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National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Northwest Fisheries Science Center
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Seattle, Washington 98112-2097

March 14 2001

WEST COAST STE...
ADMIN RECORD
VIII. A.

MEMORANDUM FOR: F/NWR - Donna Darm
F/SWR - Rebecca Lent

FROM: F/NWC - Usha Varanasi *Usha Varanasi*
for F/SWC - Michael F. Tillman

SUBJECT: Biological Review Team Reevaluation of Klamath Mountains Province steelhead

The west coast steelhead Biological Review Team (BRT) met on March 6 and 7, 2001 at the Northwest Fisheries Science Center to consider new information submitted in response to the February 12 proposed rule to list the Klamath Mountains Province Steelhead ESU as Threatened under the Endangered Species Act. Comanagers met with the BRT on March 6, including Oregon Department of Fish and Wildlife, California Department of Fish and Game, Hoopa Valley Tribe, Yurok Tribe, and the U.S. Fish and Wildlife Service.

Attached is the BRT report, "Reevaluation of the Status of Klamath Mountains Province Steelhead" which summarizes pertinent information considered by the BRT and provides a discussion of the BRTs conclusions with regard to the current status of this ESU.

Please contact Dr. Robin Waples, NWFSC, or Dr. Pete Adams, SWFSC, if you have any questions about this report.

cc: F/NWR3 - Garth Griffin
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BRT

Reevaluation of the Status of Klamath Mountains Province Steelhead

14 March 2001

Prepared by the
West Coast Steelhead Biological Review Team

Table of Contents

ACKNOWLEDGMENTS iv

INTRODUCTION 1
Listing History for KMP Steelhead 1
Status Assessments (1994-1998) 2

CURRENT RISK ASSESSMENT 5
KMP Steelhead–Oregon 5
Adult Steelhead 5
Juvenile Steelhead 6
KMP Steelhead–California 8
Trends 8
Distribution 9
Hatchery Fish 9
Outmigrating Smolt Data 9

DISCUSSION AND BRT CONCLUSIONS 10
Discussion 10
Naturally spawning hatchery fish 10
Declining trends 11
Population Abundance and Distribution 12
Summer Steelhead 13
Viability Analyses 14
BRT Determination 14
BRT Conclusions 17

CITATIONS 21

Appendix A: Risk Matrix Approach 25

ACKNOWLEDGMENTS

The Biological Review Team (BRT) for this evaluation of Klamath Mountains Province steelhead included: Peggy Busby, Dr. Richard Gustafson, Dr. Robert Iwamoto, Gene Matthews, Dr. James Myers, Dr. Mary Ruckelshaus, Dr. Michael Schiewe, Dr. Thomas Wainwright, Dr. Robin Waples, and Dr. John Williams, from NMFS Northwest Fisheries Science Center (NWFSC); Dr. Peter Adams, Dr. Eric Bjorkstedt, and Tommy Williams from NMFS Southwest Fisheries Science Center (SWFSC); Greg Bryant and Craig Wingert from NMFS Southwest Region (SWR); and Dr. Reg Reisenbichler from the Northwest Biological Science Center, USGS Biological Resources Division, Seattle.

Additional support and analyses for this evaluation were provided by Dr. Thomas Good and Dr. Michelle McClure (NWFSC), Craig Heberer (SWR), and Steve Stone (NWR).

The Biological Review Team would like to thank the numerous agencies, governments, and individuals that provided information for this review.

INTRODUCTION

In March 1999, a lawsuit was filed challenging the National Marine Fisheries Service's (NMFS) decision not to list the Klamath Mountains Province (KMP) and Northern California ESUs[1] for steelhead under the U.S. Endangered Species Act (ESA). Subsequently, Northern California ESU was listed as threatened in June 2000 (NMFS 2000) based on the failure of the State of California to implement critical conservation measures. In October 2000, U.S. District Judge Susan Illston ruled that NMFS' decision not to list KMP steelhead was arbitrary and capricious, and set aside the March 1998 final rule (NMFS 1998). Judge Illston has directed NMFS to further consider the status of KMP steelhead and file its decision by 31 March 2001. This document summarizes the information used in reconsidering the status of this ESU.

Listing History for KMP Steelhead

The Klamath Mountains Province (KMP) ESU for steelhead (*Oncorhynchus mykiss*) was identified by Busby et al. (1994) in the culmination of a status review originated in response to a 1992 petition to list southwest Oregon's Illinois River winter steelhead as a threatened or endangered "species" under the ESA. The KMP ESU occupies river basins from the Elk River in Oregon south to the Klamath and Trinity Rivers in California, inclusive. This ESU includes both winter and summer steelhead. Steelhead from this region are genetically distinct from populations to the north and south. The "half-pounder" life history[2] is reported only from this region. The Klamath Mountains Province is a unique geographical area with unusual geology and plant communities.

In March 1995, based on the status review (Busby et al. 1994), NMFS proposed to list the KMP ESU as threatened under the ESA (NMFS 1995). Concurrent with the KMP status review, NMFS conducted a status review of all west coast steelhead from Washington, Oregon, Idaho, and California (Busby et al. 1996). In 1996 NMFS published a Federal Register Notice (NMFS 1996) which described the 15 steelhead ESUs identified in the coastwide status review and proposed listing status for ten of the ESUs, including a reiteration of the proposed threatened

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[1]The Endangered Species Act (ESA) allows listing of "distinct population segments" of vertebrates as well as named species and subspecies. The policy of the National Marine Fisheries Service (NMFS) on this issue for Pacific salmon and steelhead is that a population will be considered "distinct" for purposes of the ESA if it represents an Evolutionarily Significant Unit (ESU) of the species as a whole. To be considered an ESU, a population or group of populations must 1) be substantially reproductively isolated from other populations, and 2) contribute substantially to ecological/genetic diversity of the biological species.

[2]The *half-pounder* (Snyder 1925) is a life history trait of steelhead that is found only in the Rogue, Klamath, Mad, and Eel Rivers of southern Oregon and northern California. Following smoltification, half-pounders spend only 2-4 months in the ocean, then return to fresh water. They overwinter in fresh water and emigrate to salt water again the following spring. This is often termed a false spawning migration, as few half-pounders are sexually mature.

status for KMP steelhead. The final determination for KMP steelhead, and four other ESUs, was extended in August 1997 (NMFS 1997), due to substantial scientific disagreement.

