fishery Managed under the Pacific Coast Salmon Plan* for submission to NMFS.<br><br>Council staff distributes adopted ocean salmon fishing management recommendations. |
| May 1 | NMFS implements federal ocean salmon fishing regulations, and *Preseason Report III* is made available to the public. |

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10/21/03

# PRESEASON PLANNING FOR 2004 MANAGEMENT

Situation: To plan, announce, and meet *Federal Register* deadlines for public hearing sites and the entire preseason salmon management process, staff needs to confirm details of the process prior to the end of November. The proposed 2004 process and schedule is contained in Exhibit E.3, Attachment 1. It follows the same format as in previous years.

For 2004, Council staff recommends one salmon management option hearing per coastal state, the same schedule as in 2003. The hearings would be:

March 29 Westport, Washington and Coos Bay, Oregon
March 30 Eureka, California

In 2004, the March Council meeting will occur in Tacoma, Washington and the April Council meeting in Sacramento, California. Therefore, the public comment period on Tuesday of the April meeting in Sacramento also serves as a public comment opportunity. If the states desire to have additional hearings, we suggest they organize and staff them as was done in past years. The table below provides the public attendance at the hearing sites since 1995 for Council reference.

| | Public Attendance | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Hearing Site Location[1/] | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
| **Westport** | 49 | 30 | 22 | 4 | 18 | 24 | 30 | 11 | 16 |
| Astoria | 28 | 23 | 16 | - | 14 | - | - | - | - |
| Tillamook | - | - | - | 28 | - | 13 | 16 [2/] | 18 [2/] | - |
| **North Bend/Coos Bay** | 22 | 30 | 27 | 15 | 31 | 36 | 18 | 40 | 26 |
| **Eureka** | 30 | 45 | 27 | 16 | 18 | 37 | 12 | 25 | 46 |
| Sacramento | 16 | - | - | 13 | - | - | - | - | - |
| Santa Rosa | - | - | - | - | - | 4 | - | - | - |
| Moss Landing[2/] | - | - | - | 100 | 51 | 50 | 33 | 14 | - |

1/ Sites in bold are proposed for Council staffing in 2004.
2/ Hearing staffed by state personnel.

**Council Action:**

1. **Confirm Council-staffed hearing sites and state intentions for additional hearings.**
2. **Approve staff's overall proposed schedule and process for developing 2004 ocean salmon management measures (Exhibit E.3, Attachment 1).**

References:

1. Exhibit E.3, Attachment 1: Pacific Fishery Management Council Schedule and Process for Developing 2004 Ocean Salmon Fishery Management Measures.

Agenda Order:

a. Agendum Overview — Chuck Tracy
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. **Council Action:** Approve 2004 Hearing Sites and Management Schedule

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10/21/03

Exhibit E.4
Situation Summary
November 2003

# SALMON METHODOLOGY REVIEW

Situation: Each year, the Scientific and Statistical Committee (SSC) completes a methodology review to help assure new or significantly modified methodologies employed to estimate impacts of the Council's salmon management use the best available science. This review is preparatory to the Council's adoption, at the November meeting, of all anticipated methodology changes to be implemented in the coming season, or, in certain limited cases, of providing directions for handling any unresolved methodology problems prior to the formulation of salmon management options in March. Because there is insufficient time to review new or modified methods at the March meeting, the Council may reject their use if they have not been approved the preceding November.

The methodology the SSC is expected to report on at this time is:

- Modification of the Coho Fisheries Regulation Assessment Model (FRAM) to accommodate Canadian stocks and fisheries.
- Overview of FRAM documentation from the Model Evaluation Workgroup (MEW).

**Council Action:**

1. **Approve methodology changes as appropriate for implementation in the 2004 salmon season.**
2. **Provide guidance as needed for any unresolved methodology issues.**

Reference Materials:

1. Exhibit E.4.b, Supplemental SSC Report.
2. Exhibit E.4.c, Supplemental MEW Report.
3. Exhibit E.4.d, Supplemental STT Report.

Agenda Order:

| | | |
|---|---|---|
| a. | Agendum Overview | Chuck Tracy |
| b. | SSC Report | Pete Lawson |
| c. | MEW Report | Dell Simmons |
| d. | Reports and Comments of Advisory Bodies | |
| e. | Public Comment | |
| f. | **Council Action**: Adopt Final Methodology Changes for 2004 | |

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10/21/03

TABLE E.1-1. Sequence of events in ocean salmon fishery management through October 15, 2003[a/] (Page 1 of 5)

**GENERAL MANAGEMENT ACTIONS AND INSEASON CONFERENCES**

| | |
|---|---|
| Mar. 7 | National Marine Fisheries Service (NMFS) provides the Council with a letter outlining the 2003 management guidance for stocks listed under the Endangered Species Act (ESA). |
| Mar. 14 | Council adopts three troll and three recreational ocean salmon fishery management options for public review. |
| Mar. 20-21 | North of Cape Falcon Salmon Forum meets in Olympia, Washington to initiate consideration of recommendations for treaty Indian and non-Indian salmon management options. |
| Mar. 31-Apr. 1 | Council holds public hearings on proposed 2003 management options in three locations within the three Pacific Coast states. |
| Apr. 2-3 | North of Cape Falcon Salmon Forum meets in Seattle, Washington to further consider recommendations for treaty Indian and non-Indian salmon management options. |
| Apr. 10 | Council adopts final ocean salmon fishery management recommendations for approval and implementation by the U.S. Secretary of Commerce. The proposed measures include selective fisheries and comply with the salmon fishery management plan (FMP) and the current biological opinions for listed species. An emergency rule is not required for implementation. |
| May 6 | Ocean salmon seasons implemented as recommended by the Council and published in the *Federal Register* on May 6 (68 FR 23913) and May 19 (FR 68 FR 27004). |
| June 5 | NMFS inseason conference number one results in closure of the U.S./Canada border to Cape Falcon, non-Indian commercial all-salmon-except-coho fishery effective midnight, June 6, 2003 as the 40,000 chinook quota was approached, and the preseason intent to reserve at least 800 chinook for the June 26-30 opening was in jeopardy. |
| July 18 | NMFS inseason conference number two results in opening of the Cape Falcon to Queets River recreational salmon fishery seven days per week, effective July 25. |
| Aug. 14 | NMFS inseason conference number three results in closure of the Cape Falcon to Humbug Mt. selective recreational coho fishery effective August 19, 2003 as the quota of 88,000 adipose fin clipped coho was projected to have been met. |
| Aug. 20 | NMFS inseason conference number four results in transfer of 5,000 chinook from the recreational fishery north of Cape Falcon to the commercial fishery north of Cape Falcon, resulting in overall chinook quotas of 54,600 and 69,400 for the recreational and commercial fisheries, respectively. |

**NON-INDIAN COMMERCIAL TROLL SEASONS**

| | |
|---|---|
| Mar. 15 | Cape Falcon to Florence south jetty, non-Indian commercial all-salmon-except-coho fishery opens through July 16. The fishery reopens August 1 through 19 and September 1 through October 31.<br><br>Florence south jetty to Humbug Mt., non-Indian commercial all-salmon-except-coho fishery opens through June 30. The fishery reopens July 17 through 31; August 11 through 29; and September 1 through October 31.<br><br>Humbug Mt. to Oregon/California border, non-Indian commercial all-salmon-except-coho fishery opens through May 31. The fishery is scheduled to reopen June 1 through the earlier of June 30 or a 2,500 chinook quota; reopen again July 1 through the earlier of July 31 or a 1,200 chinook quota, reopen again August 1 through the earlier of August 29 or a 2,500 chinook quota, and reopen again September 1 through the earlier of September 30 or a 3,000 chinook quota. |

TABLE E.1-1. Sequence of events in ocean salmon fishery management through October 15, 2003[a/] (Page 2 of 5)

**NON-INDIAN COMMERCIAL TROLL SEASONS**, (continued)

| | |
|---|---|
| May 1 | U.S./Canada border to Cape Falcon, non-Indian commercial all-salmon-except-coho fishery opens through the earlier of June 30 or a 40,000 chinook quota. |
| | Horse Mt. to Pt. Arena, non-Indian commercial all-salmon-except-coho fishery opens through May 31. The fishery reopens July 3 through 14; and July 18 through September 30. |
| | Pt. Arena to U.S./Mexico border, non-Indian commercial all-salmon-except-coho fishery opens through September 30. |
| May 31 | Humbug Mt. to Oregon/California border, non-Indian commercial all-salmon-except-coho fishery closes. The fishery is scheduled to reopen June 1 through the earlier of June 30 or a 2,500 chinook quota; reopen again July 1 through the earlier of July 31 or a 1,200 chinook quota, reopen again August 1 through the earlier of August 29 or a 2,500 chinook quota, and reopen again September 1 through the earlier of September 30 or a 3,000 chinook quota. |
| | Horse Mt. to Pt. Arena, non-Indian commercial all-salmon-except-coho fishery closes. The fishery reopens July 3 through 14; and July 18 through September 30. |
| June 1 | Humbug Mt. to Oregon/California border, non-Indian commercial all-salmon-except-coho fishery reopens through the earlier of June 30 or a 2,500 chinook quota. |
| June 20 | The U.S./Canada border to Cape Falcon, non-Indian commercial all-salmon-except-coho fishery closes as the 40,000 chinook quota was approached. The fishery is scheduled to reopen June 26-30 if at least 800 chinook remain on the quota. |
| June 26 | U.S./Canada border to Cape Falcon, non-Indian commercial all-salmon-except-coho fishery opens through the earlier of June 30 or a 40,000 chinook quota, with a 50 fish per vessel landing limit for the five day open period. |
| June 30 | Florence South Jetty to Humbug Mt., non-Indian commercial all-salmon-except-coho fishery closes. The fishery reopens July 17 through 31; August 11 through 29; and September 1 through October 31. |
| | The Humbug Mt. to Oregon/California border, non-Indian commercial all-salmon-except-coho fishery closes as scheduled. The fishery is scheduled to reopen July 1 through the earlier of July 31 or a 1,200 chinook quota, reopen again August 1 through the earlier of August 29 or a 2,500 chinook quota, and reopen again September 1 through the earlier of September 30 or a 3,000 chinook quota. |
| July 1 | Humbug Mt. to Oregon/California border, all-salmon-except-coho fishery reopens through the earlier of July 29 or a 1,200 chinook quota. |
| July 3 | U.S./Canada border to Cape Falcon, non-Indian commercial all-salmon fishery opens through the earlier of September 14 or a 24,400 chinook guideline or a 75,000 coho quota; the fishery is open Thursday through Monday with a 75 chinook landing limit per vessel for July 3 through 7 and a 150 chinook landing limit per vessel for subsequent five-day open periods. All coho must have a healed adipose fin clip. |
| | Horse Mt. to Pt. Arena, non-Indian commercial all-salmon-except-coho fishery opens through July 14 with a 150 fish per day per vessel landing limit, and a requirement that all fish must be landed within the area and within 24 hours of any closure. |
| July 14 | Horse Mt. to Point Arena, non-Indian commercial all-salmon-except-coho fishery closes. The fishery reopens July 18 through September 30. |
| July 16 | Cape Falcon to Florence south jetty, non-Indian commercial all-salmon-except-coho fishery closes. The fishery reopens August 1 through 19 and September 1 through October 31 |
| July 17 | Florence south jetty to Humbug Mt., Oregon, all-salmon-except-coho fishery opens through July 31. |
| July 18 | Horse Mt. to Point Arena, non-Indian commercial all-salmon-except-coho fishery opens through September 30 with no special landing limit or area restrictions. |

**NON-INDIAN COMMERCIAL TROLL SEASONS**, (continued)

| | |
|---|---|
| July 31 | Florence south jetty to Humbug Mt., Oregon, all-salmon-except-coho fishery closes. The fishery reopens August 11 through 29; and September 1 through October 31. |
| | Scheduled closure of the Humbug Mt. to Oregon/California border, non-Indian commercial all-salmon-except-coho fishery. |
| Aug. 1 | Cape Falcon to Florence south jetty, non-Indian commercial all-salmon-except-coho fishery opens through August 19. |
| | Humbug Mt. to Oregon/California, border non-Indian commercial all-salmon-except-coho fishery reopens through the earlier of August 29 or a 2,500 chinook quota. |
| Aug. 19 | Cape Falcon to Florence south jetty, non-Indian commercial all-salmon-except-coho fishery closes. The fishery reopens September 1 through October 31. |
| Aug. 29 | Florence south jetty to Humbug Mt., non-Indian commercial all-salmon-except-coho fishery closes for two days. The fishery reopens September 1 through October 31. |
| | Humbug Mt. to Oregon/California border, non-Indian commercial all-salmon-except-coho fishery closes as scheduled. The fishery reopens September 1 through the earlier of September 30 or a 3,000 chinook quota. |
| Sep. 1 | Cape Falcon to Florence south jetty, non-Indian commercial all-salmon-except-coho fishery reopens through October 31. |
| | Florence south jetty to Humbug Mt., non-Indian commercial all-salmon-except-coho fishery reopens through October 31. |
| | Humbug Mt. to Oregon/California, border non-Indian commercial all-salmon-except-coho fishery reopens through the earlier of September 30 or a 3,000 chinook quota with a 28 inch minimum size limit. |
| | Oregon/California border to Humboldt south jetty, non-Indian commercial all-salmon-except-coho fishery opens through the earlier of September 30 or a quota of 10,000 chinook. |
| Sep. 14 | U.S./Canada border to Cape Falcon, non-Indian commercial salmon fishery closes as scheduled. |
| Sep. 30 | Humbug Mt. to Oregon/California border, non-Indian commercial fishery closes as scheduled. |
| | Oregon/California border to Humboldt south jetty, non-Indian commercial fishery closes as scheduled. |
| | Horse Mt. to Pt. Arena, non-Indian commercial all-salmon-except-coho fishery closes. |
| | Pt. Arena to U.S./Mexico border, non-Indian commercial all-salmon-except-coho fishery closes. |
| Oct. 1 | Pt. Reyes to Pt. San Pedro, non-Indian commercial all-salmon-except-coho fishery opens Monday to Friday through October 17. |
| Oct. 17 | Pt. Reyes to Pt. San Pedro, non-Indian commercial all-salmon-except-coho fishery closes. |
| Oct. 31 | Cape Falcon to Florence south jetty non-Indian commercial all-salmon-except-coho fishery closes. |
| | Florence south jetty to Humbug Mt., non-Indian commercial all-salmon-except-coho fishery closes. |

**TREATY INDIAN COMMERCIAL TROLL SEASONS**

| | |
|---|---|
| May 1 | All-salmon-except-coho fisheries open through the earlier of June 30 or a 30,000 chinook quota for the May through June season (any remainder of the quota is not transferable to the July 1 through September 15 season). |
| June 30 | All-salmon-except-coho fisheries close as scheduled. |
| July 1 | All-salmon fisheries open through the earlier of September 15, a 30,000 chinook quota, or a 90,000 coho quota. |
| Sep. 15 | All-salmon commercial fisheries close. |

**RECREATIONAL SEASONS**

| | |
|---|---|
| Feb. 15 | Horse Mt. to Pt. Arena, all-salmon-except-coho fishery opens through November 16. |
| Mar. 15 | Cape Falcon to Humbug Mt., all-salmon-except-coho fishery opens through October 31. The fishery allows retention of adipose fin clipped coho beginning June 21 through the earlier of August 24 or a 88,000 coho quota, then reverts back to all-salmon-except-coho for the remainder of the season. |
| Mar. 29 | Pigeon Pt. to the U.S./Mexico border, all-salmon-except-coho fishery opens through September 28. |
| Apr. 12 | Point Arena to Pigeon Pt., all-salmon-except-coho fishery opens through November 9. |
| May 17 | Humbug Mt. to Horse Mt., all-salmon-except-coho fishery opens through September 14. |
| June 21 | Cape Falcon to Humbug Mt., all-salmon selective coho fishery opens seven days per week through the earlier of August 24 or a quota of 88,000 coho; all coho must have a healed adipose fin clip. The fishery reopens for all-salmon-except-coho the earlier of August 25 or the attainment of the coho quota, through October 31. |
| June 22 | U.S./Canada border to Cape Alava, all-salmon fishery opens seven days per week through the earlier of September 14, a 3,900 chinook guideline, or a 23,400 coho quota. Daily-bag-limit is two fish, only one of which can be a chinook, plus one additional pink salmon; all coho must have a healed adipose fin clip.<br><br>Cape Alava to Queets River, all-salmon fishery opens seven days per week though the earlier of September 8, a 2,300 chinook guideline, or a 5,750 coho quota. Daily-bag-limit is two fish, only one of which can be a chinook, plus one additional pink salmon; all coho must have a healed adipose fin clip.<br><br>Queets River to Leadbetter Pt., all-salmon fishery opens though the earlier of September 14, a 40,600 chinook guideline, or a 83,250 coho quota. Fishery runs Sunday to Thursday through July 25, then seven days per week thereafter. Daily-bag-limit is two fish, only one of which can be a chinook; all coho must have a healed adipose fin clip. |
| June 29 | Leadbetter Pt. to Cape Falcon, all-salmon fishery opens though the earlier of September 30, a 12,700 chinook guideline, or a 112,500 coho quota. Fishery runs Sunday to Thursday through July 24, then seven days per week thereafter. Daily-bag-limit is two fish, only one of which can be a chinook; all coho must have a healed adipose fin clip. Closed between Tillamook Head and Cape Falcon beginning August 1. |
| Aug. 18 | Cape Falcon to Humbug Mt., all-salmon selective coho fishery closes as the 88,000 coho quota is reached. |
| Aug. 19 | Cape Falcon to Humbug Mt., all-salmon-except-coho fishery reopens through October 31. |

