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National Oceanic and Atmospheric Administration
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MEMORANDUM TO: The Record

FROM: Rodney R. McInnis
Regional Administrator

SUBJECT: Endangered Species Act Section 7 Consultation on the Effects of Ocean Salmon Fisheries on California Coastal Chinook Salmon: Performance of the Klamath Ocean Harvest Model in 2004 and Implementation of the Reasonable and Prudent Alternative of the April 28, 2000, Biological Opinion

California Coastal Chinook salmon (coastal Chinook), an evolutionarily significant unit (ESU) of *Oncorhynchus tshawytscha*, was listed as threatened under the Endangered Species Act (ESA) on September 16, 1999 (64 FR 50394). The National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) issued a biological opinion dated April 28, 2000 (2000 opinion), which considered the effects of ocean salmon fishing conducted in accordance with the Pacific Coast Salmon Plan (FMP) on coastal Chinook salmon. The opinion concluded that ocean salmon fisheries managed under the FMP would jeopardize the continued existence of coastal Chinook and offered a reasonable and prudent alternative (RPA) to the proposed action. The RPA placed a limit on the projected annual harvest rate for age-4 Klamath River fall Chinook in the salmon fisheries authorized by NMFS under the FMP.

Klamath River fall Chinook are not part of the coastal Chinook ESU and are not listed under the ESA; the stock is used as a surrogate for estimating fishery impacts on coastal Chinook. The Klamath River fall Chinook harvest rates predicted to occur under the 2004 authorized fishing seasons met the requirements of the 2000 opinion; however the observed rate, estimated from cohort reconstructions, was 0.52, far in excess of the predicted rate of 0.15 and indicative of a level of take of coastal Chinook much higher than levels estimated in the 2000 opinion. As a result, NMFS has reinitiated section 7 consultation on the effects on coastal Chinook of ocean salmon fishing conducted in accordance with the FMP, as modified by the RPA of the 2000 opinion. This consultation considers modifications to the RPA of the 2000 opinion which are necessary to avoid jeopardizing the continued existence of coastal Chinook. This memorandum examines the reasons for the large deviation of the post-season observed 2004 harvest rate from the pre-season predicted rate[1], considers the need for changes to the management measures for

1 The 2000 opinion used the term "projected harvest rate" to refer to the harvest rate predicted during the annual

the 2005 season, currently in progress, and specifies actions NMFS believes are necessary to implement the RPA of the 2000 opinion.

1. The Reasonable and Prudent Alternative of the 2000 Opinion

The 2000 opinion specified a four-part RPA, the first part of which required that management measures developed under the FMP must achieve a projected age-4 ocean harvest rate on Klamath River fall Chinook of 0.16 or less.[2] This means that the age-4 Klamath River fall Chinook harvest rate predicted to occur under the annual fishery management measures, developed by the Pacific Fishery Management Council (PFMC) and approved and implemented by NMFS, must not exceed 0.16. NMFS uses the Klamath Ocean Harvest Model (KOHM) to predict the age-specific harvest rates on Klamath River fall Chinook resulting from proposed management measures. The 2000 opinion does not specify a post-season harvest rate limit, either as a requirement of the RPA or as an event that would trigger reinitiation of section 7 consultation, should the limit be exceeded. In establishing a pre-season harvest rate limit as the primary protective measure, NMFS anticipated that post-season harvest rates would be reasonably close to the pre-season projections: "Klamath River fall Chinook age-4 ocean harvest rates should not be allowed to exceed the levels *observed* since 1996" (p. 20, NMFS 2000). The KOHM is designed to provide an unbiased prediction of harvest rate. Therefore, post-season harvest rates are expected to deviate equally above and below the predicted values. The magnitude of the deviations will depend on the variance associated with the data used to predict the harvest rate. NMFS did not specify in the opinion what it regards as a reasonably close realization of the predicted harvest rates. The Incidental Take Statement notes that the amount of incidental take of coastal Chinook cannot be directly assessed in terms of numbers of fish, but rather specifies the expected incidental take as a harvest rate that is consistent with the terms of the RPA.

2. The Klamath Ocean Harvest Model

The KOHM is used by the PFMC's Salmon Technical Team (STT), and in turn by NMFS, to assess whether proposed management measures are likely to meet the FMP's conservation objectives for Klamath River fall Chinook salmon.[3] Between 1997 and 2001, NMFS and the California Department of Fish and Game produced a major revision of the KOHM, and reviewed, corrected and reconfigured the supporting data sets of historical catch and spawning populations of Klamath River fall Chinook. The PFMC's Scientific and Statistical Committee reviewed the KOHM and reported that "The revised KOHM is a vast improvement of the model.

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pre-season planning process to occur under a proposed set of management measures. The projected (predicted) age-4 harvest rate will be referred to in this document as the "pre-season harvest rate". The observed, or realized, age-4 harvest harvest rate, estimated through the post-season analysis of fishery and spawning escapement data, will be referred to as the "post-season harvest rate".