In March 1998, NMFS stated that the KMP ESU, along with Oregon Coast and Northern California ESUs, did not warrant listing, but should be classified as a candidate species (NMFS 1998) . Candidate status for KMP steelhead was formalized in June 1999 (NMFS 1999). In response to the ruling by Judge Illston, NMFS published a proposed rule to list KMP steelhead as threatened (NMFS 2001). The Federal Register Notices pertinent to this listing history for KMP steelhead are summarized on Table 1.

Status Assessments (1994-1998)

The Biological Review Team (BRT) that initially identified the KMP ESU expressed five areas of concern regarding the abundance of steelhead within the ESU (Busby et.al. 1994):

1. Although historical trends in overall abundance within the ESU are not clearly understood, there has been a substantial replacement of natural fish with hatchery produced fish.
2. Since about 1970, trends in abundance have been downward in most steelhead populations within the ESU, and a number of populations are considered by various agencies and groups to be at moderate to high risk of extinction.
3. Declines in summer steelhead populations are of particular concern.
4. Most populations of steelhead within the area experience a substantial infusion of naturally-spawning hatchery fish each year. After accounting for the contribution of these hatchery fish, we are unable to identify any steelhead populations that are naturally self-sustaining.
5. Total abundance of adult steelhead remains fairly large (above 10,000 individuals) in several river basins within the region, but several basins have natural runs below 1,000 adults per year.

Post-Proposed Rule Findings–In the public comment period following the August 1996 proposed rule (NMFS 1996), the Oregon Department of Fish and Wildlife (ODFW) and California Department of Fish and Game (CDFG) submitted comments disagreeing with NMFS' conclusions on the status of KMP steelhead. These comments were detailed in the July 1997 scientific disagreements memorandum from the Northwest Fisheries Science Center to the Northwest and Southwest Regional Directorates (Schiewe 1997a) and are summarized below.

- ODFW developed their own model (Chilcote 1997) to assess steelhead status in Oregon. Based on their assessment, they felt KMP steelhead did not warrant being listed as threatened.
- ODFW revised their estimates of the proportion of hatchery fish in steelhead runs. ODFW and CDFG disagreed with NMFS' use of hatchery data.
- ODFW disagreed with NMFS' use of the natural return ratio (NRR).
- ODFW disagreed with NMFS' use of angler catch data, preferring their newly developed model (Chilcote 1997) instead.

Table 1. Federal register notices of proposed and final rules on Klamath Mountains Province ESU for steelhead.

Date	Federal register	Action	Explanation	KMP status
05/20/93	58 FR 29390-29392	Request for information	Status review initiated by NMFS	ESU not yet described
05/27/94	59 FR 27527-27528	Request for information	Receipt of coastwide petition	ESU not yet described
03/16/95	60 FR 14253-14261	Proposed rule	Proposed as threatened	Proposed threatened
09/18/95	60 FR 48086	Supplementary proposed rule	Proposed protective regulations (supplements above proposed rule)	Proposed threatened
08/09/96	61 FR 41541-41561	Proposed rule	Proposed as threatened (along with other proposed listings developed from the WCS status review)	Proposed threatened
08/18/97	62 FR 43974-43976	Extension of proposed rule deadline	Six-month extension for scientific disagreement	Proposed threatened
03/19/98	63 FR 13347-13371	Final rule–determination	KMP and others not warranted for listing, warrant candidate status	Listing not warranted
06/23/99	64 FR 33466-33468	Notice of modification of list of candidate species	KMP (also NC and OC) added to candidate species list	Candidate species
02/12/01	66 FR 9808-9813	Proposed rule	Proposed as threatened	Proposed threatened

The BRT reconvened to consider the issues of scientific disagreement and communicated their findings to the Northwest and Southwest Regional Directorates in December 1997 (Schiewe 1997b). The BRT's findings are summarized below.

1. **ODFW's conservation assessment**–The BRT did not place much emphasis on the overall risk conclusions of the ODFW report due to parameter uncertainty, critical reports from peer reviewer on the scoring system proposed, and an unclear correlation between ODFW risk categories and ESA definitions of threatened and endangered species. For a full discussion of the ODFW conservation assessment and peer review comments, see Schiewe 1997b.
2. **Hatchery fish data and NRR**–Both ODFW and CDFG submitted updated information on hatchery fish abundance in the streams occupied by the KMP ESU. The new data were incorporated into existing data sets. The BRT concluded that the NRR was a valuable tool as an indicator of the sustainability of natural populations, which in turn is an indicator of extinction risk for ESUs. The BRT acknowledged that the NRR was not perfect but found that the lack of availability of data on habitat capacity (present or historical) made ODFW's alternative unfeasible.
3. **Use of angler catch data**–The BRT concluded that "the question of which method--angler catch data (with all of its limitations) or ODFW's modeling approach (an as-yet unvalidated model parameterized with data from a subset of streams within each ESU), provides a better estimate of population trends for steelhead, needed to be carefully considered. This issue is critical to ensuring the most reliable evaluation of extinction risk. The new ODFW data (smolt abundance from 3 rivers in the Klamath Mountains Province ESU and more recent estimates of adult abundance from a subset of river basins in all 3 affected ESUs) needed to be reviewed in conjunction with an detailed evaluation of their modeling approach" (Schiewe 1997b, p. 16).