TABLE E.1-1. Sequence of events in ocean salmon fishery management through October 15, 2003[a/] (Page 5 of 5)

**RECREATIONAL SEASONS**, (continued)

| | |
|---|---|
| Sep. 8 | U.S./Canada border to Cape Alava, all-salmon selective coho fishery closes as scheduled. |
| | Cape Alava to Queets River, all-salmon selective coho fishery closes as scheduled. |
| | Queets River to Leadbetter Point, all-salmon selective coho fishery closes as scheduled. |
| Sep. 14 | Humbug Mt. to Horse Mt., all-salmon-except-coho fishery closes. |
| Sep. 20 | La Push area (Teahwhit Head to "Q" buoy to Cake Rock east to the shoreline), all-salmon selective coho fishery reopens through the earlier of October 5, a 100 chinook guideline, or a 100 coho quota. |
| Sep. 28 | Pigeon Pt. to U.S./Mexico border, all-salmon-except-coho fishery closes. |
| Sep. 30 | Scheduled closure of the Leadbetter Pt. to Cape Falcon, all-salmon selective coho fishery closes as scheduled. |
| Oct. 5 | La Push area, all-salmon selective coho fishery closes as scheduled. |
| Oct. 31 | Cape Falcon to Humbug Mt., all-salmon-except-coho fishery closes. |
| Nov. 9 | Pt. Arena to Pigeon Pt., all-salmon-except-coho fishery closes. |
| Nov. 16 | Horse Mt. to Pt. Arena, all-salmon-except-coho fishery closes. |

a/ Unless stated otherwise, season openings or modifications of restrictions are effective at 0001 hours of the listed date. Closures are effective at midnight.

Exhibit E.1.a
Supplemental Letter from Robert Lohn
November 2003

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

OCT 21 2003

1504-13-WOC-OB-010

RECEIVED
OCT 23 2003
PFMC

Mr. Donald Hansen, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place
Portland, OR 97220

Dear ~~Mr. Hansen~~ Don:

Based on new information obtained since the September 8-12, 2003 Pacific Fishery Management Council (Council) meeting, I have decided not to implement the Council's recommendation to increase commercial minor deeper nearshore rockfish trip limits inseason south of 40°10' N. lat in the Pacific Coast groundfish fishery. As you'll recall, the Council recommended the increase because commercial landings of minor deeper nearshore rockfish south of 40°10' N. lat. were lower than expected in 2003. Subsequent to the Council meeting, the Groundfish Management Team (GMT) held a meeting in Seattle, WA, October 14-16, 2003. The GMT discussed new information from the Recreational Fisheries Information Network (RecFIN) at that meeting. The RecFIN data showed that landings of minor nearshore rockfish (which includes minor deeper nearshore rockfish[1]) in the recreational fishery south of 40°10' N. lat. during July and August, the first two months open to recreational groundfish fishing, have exceeded the projected recreational landings of minor nearshore rockfish for the remainder of the year. The GMT raised concerns over the accuracy of RecFIN's catch estimates, since the estimates for July and August were substantially higher than in recent years and has requested that the RecFIN program review its estimates reported for the 2003 California recreational fishery.

While landings in the commercial sector south of 40°10' N. lat. continue to remain lower than expected in 2003 (landed catch data through October 10, 2003, indicate that minor deeper nearshore rockfish catch was at 44 percent of the annual target– 21 mt landed out of a 48 mt commercial total catch OY), combined recreational and commercial landings are still estimated to have exceeded the minor nearshore harvest guideline, even if RecFIN estimates are adjusted downward. The state of California intends to close recreational fishing for nearshore rockfish at the beginning of November.

---

[1] As you know, minor deeper nearshore rockfish are managed within an overall harvest guideline for minor nearshore rockfish. The minor nearshore rockfish harvest guideline is shared between the commercial and recreational sectors. In addition, the minor nearshore rockfish harvest guideline is included as a subset of the minor rockfish OY. There are two minor rockfish OYs, one for the area north of 40°10' N. lat. and one for the area south of 40°10' N. lat.

In light of this new information, I can no longer concur with the Council's September recommendation to increase minor deeper nearshore rockfish trip limits for the commercial sector (limited entry fixed gear and open access) south of 40°10' N. lat. The National Marine Fisheries Service (NMFS) will implement all of the groundfish inseason actions recommended at the September Council meeting, except for the recommendation to increase minor deeper nearshore rockfish trip limits. Minor deeper nearshore rockfish limits for limited entry fixed gear and open access fisheries south of 40°10' N. lat. will remain as previously scheduled for the remainder of the September through October cumulative limit period at 300 lb per 2 months. During the months of November through December, the limited entry fixed gear and open access minor deeper nearshore rockfish limit south of 40°10' N. lat. will also remain as previously scheduled at 200 lb per 2 months.

In the interim before the November Council meeting in San Diego, CA, NMFS will review any additional information on the nearshore rockfish fishery and may take inseason action to conform with the state of California's closure of the recreational fishery. Any further adjustments to the nearshore rockfish fisheries will need to be discussed in more detail during the agenda item on inseason groundfish management at the upcoming November Council meeting.

Sincerely,

D. Robert Lohn
Regional Administrator

TATUS REPORT OF THE 2003 OCEAN SALMON FISHERIES OFF WASHINGTON, OREGON, and CALIFORNIA.

Preliminary Data Through October 15, 2003.

| Fishery and Area | Season Dates | Effort Days fished | CHINOOK Catch | CHINOOK Quota | CHINOOK Percent | COHO Catch | COHO Quota | COHO Percent |
|---|---|---|---|---|---|---|---|---|
| **TROLL** | | | | | | | | |
| Treaty Indian | 5/1-6/30 | 143 | 15,657 | 30,000 | 52% | Non-Retention | | |
| | 7/1-9/15 | 187 | 19,017 | 30,000 | 63% | 10,912 | 90,000 | 12% |
| Non-Indian North of Falcon | 5/1-6/30 | 854 | 36,789 | 40,000 | 92% | Non-Retention | | |
| | 6/26/-6/30 | 53 | 1,048 | 800 | | Non-Retention | | |
| | 7/3-9/14 | 1,326 | 32,384 | 32,400 | 100% | 15,257 | 75,000 | 20% |
| Cape Falcon-Florence S. Jetty | 3/15-7/16 | 3,282 | 84,398 | None | NA | Non-Retention | | |
| | 8/1-8/19 | 832 | 25,489 | None | NA | Non-Retention | | |
| | 9/1-10/31 | 1,513 | 47,406 | None | NA | Non-Retention | | |
| Florence S. Jetty - Humbug Mt. | 3/15-6/30 | 3,302 | 95,727 | None | NA | Non-Retention | | |
| | 7/17-7/31 | 204 | 4,673 | None | NA | Non-Retention | | |
| | 8/11-8/29 | 558 | 12,695 | None | NA | Non-Retention | | |
| | 9/1-10/31 | 477 | 11,461 | None | NA | Non-Retention | | |
| Humbug Mtn-OR/CA Border | 3/15-5/31 | 54 | 685 | None | NA | Non-Retention | | |
| | 6/1-6/30 | 69 | 482 | 2,500 | 19% | Non-Retention | | |
| | 7/1-7/31 | 109 | 1,082 | 1,200 | 90% | Non-Retention | | |
| | 8/1-8/29 | 107 | 1,106 | 2,500 | 44% | Non-Retention | | |
| | 9/1-9/30 | 84 | 1,187 | 3,000 | 40% | Non-Retention | | |
| OR/CA Border -Humboldt S. Jetty | 9/1-9/30 | 100 | 2,200 | 10,000 | 22% | Non-Retention | | |
| Horse Mtn-Pt. Arena | 5/1-5/31 | 620 | 31,820 | None | NA | Non-Retention | | |
| | 7/3-7/14 | 540 | 35,640 | None | NA | Non-Retention | | |
| | 7/18-9/30 | 2,700 | 162,520 | None | NA | Non-Retention | | |
| Pt.Arena - Pigeon Pt. | 5/1-9/30 | 3,950 | 195,840 | None | NA | Non-Retention | | |
| Pt. Reyes - Pt. San Pedro | 10/1-3,6-10,13-17 | 50 | 1,410 | None | NA | Non-Retention | | |
| Pigeon Pt.-US/Mexico Border | 5/1-9/30 | 1,680 | 30,540 | None | NA | Non-Retention | | |

| ishery and Area | Season Dates | Effort Angler Days | CHINOOK Catch | CHINOOK Quota | CHINOOK Percent | COHO Catch | COHO Quota | COHO Percent |
|---|---|---|---|---|---|---|---|---|
| **RECREATIONAL** | | | | | | | | |
| US/Canada Border-Cape Alava | 6/22-9/14 | 20,533 | 4,812 | 3,900 | 123% | 20,102 | 23,400 | 86% |
| Cape Alava-Queets River | 6/22-9/14 | 4,277 | 1,845 | 2,300 | 80% | 3,451 | 5,750 | 60% |
| | 9/20-10/5 | 579 | 148 | 100 | 148% | 32 | 100 | 32% |
| Queets River-Leadbetter Pt. | 6/22-9/14 | 48,138 | 21,820 | 40,600 | 54% | 39,268 | 83,250 | 47% |
| Leadbetter Pt.-Cape Falcon | 6/29-9/30 | 70,405 | 8,100 | 7,700 | 105% | 106,411 | 112,500 | 95% |
| Cape Falcon-Humbug Mtn | 3/15-10/31 | 18,392 | 7,966 | None | NA | Non-Retention | | |
| | 6/21-8/24 | 90,191 | 24,401 | None | NA | 83,796 | 88,000 | 95% |
| Humbug Mtn-Horse Mtn | 5/17-9/14 | 30,951 | 13,739 | None | NA | Non-Retention | | |
| Horse Mtn-Pt. Arena | 2/15-11/16 | 23,270 | 15,820 | None | NA | Non-Retention | | |
| Pt. Arena-Pigeon Pt. | 4/12-11/9 | 64,230 | 55,670 | None | NA | Non-Retention | | |
| Pigeon Pt.-US/Mexico Border | 3/29-9/28 | 26,390 | 11,830 | None | NA | Non-Retention | | |

| TOTALS TO DATE | Effort 2003 | Effort 2002 | Effort 2001 | Chinook Catch 2003 | Chinook Catch 2002 | Chinook Catch 2001 | Coho Catch 2003 | Coho Catch 2002 | Coho Catch 2001 |
|---|---|---|---|---|---|---|---|---|---|
| **TROLL** | | | | | | | | | |
| Treaty Indian | 281 | 286 | 540 | 34,674 | 35,997 | 25,406 | 8,392 | 8,145 | 36,769 |
| Washington Non-Treaty | 1,666 | 1,338 | 764 | 55,585 | 53,819 | 21,229 | 8,548 | 180 | 4,984 |
| Oregon | 10,889 | 9,483 | 10,125 | 290,692 | 231,720 | 259,449 | 6,439 | 1,500 | 9,367 |
| California | 9,640 | 17,000 | 13,900 | 459,970 | 386,700 | 193,100 | 0 | 0 | 0 |
| Total Troll | 22,476 | 28,107 | 25,329 | 840,921 | 708,236 | 499,184 | 23,379 | 9,825 | 51,120 |
| **RECREATIONAL** | | | | | | | | | |
| Washington | 124,139 | 95,200 | 126,400 | 34,260 | 57,821 | 22,974 | 139,453 | 74,134 | 168,062 |
| Oregon | 142,398 | 94,536 | 113,530 | 39,576 | 45,307 | 27,104 | 113,234 | 36,102 | 94,342 |
| California | 129,990 | 206,700 | 162,600 | 92,150 | 179,300 | 97,800 | 0 | 0 | 0 |
| Total Recreational | 396,527 | 396,436 | 402,530 | 165,986 | 282,428 | 147,878 | 252,687 | 110,236 | 262,404 |
| PFMC Total | NA | NA | NA | 1,006,907 | 990,664 | 647,062 | 276,066 | 120,061 | 313,524 |

a/ All non-Treaty coho fisheries are mark selective

b/ Treaty troll effort is reported as landings.

c/ Numbers shown as chinook quotas for non-Indian troll and recreational fisheries North of Falcon are guidelines rather than quotas. Only the total chinook allowable catch is a quota.

d/ The 800 chinook guideline is included in the 40,000 chinook guideline for the May/June opening.

e/ The 32,400 quota includes the preseason quota of 24,400 plus 3,000 remaining from the May/June opening and 5,000 chinook transferred from the recreational guideline for the Cape Falcon to Leadbetter Point area.

f/ 5,000 chinook from the preseason guideline of 12,700 for the Cape Falcon to Leadbetter Point recreational fishery were transferred to the north of Cape Falcon commercial non-Indian troll fishery, leaving 7,700 in the guideline.

# SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON SALMON METHODOLOGY REVIEW

Mr. Jim Packer and Mr. Larrie LaVoy of the Washington Department of Fish and Wildlife (WDFW) presented a progress report to a joint meeting of the Scientific and Statistical Committee (SSC) Salmon Subcommittee and the Salmon Technical Team (STT) on changes to the Coho Fishery Regulation Assessment Model (FRAM) for the 2004 management season. This meeting was held on October 23, 2003 in Portland.

The Coho FRAM is being changed bilaterally through the Coho Technical Committee of the Pacific Salmon Commission (PSC), so it can be used by the PSC for its coho abundance- based management agreement with Canada. The changes include a re-definition of some Canadian fishery strata, changes to the stocks representing Canadian production regions, and the addition of new coded-wire tag data and escapement estimates for some Canadian stocks. The use of a common model by the PSC and Council will be important for consistency and to keep the model developers' workload reasonable.

At the time of the meeting on October 23 the changes to the model base period data were still being evaluated and error checked. The model development process puts the Council in a difficult position this year. The model base period data will continue to be modified and reviewed by the Coho Technical Committee of the PSC until mid February. Although the PSC has said they will use abundance-based management for coho in 2004, it is not certain they will approve the modified coho FRAM for use. The Council preseason salmon management process requires that a model be in place by mid-February. This leaves no time for the Council to react to the PSC decision. In effect, for 2004 the Council is bound by the actions of the PSC. The SSC and STT can appraise the Council of changes in modeled impacts that affect Council decisions, but the Council has little choice but to accept the model as adopted by the PSC. In future years a mechanism and time schedule for inter-jurisdictional coordination of model changes needs to be established.

A progress report by the Model Evaluation Workgroup (MEW) was also presented at the meeting. A draft document, "Fishery Regulation Assessment Model (FRAM) – An Overview for Chinook and Coho," was submitted for review. This document was designed to provide a non-technical overview of the two FRAMs. The level of detail presented in the draft was sufficient for an overview; however, a technical manual that describes in detail the algorithms and methods used in FRAM and its supporting data analysis programs is needed. The SSC recommends the overview document be finalized as quickly as possible and work on the User's Manual and Programmer's Guide started.