2 The rate was specified as 0.17 in the 2000 opinion and later recalculated to 0.16 (NMFS 2002).

3 The objective for Klamath River fall Chinook is 33-34% of potential adult natural spawners, but no fewer than 35,000 naturally spawning adults in any one year.

Major components of the model are designed as independent sub-models which can be revised as our understanding improves. Documentation of the models and supporting data sets is impressively thorough and comprehensive, greatly enhancing the utility of the model" (PFMC 2001).

The KOHM uses observed annual estimates of effort, associated contact rates, and associated season length in the recreational and commercial salmon fisheries to predict fishing effort as a function of fishing opportunity (effort/day open), and contact rates as a function of fishing effort. Given a proposed season length, these two sub-models generate month-, area-, age-, and sector-specific estimates of contact rates, which, when coupled with other components of the model, allow prediction of ocean harvest rates, Klamath Basin tribal and recreational harvest, and the numbers of fish returning to spawn naturally and at hatcheries in the Klamath Basin.

3. Performance of the Klamath Ocean Harvest Model in 2004

The current version of the KOHM has been used to manage salmon fisheries off Oregon and California since 2002. It is intended to provide an unbiased estimate of harvest rates under proposed fishing seasons. The model performed reasonably well in 2002 and 2003, but substantially under-predicted the 2004 age-4 ocean harvest rate (Table 1).

Table 1: Pre-season and post-season Klamath River fall Chinook age-4 ocean harvest rates

	Pre-season	Post-season	Pre-season Post-season
2002	0.13	0.15	87%
2003	0.16	0.23	70%
2004	0.15	0.52	29%
Average	0.15	0.30	49%

A thorough review of the KOHM modeling procedures for the 2004 seasons was conducted by the NMFS Southwest Fisheries Science Center to ensure that the operation of the KOHM was not responsible for the large disparity between the pre-season and post-season harvest rates for the 2004 salmon fishery. The review did not identify any errors or biases in the design, implementation, or execution of the KOHM that would result in an under-prediction of the harvest rate (M. Mohr, NMFS, personal communication, June 10, 2005). The review and analysis confirmed a report by the STT (PFMC 2005) that the poor performance of the KOHM in projecting the age-4 ocean harvest rate for Klamath fall Chinook in 2004 was due largely to the failure of the contact rate-effort module to accurately predict the 2004 contact rates per unit of effort in various fisheries off Oregon and California. The KOHM uses observed contact rates (c) and associated effort (f) over the entire time series of available data (1983 to the most recently available) to predict future contact rates per unit of effort (c/f). The values of c/f and effort/day open predicted by the model are therefore limited to values that are within the range of the historical data. In the 30 commercial fishery time-area cells in the KOHM that were active in 2004, the age-4 c/f values were under-predicted in 21 cells (Figure 1). In several cells, c/f values were observed that substantially exceeded any on record. In contrast, the effort predictor module predicted the 2004 effort levels reasonably well, with the exception of Oregon's early commercial seasons (Figure 2).

The slope of the lines predicting c/f (Figure 1) is a measure of average stock distribution and

vulnerability. Vulnerability is the fraction of the local stock which is caught by a unit of fishing effort. It can vary with changes in the behavior of the fish, or in the efficiency of the fishing gear (Ricker 1975). There are at least two possible explanations for the under-prediction of the 2004 age-4 *c/f* values and, consequently, the 2004 harvest rate:

1. As a result of a change in stock distribution, and/or the vulnerability of Klamath River fall Chinook, *c/f* values are increasing over time (first seen in 2003 and more fully expressed in 2004).

2. The high *c/f* values observed in 2004, while very unusual, do not reflect a chronic change in stock distribution, and/or vulnerability, but instead reflect the high interannual variability present in these estimated rates. Estimated rates of this magnitude can be expected to occur again, although infrequently.

A time series of *c/f* values (Figure 3) displays the rates observed in cells off Oregon and California over a 22-year period. Inspection of the series suggests that *c/f* was unusually high in many of the time-area cells in 2003 and 2004. However, a longer term trend is not apparent and additional observations of *c/f* are necessary to determine which of the above explanations is primarily responsible for the substantial under-prediction of the harvest rate in 2004.

The accuracy and precision of the KOHM will in most cases be improved by increasing the sampling rates associated with estimating the various KOHM input parameters (harvest, effort, escapement, size at age, etc.), or by increasing the tagging rates of the hatchery stocks used in the analysis. However, the unusually high *c/f* values observed in numerous cells, primarily in the commercial fishery but also in the recreational fishery, suggests that the failure of the KOHM in predicting the 2004 age-4 contact rates (and resulting harvest rate) is not a result of inadequate sampling rates, but rather due to either an acute or chronic change in the distribution and/or vulnerability of Klamath River fall Chinook.