BRT's conclusions–After considering the scientific disagreements and new data, the BRT arrived at the following conclusions (Schiewe 1997b, p.29):

> A majority of the BRT concluded that steelhead in the Klamath Mountains Province ESU are likely to become endangered in the foreseeable future, while a minority felt that this ESU was not presently at significant risk. The BRT expressed concern about the many populations in the Klamath Mountains Province ESU for which there are no recent abundance data. The BRT felt that conserving the diversity of both summer and winter life history forms was especially important in this ESU because of the broad distribution of summer steelhead populations throughout the KMP region, resulting in an unusual richness of the summer steelhead ecotype in this, compared to other, coastal steelhead ESUs. Although the percentage of naturally spawning hatchery fish is relatively low to moderate (5-29%) in Oregon streams in this ESU, and the number of hatchery fish planted is being reduced, the BRT expressed concern with the percentage of hatchery strays (average 11%) of unknown origin spawning naturally in unplanted Oregon streams. In California, the risk associated with hatchery operations in the Klamath and Trinity Rivers was a major concern to the BRT, due to the long-term high abundance of naturally spawning hatchery fish in the Trinity River and the apparent inability of the Iron Gate Hatchery stock, derived from native fish, to maintain itself. Although the Iron

Gate Hatchery stock was not by itself evaluated as an ESU consideration, its dramatic decline is thought to result from current mainstem habitat conditions, and therefore its downward trend may be representative of risks associated with the native population. Widespread loss of historic spawning habitat due to blockages by dams and reduction in instream habitat quality caused by logging, water withdrawals, sedimentation, and mining are continuing risk factors for steelhead in this ESU.

NMFS' Listing Determination (1998)–NMFS determined that "existing and recently implemented State conservation efforts, and Federal management programs such as the NFP" [National Forest Plan] "have ameliorated risks to this species" (NMFS 1998, p. 13366). However, NMFS remained concerned about the status of steelhead in the KMP ESU and determined that additional monitoring was necessary as a candidate species, and that its status would be revisited within four years (NMFS 1998).

CURRENT RISK ASSESSMENT

The determination by NMFS to place KMP steelhead on the candidate species list was based on data available during the initial status review, data made available during the 1997 scientific disagreements deferral, and conservation measures developed by the states of Oregon and California. For the current review, the BRT considered information that has become available since the 1997 assessment, with particular emphasis on how that information addressed the five concerns that the BRT initially expressed in 1994. Information from a wide variety of sources was submitted to NMFS during the public comment period, at public hearings, and during meetings with comanagers. As with previous BRT reports, this document does not attempt to provide a comprehensive listing of information received and considered, rather only information directly integral to the BRTs findings will be cited.

The geographic location of the KMP ESU spans the border between the states of Oregon and California. As data availability and format differ greatly between the two sides of the ESU, this "Risk Assessment" section will be structured accordingly.

KMP Steelhead–Oregon

The steelhead river basins on the Oregon side of the KMP ESU include the Elk River (Cape Blanco) and all steelhead bearing streams south of that basin. All of the data presented for Oregon-KMP were provided by ODFW.

Adult Steelhead

Prior to 1991, data on steelhead populations and trends were available through angler reports; changes in fishing regulations since 1991 have restricted anglers from retaining wild fish, making this type of data less useful. Other long-term data sets for Oregon-KMP steelhead are available, as well as new methods currently being developed.

Dam counts have been another source of information for estimating steelhead abundance. Data for steelhead runs passing Gold Ray Dam on the Rogue River (RKm 203) are available from 1943 to present (Chilcote 1997, Chilcote 2001, ODFW 1990, ODFW 1994, Streamnet 2001). Applegate Dam (RKm 75 of the Applegate River, tributary to the Rogue River at RKm 154) is another location where steelhead abundance is monitored, through trapping of adults to collect broodstock (Chilcote 2001). Seining steelhead in the lower Rogue River, in the vicinity of Huntley Park, has been used to monitor summer steelhead and half-pounders since 1976 (Streamnet 2001). Redd counts are used by ODFW to monitor some steelhead populations (Chilcote 2001). Chilcote (1997) describes the formula used by ODFW to convert redd counts to an estimate of spawner abundance, which requires estimates or assumptions of the proportion of female steelhead in the spawning population. To collect data on adult steelhead beyond the Rogue River Basin, ODFW has begun using gillnets to sample winter steelhead in coastal streams (Bowles 2001).

Abundance and trends–Schiewe (1997b) reported 5-year geometric means (1993-1997) for wild steelhead from the Applegate and Upper Rogue Rivers. Updated data were considered in the current review (1996-2000) with mixed results. Applegate River wild winter steelhead increased from 906 to 1,325. Upper Rogue River wild winter steelhead are relatively unchanged from 6,838 to 6,789. Upper Rogue River wild summer steelhead declined from 3,885 to 2,973.

Long term trends for steelhead within the Rogue River Basin appear to be somewhat positive for wild winter steelhead, while several populations of summer steelhead that occupy tributaries in the mid-Rogue area exhibit long-term declines; however, some of these populations demonstrate positive short-term trends (Table 2). No current abundance and trend information is available for Oregon-KMP steelhead outside of the Rogue River Basin.

Hatchery contribution–In recent years, ODFW has been changing hatchery release policies. Currently, within the Oregon portion of KMP, hatchery steelhead are released at three locations: Cole Rivers Hatchery (Rogue River), Applegate Dam (Applegate River, Rogue River Basin) and Chetco River (downstream of the North Fork) (ODFW 2001). As of 1998, ODFW estimated that 15% of natural steelhead spawning within the Oregon-KMP was by hatchery origin fish (ODFW 2001). Preliminary data from gillnet sampling in Oregon-KMP streams outside of the Rogue River Basin suggest a hatchery fish proportion of <7% among returning steelhead, all of which would be strays from undetermined hatcheries (ODFW 2001). Similar data collection in the Chetco River has yielded unclear results, as the gillnet sampling occurs below the North Fork Chetco River, the area of the basin to which hatchery fish would be expected to return.

Juvenile Steelhead

ODFW conducted juvenile surveys for wild steelhead at randomly selected sites in 1999 and 2000 (ODFW 2001). Juvenile steelhead were present at 96% of the 48 Rogue River Basin

Table 2. Abundance and trend data for Oregon steelhead populations in the Rogue River Basin.