PFMC
11/04/03

# FISHERY REGULATION ASSESSMENT MODEL

# (FRAM)

## - An OVERVIEW for CHINOOK and COHO -



## MODEL EVALUATION WORKGROUP[1]

## Revision: October 23, 2003

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1 MEW Members: Henry Yuen (USFWS); Andy Rankis (NWIFC); Larrie LaVoy (WDFW); Jim Packer (WDFW); Curt Melcher (ODFW); Bob Conrad (NWIFC); C. Dell Simmons (NMFS); Rishi Sharma (CRITFC), Alan Grover, CDFG

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# 1. INTRODUCTION

The Fishery Regulation Assessment Model (FRAM) is currently used by the Pacific Fishery Management Council (PFMC) to annually estimate impacts of proposed ocean and terminal fisheries on chinook and coho salmon stocks. FRAM is a single season modeling tool with separate processing code for chinook and coho. The chinook version evaluates impacts on most stock groups originating from the south central Oregon coast, Columbia River, Puget Sound and Southern British Columbia. The coho version evaluates impacts on a comprehensive set of stocks originating from Central California to Southeast Alaska representing total West Coast production. The FRAM produces a variety of output reports that are used to examine impacts for compliance with management objectives, allocation arrangements, ESA compliance, and domestic and international legal obligations. Until recently FRAM was not used for assessing compliance with chinook or coho agreements in international fisheries management forums. However, the U.S. and Canada have agreed to develop a bilateral regional coho planning tool. FRAM will be used for development of the first version of the regional model. The intent is to have a single common tool that can support both domestic and international fishery planning processes using a common set of data and assumptions.

## 1.1 BACKGROUND

The need for salmon fishery assessment tools at the stock specific level became a necessity beginning in the mid-1970's with treaty fishery rights litigation and the associated legal obligation for the states of Washington and Oregon to provide treaty tribes with the opportunity to harvest specific shares of individual runs. Other legal issues such as the Magnuson Fishery Conservation Management Act and the Law of the Seas convention contributed to the need for developing better assessment tools. These legal issues in conjunction with the information available from the coast wide coded wire tag (CWT) program provided the impetus for developing the early salmon fishery assessment models.

In the late 1970s, the Washington Department of Fisheries (WDF) and U.S. National Bureau of Standards (NBS) developed a model for evaluating alternative fishery regulatory packages. The WDF/NBS Model could be configured for either chinook or coho by using different input data files. This model was coded in FORTRAN and ran on a mainframe computer at the University of Washington. Model runs were usually processed over night and results were painstakingly extracted from large volumes of printed output reports. The WDF/NBS model was not extensively employed by the PFMC because it proved costly to operate and its results were difficult to obtain in a timely manner. Morishima and Henry (2000) provide a more indepth history of Pacific Northwest salmon management and fishery modeling.

In the early 1980s, the development of personal computers permitted the WDF/NBS model to be converted into simple spreadsheet models. The first spreadsheet model for chinook used by the PFMC was developed in the mid 1980s to model Columbia River

"tule" fall chinook. The Coho Assessment Model (CAM) was the corresponding spreadsheet model for coho and covered stocks from the Columbia River, Puget Sound, and Washington and Oregon coastal areas. This transformation improved accessibility to the model during PFMC preseason planning processes. The Coho Assessment Model (CAM) was revised over time, principally to improve report generation capabilities and provide more detailed information on management of terminal area fisheries through the use of Terminal Area Management Modules (TAMMs). The CAM was used as the primary model for evaluating coho impacts for PFMC fisheries until the mid 1990s.

Increasing demands for information soon outstripped the capacity of these spreadsheet models to evaluate the fishery regimes under consideration by the PFMC. In the mid 1990s, CAM was programmed in QUICK BASIC and was renamed FRAM. The recognition that common algorithms underlie both the coho and chinook spreadsheet models led to the effort to develop the QUICK BASIC version of FRAM for both species. The FRAM code could be used to evaluate fishery regimes for either chinook or coho by using different input file configurations. In 1998, FRAM was converted to VISUAL BASIC to take advantage of improved user interfaces available through the MS WINDOWS operating system. A multi-agency Model Evaluation Subgroup periodically reviewed model performance and parameter estimation methods and coordinated revisions to model capabilities during this period (1998-2000).

In 2002, Canada and the United States reached an agreement through the PSC process to manage coho salmon using abundance-based criteria to protect weak stocks. The stocks of concern to the PSC are from Washington and southern British Columbia but fishery impacts on those stocks occur from Oregon to Southeast Alaska. Beginning in 2004, the Coho FRAM will be used to evaluate fishing regimes for consistency with the new agreement

## 2. MODEL OVERVIEW

The FRAM is a discrete, time-oriented, age-structured, deterministic computer model intended to measure the impacts from a variety of regulation mechanisms for a single management year. It predicts point estimates for fishery impacts by stock, for specific time periods and age classes. The FRAM performs bookkeeping functions to track the progress of individual stock groups as the fisheries in each time step exploit them. Individual stock groups are exploited as a single pool; that is, in each time step all pre-terminal fisheries operate on the entire cohort and all terminal fisheries operate on the mature run.

## 2.1 STOCKS

Currently, 33 stock groups are represented in Chinook FRAM and 128 stock groups are represented in Coho FRAM (see Appendices 1 and 2 for lists of the stocks). Each of these groups have both marked and unmarked components to permit assessment of mark-selective fishery regulations. For most wild stocks and hatchery stocks without marking or tagging programs, the cohort size of the marked component is zero and therefore the current version of FRAM has a virtual total of 256 stock groups for coho and 66 for chinook. Stocks or stock-aggregates represented in the FRAM were chosen based on the level of management interest, the contribution rate to PFMC fisheries, and the availability of representative CWT recoveries in the fisheries.

## 2.2 FISHERIES

The FRAM includes preterminal and terminal fisheries in southeast Alaska, Canada, Puget Sound, and off the coasts of Washington, Oregon, and California. There are 73 fisheries in Chinook FRAM and 206 fisheries in Coho FRAM. The intent is to encompass all fishery impacts to modeled chinook and coho stocks in order to account for all fishing-related impacts and thereby improve model accuracy. Terminal fisheries in Chinook FRAM are aggregations of gears and management areas. Terminal fisheries in Coho FRAM are modeled with finer resolution, most notably by including individual freshwater fisheries. Fishery number and fishery name for each of the FRAM fisheries are listed in Appendix 3 for chinook and Appendix 4 for coho.

## 2.3 TIME STEPS

The time step structure used in FRAM represents a compromise level of resolution that corresponds to fishery management planning and species-specific migration and maturation schedules.

The FRAM consists of four time periods for chinook and five periods for coho (Table 2-1). At each time step a cohort is subjected to natural mortality, preterminal fisheries, maturation (chinook only), and terminal fisheries.

**Table 2-1. FRAM Time Steps for Coho and Chinook.**

| Coho | | Chinook | |
|---|---|---|---|
| Period | Months | Period | Months |
| Time 1 | January-June | Time 1 | Preceding October-April |
| Time 2 | July | Time 2 | May-June |
| Time 3 | August | Time 3 | July-September |
| Time 4 | September | Time 4 | October-April |
| Time 5 | October - December | | |

The recovery data available in the CWT database limit the time-step resolution of the model. Increasing the time-step resolution of the model usually decreases the number of CWT recoveries for a stock within a time period. Since estimation of fishery impacts, like exploitation rates, is dependent on CWT recovery information, decreasing the number of CWT recoveries in time/area strata increases the variance of the estimated exploitation rates in those strata. In recognition of these data limitations, efforts were made to restrict the level of time-step resolution to that necessary for fishery management purposes.

## 2.4 ASSUMPTIONS AND LIMITATIONS

Major assumptions and limitations of the model are described briefly below.

1. CWT fish accurately represent the modeled stock: Many "model" stocks are aggregates of stocks that are represented by CWTs from only one component. For example, in many cases, wild stocks are aggregated with hatchery stocks, and both are represented by the hatchery stock's CWT data. Therefore, for each modeled stock-aggregate, it is assumed that the CWT accurately depicts the exploitation and distribution of the untagged fish represented within that model stock.

2. Length at age of chinook is stock specific and is constant from year to year. Growth functions are used for chinook in determining the proportion of the age class that is legal size in size-limit fisheries. Parameters for the growth curves were estimated from data collected over a number of years. It is assumed that growth in the year to be modeled is similar to that in the years used to estimate the parameters.

3. Stock distribution and migration is constant from year to year and estimated as the average distribution in the base period data. We currently lack data on the annual variability in distribution and migration patterns of chinook and coho salmon stocks. In the absence of such estimates, fishery specific exploitation rates are computed relative to the entire cohort. Changes in the distribution and migration of stocks from the base period will result in poor estimates of stock composition and stock-specific exploitation rates.

4. Single encounters with gear. Within each time-area-fishery strata, fish are assumed to be vulnerable to the gear only once. The catch equations used in the model are discrete not instantaneous. Potential bias in the estimates may increase with large selective fisheries or longer time intervals, both of which increase the likelihood that fish will encounter the gear more than once.

While it is difficult to directly test the validity of these assumptions, results of validation exercises provide one assessment of how well these assumptions are met and/or the sensitivity of the model to the assumptions. Very poor model performance, for example,

could indicate that one or more of these assumptions has been violated or that the model structure is flawed.

## 3. BASE PERIOD DATA

The Chinook FRAM is calibrated using escapement, catch, and CWT recovery data from 1974-79 brood year CWT releases. During the late 1970's and early 1980's , fisheries were being conducted across an extensive geographic area over an extended period of time, thus giving the best available representation of CWT stock distribution. Not all stocks represented in the Chinook FRAM have CWT recovery data available from the 1974-79 brood year base period (e.g., Snake River fall chinook). These stocks are categorized as "Out of Base" stocks. Available CWT data for these stocks are translated to equivalent base period recovery and escapement data using known fishing effort and harvest relationships between recovery years.

Model base period data for the Coho FRAM is derived from fishery and escapement recoveries of CWTs and terminal area run size estimates for the years 1986-1991.

Chinook and coho base period data are used to estimate base period stock abundances, stock age specific time-area-fishery exploitation rates and maturation rates. These estimates are derived through species-specific cohort analysis procedures. Cohort analysis is a series of steps and processes that uses CWT recoveries and base period catch and escapement data to "back-calculate" or reconstruct a pre-fishing cohort size for each stock and age group using assumed natural mortality and incidental mortality rates

## 4. GENERAL INPUT TYPES

The five general types of input values used by FRAM are:

1. Cohort Abundance. For each stock or stock aggregate, an annual estimate of abundance is obtained from a source that is independent of the model. For preseason simulation modeling, these forecasts of stock abundance are used to estimate initial cohort size. For chinook, initial stock abundance estimates are segregated by age class, from age- 2 to age-5-year old fish. For coho, only one age class is assumed vulnerable to fisheries and forecast (January age 3). Chinook and coho abundance estimates are further segregated by mark status ("marked" or "unmarked").

2. Size Limits. For chinook, minimum size limits are specified by fishery where appropriate. For coho, age-3 fish are assumed fully vulnerable and age-2 fish are assumed fully invulnerable to modeled fisheries.

3. Fishery Catch Mortality: The model provides five options for estimating mortality in a fishery: a quota, an exploitation rate scalar, a ceiling, "selective", and harvest rate (for Puget Sound terminal fisheries only).

a) Quota. Catch in the fishery is set equal to a value input by the user.
b) Exploitation rate scalar. The exploitation rate in the fishery is scaled, relative to the base period, using a scalar input by the user.
c) Ceiling. Catch is first calculated based on an exploitation rate scalar and then compared to a ceiling; if the estimated catch exceeds the ceiling, then the catch is truncated at the ceiling value.
d) Selective. Identified as either a quota or exploitation rate scalar controlled fishery with additional calculations to cover catches and encounters between marked and unmarked groups.
e) Harvest rate. A terminal area harvest rate is applied to the number of all fish present in the terminal area or to the number of local origin stock only.

4. Release Mortality. This is the mortality associated with the release of landed fish from hook-and-line and other gears. Release mortality rates assumed for coho are shown in Table 3-2a, and for Chinook in Table 3-2b. Hook-and-release mortality is assessed when coho or chinook are not allowed to be retained (so-called "chinook/coho nonretention", or CNR fisheries), when size limits apply, and to account for the voluntary release of otherwise retainable fish. Release mortality has been estimated in a number of studies of hook-and-line fisheries, and release mortality rates for ocean troll and recreational fisheries have been formally adopted by the PFMC. Release mortality in net fisheries for chinook or coho nonretention is estimated external to FRAM and input into the model as either "landed catch" or as CNR mortality.

   Two other types of release mortality are computed in the case of a selective fishery: Unmarked Recognition Error (or Retention Error Rate) is the probability that an unmarked fish will be retained inappropriately in a selective fishery (e.g. fisher fails to identify mark, fisher fails to comply with release requirement). Marked Recognition Error is the probability that a marked fish will be inadvertently released. These rates are identified in Table 3-1.

5. Other Non-landed Mortality. This category includes mortality not associated with direct handling (or landing) of the fish (see Table 3-2a for Coho and Table, 3-2b for Chinook). Application is for sport and troll hook-and-line 'drop-off' (fish that drop off from the hook before they are brought to vessel but die from hook injuries), and net gear 'drop-out' (fish which are not brought on board but die, from injury, as a result of being netted). Except for freshwater sport fisheries for chinook where there is no drop off mortality assigned, a 5% mortality rate is applied to the landed catch to account for "other non-landed mortality" in hook-and-line fisheries. Similarly there is no drop out mortality assigned in chinook freshwater net fisheries; coho freshwater net drop out mortality is 2% of landed catch. Marine Net drop out mortality rates in marine fisheries vary depending on species, net type, or terminal vs. preterminal nature of the fishery.

**Table 3-1. Mark Selective Fishery Input Values.**

| Fishery | Mark Release Rate (% of marked released) | Unmark Retention Rate (% of unmarked retained) |
|---|---|---|
| NOF troll, sport | 6% | 2% |
| SOF sport | 6% | 2% |
| Area 5,6 sport—2001 coho | 34% | 2% |
| Area 5,6 sport—2002 coho | 38% | 2% |
| Area 5,6 sport—2003 coho | 38% | 2% |
| Area 5,6 sport—2003 chin | 6% | 8% |
| Area 7 sport—2001 coho | 6% | 5% |
| Area 7 sport—2002 coho | 9% | 8% |
| Area 7 sport—2003 coho | 9% | 8% |
| Area 13 sport—2002 coho | 18% | 27% |
| Area 13 sport—2003 coho | 18% | 27% |
| Other PS marine sport | 9% | 8% |

**Table 3-2-a coho. Fishery related FRAM/TAMM Mortality Rates Applied to Southern U.S. Fisheries in 2003.**

| Fishery, As Designated by: Area, User Group, and/or Gear Type | Fishery Type | Comments | Release Mortality | "Other": "Dropout", and "Drop-off" [1] |
|---|---|---|---|---|
| PFMC Ocean Recreational | MSF | barbless | 14.0% | 5.0% |
| | Non-Retention | | none assessed | none assessed |
| PFMC Ocean T-Troll | Retention | | n.a. | 5.0% |
| PFMC Ocean NT-Troll | MSF | barbless | 26.0% | 5.0% |
| Area 5, 6C Troll | Retention | | n.a. | 5.0% |
| Puget Sound Recreational | Retention | | n.a. | 5.0% |
| | MSF | barbless | 7.0% | 5.0% |
| WA Coastal Recreational | Retention | | n.a. | 5.0% |
| Buoy 10 Recreational | MSF | barbed | 16.0% | 5.0% |
| Gillnet and Setnet | | | n.a. | 2.0% |
| PS Purse Seine | | | 26.0% | 0.0% |
| PS Reef Net, Beach Seine, Round Haul | | | none assessed | none assessed |
| Freshwater Net | | | n.a. | 2.0% |
| Freshwater Recreational | Retention | | n.a. | 5.0% |
| | Non-Retention | | 10.0% | 5.0% |

1) The "other" mortality rates are applied to landed fish (retention fisheries), thus FRAM does not assess "drop-off" in non-retention fisheries. For mark selective fisheries (MSF) "other" mortality rates are applied to encounters of marked and unmarked fish.