4. The 2005 Salmon Management Measures

The 2005 salmon fishery management measures recommended to NMFS by the PFMC provided for a projected harvest rate of 7.7% for age-4 Klamath River fall Chinook (70 FR 23054, May 4, 2005). In approving the measures, NMFS announced that it was reinitiating section 7 consultation on coastal Chinook and would advise the PFMC at its June 2005 meeting whether any changes in the 2005 management measures were necessary as a result of the consultation. After reviewing the causes of the failure to accurately predict the 2004 age-4 harvest rate, and the options (described below) for reducing the risk of again significantly exceeding the pre-season harvest rate limit of 0.16, NMFS has determined that no additional changes to the 2005 management measures are necessary. NMFS' decision to approve and implement the PFMC recommendations for the 2005 salmon seasons is supported by the analysis presented by the STT to the PFMC at its March 2005 meeting, in response to concern that the realized harvest rate for 2005 might again far exceed the predicted rate (PFMC 2005). The STT identified two methods

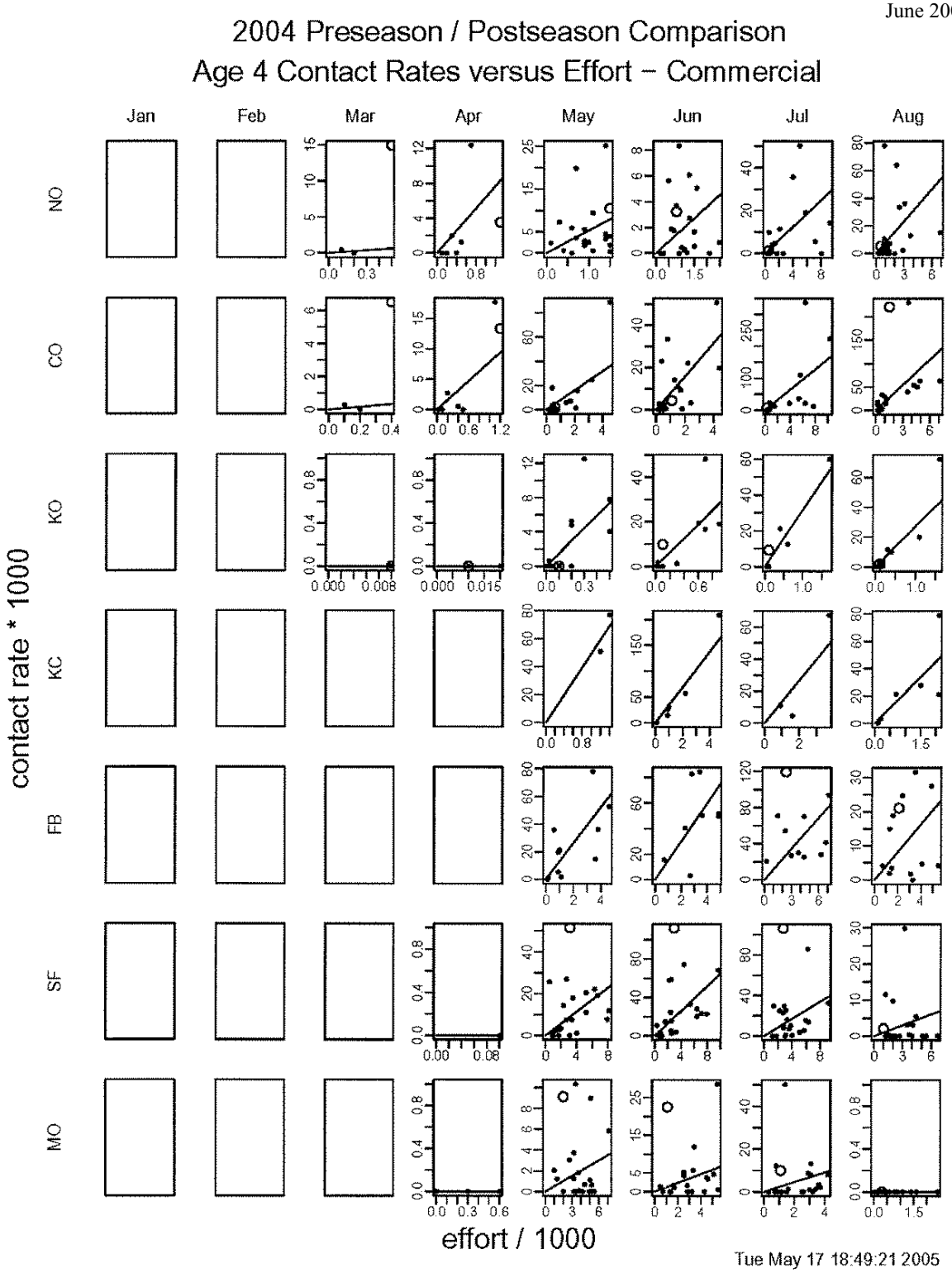

Figure 1. KOHM performance in predicting age-4 contact rates in the 2004 commercial fishery. Each frame corresponds to a month-specific KOHM catch area. Solid circles represent the available observations of contact rates plotted against the corresponding observed effort. The ratio-estimator of each set (solid line) is based on all data pairs available at the time (1983-2003); it predicts future contact rates for any level of predicted effort. The observed 2004 contact rates and effort are represented by open circles.