Population	Data type[1]	Time frame	Data range (among years)	5 yr. geometric mean	Short-term trend (7-10 yr) percent change per year (se)	Long-term trend, percent change per year (se)	Reference
Kane Creek summer steelhead	RC	1975-1998	6.9-31.3 redds/mile	7.0 redds/mile	4.9 (12.7)	-13.5 (2.5)	Martin (ODFW) 1999
Foots Creek summer steelhead	RC	1975-1998	4.7-10 redds/mile	6.0 redds/mile	-20.3 (8.3)	-13.7 (2.2)	Martin (ODFW) 1999
Antelope Creek summer steelhead	RC	1983-1998	0.0-30.7 redds/mile	3.0 redds/mile	14.7 (10.8)	-11.2 (4.9)	Martin (ODFW) 1999
Cheney Creek summer steelhead	RC	1983-1998	0.7-41.5 redds/mile	4.0 redds/mile	-18.2 (8.3)	-11.1 (4.8)	Martin (ODFW) 1999
Jones Creek summer steelhead	RC	1983-1998	0.0-44.0 redds/mile	10.0 redds/mile	0.8 (11.0)	-4.8 (4.6)	Martin (ODFW) 1999
Coyote Creek summer steelhead	RC	1986-1998	0.0-38.0 redds/mile	3.0 redds/mile	-19.6 (9.6)	-24.3 (6.4)	Martin (ODFW) 1999
Indian Creek summer steelhead	RC	1981-1997	8.0-57.3 redds/mile	11.0 redds/mile	-15.1 (4.5)	-12.1 (2.5)	Martin (ODFW) 1999
Upper Rogue River wild winter steelhead	DC	1943-2000		6,789	9.2 (4.9)	0.6 (0.3)	Streamnet, Chilcote 2001
Upper Rogue River wild summer steelhead	DC	1943-2000		2,973	-1.3 (5.1)	0.5 (0.5)	Streamnet, Chilcote 2001
Applegate River wild winter steelhead	RR	1983-2000		1,325	21.1 (7.9)	6.9 (3.6)	Chilcote 2001
Lower Rogue River wild summer steelhead–adults	S	1976-1998			15.4 (5.9)	-6.1 (2.0)	Streamnet
Lower Rogue River hatchery summer steelhead–adults	S	1976-1998			22.8 (9.4)	-2.1 (2.2)	Streamnet
Lower Rogue River wild steelhead–half-pounders	S	1976-1998			7.8 (8.2)	-3.7 (1.9)	Streamnet
Lower Rogue River hatchery steelhead–half-pounders	S	1976-1998			25.1 (8.8)	4.0 (2.5)	Streamnet

[1]Data Types

RD = redd count — DC = dam count

RR = run reconstruction (see reference) — S = seining sites sampled in 1999 and 95% of the 44 sites sampled in 2000. In other coastal basins within the Oregon-KMP, juveniles were present at all of the 47 sites in 1999 and the 44 sites in 2000. It was noted that sub-yearling steelhead and cutthroat trout could not be visually differentiated, but as estimates of cutthroat trout in >1+ samples ranged from 10% in the Rogue Basin to 15% outside of the basin, it was felt that most of the juveniles were steelhead. Densities of sub-yearlings (0.32 to 0.96 fish/m^2) and yearling and older fish (0.034 to 0.097 fish/m^2) were variable but similar to published late-summer densities in streams of the Pacific Northwest (ODFW 2001). Sites outside of the Rogue basin were comparable to (generally higher, but not statistically different from) those inside of it in terms of juvenile densities.

KMP Steelhead–California

The steelhead river basins on the California side of the KMP ESU (California-KMP) include all steelhead bearing streams from the Oregon border, south to include the Klamath-Trinity River Basin. Primary steelhead streams include the Smith River, Klamath River Basin, and Trinity River Basin. South of this is the Northern California steelhead ESU (Busby et al. 1996). Numerous data sets including new or updated time series of abundance estimates or indices for various life history stages and run-types of steelhead in the California portion of the KMP were provided by USFS, USFWS, CDFG, the Hoopa Valley and Yurok Tribes, Simpson Lumber, and Stimson Lumber. Below, we highlight data sets that proved useful in evaluating the status of KMP steelhead. Much of these data consist of population indices, such as "peak live fish counts" or "smolt abundance indices" rather than estimates of actual abundance. Most data on adult numbers represent summer steelhead, as winter steelhead are difficult to observe; conversely, most data on smolt or juvenile abundance are thought to be dominated by production of winter steelhead, as this is the dominant life-history type in the area.

Trends

Overall, recent trends for summer steelhead were mixed. Updated time series based on snorkel counts of summer steelhead in holding pools ("peak live fish") for Elk Creek, Dillon Creek, Clear Creek and Wooley Creek (tributaries of the Klamath; all updated through 2000) indicated that summer steelhead numbers remained low throughout the 1990s but suggest a modest increase in abundance in 2000 (KNF 2001). Similar abundance indices for the South Fork of the Trinity River and Hayfork Creek suggest similar modest increases in abundance of summer steelhead in the late 1990s to 2000, although the numbers of steelhead counted remained low. Based on snorkel counts through 1998, summer steelhead in the New River appear to be relatively stable—this may reflect the remote, relatively pristine nature of the New River Basin. Updated snorkel counts in the Smith River did not show an upturn in 2000 and downward trends persisted in the updated datasets (Smith River NRA 2001); however, these data were collected from a small section of the river and may not be representative of the total population of summer steelhead in the Smith River (Smith River NRA 2001).

Updated estimates of the total number of fall-run steelhead in the Trinity River, the natural component of this run and the escapement of natural fish based on counts of fish passed through the Willow Creek Weir suggest an upward trend in the run-size and escapement of natural fish in the late 1990s (Koch 2001). Catch records for the Klamath river indicate a similar upturn in catch (and release) of naturally spawned winter-run steelhead beginning in 1997 (Koch 2001).

Distribution

Few data are available describing the historic and current distribution of summer steelhead throughout the ESU. Data on positive distribution of summer steelhead in the California portion of the KMP can be garnered from the aggregated data sets, but no systematic survey of presence or absence of summer steelhead was available. A 1997 Klamath National Forest survey found no adult steelhead in one stream, and found only half-pounders in two other streams, all of which had contained adult steelhead in previous years. With so few data, no determination of changes in distribution could be made.

Hatchery Fish

Data from the Willow Creek Weir on the Trinity River indicate that hatchery fish comprise 20-70% of steelhead moving upstream during the weir's deployment—this weir samples mostly fall-run steelhead (Koch 2001).