**Table 3-2-b chinook. Fishery related FRAM/TAMM Mortality Rates applied to Southern U.S. Fisheries in 2003.**

| Fishery, As Designated by: Area, User Group, and/or Gear Type | Fishery Type | Comments | "Shaker" Release Mortality | "Adult" Release Mortality | "Other": "Dropout", and "Drop-off" [1] |
|---|---|---|---|---|---|
| PFMC Ocean Recreational | Retention | N Port Orford | 14.0% | n.a. | 5.0% |
| | Retention | S Port Orford | 23.0% | n.a. | 5.0% |
| PFMC Ocean Troll | Retention | barbless | 25.5% | n.a. | 5.0% |
| Area 5,6,7 T-Troll | Retention | barbed | 30.0% | n.a. | 5.0% |
| Puget Sound Recreational | Retention | barbless | 20.0% | n.a. | 5.0% |
| | MSF | barbless | 20.0% | 10.0% | 5.0% |
| | Non-Retention | barbless | 20.0% | 10.0% | none assessed |
| Buoy 10 Recreational | not modeled within FRAM | | n.a. | n.a. | n.a. |
| Commercial Net | | | | | |
| PS Areas 4B,5,6,6C | Preterm. GN & SN | | n.a. | n.a. | 3.0% |
| WA Coastal & Col R. Net | Preterm. GN & SN | | n.a. | n.a. | 3.0% |
| PS Areas 6A,7,7A | Preterm. GN, SN, & PS | | n.a. | n.a. | 1.0% |
| NT PS Areas: 6B,9,12,12B,12C | Preterm. GN, SN, & PS | | n.a. | n.a. | 1.0% |
| T PS Areas:7B,7C,7D | Preterm. GN, SN, & PS | | n.a. | n.a. | 1.0% |
| All other PS marine net | Term. GN & SN | | n.a. | n.a. | 2.0% |
| PS Purse Seine | | Chinook (imm.) | n.a. | 45.0% | 0.0% |
| | | Chinook (mat.) | n.a. | 33.0% | 0.0% |
| PS Reef Net, Beach Seine, Round Haul | | | none assessed | none assessed | none assessed |
| Freshwater Net | | | n.a. | n.a. | none assessed |
| Freshwater Recreational | Retention | | n.a. | n.a. | none assessed |
| | MSF | TAMM | n.a. | 10.0% | none assessed |
| | Non-Retention | TAMM | n.a. | 10.0% | none assessed |

1) The "other" mortality rates are applied to landed fish (retention fisheries), thus FRAM does not assess "drop-off" in non-retention fisheries. For mark selective fisheries (MSF) "other" mortality rates are applied to encounters of marked and unmarked fish.

## 5. OUTPUT REPORTS AND MODEL USE

Model results are available as either standard FRAM printed output reports or in EXCEL spreadsheets that are linked to FRAM results/reports. These spreadsheets provide comprehensive summaries of fishery mortality, exploitation rate, run size, and escapement for key stocks in PFMC and North of Falcon annual salmon season setting processes. Early versions of these spreadsheets focused on finer resolution of stocks and fisheries in Puget Sound terminal areas in the TAMM. The TAMM spreadsheets have now broadened in scope and contain information for both pre-terminal and terminal fisheries as well as FRAM fishery inputs for terminal fisheries in coastal Washington (coho) and in Puget Sound (both species). Other model results not shown in the spreadsheets can be generated directly from FRAM. These reports include summaries of catch by fishery, catch by stock, catch by age, and escapement/run size reports. A new report has been created for FRAM to provide more detailed information relative to mark-selective fisheries for chinook and coho. For a full scope of FRAM report generating functions, refer to "Users Manual for the Fishery Regulation Assessment Model (FRAM) for Chinook and Coho" (MEW *in prep.*).

## 6. COMPUTATIONAL STRUCTURE

For each time step and fishery strata, FRAM simulates fishery regulations using the sequence of computations depicted for coho (Figure 1) and chinook (Figure 2).

**Figure 1. Coho model flow chart.**

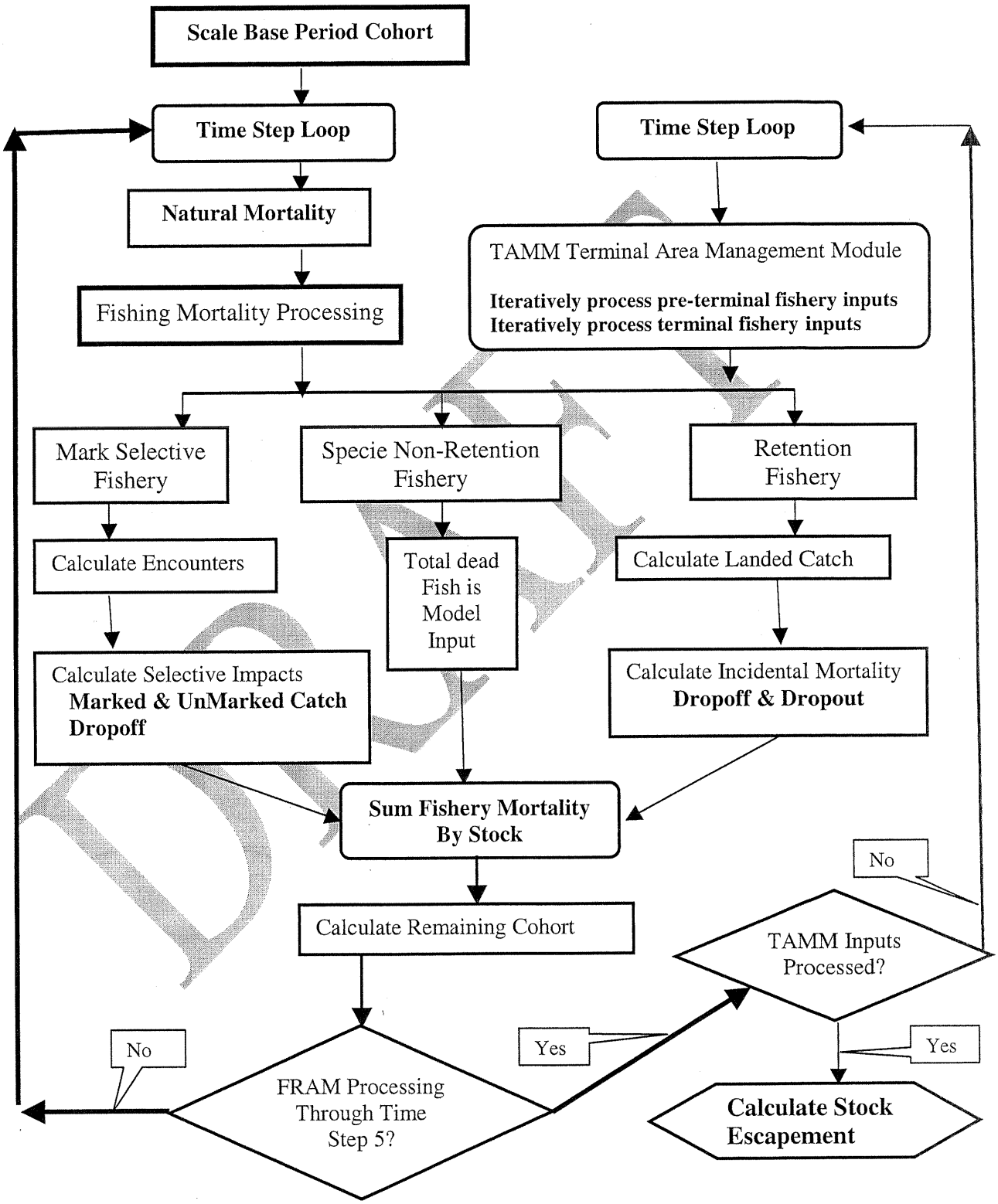
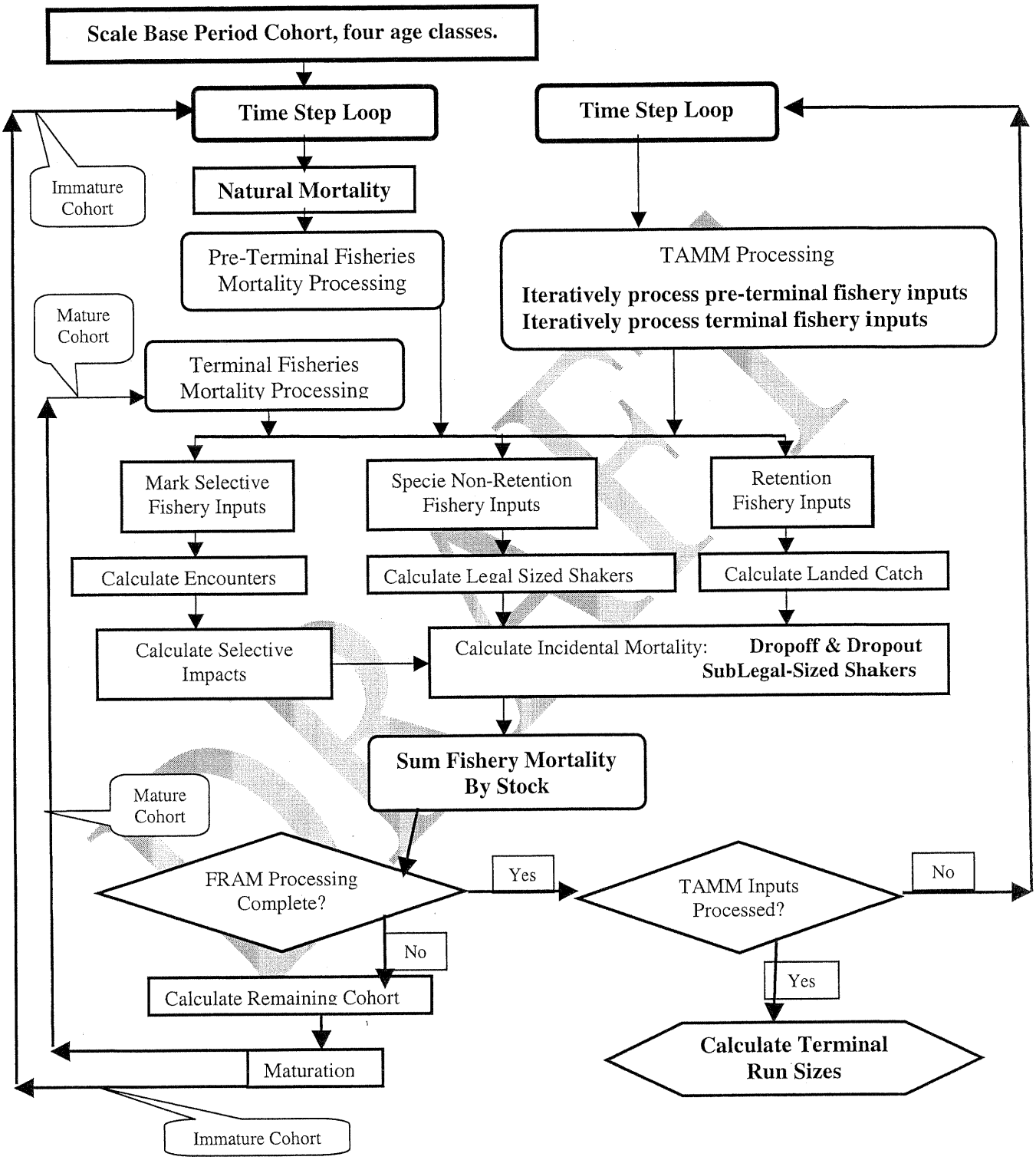


**Figure 2. Chinook model flow chart.**



## 6.1 CATCH

The FRAM simulates fisheries through the use of linear equations. Different types of computations are used, depending upon whether or not a fishery operates under mark-retention restrictions. If all fish can be retained regardless of mark status, the following general formula is used (Mark Selective Fisheries are described in Section 6.3):

$$Catch_{s,a,f,t} = BPER_{s,a,f,t} * Cohort_{s,a,t} * PV_{s,a,t} * FishScalar_{f,t} * SHRS_{s,f,t}$$

Where:

| | |
|---|---|
| $Catch_{s,a,f,t}$ | Catch for stock s, age a, in fishery f, at time step t |
| $BPER_{s,a,f,t}$ | Base Period Exploitation Rate (Harvest Rate for Terminal Fisheries) for stock *s*, age *a*, in fishery *f*, at time step *t*. The BPER is derived from cohort analysis using CWT release and recovery data for 1979-1982. |
| $Cohort_{s,t}$ | Number of fish in cohort (for PreTerminal Fisheries; Terminal Run Size for Terminal Fisheries) for stock *s* in time step *t* |
| $PV_{s,a,t}$ | Proportion of Cohort for stock *s*, age *a*, vulnerable to the gear at time step *t*. For chinook PV is a function of a Von Bertalanffy growth curve; for coho PV is always = 1.0 |
| $FishScalar_{f,t}$ | Impact scalar for fishery f at time step t relative to the base period |
| $SHRS_{s,f,t}$ | Stock specific Exploitation Rate Scalar for stock *s*, in fishery *f*, at time step t. The default value of 1.0 is rarely changed. |

The parameter $FishScalar_{f,t}$ is the foundation for the model's fishery simulation algorithms. FRAM can evaluate two general types of fisheries: (1) effort-based or (2) catch-based. For effort-based fisheries, the parameter $FishScalar_{f,t}$ is specified by the modeler to reflect expected effort relative to that observed during the model's base period. For catch-based fisheries, $FishScalar_{f,t}$ is computed automatically so as to attain a specified catch level. If the catch level is to be modeled as a quota, then $FishScalar_{f,t}$ is computed as:

$$FishScalar_{f,t} = \frac{QuotaLevel_{f,t}}{\sum_{s}\sum_{a} Catch_{s,a,f,t}}$$

If the catch level is to be modeled as a ceiling, both an effort scalar and quota are specified. The $FishScalar_{f,t}$ is computed in the same manner for the quota catch level, but has a maximum value based on the ceiling. Up to the ceiling level, the expected catches are based on the effort scalar.

## 6.2 INCIDENTAL MORTALITY

Several types of incidental mortality can be covered in FRAM either via external calculations of mortality or thru internal FRAM processing. Incidental mortality associated with hook-and-line dropoff and net dropout is expressed as a fraction of retained catch or as a fraction of encounters in the case of mark selective fisheries. Incidental mortality in mark selective fisheries is discussed in the next section.

Mortalities in species non-retention fisheries (CNR) are derived using four different methods for chinook and one for coho. Chinook non-retention mortalities are model estimates from inputs of: the level of open vs. non-retention effort within each time step (Method 1 & 2), legal and sub-legal encounters (Method 3), or from total encounters (Method 4). The method for coho is simply an external-to-the-model estimate of coho mortalities in a fishery based on historical observations. The methods were developed to fit the observations from various fisheries. The Method 1 was developed for Canadian and Alaskan fisheries that had both open and non-retention regulation periods and had changes in the gear or fishing patterns to avoid chinook encounters.