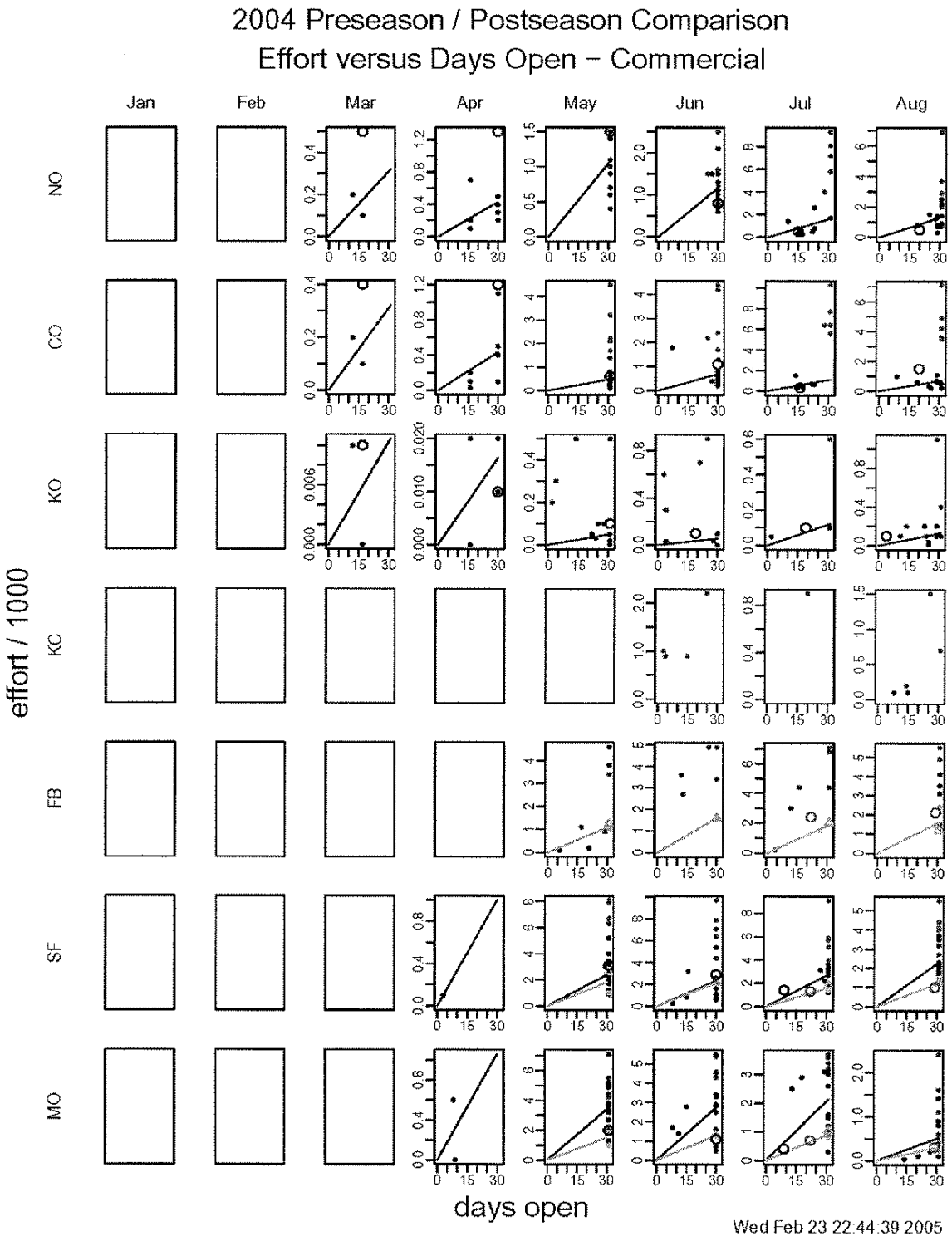

Figure 2: Comparison of predicted and observed values of effort/days open in the commercial fishery. The ratio-estimator of each set (solid line) is based on data observed between 1991 and 2003; it predicts future effort for any number of days the fishery is open. Red closed circles are data observed between 1986 and 1990, which are believed to poorly reflect current fleet characteristics. The observed 2004 effort/days open values are represented by open circles.