In the Smith River, estimates of hatchery composition are available from angler-catch data and they show a range of about 27%-37% hatchery composition in recent years (CDFG S-RAMP Study 2c1). These data, however, may overestimate the proportion of hatchery fish in the run because of recent (1998) harvest regulations that restrict catch of wild fish. Furthermore, they do not provide direct estimates of the fraction of hatchery fish that spawn naturally; in this system, hatchery fish are released up to 14 miles upstream of the hatchery facility, fishery data are collected over this portion of the river, and few data (and none that include hatchery-natural ratios) are collected in the spawning habitat, which lies further upstream.

In the Klamath River from 1991 to 1997, between 301 and 583 adult steelhead were reported as retained annually in the Klamath (Koch 2001) . After the prohibition on retaining wild fish was implemented in 1998, the total number of fish retained dropped to 33-72 in 1998-2000; over the same period, catch and release of adults rose from almost zero to 2000 adults in 2000. This suggests that most of the adult steelhead captured by anglers in the Klamath River basin are of natural origin.

Outmigrating Smolt Data

Data on abundance of outmigrating smolts were provided for the following areas: Trinity River near Willow Creek and Horse Linto Creek (Boberg 1996); Shasta and Scott Rivers (CDFG S-RAMP Study 3a1); Mill Creek, a tributary of the Smith River (Stimson Lumber Co.), a set of creeks in the Little River watershed (Simpson Lumber Co.); Mill Creek, a tributary of the Trinity River (Hoopa Valley Tribe); Hunter and McGarvey Creeks, tributaries to the Klamath (Yurok Tribe 2001), and the Klamath (Big Bar) and Trinity (near Willow Creek) Rivers (Gould, FWS

2001). Data provided by Simpson Lumber, Stimpson Lumber and the Yurok Tribe were collected using stratified mark-recapture methods to estimate trap efficiency—these estimates are likely to be reasonably accurate and in these cases, . In other cases, data are often presented as unexpanded counts, or estimates based on less rigorous expansions. Little useful information relevant to assessing risks facing KMP steelhead was gleaned from these data due to the variability in the data, high uncertainty regarding how well some of these data sets reflect actual abundance of outmigrating smolts, and uncertainty in how these data indicate the status of the population. Nevertheless, increasing trends in smolt production were noted for the West Branch of Mill Creek (Smith River) and Hunter and McGarvey Creeks (Klamath).

DISCUSSION AND BRT CONCLUSIONS

The BRT considered the new information in the context of previously existing information and discussed the interpretation of these collective data with respect to a variety of factors that have been important in previous risk assessments for this ESU.

Discussion

Naturally spawning hatchery fish

The original status review for KMP (Busby et al. 1994) identified the high estimated proportion of naturally spawning hatchery fish as a major risk factor. Subsequently, ODFW (Chilcote 1997) indicated that some of the earlier estimates they had provided, and which were used in the 1994 status review, were largely based on samples provided by anglers and thus were upwardly biased by counts of non-spawning half-pounders. More recently, ODFW (2001) has collected new empirical data indicating that the percentage of naturally spawning hatchery fish is very low (<4%) in the upper Rogue Basin. The hatchery proportion remains relatively high in two areas of the Oregon portion of the ESU that still have hatchery programs: the Applegate River (about 25% of natural spawners are hatchery origin) and the Chetco River (about 50% of the fish in the lower river are of hatchery origin). The incidence of natural spawning by hatchery fish in the Chetco River is not known but is likely much lower; most of the spawning areas are above the sampling area, which is also near the area where juvenile hatchery fish are released and hatchery broodstock is collected. In 2000-01, ODFW also sampled adult steelhead returning to other non-Rogue streams in the Oregon part of this ESU and found that 7% were hatchery fish. This compares with an estimate of 15% in the 1997 ODFW report and 25-80% for most populations considered by Busby et al. (1994) for which ODFW provided information.

In California, the largest proportions of naturally spawning hatchery fish are believed to occur in the Trinity River, where estimates from the 1990s range from 20%-70% hatchery. These estimates apply to fall-run fish. Because the hatchery program in the Trinity propagates mostly fall-run fish, natural spawners in the Trinity River that return at other runtimes are believed to be predominantly of natural origin. In the Klamath, the Iron Gate Hatchery stock has been such a poor producer of adult returns (Koch 2001) that the proportion of naturally spawning hatchery fish in the basin is believed to be low. As discussed above, recent angler-catch data for the Klamath River (CDFG) supports this conclusion. In the Smith River, an estimated 27-37% of adults in the lower portion of the river have been hatchery fish in recent years; however, as discussed above, this probably overestimates (but by an unknown amount) the proportion of hatchery fish in natural spawning areas.

Based on this information, the BRT concluded that significant impacts of naturally spawning hatchery fish appear to be localized to a few areas of the ESU: the Applegate River, the Trinity River fall run, and perhaps the Smith River and the Chetco River.

Declining trends

Most populations in the Oregon part of this ESU for which adequate data were available during the initial status review showed sharply declining trends (Busby et al. 1994). Trends were mixed in the data sets for California populations. For both states, the trends in the initial status review were based on data series that ended in 1989 to 1991. Comparisons of recent trends with these older data are difficult because most of the Oregon data series were based on angler counts, and these data stopped after implementation of catch and release regulations in 1991. Outside of the Rogue River in Oregon, no recent information is available to estimate trends in adult abundance.

In California, adult trend data are available for a number of relatively small summer steelhead populations. Most of these showed a precipitous decline to very low abundance around 1990 and relatively little change since that time. In 2000, however, many of these populations showed a modest increase in abundance.

Interpretation of these trend data is difficult because they are sensitive to the initial year in the data series. For most steelhead populations coastwide, peak abundances over the last 30-40 years occurred during the 1980s. Therefore, population trends that started during this period almost universally show declines. However, it is difficult to determine whether these declines are part of a natural cycle of abundance or something more serious. Trends that cover longer time series (e.g., the counts at Gold Ray Dam) are often positive or flat. Most of the trends for summer steelhead are based on snorkle surveys that do not represent population abundance and are difficult to standardize across years.

Some insight into effects of the last few years of data on population trends can be gained by comparing current short-term trends (based on the most recent 7-10 years of data) with short-term trends computed based on data available at the time of the last status review update (1997). In Oregon streams, the current short term trends are more positive (or at least less negative) than they were in 1997 for all of the streams for which a comparison is possible; in California streams, seven of the current trends for natural populations are better than they were in 1997, two are essentially unchanged, and two are less favorable than they were in 1997. Collectively, these data indicate that in most areas within the ESU, recent trends are somewhat more favorable now than they were at the time of the last status assessment. In spite of these relative improvements, however, in some cases the populations are still declining.