### METHOD 1 – Computed Mortalities

$$CNRLegal_{s,a,f,t} = Catch_{s,a,f,t} * \frac{1 - FishScalar_{f,t}}{FishScalar_{f,t}} * RelRate_f * LegalSelRate_{f,t}$$

$$CNRSub_{s,a,f,t} = TotCatch_{f,t} * \frac{1 - FishScalar_{f,t}}{FishScalar_{f,t}} * RelRate_f * SubSelRate_{f,t} * PropSubPop_{s,a,f,t}$$

### METHOD 2 – Ratio of Non-Retention to Retention Days

$$CNRLegal_{s,a,f,t} = Catch_{s,a,f,t} * (CNRDays_{f,t} / RetentDays_{f,t}) * RelRate_f * LegalSelRate_{f,t}$$

$$CNRSub_{s,a,f,t} = Shakers_{s,a,f,t} * (CNRDays_{f,t} / RetentDays_{f,t}) * RelRate_f * SubSelRate_{f,t}$$

### METHOD 3 – External Estimates of Legal and Sub-Legal Sized Encounters

$$LegalPropCatch_{s,a,f,t} = Catch_{s,a,f,t} / TotCatch_{f,t}$$

$$SubLegNR_{s,a,f,t} = SubLegPop_{s,a,t} * SubER_{s,a,f,t} * RelRate_{f,t}$$

$$SubLegPropEnc_{s,a,f,t} = SubLegNR_{s,a,f,t} \Big/ \sum_s \sum_a SubLegNR_{s,a,f,t}$$

$$CNRLegal_{s,a,f,t} = LegalPropCatch_{s,a,f,t} * LegalEnc_{f,t} * RelRate_f * PropModelStock_f$$

$$CNRSub_{s,a,f,t} = SubLegPropEnc_{s,a,f,t} * SubLegEnc_{f,t} * RelRate_f * PropModelStock_f$$

## METHOD 4 – External Estimate of Total Encounters

$$LegalPropCatch_{s,a,f,t} = Catch_{s,a,f,t} / TotCatch_{f,t}$$

$$LegalEnc_{s,a,f,t} = BPER_{s,a,f,t} * Cohort_{s,t} * PV_{s,a,t} * SHRS_{s,f,t}$$

$$SubLegEnc_{s,a,f,t} = SubER_{s,a,f,t} * SubLegPop_{s,a,t}$$

$$CNRScalar_{f,t} = TotalEstCNR_{f,t} \Big/ \sum_{s}\sum_{a} LegalEnc_{s,a,f,t} + \sum_{s}\sum_{a} SubLegEnc_{s,a,f,t}$$

$$CNRLegal_{s,a,f,t} = LegalEnc_{s,a,f,t} * CNRScalar_{f,t}$$

$$CNRSub_{s,a,f,t} = SubLegEnc_{s,a,f,t} * CNRScalar_{f,t}$$

## METHOD 5 – Coho Non-Retention Mortalities from External Estimates

$$PropCatch_{s,a,f,t} = BPER_{s,a,f,t} * Cohort_{s,t} * SHRS_{s,f,t} / TotCatch_{f,t}$$

$$CNR_{s,a,f,t} = EstCNRMorts_{f,t} * PropCatch_{s,a,f,t}$$

Where:

| | |
|---|---|
| $CNRLegal_{s,a,f,t}$ | Legal Sized Adult Non-Retention Mortality for stock ***s,*** age ***a***, in fishery ***f,*** at time step ***t*** |
| $CNRSub_{s,a,f,t}$ | Sub-Legal Sized Non-Retention Mortality for stock ***s,*** age ***a***, in fishery ***f,*** at time step ***t*** |
| $Catch_{s,a,f,t}$ | Catch for stock ***s,*** age ***a***, in fishery ***f,*** at time step ***t*** |
| $FishScalar_{f,t,a}$ | Impact scalar for fishery ***f*** at time step ***t*** relative to the base period |
| $RelRate_{f}$ | Release Mortality Rate for Sub-Legal sized fish in fishery ***f*** |
| $LegalSelRate_{f}$ | Legal Sized Adult Selectivity Rate for fishery ***f***, in response to changes in gear or fishing pattern. |
| $SubSelRate_{f}$ | Sub-Legal Sized Selectivity Rate for fishery ***f,*** in response to changes in gear or fishing pattern. |
| $PropSubPop_{s,a,f,t}$ | Proportion of Sub-Legal Sized Population for stock ***s,*** age ***a***, in fishery ***f,*** at time step ***t*** |
| $TotCatch_{,f,t}$ | Total Landed Catch in fishery ***f,*** at time step ***t*** |
| $CNRDays_{f,t}$ | Number of Non-Retention Days in fishery ***f,*** at time step ***t*** |
| $RetentDays_{f,t}$ | Number of Retention Days in fishery ***f,*** at time step ***t*** |
| $Shakers_{s,a,f,t}$ | Sub-Legal Shaker Mortality for stock ***s,*** age ***a***, in fishery ***f,*** at time step ***t*** |
| $LegalPropCatch_{s,a,f,t}$ | Proportion of Legal Sized Catch for stock ***s,*** age ***a***, in fishery ***f,*** at time step ***t*** |
| $SubLegNR_{s,a,f,t}$ | Sub-Legal Sized Non-Retention for stock ***s,*** age ***a***, in fishery ***f,*** at time step ***t*** |
| $SubLegPop_{s,a,f,t}$ | Sub-Legal Sized Population for stock ***s,*** age ***a***, at time step ***t*** |
| $SubER_{s,a,f,t}$ | Sub-Legal Sized Encounter Rate for stock ***s,*** age ***a***, in fishery ***f,*** at time step ***t*** |
| $SubLegPropEnc_{s,a,f,t}$ | Sub-Legal Sized Proportion of Encounters for stock ***s,*** age ***a***, in fishery ***f,*** at time step ***t*** |
| $LegalEnc_{s,a,f,t}$ | Legal Sized Encounters for stock ***s,*** age ***a***, in fishery ***f,*** at time step ***t*** |
| $PropModelStock_{f}$ | Proportion of Model Stocks to Total Catch in fishery ***f*** |
| $SubLegEnc_{s,a,f,t}$ | Sub-Legal Sized Encounters for stock ***s,*** age ***a***, in fishery ***f,*** at time step ***t*** |
| $CNRScalar_{f,t}$ | Non-Retention Scalar in fishery ***f,*** at time step ***t*** |
| $TotalEstCNR_{f,t}$ | Total Estimated Non-Retention (legal and sub-legal) in fishery ***f,*** at time step ***t*** |
| $PropCatch_{s,a,f,t}$ | Proportion of Coho Catch for stock ***s,*** age ***a***, in fishery ***f,*** at time step ***t*** |
| $EstCNRMorts_{f,t}$ | Estimated Coho Non-Retention Mortalities in fishery ***f,*** at time step ***t*** |
| $CNR_{s,a,f,t}$ | Coho Non-Retention Mortality for stock ***s,*** age ***a***, in fishery ***f,*** at time step ***t*** |

Sub-legal shaker mortality is not estimated for coho since most minimum size limits- if they exist - apply to age 2 fish that are not represented in the model. The calculations for sub-legal sized chinook (shakers) are shown below. The sub-legal and legal size encounters are stock and age specific and are calculated using Von Bertalanffy growth curves generated from CWT data.

$$SubLegProp_{s,a,t} = 1 - PV_{s,a,t}$$

$$SubLegPop_{s,a,t} = Cohort_{s,a,t} * SubLegProp_{s,a,t}$$

$$Shakers_{s,a,f,t} = SubER_{s,a,f,t} * SubLegPop_{s,t} * FishScalar_{f,t} * RelRate_{f}$$

Where:

| | |
|---|---|
| $Shakers_{s,a,f,t}$ | Sub-Legal Shaker Mortality for stock *s*, age *a*, in fishery *f*, at time step *t* |
| $SubER_{s,a,f,t}$ | Base Period Sub-Legal Encounter Rate for stock *s*, age *a*, in fishery *f*, at time step *t*. The SubER is derived from fishery observations. |
| $Cohort_{s,t}$ | Number of fish in cohort (for PreTerminal Fisheries; Terminal Run Size for Terminal Fisheries) for stock *s* at time step *t*. |
| $1\text{-}PV_{s,a,t}$ | Proportion of Cohort for stock *s*, age *a*, vulnerable to the gear at time step *t*. For chinook PV is function of Von Bertalanffy growth curve; for coho , PV is always = 1. |
| $RelRate_{f}$ | Release Mortality Rate for Sub-Legal sized fish in fishery *f* |

## 6.3 MARK-SELECTIVE FISHERIES

The implementation of mark-selective fishery regulations requires the use of more complex computations. Different equations are employed for marked and unmarked fish. The forms of equations utilized in Chinook FRAM under non-selective and mark-selective fisheries are depicted in the following table. Computations for chinook mark-selective fisheries must account for sub-legal mortality, which does not differ between marked and unmarked components. The counterpart equations for coho would not contain the elements associated with sub-legal mortality.

| | Non-Selective | Mark-Selective Fisheries | |
|---|---|---|---|
| | Discrete Equations | Marked Fish | UnMarked Fish |
| Landed mortalities | $C_f = ER_f N_\bullet$ | $C_f = ER_f * N_\bullet * (1 - mre)$ | $C_f = ER_f * N_\bullet * ure$ |
| Release mortalities | $R_f = C_f * srr$ | $R_f = ER_f * N_\bullet * mre * rm$ | $R_f = ER_f * N_\bullet * (1 - ure) *$ |
| Drop-off mortalities | $D_f = C_f * dmr$ | $D_f = ER_f * N_\bullet * dmr$ | $D_f = ER_f * N_\bullet * dmr$ |

Where:

$C_f$ = number of landed mortalities in fishery *f*

$D_f$ = drop off mortalities

dmr = drop off mortality rate

$ER_f$ = exploitation rate in fishery *f*. (This parameter is equivalent to BPER*PV*SHRS in the previously described formulation.)

mre = marked retention error (releasing marked fish in a selective fishery)

N• = cohort size at beginning of time period

$R_f$ = number of release mortalities in fishery f

srr = release rate of sub-legal sized fish

rm = release mortality rate

ure = unmarked recognition error (retaining and landing unmarked fish in a selective fishery)

## 6.4 OTHER ALGORITHMS

The FRAM uses several other algorithms to estimate various biological processes during the catch calculation routine. These include scaling cohort sizes by stock and age, natural mortality, maturation, and escapement. The base period initial starting cohort size is multiplied by the current year stock scalar by age ($StockScalar_{s,a}$) to estimate the starting cohort sizes for all stocks. Within a time step, the cohort sizes are first decreased to account for natural mortality. The natural mortality rates are species and age specific. The maturation process occurs after the pre-terminal catch has been calculated and results in a mature cohort for each stock, age, and time step. All fisheries in FRAM are

designated as pre-terminal or terminal in the base period data. The terminal fisheries only harvest fish from the mature cohort thus simulating a migration pattern from the pre-terminal mixed stock areas. Escapement is defined as any fish from the mature cohort that does not die from fishery-related mortality. In the current versions of the chinook and coho base periods all maturation and escapement of a stock occurs within a single time step. The only exceptions are Skagit stocks of spring and summer/fall chinook and Columbia River summer chinook.

The algorithms to calculate the parameters for "Adult Equivalency" and "Model Stock Proportions" are used primarily for reporting purposes. The Adult Equivalency (AEQ) is used to discount catch and exploitation rates for younger age classes so that they can be added together. The AEQ values are expressed in terms of the expected contribution to the age-5, time step 3 fish, which is the oldest age-class at the final time step. The AEQ value for this maximum-age/final-time-step is 1.0 and all other age/time-step values are a proportion of this value. The calculation algorithm takes into account the maturation and natural mortality rates. The Model Stock Proportion is the proportion of the total catch in a fishery/time-step that is accounted for by the model stocks. This value is only calculated for Chinook . The coho cohort analysis used to create the model base period exploitation rates include estimates for all production regions.

The sequence of computations and equations are as follows:

**1) Scale Cohort for Current Year**

$$Cohort_{s,a,1} = BPCohort_{s,a} * StockScalar_{s,a}$$

**2) Natural Mortality (See Appendix 5 for assumed rates for Chinook and Coho)**

$$Cohort_{s,a,t} = Cohort_{s,a,t} * (1 - NatMortRate_{a,t})$$

**3) Maturation (chinook only)**

$$TermCohort_{s,a,t} = Cohort_{s,a,t} * MatRate_{s,a,t}$$

**4) Escapement (chinook only)**

$$TotTermMort_{s,a,t} = \sum_{f-term} (Catch_{s,a,f,t} + Shakers_{s,a,f,t} + Dropoff_{s,a,f,t} + LegalShakers_{s,a,f,t} + CNR_{s,a,f,t})$$

$$Escape_{s,a,t} = TermCohort_{s,a,t} - TotTermMort_{s,a,t}$$

**5) Adult Equivalency (chinook only)**

$$AEQ_{s,a,t} = [MatRate_{s,a,t} + (1 - MatRate_{s,a,t}) * (1 - NatMortRate_{s,a,t})] * AEQ_{s,a,t+1}$$

$AEQ_{s,a,t} = 1$ for a=5 and t=3 (Max-Age, Final Time Step)

**6) Proportion Model Stocks** (chinook only)

$$PropModelStock_{f,t} = \sum_{s}\sum_{a}\sum_{f}\sum_{t} Catch_{s,a,f,t} / TotalCatch_{f,t}$$

**7) Exploitation Rate**

$$ER_{s,a,f,t} = \frac{(Catch_{s,a,f,t} + Shakers_{s,a,f,t+} + LegalShakers_{s,a,f,t} + Dropoff_{s,a,f,t})}{(Catch_{s,a,f,t} + Shakers_{s,a,f,t+} + LegalShakers_{s,a,f,t} + Dropoff_{s,a,f,t} + Escape_{s,a,t})}$$

Where:

| | |
|---|---|
| $Cohort_{s,a,1}$ | Starting Cohort for stock s, age a, at time step 1 |
| $BPCohort_{s,a}$ | Base Period Starting Cohort stock s, age a |
| $StockScalar_{s,a}$ | Pre-Season forecast scalar for stock s, age a |
| $NatMortRate_{a,t}$ | Natural Mortality Rate age a, at time step t |
| $TermCohort_{s,a,,t}$ | Mature Cohort for stock s, age a, at time step t |
| $MatRate_{s,a,t}$ | Maturation Rate for stock s, age a, at time step t |
| $TotTermMort_{s,a,t}$ | Terminal Fishery Total Mortality for stock s, age a, at time step t |
| $Escape_{s,a,t}$ | Escapement for stock s, age a, at time step t |
| $Catch_{s,a,f,t}$ | Catch for stock s, age a, in fishery f, at time step t |
| $Shakers_{s,a,f,t}$ | Sub-Legal Mortality for stock s, age a, in fishery f, at time step t |
| $Dropoff_{s,a,f,t}$ | Non-Landed Mortality for stock s, age a, in fishery f, at time step t |
| $LegalShakers_{s,a,f,t}$ | Legal-Sized Mortality for stock s, age a, in fishery f, at time step t |
| $CNR_{s,a,f,t}$ | Non-Retention Mortality for stock s, age a, in fishery f, at time step t |
| $TotalCatch_{f,t}$ | Total Catch of all stocks in fishery f, at time step t |
| $PropModelStock_{f,t}$ | Proportion of Model Stocks Catch to TotalCatch in fishery f, at time step t |

## 7. TERMINAL AREA MANAGEMENT MODULE (TAMM)

The FRAM program interacts with two species-specific (chinook and coho) spreadsheet programs that allow users to specify terminal fishery impacts on a finer level of resolution. The spreadsheet program, TAMM, began with separate sections for each of the six Puget Sound terminal areas (Table 7-1) that are defined in the management plan for the State of Washington and the Treaty Tribes of Puget Sound. This structure has supported development of unique regional management goals, and allows managers the flexibility to analyze and report FRAM model output according to their needs. The chinook TAMM contains the original Puget Sound sections, while the coho TAMM has been expanded to allow report generation for many non-Puget Sound stock groups.

**Table 7-1. Puget Sound Terminal Management Regions.**

| | |
|---|---|
| Nooksack-Samish | Skagit |
| Stillaguamish-Snohomish | South Sound |
| Hood Canal | Strait of Juan de Fuca |

Historically, managers used TAMMs to analyze fishery impacts on individual population components of the larger FRAM stock groupings. The relatively new 1986-1991 coho base period now includes individual Puget Sound populations (61 stocks) at the management level of resolution. Similarly, the expanded Puget Sound coho fisheries are comprehensive; thus coho TAMM now serves more as a recipient of FRAM output for customized report generation. In contrast, chinook TAMM remains a critical element of pre-season Puget Sound modeling, as many populations of management focus need to be "extracted" from the aggregated FRAM stock groupings. Abundance levels of every Puget Sound chinook hatchery and natural population are entered into the TAMM, as are harvest impacts from all Puget Sound fisheries, to allow fishery specific impact analyses on all the populations of interest.

The current chinook base period data (as in the older versions of the coho base period) aggregates terminal area fisheries for FRAM modeling at a higher level than used for management. Typically FRAM has no individual area freshwater terminal sport fisheries, nor freshwater net fisheries. The chinook TAMM provides the ability to model the individual Puget Sound marine and freshwater net fisheries by smaller date increments associated with fisheries directed at chinook, pink, coho, chum or steelhead. In addition, test fisheries and fisheries in sub-area can be specified. Similarly, the ability to model individual Puget Sound freshwater sport fisheries is also provided. The appropriate chinook TAMM fishery impacts are summed into the terminal fishery definitions used by FRAM to calculate the FRAM fishery scalar inputs.