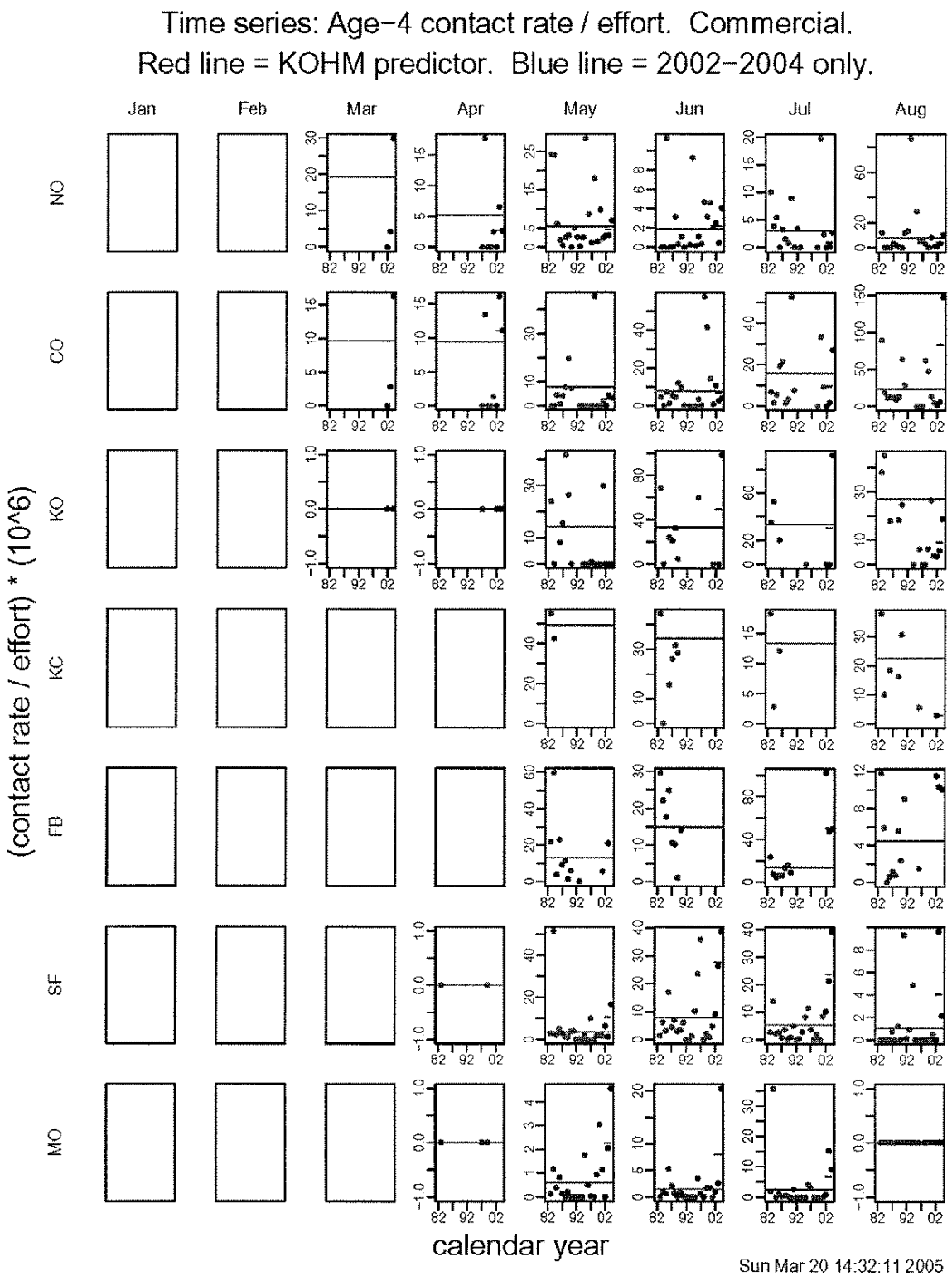

Figure 3: Time series of age-4 contact rates/effort in the commercial fishery. Red lines correspond to the slopes of lines from Figure 1, except that they include the observed 2004 data. Blue lines represent the slopes of lines based only on the 2002, 2003, and 2004 observed contact rates and effort.

to evaluate the risk.

A. "Buffering" the harvest rate prediction with a "scaling factor"

In this approach, the mean of the pre-season/post-season age-4 ocean harvest rates for the 2002, 2003, and 2004 seasons, is used as an index of KOHM performance in predicting age-4 harvest rate. The average pre-season rate was 49% of the average post-season rate (Table 1). If the KOHM again under-predicted the age-4 harvest rate for 2005 by the same average factor, then the pre-season harvest rate under the proposed 2005 management measures of 0.077 would result in an observed rate of 0.077/0.49=0.157, which is less than the 0.16 pre-season rate specified in the 2000 RPA. The buffering-by-scaling-factor approach is simplistic and may be appropriate in cases where the causes of model inaccuracy are unknown. The input variables needed to project the harvest rate are numerous and vary independently; it is therefore possible for different components of the model to perform poorly, but in a compensatory way, so as to produce a reasonably accurate prediction of harvest rate. Alternatively, certain combinations of normally small prediction errors can produce a large error in the harvest rate prediction. Attempting to adjust for putative biases in the model by applying a correction factor based on the ratio of predicted to observed harvest rates can have significant undesired consequences (Dixon 1995).