Population Abundance and Distribution

Reliable estimates of population abundance are available for only a fraction of the populations in this ESU. Throughout the ESU, monitoring of winter steelhead--which local biologists agree is the dominant and most abundant life history form--is very poor due to logistical difficulties in sampling adults during the winter season. The most reliable data are probably counts at Gold Ray Dam that separate fish of hatchery and natural origin. These data show recent (5yr) geometric mean abundance of about 6800 natural origin winter steelhead and about 3000 natural origin summer steelhead. In the Trinity River, counts at Willow Creek weir provide an estimate of about 2000 natural origin fall-run spawners per year.

To help address the considerable information gap for the majority of steelhead populations in this ESU, in 1999 and 2000 ODFW conducted juvenile density surveys in streams in Oregon. Based on results summarized above, they concluded that steelhead populations in other Oregon streams in the ESU were at least as robust as those in the Rogue basin. ODFW also found juvenile *O. mykiss* present in almost all the sites they examined in the Rogue River basin and in all of the sites examined in other Oregon streams. This suggests that adult steelhead are well distributed throughout suitable habitat in the Oregon portion of the ESU. However, as this study did not separate out data for the higher elevation habitats most likely to support summer steelhead, the mean density values could be masking lower densities of summer steelhead.

ODFW also used four methods to estimate total adult abundance of steelhead in the Oregon portion of the ESU. All involved extrapolation based on the total number of miles of steelhead habitat, and two also involved expanding from juveniles to adults based on estimated survival rates. All methods yielded estimates in the range 69,000 to 83,000 adults.

No comparable methods have been used to estimate total abundance for California populations. However, CDFG and tribal biologists did point out that existing data provide information about only a fraction of the natural steelhead populations in the California portion of this ESU. For example, the Willow Creek weir samples steelhead only over a period of only about 3 months during the fall run and thus provides no information about other runs in the basin. Based on professional judgement and the consensus that the largely unsampled winter-run populations are the most abundant, California biologists estimated natural escapement in the California part of this ESU to be approximately 30,000 - 50,000 adults per year. Combined with the ODFW estimates, these suggest the total abundance of naturally spawning steelhead in the ESU may be approximately 100,000 - 130,000.

Finally, ODFW biologists observed that the Klamath Mountains Province ESU is a geologically unique area; in fact, geological and ecological distinctiveness was one of the factors that helped identify this area as an ESU (Busby et al. 1994). This area is characterized by high relief and highly erosive habitat that is more well-suited to steelhead than the generally lower-relief streams in coastal areas to the north and the south of the KMP. The widespread availability of good steelhead habitat throughout the KMP made the ODFW biologists more comfortable in extrapolating steelhead data into unsampled areas.

The BRT regarded the overall abundance estimates as only very crude approximations. Two of the ODFW methods are based on survival estimates that may be optimistic, and all depend on the assumption that unsampled areas are comparable to the small fraction of the areas actually sampled. The abundance estimates for the California side are even less rigorous. However, even if the estimates are high by a factor of two, they still would represent a significant number of natural fish--quite possibly more than in any other steelhead ESU considered in the coastwide status review.

The BRT agreed that the juvenile abundance data suggest that adult steelhead are well distributed throughout at least the Oregon part of the ESU. However, the BRT noted the large variance associated with these estimates and also noted that other studies (e.g., Shea and Mangel 2001) have shown that juvenile abundance data provides at best low power to estimate adult abundance of salmon and steelhead. The BRT asked ODFW whether the average densities for the Rogue River might have been lowered by inclusion of data for depressed summer steelhead populations; if so, the densities in winter run areas outside the Rogue might be comparable to, or even less than, densities for winter-run areas in the Rogue. However, it was not possible within the time frame available to determine whether the data have been collected in a fashion that would allow this type of analysis.

Summer Steelhead

In previous status reviews, the BRT expressed serious concern about the status of summer steelhead in this ESU. Those concerns have not diminished. Summer steelhead populations remain severely depressed throughout the ESU, in spite of a modest upward turn in 2000 in many streams. The uniformity in the status of summer steelhead throughout large geographic areas of this ESU suggest that they may all be experiencing a common risk factor(s)--perhaps poor environmental conditions in freshwater habitat or in the ocean.

As discussed above, little direct information is available regarding historical distribution of summer steelhead in this ESU. However, it is believed that, historically, summer steelhead occurred primarily in the upper parts of the major basins–the Rogue, Klamath, and Trinity. Considerable summer-run habitat has already been lost above impassible dams in these three systems. Recent data indicate that summer steelhead still exist in about five areas within each of these major basins, which may be the most widespread representation of the summer-run life history type for any ESU of the coastal subspecies of steelhead. Whether summer steelhead have disappeared from other areas that they used historically cannot be determined based on available data, but the 1997 Klamath National Forest Survey cited above provides some reason for concern that this may be the case.

Viability Analyses

Chilcote (2001) revised a method he used previously (Chilcote 1997) to estimate viability of Oregon steelhead populations, including four populations in the Rogue River basin for which adequate data were available. On the basis of this analysis, Chilcote concluded that the summer- and winter-run populations in the upper Rogue and the winter run population in the Applegate all have a negligible probability of extinction, but the mid-Rogue summer-run population is at appreciable risk. The BRT has concerns about several aspects of this viability model (in particular the form of the recruitment function, the use of an 18-year cycle of ocean survivals, the choice of viability criteria, and assumptions about hatchery fish) that they believe can lead to overly optimistic conclusions regarding viability. Nevertheless, the BRT did not disagree with the the conclusions regarding viability of the upper Rogue River winter-run population, which appears to be healthy based on overall abundance and trend. The Upper Rogue summer-run population also is relatively large, but the ODFW model does not account for the sharp downward trend in recent years which, if it persists into the future, could eventually place the population at risk. The BRT was skeptical of the conclusion of no extinction risk for the Applegate population because it depends upon specific assumptions about the response of the natural fish to naturally spawning hatchery fish. Other assumptions could lead to the conclusion that the population is falling far short of replacing itself.