The TAMM fishery inputs, in addition to a fixed catch, allow for two fishery control mechanisms that are not used by FRAM. The control mechanisms (harvest rates) are percent of terminal area abundance (TAA) and percent of extreme terminal run size (ETRS). Each terminal area has specific rules for calculation of the TAA and ETRS values. Basically the TAA rules include the escapement of all local area stocks and terminal catch of all stocks. The ETRS rules include escapement and only the terminal

catch of the local area stocks, but an associated non-local stock catch is also calculated as base period proportion of total fishery catch. The derivation of these rules comes from the definitions used in the annual terminal run reconstruction for each of the species. Run reconstruction estimates are used in the calculation of modeling inputs for terminal area fishery impacts under the TAA and ETRS methods. The same run reconstructions may be used to develop in-season run size update models.

The TAA and ETRS methods create a problem for estimating the FRAM fishery scalars because the run size in each terminal region is dependent on the impacts from all the other regions. For example, a decrease in Skagit terminal fisheries results in higher escapement for Nooksack and higher TAA and ETRS values. The fishery impacts in Nooksack terminal fisheries would then be calculated higher which lowers the original Skagit TAA and ETRS values.

An iterative process was developed to solve the problem of simultaneous equations between the terminal areas. The FRAM program reruns the terminal fishery time steps until the difference between the TAMM specified expected fishery impacts and FRAM estimates (calculated from base period exploitation rates) are within +/- 0.1% of the expected value or the difference is less than one fish. On each iteration the FRAM fishery scalars are adjusted by the proportion of the expected value divided by the FRAM estimate for each terminal fishery.

As already discussed, the current FRAM coho base period data has much finer resolution of the terminal area fisheries than does the chinook base period. This is a result of the coho run reconstruction program RRTERM fishery definitions that were used to develop this coho base period data. The coho TAMM fishery definitions are the same as the FRAM terminal fisheries and thus allow direct input for effort base fishery scalars and quota values. An iterative process is still needed for the TAA and ETRS abundance based methods.

The TAMM spreadsheets are used to create most of the output reports needed by fishery managers during the negotiation processes. This functionality was preserved in the current TAMM spreadsheets to ensure continuity and familiarity with the older versions of the program and to divide the duties and responsibilities for input and error checking during the intense management sessions.

## 8. REFERENCES


Chinook Model Work Group (CMWG). 1989. Chinook model specifications. Unpub. draft report, Aug. 8, 1989. Chinook Model Work Group. 12 pages.

CMWG. 1990a. Description and preliminary documentation for a model of chinook fisheries. Unpub. draft report, Oct. 19, 1990. Chinook Model Work Group. 45 pages.

CMWG. 1990b. Supplemental documentation for chinook model. Unpub. draft report, Nov. 14, 1990. Chinook Model Work Group. 13 pages.

CMWG. 1991. Chinook model status report. Unpub. draft report for PFMC Sci. and Stat. Comm., Feb. 21, 1991. Chinook Model Work Group. 9 pages

CMWG. 1992. Chinook model status report. Unpub. draft report for PFMC Sci. and Stat. Comm., Nov. 24, 1992. Chinook Model Work Group. 12 pages.

CMWG. 1996. Chinook model validation and management system evaluation. Unpub. draft report, May, 1996. Chinook Model Work Group. 26 pages.

Chinook Technical Committee. 1992. Long-term research plans for coastwide pacific chinook stocks. Pacific Salmon Commission, Report TCCHINOOK (92)-3. Vancouver, British Columbia.

Hunter, M.A. 1985. The 1976-1978 brood coho model. Progress Report 222. Washington Department of Fisheries. Olympia, Washington.

Johnson, F.C. 1975. A model for salmon fishery regulatory analysis: second interim report. NBS Report 75745. Nat. Bur. Standards. Washington, DC.

Morishima, G. S., and Henry, K. A. 2000. The History and Status of Pacific Northwest Chinook and Coho Salmon Ocean Fisheries and Prospects for Sustainability. Pages 219-235 *in* E. E. Knudsen, C. R. Stewart, D. D. MacDonald, J. E. Williams, and D. W. Reiser, editors. Sustainable Fisheries Management, Pacific Salmon. Lewis Publishers, Boca Raton, New York.

Packer, J. 1994. Memo to CAM Working Group Re: New Coho Assessment Model Program. January 10, 1994. 47 pages incl. attachment.

The Policy Work Group on Net Dropout Rates. 1989. Recommendation of the policy work group on net dropout rates. July 25, 1989. 2 pages.

Scott, Jr., J.B. 1988. Coho Fishery Management Assessment Model - User's Manual. 181 pages.

Washington Department of Fisheries. 1981. The WDF/NBS Catch Regulation Analysis Model: A Contemporary Salmon Management Tool. 10 pages.

Washington Department of Fish and Wildlife. 1997. Coho FRAM Changes for Mass Marking and Selective Fisheries. 16 pages.

Washington Department of Fish and Wildlife and Northwest Indian Fisheries Commission. 1995. Users manual for the fishery regulation assessment model (FRAM) for chinook and coho. Draft report, Dec. 3, 1995. Washington Department of Fish and Wildlife and Northwest Indian Fisheries Commission. 88 pages.

# APPENDICES

## Appendix 1. Chinook FRAM Stocks.

| Unmarked Stock # | Stock Name | Abbreviated Name | CWT Broods Included* |
|---|---|---|---|
| 1 | Nooksack-Samish summer/fall | NkSm FlFi | 77,79 |
| 3 | North Fork Nooksack early (spring) | NFNK Sprg | OOB - 84,88 (N. Fk.) |
| 5 | South Fork Nooksack early (spring) | SFNK Sprg | OOB - 84,88 (N. Fk.) |
| 7 | Skagit summer/fall fingerling | Skag FlFi | 76,77 |
| 9 | Skagit summer/fall yearling | Skag FlYr | 76 |
| 11 | Skagit spring yearling | Skag SpYr | OOB - 85, 86, 87,90 |
| 13 | Snohomish summer/fall fingerling | Snoh FlFi | OOB - 86, 87, 88 |
| 15 | Snohomish summer/fall yearling | Snoh FlYr | 76 |
| 17 | Stillaguamish summer/fall fingerling | Stil FlFi | OOB - 86, 87, 88,89,90 |
| 19 | Tulalip summer/fall fingerling | Tula FlFi | OOB - 86, 87, 88 |
| 21 | Mid S. Puget Sound fall fingerling | USPS FlFi | 78,79 |
| 23 | UW Accelerated fall fingerling | UW-A FlFi | 77-79 |
| 25 | Deep S. Puget Sound fall fingerling | DSPS FlFi | 78,79 |
| 27 | South Puget Sound fall yearling | SPSo FlYr | 78,79 |
| 29 | White River spring fingerling | Whte SpFi | OOB – 91-93 |
| 31 | Hood Canal fall fingerling | HdCl FlFi | 78,79 |
| 33 | Hood Canal fall yearling | HdCl FlYr | 78,79 |
| 35 | Juan de Fuca Tribs. fall fingerling | SJDF FlFi | 78,79 |
| 37 | Oregon Lower Columbia River Hatchery | Oregn LRH | 78,79 |
| 39 | Wash. Lower Columbia River Hatchery | Washn LRH | 77,79 |
| 41 | Lower Columbia River Wild | Low CR Wi | 77-78 |
| 43 | Bonneville Pool Hatchery tule | BP H Tule | 76-79 |
| 45 | Columbia Upriver summer | Upp CR Su | 76,77 |
| 47 | Columbia Upriver bright | Col R Brt | 75-77 |
| 49 | Washington Lower River spring | WaLR Sprg | 77 |
| 51 | Willamette spring | Will Sprg | 76-78 |
| 53 | Snake River fall | SnakeR Fl | OOB - 84, 85, 86 |
| 55 | Oregon North Migrating fall | Ore No Fl | 76-78 |
| 57 | WCVI Total | WCVI Totl | 74-77 |
| 59 | Fraser Late | Fraser Lt | OOB - 81,82,83 |
| 61 | Fraser Early | Fraser Er | 78,79; OOB -, 86 |
| 63 | Lower Georgia Strait fall | Lwr Geo St | 77,78 |
| 65 | White River spring yearling | Whte SpYr | OOB – 91-93 |

*OOB = Out of Base

## Appendix 2. Coho FRAM Stocks.

| Production Region | Unmarked Stock # | FRAM abbrev. | Coho Stock Name | Production Region | Unmarked Stock # | FRAM abbrev. | Coho Stock Name |
|---|---|---|---|---|---|---|---|
| NOOKSM | 1 | nkskrw | Nooksack River Wild | SJDFCA | 107 | dungew | Dungeness River Wild |
| NOOKSM | 3 | kendlh | Kendall Creek Hatchery | SJDFCA | 109 | dungeh | Dungeness Hatchery |
| NOOKSM | 5 | skokmh | Skookum Creek Hatchery | SJDFCA | 111 | elwhaw | Elwha River Wild |
| NOOKSM | 7 | lumpdh | Lummi Ponds Hatchery | SJDFCA | 113 | elwhah | Elwha Hatchery |
| NOOKSM | 9 | bhambh | Bellingham Bay Net Pens | SJDFCA | 115 | ejdfmw | East JDF Miscellaneous Wild |
| NOOKSM | 11 | samshw | Samish River Wild | SJDFCA | 117 | wjdfmw | West JDF Misc. Wild |
| NOOKSM | 13 | Ar77aw | Area 7/7A Independent Wild | SJDFCA | 119 | ptangh | Port Angeles Net Pens |
| NOOKSM | 15 | whatch | Whatcom Creek Hatchery | SJDFCA | 121 | area9w | Area 9 Miscellaneous Wild |
| SKAGIT | 17 | skagtw | Skagit River Wild | MAKAHC | 123 | makahw | Makah Coastal Wild |
| SKAGIT | 19 | skagth | Skagit River Hatchery | MAKAHC | 125 | makahh | Makah Coastal Hatchery |
| SKAGIT | 21 | skgbkh | Baker (Skagit) Hatchery | QUILUT | 127 | quilsw | Quillayute R Summer Natural |
| SKAGIT | 23 | skgbkw | Baker (Skagit) Wild | QUILUT | 129 | quilsh | Quillayute R Summer Hatchery |
| SKAGIT | 25 | swinch | Swinomish Channel Hatchery | QUILUT | 131 | quilfw | Quillayute River Fall Natural |
| SKAGIT | 27 | oakhbh | Oak Harbor Net Pens | QUILUT | 133 | quilfh | Quillayute River Fall Hatchery |
| STILSN | 29 | stillw | Stillaguamish River Wild | HOHRIV | 135 | hohrvw | Hoh River Wild |
| STILSN | 31 | stillh | Stillaguamish River Hatchery | HOHRIV | 137 | hohrvh | Hoh River Hatchery |
| STILSN | 33 | tuliph | Tulalip Hatchery | QUEETS | 139 | quetfw | Queets River Fall Natural |
| STILSN | 35 | snohow | Snohomish River Wild | QUEETS | 141 | quetfh | Queets River Fall Hatchery |
| STILSN | 37 | snohoh | Snohomish River Hatchery | QUEETS | 141 | quetfh | Queets River Fall Hatchery |
| STILSN | 39 | ar8anh | Area 8A Net Pens | QUEETS | 143 | quetph | Queets R Supplemental Hat. |
| HOODCL | 41 | ptgamh | Port Gamble Net Pens | QUINLT | 145 | quinfw | Quinault River Fall Natural |
| HOODCL | 43 | ptgamw | Port Gamble Bay Wild | QUINLT | 147 | quinfh | Quinault River Fall Hatchery |
| HOODCL | 45 | ar12bw | Area 12/12B Wild | GRAYHB | 149 | chehlw | Chehalis River Wild |
| HOODCL | 47 | qlcnh | Quilcene Hatchery | GRAYHB | 151 | chehlh | Chehalis River (Bingham) Hat. |
| HOODCL | 49 | qlcenbh | Quilcene Bay Net Pens | GRAYHB | 153 | humptw | Humptulips River Wild |
| HOODCL | 51 | ar12aw | Area 12A Wild | GRAYHB | 155 | humpth | Humptulips River Hatchery |
| HOODCL | 53 | hoodsh | Hoodsport Hatchery | GRAYHB | 157 | gryhmw | Grays Harbor Misc. Wild |
| HOODCL | 55 | ar12dw | Area 12C/12D Wild | GRAYHB | 159 | gryhbh | Grays Harbor Net Pens |
| HOODCL | 57 | gadamh | George Adams Hatchery | WILLAPA | 161 | willaw | Willapa Bay Natural |
| HOODCL | 59 | skokrw | Skokomish River Wild | WILLAPA | 163 | willah | Willapa Bay Hatchery |
| SPGSND | 61 | ar13bw | Area 13B Misc. Wild | COLRIV | 165 | colreh | Columbia River Early Hatchery |
| SPGSND | 63 | deschw | Deschutes R. (WA) Wild | COLRIV | 167 | youngh | Youngs Bay Hatchery |
| SPGSND | 65 | ssdnph | South Puget Sound Net Pens | COLRIV | 169 | sandew | Sandy Early Wild |
| SPGSND | 67 | nisqlh | Nisqually River Hatchery | COLRIV | 171 | clakew | Clakamas Early Wild |
| SPGSND | 69 | nisqlw | Nisqually River Wild | COLRIV | 173 | claklw | Clakamas Late Wild |
| SPGSND | 71 | foxish | Fox Island Net Pens | COLRIV | 175 | colrlh | Columbia River Late Hatchery |
| SPGSND | 73 | mintch | Minter Creek Hatchery | OREGON | 177 | orenoh | Oregon North Coastal Hatchery |
| SPGSND | 75 | ar13mw | Area 13 Miscellaneous Wild | OREGON | 179 | orenow | Oregon North Coastal Wild |
| SPGSND | 77 | chambh | Chambers Creek Hatchery | OREGON | 181 | orenmh | Oregon No. Mid Coastal Hatch |
| SPGSND | 79 | ar13mh | Area 13 Misc. Hatchery | OREGON | 183 | orenmw | Oregon No. Mid Coastal Wild |
| SPGSND | 81 | ar13aw | Area 13A Misc. Wild | OREGON | 185 | oresmh | Oregon So. Mid Coastal Hatch |
| SPGSND | 83 | puyalh | Puyallup River Hatchery | OREGON | 187 | oresmw | Oregon So. Mid Coastal Wild |
| SPGSND | 85 | puyalw | Puyallup River Wild | OREGON | 189 | oranah | Oregon Anadromous Hatchery |
| SPGSND | 87 | are11h | Area 11 Hatchery | OREGON | 191 | oraqah | Oregon Aqua-Foods Hatchery |
| SPGSND | 89 | ar11mw | Area 11 Miscellaneous Wild | ORECAL | 193 | oresoh | Oregon South Coastal Hatchery |
| SPGSND | 91 | ar10eh | Area 10E Hatchery | ORECAL | 195 | oresow | Oregon South Coastal Wild |
| SPGSND | 93 | ar10ew | Area 10E Misc. Wild | ORECAL | 197 | calnoh | California North Coastal Hatch |
| SPGSND | 95 | greenh | Green River Hatchery | ORECAL | 199 | calnow | California North Coastal Wild |
| SPGSND | 97 | greenw | Green River Wild | ORECAL | 201 | calcnh | California Central Coastal Hat. |
| SPGSND | 99 | lakwah | Lake Washington Hatchery | ORECAL | 203 | calcnw | California Central Coastal Wild |
| SPGSND | 101 | lakwaw | Lake Washington Wild | GSMLND | 205 | gsmndh | Georgia Strait Mainland Hatch |
| SPGSND | 103 | are10h | Area 10 H inc. Ebay,SeaAq NP | GSMLND | 207 | gsmndw | Georgia Strait Mainland Wild |
| SPGSND | 105 | ar10mw | Area 10 Miscellaneous Wild | GSVNCI | 209 | gsvcih | Georgia Strait Vanc .Is Hatch |