B. Modification of the contact-rate - effort sub-model

The second method presented by the STT involved alterations to the KOHM module thought to be primarily responsible for the under-prediction of the harvest rate in 2003 and 2004. The modification adjusts the model to better predict the high *c/f* values observed in 2004. The *c/f* sub-model was altered so that only the most recent 3 years of contact rate and effort observations were used to estimate *c/f*, rather than the entire 22-year data base. The resulting *c/f* predictors for the commercial sector are displayed in Figure 3 as the short horizontal blue lines on the right side of each panel. In most panels, the *c/f* predictors increase, in some cases, substantially. The cumulative effect of the modified ratio-estimators is to increase the harvest rate predicted for a given set of proposed management measures compared to that predicted using the normal base. The STT modeled each of the four management options under consideration by the PFMC for the 2005 salmon season and reported the results using the normal base and the recent 3-year base. With the normal base, the harvest rates of the four options ranged from 0.076 to 0.079, less than the 0.16 pre-season rate specified in the 2000 RPA. The harvest rates for the same management measures computed using the recent 3-year base ranged from 0.108 to 0.126. The harvest rate predicted for the management measures approved by NMFS, 0.077 using the normal base, would increase to 0.13 if the recent 3-year base were used.

Both methods proposed by the STT for assessing the risk of an excessive harvest rate given the 0.077 harvest rate prediction for the 2005 season, yield post-season harvest rates that are not likely to exceed the pre-season harvest rate limit of 0.16 specified by the 2000 opinion. NMFS finds that the age-4 ocean harvest rate predicted under the 2005 salmon management measures is low enough that the likelihood of the observed harvest rate again exceeding the pre-season limit to the extent that it did so in 2004 is small. NMFS has no in-season changes for the PFMC to consider with respect to coastal Chinook.

5. Future Actions for Implementing the RPA of the 2000 Opinion

A. Key Considerations of the 2000 Opinion

When the 2000 opinion was completed, the available data on coastal Chinook provided only crude indices of spawning abundance and ocean distribution; no estimates of harvest rates were available for the stock. A more southerly ocean distribution of coastal Chinook[4] relative to Klamath River fall Chinook, in combination with the larger amounts of sport and commercial fishing effort south of Point Arena, likely result in ocean harvest rates on coastal Chinook that are higher than the rates estimated for Klamath River fall Chinook, but lower than the harvest rates on Central Valley fall Chinook. While the estimates of realized ocean harvest rates on Klamath River fall Chinook are determined annually through cohort analysis, at the time the 2000 opinion was issued, estimates of realized harvest rates, based on cohort reconstructions, were not available for any Central Valley Chinook stock.[5] Therefore, estimates of ocean harvest rates on coastal Chinook were, and remain, conjectural: probably higher than those on Klamath River fall Chinook and lower than the rates on Central Valley fall Chinook, which are poorly characterized. The ocean harvest rates on coastal Chinook have likely declined sharply relative to rates that existed into the late 1980s, in concert with the reductions in ocean harvest rates on Klamath River fall Chinook, which were necessary to meet the changing management goals for that stock.[6] The 2000 opinion acknowledged that characterizing the effects of any particular level of ocean harvest on the viability of the population is also speculative: "The uncertainty regarding abundance trends of coastal Chinook populations and the absence of reliable estimates of ocean harvest rates for coastal Chinook make it difficult to assess the potential for coastal Chinook populations to recover under the current levels of fishing mortality" (p. 18, NMFS 2000).

B. Conclusions of the 2000 Opinion

The 2000 opinion's conclusion of "likely to jeopardize" was based on the absence of FMP management objectives that specifically regulate the harvest of coastal Chinook[7], and concern that future improvements in the abundance of Klamath River fall Chinook would permit increases in fishing effort and ocean harvest rates on coastal Chinook substantially higher than levels that had been allowed during the 1990s. The opinion estimated that pre-season ocean harvest rates on age-4 Klamath River fall Chinook, if limited only by the FMP objectives for Klamath River fall Chinook, could exceed 0.20, depending on the relative year-class strengths and abundance of Klamath River fall Chinook. The opinion concluded that such increases would

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4 The recoveries of a limited number of coded wire tagged coastal Chinook suggested an ocean distribution intermediate to Klamath River fall Chinook and Central Valley fall Chinook.

5 Since the issuance of the 2000 opinion, harvest rate estimates have become available for several Central Valley Chinook stocks, including Sacramento River winter Chinook, Butte Creek spring Chinook, and Feather River fall Chinook. These estimates are for a limited numbers of years and have been estimated on an ad hoc basis.

6 In 1992, the specification of the fishing rights of the Yurok and Hoopa Valley Indian Tribes by the Department of the Interior resulted in a permanent reduction in ocean harvest rates of Klamath River fall Chinook.

7 The FMP contains a generic objective that PFMC fisheries will be managed consistent with NMFS' ESA section 7 consultation standards.

also allow increased fishing mortality on coastal Chinook and appreciably reduce the likelihood of the survival and recovery of the population. However, as a result of the paucity of population trend data and the absence of ocean harvest rate estimates for coastal Chinook, the 2000 opinion was unable to specify any particular combination of harvest rates and population trend indicators (such as cohort replacement rates) which would constitute a condition likely or not to jeopardize the continued existence of coastal Chinook.