BRT Determination

The BRT used a two-step process to develop its conclusions on the status of KMP steelhead: Risk Matrix and FEMAT Risk Assessment.

Risk matrix–The BRT used the above information in filling out the matrix of risk factors (Appendix A). Major elements of that exercise are discussed below.

Abundance and distribution

This element covers demographic and genetic risks caused by small population size and risks to the ESU as a whole caused by reductions in distribution of populations. The mean score for this element was 3.0 (range 2-4), indicating moderate risk. Most of the concerns regarding this element were for summer steelhead populations, most of which are at very low abundance. The BRT remains concerned about possible loss of this key life history type in portions of the ESU.

Trends and productivity

Mean score for this element was 2.9 (range 2-4), indicating moderate risk. The scores reflect the mixed nature of the trend data; many are declining, but others are not. General lack of reliable trend data for most winter-run populations remains a concern and a major source of uncertainty.

Genetic integrity

This element primarily covers genetic risks to natural populations from hatchery programs, including loss of fitness and loss of diversity among populations. The mean score for this element was 2.3 (range 2-3), indicating low to moderate risk. The concerns focused primarily on areas with a relatively high proportion of naturally spawning hatchery fish (Trinity, Applegate, and perhaps Smith and Chetco Rivers).

Other risk factors

The only additional risk factor identified was the very low survival of Iron Gate Hatchery fish. Although in itself this is not a risk factor for wild fish, it may be an indication of serious environmental problems in the river that could also affect wild fish. The BRT expressed concern about this issue but recognized that at this point it is only speculative.

Recent events

The BRT considered factors that have recently occurred and which may have predictable consequences for steelhead populations but whose effects for the most part have not yet been reflected in the data. 1) There are some indications that atmospheric and oceanographic conditions have recently shifted toward a regime more favorable for ocean survival of salmonids in the Pacific Northwest. The majority of the BRT felt that this might benefit steelhead in the KMP ESU in the near future. However, the BRT acknowledged that there is no way to predict with any certainty how long favorable ocean conditions might last, and that no one has demonstrated a direct link between ocean conditions and marine survival of KMP steelhead. 2) The majority of the BRT felt that habitat improvements (e.g., stream restoration activities, riparian corridor restoration, improvements to culverts, road removal) that have occurred through various state and federal programs should improve conditions for steelhead, but there is no basis at this point for quantifying the possible beneficial effects of these activities. 3) No-take provisions for wild steelhead have recently (1998) been implemented in both Oregon and California portions of the ESU. As discussed above, the first 2-3 years of data for Klamath River steelhead suggest that this has already been effective in allowing several hundred more natural fish per year to spawn naturally. The BRT all concluded that this management change would benefit wild steelhead populations in the near term. 4) Drought and recent power shortages. The BRT was concerned that these factors might lead to low water flows in some streams, but insufficient information was available to provide any quantitative evaluation of this factor.

Scores for each of three major risk elements were lower than in the last BRT evaluation of this ESU. In 1997, the mean (and range) scores were 3.4 (2-5), 3.4 (3-4), and 3.0 (2-4) for abundance, trends, and genetic integrity, respectively (Schiewe 1997b). The current risk matrix scores can also be compared with scores for 11 other steelhead ESUs that were considered for final listing determinations by the BRT in 1997 (Table 3). Of those 11 ESUs, 10 were subsequently listed as threatened or endangered species. For those 10 listed ESUs, the range of the mean risk scores were as follows: abundance (3.4-5.0); trends (3.4-4.4); genetic integrity (2.8-4.3). The current mean risk scores for the KMP ESU, therefore, are lower than those for any listed ESU for each of the three risk elements. The only ESU included in the 1997 evaluations that was not listed was the Oregon Coast ESU, for which the respective risk scores were 2.9, 2.9, and 3.1. The current risk scores for the KMP ESU are comparable to those of the Oregon Coast ESU for abundance and trends and lower than the Oregon Coast ESU for genetic integrity.

Table 3. Summary of main risk categories for the steelhead ESUs considered for final listing in 1997, comparing mean BRT scores from November 1997 (and listing status), to BRT mean scores for KMP in March 2001. Listing status for each ESU as of June 2000 is shown.

ESU	Listing status (as of June 2000)	Abundance	Trend-Productivity-Variability	Genetic Integrity
Upper Columbia River	Endangered	3.9	3.9	3.9
Southern California	Endangered	5	4.4	2.8
Snake River Basin	Threatened	3.6	3.7	2.8
Middle Columbia River	Threatened	3.4	3.6	3.8
Lower Columbia River	Threatened	3.4	4.1	3.7
Upper Willamette River	Threatened	3.5	3.9	3.4
Northern California	Threatened	3.4	3.4	3.0
Central Valley	Threatened	4.4	4.4	4.3
Central California Coast	Threatened	3.4	3.6	3.4
South-Central California Coast	Threatened	4.2	3.6	2.5
Oregon Coast	Candidate	2.9	2.9	3.1
Klamath Mountains Province	Candidate	3.4	3.4	3.0
Klamath Mountains Province	**BRT review March 7, 2001**	**3.0**	**2.9**	**2.3**

FEMAT risk assessment– TheBRT used a method for characterizing uncertainty fashioned after an approach used by the Forest Ecosystem Management Assessment Team (FEMAT 1993). This method has been used by previous BRTs in evaluating coho and chinook salmon, and cutthroat trout. Each BRT member was given 10 total "likelihood" points to distribute in any way among the three risk categories: 1) At risk of extinction 2) Likely to become endangered 3) Not endangered or likely to become so. For example, complete confidence that an ESU should be in one risk category would be represented by most or all of the 10 points allocated to that category. Alternatively, a BRT member who was undecided about whether the ESU was likely to become endangered but who believed the ESU was at some risk could allocate the same (or nearly the same) number of points into each of the "likely to become endangered" and "not likely to become endangered" categories. This assessment process follows well-documented peer-reviewed methods for making probabilistic judgements (references in FEMAT 1993, p. iv:40-45). The BRT interpretation of these scores was similar to FEMAT's, which said the likelihoods were "not probabilities in the classical notion of frequencies. They represented degrees of belief [in risk evaluations], expressed in a probability-like scale that could be mathematically aggregated and compared across [ESUs]" (FEMAT 1993 p. iv:44).