## Appendix 2. Coho FRAM Stocks (cont.)

| Production Region | Unmarked Stock # | FRAM abbrev. | Coho Stock Name | Production Region | Unmarked Stock # | FRAM abbrev. | Coho Stock Name |
|---|---|---|---|---|---|---|---|
| GSVNCI | 211 | gsvciw | Georgia Strait Vanc. IslWild | THOMPR | 235 | thompw | Thompson River Wild |
| JNSTRT | 213 | Jnstrh | Johnstone Strait Hatchery | BCCNTL | 237 | bccnhw | BC Central Coast Hatch/Wild |
| JNSTRT | 215 | Jnstrw | Johnstone Strait Wild | BCNCST | 239 | bcnchw | BC North Coast Hatchery/Wild |
| SWVNCI | 217 | Swvcih | SW Vancouver Island Hatch | QUEENC | 241 | quenhw | Queen Charlotte Is Hatch/Wild |
| SWVNCI | 219 | Swvciw | SW Vancouver Island Wild | NASSRV | 243 | nasshw | Nass River Hatchery/Wild |
| NWVNCI | 221 | nwvcih | NW Vancouver Island Hatchery | SKEENA | 245 | skeehw | Skeena River Hatchery/Wild |
| NWVNCI | 223 | nwvciw | NW Vancouver Island Wild | TRANAC | 247 | tranhw | Trans Boundary Hatchery/Wild |
| FRSLOW | 225 | frslwh | Lower Fraser River Hatchery | NIASKA | 249 | niakhw | Alaska No. Inside Hatch/Wild |
| FRSLOW | 227 | frslww | Lower Fraser River Wild | NOASKA | 251 | noakhw | Alaska No. Outside Hatch/Wild |
| FRSUPP | 229 | frsuph | Upper Fraser River Hatchery | SIASKA | 253 | siakhw | Alaska So. Inside Hatch/Wild |
| FRSUPP | 231 | frsupw | Upper Fraser River Wild | SOASKA | 255 | soakhw | Alaska So. Outside Hatch/Wild |
| THOMPR | 233 | thomph | Thompson River Hatchery | | | | |

## Appendix 3. Chinook FRAM Fisheries

| # | Fishery Name | # | Fishery Name |
|---|---|---|---|
| 1 | Southeast Alaska Troll | 26 | NT Columbia River Troll (Area 1) |
| 2 | Southeast Alaska Net | 27 | Columbia River Sport (Area 1) |
| 3 | Southeast Alaska Sport | 28 | Columbia River Net |
| 4 | North/Central British Columbia Net | 29 | Buoy 10 Sport |
| 5 | WCVI Net | 30 | Orford Reef-Cape Falcon Troll (Central |
| 6 | Strait of Georgia Net | 31 | Orford Reef-Cape Falcon Sport (Central |
| 7 | Canada Juan de Fuca Net (Area 20) | 32 | Horse Mountain-Orford Reef Troll |
| 8 | North/Central British Columbia Sport | 33 | Horse Mountain-Orford Reef Sport |
| 9 | North/Central British Columbia Troll | 34 | Southern California Troll |
| 10 | WCVI Troll | 35 | Southern California Sport |
| 11 | WCVI Sport | 36 | Area 7 Sport |
| 12 | Strait of Georgia Troll | 37 | NT San Juan Net (Area 6A,7,7A) |
| 13 | North Strait of Georgia Sport | 38 | T San Juan Net (Area 6A,7,7A) |
| 14 | South Strait of Georgia Sport | 39 | NT Nooksack-Samish Net |
| 15 | BC Juan de Fuca Sport | 40 | T Nooksack-Samish Net |
| 16 | NT Cape Flattery-Quillayute Troll (Area 3-4) | 41 | T Juan de Fuca Troll (Area 5,6,7) |
| 17 | T Cape Flattery-Quillayute Troll (Area 3-4) | 42 | Area 5/6 Sport |
| 18 | Cape Flattery-Quillayute Sport (Area 3-4) | 43 | NT Juan de Fuca Net (Area 4B,5,6,6C) |
| 19 | Cape Flattery-Quillayute Net (Area 3-4) | 44 | T Juan de Fuca Net (Area 4B,5,6,6C) |
| 20 | NT Grays Harbor Troll (Area 2) | 45 | Area 8 Sport [1] |
| 21 | T Grays Harbor Troll (Area 2) | 46 | NT Skagit Net (Area 8) |
| 22 | Grays Harbor Sport (Area 2) | 47 | T Skagit Net (Area 8) |
| 23 | NT Grays Harbor Net | 48 | Area 8D Sport |
| 24 | T Grays Harbor Net | 49 | NT Stilly-Snohomish Net (Area 8A) |
| 25 | Willapa Net | 50 | T Stilly-Snohomish Net (Area 8A) |

## Appendix 3. Chinook FRAM Fisheries (cont.).

| # | Fishery Name | # | Fishery Name |
|---|---|---|---|
| 51 | NT Tulalip Bay Net (Area 8D) | 63 | T Area 10E Net |
| 52 | T Tulalip Bay Net (Area 8D) | 64 | Area 12 Sport |
| 53 | Area 9 Sport | 65 | NT Hood Canal Net (Area 12,12B,12C) |
| 54 | NT Area 6B/9 Net | 66 | T Hood Canal Net (Area 12,12B,12C) |
| 55 | T Area 6B/9 Net | 67 | Area 13 Sport |
| 56 | Area 10 Sport | 68 | NT Deep S.Puget Sound Net (13,13D-K) |
| 57 | Area 11 Sport | 69 | T Deep S. Puget Sound Net (13,13D-K) |
| 58 | NT Area 10/11 Net | 70 | NT Area 13A Net |
| 59 | T Area 10/11 Net | 71 | T Area 13A Net |
| 60 | NT Area 10A Net | 72 | Freshwater Sport |
| 61 | T Area 10A Net | 73 | Freshwater Net [2] |
| 62 | NT Area 10E Net | | |

Notes:
* (T = Treaty; NT = Nontreaty)
1 Sport areas 8-1 and 8-2 were combined and input into Fishery 45.
2 In Puget Sound, fishery 73 combines ... Area 11A with Puyallup River; Areas 9A, 12A, 12D with Hood Canal; Area 13C with Chambers Creek.

## Appendix 4. Coho FRAM Fisheries.

| Fishery Abbrev. | Fish Num. | Coho FRAM Fishery Longname | Fishery Abbrev. | Fish Num. | Coho FRAM Fishery Longname |
|---|---|---|---|---|---|
| No Cal Trm | 1 | North California Coast Terminal Catch | Area3TrlNT | 38 | Area 3 Troll Nontreaty (LaPush) |
| Cn Cal Trm | 2 | Central California Coast Term Catch | Area3TrlTR | 39 | Area 3 Troll Treaty (LaPush) |
| Ft Brg Spt | 3 | Fort Bragg Sport | Area 3 Spt | 40 | Area 3 Sport (LaPush) |
| Ft Brg Trl | 4 | Fort Bragg Troll | Area 4 Spt | 41 | Area 4 Sport (Neah Bay) |
| Ca KMZ Spt | 5 | KMZ Sport (Klamath Management Zone) | A4/4BTrlNT | 42 | Area 4/4B (Neah Bay PFMC Regs) Troll NotTreaty |
| Ca KMZ Trl | 6 | KMZ Troll (Klamath Management Zone) | A4/4BTrlTR | 43 | Area 4/4B (Neah Bay PFMC Regs) Troll Treaty |
| So Cal Spt | 7 | Southern California Sport | A 5-6C Trl | 44 | Area 5, 6, 6C Troll (Strait of Juan de Fuca) |
| So Cal Trl | 8 | Southern California Troll | Willpa Spt | 45 | Willapa Bay (Area 2.1) Sport |
| So Ore Trm | 9 | South Oregon Coast Terminal Catch | Wlp Tb Spt | 46 | Willapa Tributary Sport |
| Or Prv Trm | 10 | Oregon Private Hatchery Terminal Catch | WlpaBT Net | 47 | Willapa Bay & FW Trib Net |
| SMi Or Trm | 11 | South-Mid Oregon Coast Terminal Catch | GryHbr Spt | 48 | Grays Harbor (Area 2.2) Sport |
| NMi Or Trm | 12 | North-Mid Oregon Coast Terminal Catch | SGryHb Spt | 49 | South Grays Harbor Sport (Westport Boat Basin) |
| No Ore Trm | 13 | North Oregon Coast Terminal Catch | GryHbr Net | 50 | Grays Harbor Estuary Net |
| Or Cst Trm | 14 | Mid-North Oregon Coast Terminal Catch | Hump R Spt | 51 | Humptulips River Sport |
| Brkngs Spt | 15 | Brookings Sport | LwCheh Net | 52 | Lower Chehalis River Net |
| Brkngs Trl | 16 | Brookings Troll | Hump R C&S | 53 | Humptulips River Ceremonial & Subsistence |
| Newprt Spt | 17 | Newport Sport | Chehal Spt | 54 | Chehalis River Sport |
| Newprt Trl | 18 | Newport Troll | Hump R Net | 55 | Humptulips River Net |
| Coos B Spt | 19 | Coos Bay Sport | UpCheh Net | 56 | Upper Chehalis River Net |
| Coos B Trl | 20 | Coos Bay Troll | Chehal C&S | 57 | Chehalis River Ceremonial & Subsistence |
| Tillmk Spt | 21 | Tillamook Sport | Wynoch Spt | 58 | Wynochee River Sport |
| Tillmk Trl | 22 | Tillamook Troll | Hoquam Spt | 59 | Hoquiam River Sport |
| Buoy10 Spt | 23 | Buoy 10 Sport (Columbia River Estuary) | Wishkh Spt | 60 | Wishkah River Sport |
| L ColR Spt | 24 | Lower Columbia River Mainstem Sport | Satsop Spt | 61 | Satsop River Sport |
| L ColR Net | 25 | Lower Columbia River Net (Excl Youngs Bay) | Quin R Spt | 62 | Quinault River Sport |
| Yngs B Net | 26 | Youngs Bay Net | Quin R Net | 63 | Quinault River Net |
| LCROrT Spt | 27 | Below Bonneville Ore. Tributary Sport | Quin R C&S | 64 | Quinault River Ceremonial & Subsistence |
| Clackm Spt | 28 | Clackamas River Sport | Queets Spt | 65 | Queets River Sport |
| SandyR Spt | 29 | Sandy River Sport | Clrwtr Spt | 66 | Clearwater River Sport |
| LCRWaT Spt | 30 | Below Bonneville Washington Tributary Sport | Salm R Spt | 67 | Salmon River (Queets) Sport |
| UpColR Spt | 31 | Above Bonneville Sport | Queets Net | 68 | Queets River Net |
| UpColR Net | 32 | Above Bonneville Net | Queets C&S | 69 | Queets River Ceremonial & Subsistence |
| A1-Ast Spt | 33 | Area 1 (Illwaco) & Astoria Sport | Quilly Spt | 70 | Quillayute River Sport |
| A1-Ast Trl | 34 | Area 1 (Illwaco) & Astoria Troll | Quilly Net | 71 | Quillayute River Net |
| Area2TrlNT | 35 | Area 2 Troll Nontreaty (Westport) | Quilly C&S | 72 | Quillayute River Ceremonial & Subsistence |
| Area2TrlTR | 36 | Area 2 Troll Treaty (Westport) | Hoh R Spt | 73 | Hoh River Sport |
| Area 2 Spt | 37 | Area 2 Sport (Westport) | Hoh R Net | 74 | Hoh River Net |

## Appendix 4. Coho FRAM fisheries (continued).

| Fishery Abbrev. | Fish Num. | Coho FRAM Fishery Longname | Fishery Abbrev. | Fish Num. | Coho FRAM Fishery Longname |
|---|---|---|---|---|---|
| Hoh R C&S | 75 | Hoh River Ceremonial & Subsistence | Ar8A NetNT | 109 | Area 8A Stillaguamish/Snohomish Net Nontreaty |
| Mak FW Spt | 76 | Makah Tributary Sport | Ar8A NetTR | 110 | Area 8A Stillaguamish/Snohomish Net Treaty |
| Mak FW Net | 77 | Makah Freshwater Net | Ar8D NetNT | 111 | Area 8D Tulalip Bay Net Nontreaty |
| Makah C&S | 78 | Makah Ceremonial & Subsistence | Ar8D NetTR | 112 | Area 8D Tulalip Bay Net Treaty |
| A 4-4A Net | 79 | Area 4, 4A Net (Neah Bay) | Stil R Net | 113 | Stillaguamish River Net |
| A4B6CNetNT | 80 | Area 4B, 5, 6C Net Nontreaty (Strait of JDF) | Snoh R Net | 114 | Snohomish River Net |
| A4B6CNetTR | 81 | Area 4B, 5, 6C Net Treaty (Strait of JDF) | Ar 8-2 Spt | 115 | Area 8.2 Marine Sport |
| Ar6D NetNT | 82 | Area 6D Dungeness Bay/River Net Nontreaty | Stil R Spt | 116 | Stillaguamish River Sport |
| Ar6D NetTR | 83 | Area 6D Dungeness Bay/River Net Treaty | Snoh R Spt | 117 | Snohomish River Sport |
| Elwha Net | 84 | Elwha River Net | Ar 10 Spt | 118 | Area 10 Marine Sport (Seattle) |
| WJDF T Net | 85 | West JDF Straits Tributary Net | Ar10 NetNT | 119 | Area 10 Net Nontreaty (Seattle) |
| EJDF T Net | 86 | East JDF Straits Tributary Net | Ar10 NetTR | 120 | Area 10 Net Treaty (Seattle) |
| A6-7ANetNT | 87 | Area 7, 7A Net Nontreaty (San Juan Islands) | Ar10ANetNT | 121 | Area 10A Net Nontreaty (Elliott Bay) |
| A6-7ANetTR | 88 | Area 7, 7A Net Treaty (San Juan Islands) | Ar10ANetTR | 122 | Area 10A Net Treaty (Elliott Bay) |
| EJDF FWSpt | 89 | East JDF Straits Tributary Sport | Ar10ENetNT | 123 | Area 10E Net Nontreaty (East Kitsap) |
| WJDF FWSpt | 90 | West JDF Straits Tributary Sport | Ar10EnetTR | 124 | Area 10E Net Treaty (East Kitsap) |
| Area 5 Spt | 91 | Area 5 Marine Sport (Sekiu) | 10F-G Net | 125 | Area 10F-G Ship Canal/Lake Washington Net Treaty |
| Area 6 Spt | 92 | Area 6 Marine Sport (Port Angeles) | Duwm R Net | 126 | Green/Duwamish River Net |
| Area 7 Spt | 93 | Area 7 Marine Sport (San Juan Islands) | Duwm R Spt | 127 | Green/Duwamish River Sport |
| Dung R Spt | 94 | Dungeness River Sport | L WaSm Spt | 128 | Lake Washington-Lake Sammamish Tributary Sport |
| ElwhaR Spt | 95 | Elwha River Sport | Ar 11 Spt | 129 | Area 11 Marine Sport (Tacoma) |
| A7BCDNetNT | 96 | Area 7B-7C-7D Net Nontreaty (Bellingham Bay) | Ar11 NetNT | 130 | Area 11 Net Nontreaty (Tacoma) |
| A7BCDNetTR | 97 | Area 7B-7C-7D Net Treaty (Bellingham Bay) | Ar11 NetTR | 131 | Area 11 Net Treaty (Tacoma) |
| Nook R Net | 98 | Nooksack River Net | Ar11ANetNT | 132 | Area 11A Net Nontreaty (Commencement Bay) |
| Nook R Spt | 99 | Nooksack River Sport | Ar11ANetTR | 133 | Area 11A Net Treaty (Commencement Bay) |
| Samh R Spt | 100 | Samish River Sport | Puyl R Net | 134 | Puyallup River Net |
| Ar 8 NetNT | 101 | Area 8 Skagit Marine Net Nontreaty | Puyl R Spt | 135 | Puyallup River Sport |
| Ar 8 NetTR | 102 | Area 8 Skagit Marine Net Treaty | Ar 13 Spt | 136 | Area 13 Marine Sport (South Puget Sound) |
| Skag R Net | 103 | Skagit River Net | Ar13 NetNT | 137 | Area 13 Net Nontreaty (South Puget Sound) |
| SkgR TsNet | 104 | Skagit River Test Net | Ar13 NetTR | 138 | Area 13 Net Treaty (South Puget Sound) |
| SwinCh Net | 105 | Swinomish Channel Net | Ar13CNetNT | 139 | Area 13C Net Nontreaty (Chambers Bay) |
| Ar 8-1 Spt | 106 | Area 8.1 Marine Sport | Ar13CNetTR | 140 | Area 13C Net Treaty (Chambers Bay) |
| Area 9 Spt | 107 | Area 9 Marine Sport (Admiralty Inlet) | Ar13ANetNT | 141 | Area 13A Net Nontreaty (Carr Inlet) |
| Skag R Spt | 108 | Skagit River Sport | Ar13ANetTR | 142 | Area 13A Net Treaty (Carr Inlet) |