In light of the substantial uncertainty regarding the status of the population and the effects of fishing, and lacking the supporting viability analysis, NMFS decided to limit the impacts of fishing by specifying a pre-season harvest rate limit on a surrogate population for which pre- and post-season harvest rate estimates were available. The 2000 opinion concluded that "harvest of coastal Chinook under management measures [of the past four years] designed to achieve low ocean harvest rates on Klamath River fall Chinook and reduced ocean harvest of Sacramento River winter Chinook appears to be sufficiently low to allow persistence of coastal Chinook populations at low abundance levels"(p. 19, NMFS 2000). The pre-season harvest rate limit of 0.16 corresponds to the highest post-season rate observed over a four-year period during which the spawning escapement data suggested a stable population. During the same period, the highest pre-season rate prediction was 0.17. The harvest rate limit of 0.16 was regarded as consistent with the rates specified by NMFS for other listed salmon populations.[8]

6. Status of California Coastal Chinook

A review of the status, life history and critical habitat of coastal Chinook is provided in the 2000 opinion. The following is a summary of new information on the ESU that has developed since the 2000 opinion.

Since 2000, NMFS has undertaken an extensive review of all west coast salmonids and has published proposed rules for listings of 27 ESUs (69FR 33102) and their critical habitats (69FR 71880). The proposed coastal Chinook ESU is defined to include all naturally spawned populations of Chinook salmon from rivers and streams south of the Klamath River to the Russian River, California (64FR50394, September 16, 1999). Seven artificial propagation programs are proposed to be included as part of the ESU: the Humboldt Fish Action Council (Freshwater Creek), Yager Creek, Redwood Creek, Hollow Tree, Van Arsdale Fish Station, Mattole Salmon Group, and Mad River Hatchery fall-run Chinook hatchery programs. NMFS has determined that these artificially propagated stocks are genetically no more than moderately divergent from the natural populations.

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8 The range of consultation standards for listed salmon populations is large. For example, the standard for Puget Sound spring and fall Chinook is a brood year exploitation rate of 5% or less on average in PFMC fisheries; for Lower Columbia River tule fall Chinook, a brood year exploitation rate not more than 49% in all fisheries combined; 13% to 35% annual exploitation rate in all fisheries combined for Oregon Coastal Natural coho; and an annual ocean exploitation rate of 13% or less for Southern Oregon Northern California coho. Spawner reduction rates between 23% and 26% are expected for Sacramento winter Chinook under the consultation standard for that stock.

Critical habitat was vacated by court order on September 29, 2003 (68FR 55900). Proposed critical habitat for coastal Chinook was published December 10, 2004 (69FR 71880). Proposed critical habitat for coastal Chinook includes 1,513 miles of stream habitat and 25 square miles of estuary habitat. Marine waters are not proposed for listing as critical habitat.

These proposed listings are based on a number of reports from NMFS, including the updated status review published in 2003 by the west coast Biological Review Team (BRT). The status review provided the BRT findings on the status of 27 salmonids ESUs, including coastal Chinook. The BRT used the Viable Salmon Populations (VSP) model developed by McElhany et al. (2000) which assesses risk to salmon populations based upon four criteria: abundance, growth rate/productivity, spatial structure and connectivity, and diversity. The BRT found moderately high risks to the coastal Chinook in each of these categories. The BRT could not perform a formal analysis of coastal Chinook population trends due to insufficient data.

A review of spawning surveys at the following sites was conducted as part of the status review of coastal Chinook: Prairie Creek (Redwood Creek Basin), Freshwater Creek, Mad River/Eel River, Mattole River, and the Russian River. In each of these surveys, counts were incomplete, survey methods were inconsistent, or the time series was too short to draw inferences regarding trends. Nonetheless, a review of the existing surveys suggests that coastal Chinook spawning numbers are not declining since the 2000 opinion and in the Russian River, spawner counts have increased recently. However, the genetic composition of the Russian River Chinook is not known, therefore evaluating the significance of the recent increases to the wild coastal Chinook population is not possible. It is clear that all of the spawner counts are substantially lower than historic estimates of coastal Chinook in the ESU, and this is particularly true for the spring run component of the ESU.

The BRT concluded that no new information was available to suggest that coastal Chinook should be re-classified as endangered, rather than threatened. The following two paragraphs provide the findings of the BRT regarding coastal Chinook for the 2003 report (NMFS 2003):

A majority (67%) of the BRT votes for the ESU fell in the "likely to become endangered" category, with votes falling in the "danger of extinction" category outnumbering those in "not warranted" category by nearly 2-to-1. The BRT found moderately high risks in all VSP elements, with mean risk matrix scores ranging from 3.1 for diversity to 3.9 for abundance (on a scale of 1 to 5).

The BRT was concerned by continued evidence of low population sizes relative to historical abundance and mixed trends in the few time series of abundance indices available for analysis, and by the low abundance and potential extirpations of populations in the southern part of the ESU. The BRT's concerns regarding genetic integrity of the ESU were moderate or low relative to similar issues from other ESUs because: 1) hatchery production in this ESU is on a minor scale, and 2) current hatchery programs are largely focused on supplementing and restoring local populations. However, the BRT did have concerns with respect to diversity that were based largely on the loss of spring-run Chinook salmon in the Eel River basin and elsewhere in the ESU, and to a lesser degree on the potential loss of diversity concurrent with low abundance or

extirpations of populations in the southern potion of the ESU. Overall, the BRT was strongly concerned by the paucity of information and resultant uncertainty associated with estimates of abundance, natural productivity, and distribution of Chinook salmon in the ESU.

The BRT review and the available spawner counts do not suggest any significant change in the status of the coastal Chinook ESU since the issuance of the 2000 opinion. Therefore, the determination of the 2000 opinion remains unchanged and the 2000 RPA continues to be necessary to ensure that implementation of the Pacific Coast Salmon Plan is not likely to jeopardize the continued existence of coastal Chinook.

7. Implementation of the 2000 RPA

The RPA of the 2000 opinion consists of four parts, which require: 1) a limit on the pre-season harvest rate for age-4 Klamath River fall Chinook salmon; 2) further evaluation by NMFS of the use of the Klamath River fall Chinook age-4 ocean harvest rate as an indicator of the harvest rate on California coastal Chinook populations; 3) the identification of monitoring and evaluation programs that will permit the post-season estimation of ocean harvest rates on one or more appropriate Central Valley Chinook stocks; and 4) monitoring and sampling of ocean salmon fisheries for stock composition, including the collection of coded wire tags in all fisheries and other biological information to allow for a post-season analysis of fishery impacts on listed species.

NMFS will take the following actions with respect to parts 1 and 2 of the the RPA of the 2000 opinion to ensure that the PFMC and NMFS have sufficient information regarding the accuracy of the KOHM in predicting ocean harvest rates, and to ensure that additional information on the ocean distribution of coastal Chinook, necessary for assessing the impacts of ocean salmon fisheries, is acquired in a timely manner.

1) Management measures developed under the FMP must achieve a projected age-4 ocean harvest rate on Klamath River fall Chinook of 0.16 or less.

The limit of 0.16 on the pre-season harvest rate target for age-4 Klamath River fall Chinook remains unchanged, pending an assessment of the accuracy of the KOHM. Ocean harvest rates are forecast with predictors intended to be unbiased and the realized harvest rates are expected to deviate both positively and negatively from the predicted values.

As a result of the observed 2004 harvest rate of 0.52, NMFS is concerned that the specification of a pre-season rate alone may not provide sufficient protection for coastal Chinook. At present it is unknown whether such a large deviation is the result of chronic changes in the distribution and/or vulnerability of Klamath River fall Chinook (and perhaps coastal Chinook as well) or only an unusual event, consistent with the inter-annual variability of these estimates. If the former is true, as indicated by a continuation in 2005 of the exceptionally high values of contact rates per unit effort (*c/f*) observed in 2004, NMFS, in cooperation with the PFMC and STT will modify the KOHM for the 2006 seasons to more heavily weight recent year *c/f* values. If the

2005 observed *c/f* values are reasonably close to predicted values, suggesting that the 2004 result was exceptional, NMFS will determine whether coastal Chinook can tolerate occasional events like the 2004 harvest rate. To answer that question, NMFS will estimate how frequently large scale deviations of the post-season rate from the pre-season target are expected to occur. Specifically NMFS should know the probability that the post-season age-4 harvest rate will not exceed a specified limit, given a pre-season harvest rate target. Depending on the outcome of that product, NMFS may specify either pre- or post-season limits on the age-4 harvest rate to better protect coastal Chinook. The methodology for estimating the accuracy of the KOHM will be developed by the Southwest Fisheries Science Center. If NMFS integrates the estimation of the accuracy of the harvest rate prediction into the RPA of the 2000 opinion, the methodology will be reviewed by the PFMC's Statistical and Scientific Committee.

2) NMFS must continue to evaluate the use of the Klamath River fall Chinook age-4 ocean harvest rate as an indicator of the harvest rate on California coastal Chinook populations.

The second part of the 2000 RPA identified the need to evaluate whether applying a harvest rate limit only to those management areas most likely to affect harvest of coastal Chinook would provide better protection for the population. Since the issuance of the 2000 opinion, little new information has been collected on coastal Chinook that would help in this evaluation. The uncertainty regarding the extent to which Klamath River fall Chinook harvest rates correspond to coastal Chinook harvest rates, and the poor performance of the KOHM in predicting the 2004 harvest rate underscore the urgent need for better information on the coastal Chinook population.

NMFS will initiate a study of the 2006 fishery to determine the feasibility of characterizing the ocean catch and distribution of coastal Chinook relative to other stocks, between the U.S. - Mexico border and Cape Falcon, using genetic stock identification techniques. If the study indicates that reasonable levels of sampling of commercial and recreational ocean fisheries can usefully characterize the catch and distribution of coastal Chinook, NMFS will conduct such a study, to be completed by 2010, for a minimum of three consecutive years. NMFS will evaluate the results and revise the coastal Chinook RPA as appropriate.

8. Incidental Take Statement

The incidental take statement of the 2000 opinion remains unchanged with respect to coastal Chinook. NMFS expects that new information regarding the ocean distribution of coastal Chinook and estimates of the accuracy of NMFS' predictions of ocean harvest rates will provide the basis for revising the incidental take statement in the future.

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