## Appendix 4. Coho FRAM fisheries (continued).

| Fishery Abbrev. | Fish Num. | Coho FRAM Fishery Longname | Fishery Abbrev. | Fish Num. | Coho FRAM Fishery Longname |
|---|---|---|---|---|---|
| Ar13DNetNT | 143 | Area 13D Net Nontreaty (South Puget Sound) | No BC Trl | 175 | Northern British Columbia Troll |
| Ar13DNetTR | 144 | Area 13D Net Treaty (South Puget Sound) | NoC BC Trl | 176 | North Central British Columbia Troll |
| A13FKNetNT | 145 | Area 13F-13K Net Nontreaty (South PS Inlets) | SoC BC Trl | 177 | South Central British Columbia Troll |
| A13FKNetTR | 146 | Area 13F-13K Net Treaty (South PS Inlets) | NW VI Trl | 178 | NW Vancouver Island Troll |
| Nisq R Net | 147 | Nisqually River Net | SW VI Trl | 179 | SW Vancouver Island Troll |
| McAlls Net | 148 | McAllister Creek Net | GeoStr Trl | 180 | Georgia Straits Troll |
| 13D-K TSpt | 149 | 13D-13K Tributary Sport (South PS Inlets) | BC JDF Trl | 181 | British Columbia Juan de Fuca Troll |
| Nisq R Spt | 150 | Nisqually River Sport | No BC Net | 182 | Northern British Columbia Net |
| Desc R Spt | 151 | Deschutes River Sport (Olympia) | Cen BC Net | 183 | Central British Columbia Net |
| Ar 12 Spt | 152 | Area 12 Marine Sport (Hood Canal) | NW VI Net | 184 | NW Vancouver Island Net |
| 1212BNetNT | 153 | Area 12-12B Net Nontreaty (Upper Hood Canal) | SW VI Net | 185 | SW Vancouver Island Net |
| 1212BNetTR | 154 | Area 12-12B Net Treaty (Upper Hood Canal) | Johnst Net | 186 | Johnstone Straits Net |
| Ar9A NetNT | 155 | Area 9A Net Nontreaty (Port Gamble) | GeoStr Net | 187 | Georgia Straits Net |
| Ar9A NetTR | 156 | Area 9-9A Net Treaty (Port Gamble/On Reservation) | Fraser Net | 188 | Fraser River Gill Net |
| Ar12ANetNT | 157 | 12A Net Nontreaty (Quilcene Bay) | BC JDF Net | 189 | British Columbia Juan de Fuca Net |
| Ar12ANetTR | 158 | 12A Net Treaty (Quilcene Bay) | No BC Spt | 190 | Northern British Columbia Sport |
| A12CDNetNT | 159 | 12C-12D Net Nontreaty (Lower Hood Canal) | Cen BC Spt | 191 | Central British Columbia Sport |
| A12CDNetTR | 160 | 12C-12D Net Treaty (Lower Hood Canal) | BC JDF Spt | 192 | British Columbia Juan de Fuca Sport |
| Skok R Net | 161 | Skokomish River Net | WC VI Spt | 193 | West Coast Vancouver Island Sport |
| Quilcn Net | 162 | Quilcene River Net | NGaStr Spt | 194 | North Georgia Straits Sport |
| 1212B TSpt | 163 | 12-12B Tributary FW Sport | SGaStr Spt | 195 | South Georgia Straits Sport |
| Quilcn Spt | 164 | 12A Tributary FW Sport (Quilcene River) | Albern Spt | 196 | Alberni Canal Sport |
| 12C-D TSpt | 165 | 12C-12D Tributary FW Sport | BCCNTL TTR | 197 | BCCNTL Terminal Run (Catch + Escapement) |
| Skok R Spt | 166 | Skokomish River Sport | BCNCST TTR | 198 | BCNCST Terminal Run (Catch + Escapement) |
| GSMLND Trm | 167 | Georgia Strait Mainland Terminal Catch | QUEENC TTR | 199 | QUEENC Terminal Run (Catch + Escapement) |
| GSVNCI Trm | 168 | Georgia Strait Vancouver Island Terminal Catch | NASSRV TTR | 200 | NASSRV Terminal Run (Catch + Escapement) |
| JNSTRT Trm | 169 | Johnstone Strait Terminal Catch | SKEENA TTR | 201 | SKEENA Terminal Run (Catch + Escapement) |
| SWVNCI Trm | 170 | SW Vancouver Island Terminal Catch | SW AK Trl | 202 | Southwest Alaska Troll |
| NWVNCI Trm | 171 | NW Vancouver Island Terminal Catch | SE AK Trl | 203 | Southeast Alaska Troll |
| FRSLOW Trm | 172 | Lower Fraser River Terminal Catch | NW AK Trl | 204 | Northwest Alaska Troll |
| FRSUPP Trm | 173 | Upper Fraser River Terminal Catch | NE AK Trl | 205 | Northeast Alaska Troll |
| THOMPR Trm | 174 | Thompson River Terminal Catch | Alaska Net | 206 | Alaska Net (Areas 182:183:185:192) |

**Appendix 5. Time Period and Age Specific rates used by FRAM to simulate Chinook and Coho natural mortality.**

| Chinook | Time Steps | | | |
|---|---|---|---|---|
| Ages | 1. Oct. to April | 2. May to June | 3. July to Sept. | 4. Oct. to April |
| 2 | 0.2577 | 0.0816 | 0.1199 | 0.1878 |
| 3 | 0.1878 | 0.0577 | 0.0853 | 0.1221 |
| 4 | 0.1221 | 0.0365 | 0.0543 | 0.0596 |
| 5 | 0.0596 | 0.0174 | 0.0260 | 0.0596 |

| Coho | Time Steps | | | | |
|---|---|---|---|---|---|
| Ages | 1. Jan. to June | 2. July | 3. August | 4. Sept. | 5. Oct to Dec. |
| | | | | | |
| 3 | 0.117504 | 0.020618 | 0.020618 | 0.020618 | 0.020618 |

## Appendix 6. Glossary.

**Adult Equivalent (AEQ)** - The potential contribution of fish of a given age to the spawning escapement, in the absence of fishing. Because of natural mortality and unaccounted losses, not all unharvested fish contribute to spawning escapement. For example, a two-year-old chinook has a lower probability of surviving to spawn, in the absence of fishing, than does a five-year-old, and these two age classes have different "adult equivalents".

**Base Period** - A set of brood years from which CWT data are used to estimate exploitation rates, maturation rates, and stock abundances. The years used for the base period differ by species. and stock. Brood years are chosen based on consistent coded-wire tagging of stocks, consistent CWT sampling of fisheries, and the relatively consistent execution of fisheries during the return years. Some stocks in the model were not tagged during the base base period; recoveries of these stocks (called "out-of-base" stocks) are adjusted to account for changes in exploitation rates relative to the base period.

**Catch Ceiling** - A fishery catch limitation expressed in numbers of fish. A ceiling fishery is managed so as not to exceed the ceiling; actual catch is expected to fall somewhere below the ceiling.

**Catch Quota** - A fishery catch allocation expressed in numbers of fish. A quota fishery is managed to catch the quota; actual catch is expected to be slightly above or below the quota.

**Chinook/Coho Nonretention** (CNR) - Time periods when salmon fishing is allowed, but the retention of chinook (or coho) salmon is prohibited.

**Cohort Analysis** - A sequential population analysis technique that is used during model calibration to reconstruct the exploited life history of coded-wire tag groups.

**Cohort Size (initial)** - The total number of fish of a given age and stock at the beginning of the fishing season.

**Coded-Wire Tag (CWT)** - Coded microwire tags that are implanted in juvenile salmon prior to release. A tagged fish usually has its adipose fin removed to signal tag presence. Fisheries and escapements are sampled for tagged fish. When recovered, the binary code on the tag provides specific information about the tag group (e.g., location and timing of release, special hatchery treatments, etc.).

**Dropoff Mortality** - Mortality of salmon that "drop-off" sport or troll fishing gear before they are landed, and die from their injuries prior to harvest or spawning.

**Dropout Mortality** - Mortality of salmon that die in a fishing net and "drop-out" prior to harvest or salmon that disentangle from a net while it is in the water and die from their injuries prior to harvest or spawning.

**Exploitation Rate (ER)** - Catch or total fishing mortality in a fishery expressed as a proportion of the total cohort size in all areas (i.e., the total number of fish in the stock of interest at the beginning of the fishing year).

**Exploitation Rate Scalar** - A multiplier used to estimate fishery impacts by adjusting the base periods exploitation rates. Exploitation rate scalars can be either stock or fishery specific, or they can be applied to all stocks in a fishery.

**FRAM** - The Fishery Regulation Assessment Model is a simulation model developed for use in estimating the impacts of Pacific Coast salmon fisheries on chinook and coho stocks of interest to fishery managers.

**Harvest Rate (HR)** - Catch or total fishing mortality in a fishery expressed as a proportion of the total fish abundance available in a given fishing area at the start of a time period.

**Hooking Mortality** - Mortality of salmon that are caught and released by sport or troll hook-and-line gear, and die from their injuries prior to harvest or spawning.

**Management System Evaluation** - An evaluation of how well the model predicts variables of interest (e.g., terminal runs, catch by stock, and stock composition) when pre-season estimates of abundance and fishery catches are used as input data. In other words, given that the model performs adequately, does our preseason decision making process, based on preseason predictions, result in the anticipated outcome?

**Marked Recognition Error** - Tthe probability that a marked fish will be inadvertently released.

**Model Calibration** - Model process involving base period data which (1) scales the coded-wire tag recoveries to represent a stock, (2) allocates non-landed catch mortality to stocks, and (3) reconstructs the cohort in order to compute exploitation rates, maturation rates, and stock abundance.

**Model Simulation** - Use of the model to vary the calibrated fish population abundance and fishing rates to portray the effects, on the stocks and fisheries, of different sets of sport and commercial fishery regulations.

**Non-landed Catch** - This category of fishery-related mortality includes hook-and-line drop-off, net gear drop-out, hooking mortality, and other sources of nonlanded mortality such as unreported or illegal catch.

**Nontreaty Fisheries** - Fisheries conducted by fishers who are not members of the twenty-four Belloni or Boldt Case Area Tribes.

**Preterminal** - In FRAM, a "preterminal" fishery is one that operates on both mature and immature fish.

**Shaker Mortality – "Shakers"** - This term is synonomous with hooking mortality and represents fish that are released from recreational and troll hook and line fisheries, either because they are outside of the regulatory size limits, because the species is not allowed to be kept, or because the individual fisher chooses, for personal or economic reasons, to release the fish.

**Terminal** - In FRAM, a "terminal" fishery is one that operates only on mature fish. These fisheries tend to be adjacent to a stock's stream of origin and harvest returning adult fish.

**Terminal Area Management Modules (TAMM)** - Spreadsheets external to but integrated with FRAM that are used to: (1) provide input for FRAM simulations regarding projected Puget Sound terminal area catches or stock-specific impacts; (2) compute escapements for Puget Sound stock aggregates; and (3) create output reports that summarize simulated regulations, stock exploitation rates, allocation accounting, and escapement estimates.

**Treaty Fisheries** - Fisheries conducted by members of the twenty-four Belloni or Boldt Case Area Tribes.

**Unmarked Recognition Error (or Retention Error Rate)** - the probability that an unmarked fish will be retained inappropriately in a selective fishery (e.g. naturally-occurring marks, fisher fails to identify mark, fisher fails to comply with release requirement).

**Validation** - An evaluation of how well the model predicts variables of interest (e.g., terminal runs, catch by stock, and stock composition) when post-season estimates of stock abundance and fishery catches are used as input data. Validation is intended to evaluate performance of the model. In other words, does the model yield correct stock-specific impacts using, as inputs, actual stock size and fishery catch information.

# MODEL EVALUATION WORKGROUP REPORT

The Model Evaluation Workgroup (MEW) met October 23, 2003 to review an Overview Fishery Regulation Assessment Model (FRAM) document (Exhibit E.4.c, Supplemental Attachment 1) and to set priorities for future work. Comments obtained from the Salmon Technical Team (STT) and the Scientific and Statistical Committee (SSC) Salmon Subcommittee were incorporated into the draft provided to the Council.

The Overview provides a general description of FRAM. It defines the chinook and coho stocks and fisheries, time steps, and information on various types and magnitudes of incidental mortality rates used in different fisheries. It also includes a flow chart of computations within FRAM, a list of the fundamental equations used, and a description of the interdependence with some of the ancillary models used, such as the Terminal Area Management Modules (TAMMs).

The MEW recommends continued development of a detailed FRAM documentation, with the next tasks being documentation of the coho cohort reconstruction analysis and documentation of the chinook FRAM calibration process. The MEW also recommended starting development of a FRAM user's manual. It is anticipated the user's manual and the coho cohort reconstruction documentation could be substantially completed by the end of the year. The chinook FRAM calibration documentation, although already initiated, will require significantly more time and effort, and will be included with the final documentation package, which should be completed by fall 2004.

Reference Materials:

1. Exhibit E.4.c, Supplemental Attachment 1: DRAFT Fishery Regulation Assessment Model (FRAM) - An Overview for Chinook and Coho

PFMC
11/03/03

# SALMON TECHNICAL TEAM REPORT

The Salmon Technical Team (STT) and the Salmon Subcommittee of the Scientific and Statistical Committee (SSC) met on October 23, 2003 to review methodology changes for the 2004 management season. Two items were reviewed: changes to the Coho Fishery Regulation Assessment Model (FRAM), and FRAM documentation.

## Coho FRAM

Changes were made to the Coho FRAM to accommodate Canadian fishery planning needs for implementation of the Pacific Salmon Commission's Coho Abundance Based Management agreement (CoABM). These changes include (1) changes in fishery strata for fisheries in Central British Columbia, Johnstone Strait, and the Strait of Georgia, and (2) changes in the representation of Canadian production regions. Changes to the production regions include reconfiguration to represent the regional aggregates specified in the CoABM, incorporation of additional CWT codes in the input files, new methodology for estimating escapement in areas where escapement estimates were not previously available, and estimates of hatchery and wild production.

The STT believes these changes represent a substantial improvement in the Coho FRAM and endorses the use of the updated model for the 2004 management season. However, the STT notes that the results of the modified model are not consistent with the results of the previous model, especially with respect to impacts on the Upper Fraser (including Thompson) stock, and anticipates the Pacific Salmon Commission will need to revisit aspects of the CoABM agreement. The STT also notes that the model results are preliminary and will be subject to continued technical review and error checking over the next few weeks. The STT urges the Coho Technical Committee to continue their evaluation of the model modifications.

## Model Documentation

The Model Evaluation Workgroup (MEW) presented a draft Overview of the Coho and Chinook FRAM. The MEW intends to also produce a Users Manual detailing the operation of the model and a Programmers Guide with much more detailed documentation of the model algorithms. The STT recommends the Overview be finalized and the MEW then focus their attention on the Users Manual and Programmers Guide.

PFMC
11/03/03

Exhibit E.4.d
Supplemental Tribal Comment
November 2003

# STATEMENT FOR PACIFIC SALMON COMMISSION COHO MODEL REVIEW

Mr. Chairman, Council members, as you are aware in addition to serving on the Pacific Council, I also serve on the Southern Panel of the U.S./Canada Pacific Salmon Commission. The Coho model before the Pacific Council today represents a commitment from the 2002 Coho Agreement reached with Canada, which was to develop a joint bilateral Fishery Regulation Assessment Model (FRAM) model.

However, I caution the Council not to proceed too quickly with the adoption of this revised Coho model. This model is being developed bilaterally for use by the U.S./Canada Pacific Salmon Commission (PSC). Currently, it has yet to be presented and fully reviewed within the PSC forum, which meets annually in January and February. I also believe this new model needs to undergo additional testing and error checking. Consequently, this new version of the model that has been reviewed by our technical committees, and before the Council today, has not been approved or adopted in the PSC forum and is still subject to change.

In recognition of the differences in review schedules between the international and domestic processes, I recommend the Council grant no more than a tentative acceptance of the model basic framework and function. Formal Council acceptance of the model should not occur until completion of the PSC model review process and after the Council's technical committees have had an opportunity to review the final version. Although no major changes are anticipated, I believe this is the most prudent action to take at this point in time.

PFMC
11/04/03