BRT Conclusions

After considering all of the above information, the BRT voted on the status of the KMP ESU using the FEMAT method described above. A majority of the likelihood points (93) fell in the "not in danger of extinction nor likely to become so" category, and a substantial minority (66) fell in the "likely to become endangered" category (see Table 4). The distribution of likelihood points among categories and among BRT members reflected the substantial degree of uncertainty that continues to be associated with evaluation of the status of this ESU. Every member cast some likelihood points in both of the above categories, and one member also assigned one point to the "at risk of extinction" category. Eleven of the members placed a majority of their likelihood points in the "not in danger of extinction nor likely to become so" category, and the other five members placed a majority of their points in the "likely to become endangered" category.

This result differs from that of previous evaluations of this ESU, in which a majority of the BRT concluded that the ESU was likely to become endangered in the foreseeable future. The BRT vote thus paralleled the reductions in the risk scores in the risk matrix discussed above. The change in overall risk assessment can primarily be attributed to new information that affected the interpretation of two major factors:

1. Current information indicates that the proportion of naturally spawning hatchery fish, at least in Oregon, is much lower than indicated by data available for the initial status review (1994), and somewhat lower than the revised estimates available at the time of the last assessment (1997). The new information reduced concerns of the BRT for genetic risks associated with artificial propagation and increased confidence that naturally sustaining populations are more widely distributed throughout this ESU than previously thought.

Table 4. Tally of vote distribution regarding the status of the KMP ESU, March 7, 2001. Each of 16 BRT members allocated 10 points among the three status categories.

BRT ballot	At risk of extinction	Likely to become endangered	Not endangered, or likely to become so	Total points voted
1	0	7	3	10
2	0	4	6	10
3	0	7	3	10
4	0	2	8	10
5	0	2	8	10
6	0	2	8	10
7	0	3	7	10
8	0	4	6	10
9	0	4	6	10
10	0	4	6	10
11	0	3	7	10
12	0	1	9	10
13	1	7	2	10
14	0	6	4	10
15	0	7	3	10
16	0	3	7	10
Point total	1	66	93	160
(percent)	(0.6%)	(41.2%)	(58.1%)	

2. Although solid estimates of overall abundance in this ESU are still not available, new information provided reason to believe that abundance of natural fish in this ESU is probably at least 50,000 adults and may exceed 100,000. Natural production in this ESU may exceed that of any other steelhead ESU considered in the coastwide status review.

In spite of these relatively favorable indicators, the BRT remains concerned about several aspects of the status of this ESU. First, as discussed above, the status of summer steelhead throughout this ESU continues to be a serious concern to the BRT as well as to local biologists. Second, the pervasive lack of information for winter-run populations, which by all accounts represent the majority of fish in this ESU, continues to hinder a more quantitative and reliable assessment of the status of KMP steelhead. More effort is needed to collect biological data on winter steelhead throughout this ESU. Third, the contribution of hatchery fish to natural spawning escapements continues to be high in some areas, and this poses continuing demographic, ecological, and genetic risks to wild populations. In particular, several BRT members were concerned about continued releases of hatchery fish in the Smith River, 20 km upstream of the Rowdy Creek broodstock collection site, without any efforts to monitor the impacts on natural spawners. Ongoing monitoring of these effects, as well as longer time series of data to demonstrate conclusively whether previous estimates of hatchery contribution were biased upwards, should be an important component of steelhead conservation programs in this area.

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Appendix A: Risk Matrix Approach

Appendix A: Risk Matrix Approach

To tie the various risk considerations into an overall assessment of extinction risk for each ESU, Biological Review Team (BRT) members scored risks in a number of categories using a matrix form (Table A.1). For scoring and reaching an overall conclusion regarding extinction risk for an ESU, the following method was used: 1) After reviewing previous documents and hearing presentations and discussions during the meeting, each BRT member filled in as much of the matrix as possible, scoring the various factors according to the relative degree of risk based on available information. 2) Scores from individual members were tallied on a single sheet, and summarized. 3) The BRT reached an overall conclusion regarding the degree of extinction risk facing each ESU after steps 1 and 2 were completed for all ESUs.

The following is a list of factors considered, along with sub-categories and important questions for each. This is not a complete list, but covers the considerations that have been important in past status reviews. Specific considerations within each of these areas are discussed more fully in the main report.

Abundance

Questions regarding abundance can be put into three sub-categories:

Small population risks: Is the overall ESU (or discrete populations within the ESU) at such low abundance that small-population risks (random genetic effects, Allee effects, random demographic or environmental effects) are likely to be significant?

Distribution: Do present populations adequately represent historical patterns of geographic distribution and ecological/genetic/life-history diversity? Does fragmentation of previously connected populations pose a risk? Is the ESU at risk in a significant portion of its range?

Habitat capacity: Is abundance limited by current habitat capacity? If so, is current habitat capacity adequate to ensure continued population viability? (Here, only habitat capacity is considered. Habitat quality as it affects trends or productivity is considered in the next section.)

Trends, Productivity, and Variability

Again, considerations may be divided into three sub-categories:

Population trends: Is the overall ESU (or populations within it) declining in abundance at a rate that risks extinction in the near future? Is variation in population abundance, in combination with average abundance and trends, sufficiently high to cause risk of extinction?

Productivity: Has population productivity declined or is it declining toward the point where populations may not be sustainable? Is there evidence that natural populations are/can be self sustaining without the infusion of hatchery-reared fish?

Limiting factors: Are there factors (such as poor freshwater or ocean habitat quality, harvest or other human-induced mortality, interactions with other species) that currently limit productivity to the point where populations may not be sustainable? Are such factors expected to continue into the future? Are there natural or anthropogenic factors that have increased variability in reproduction or survival for populations beyond the historic range of environmental variability? Are there factors that have increased the vulnerability of populations to natural levels of environmental variability?

Genetic integrity

Genetic integrity can be affected through either random effects (included under "Small population risks above) or directional effects. The major sources of directional effects that are of concern here are introduced genotypes, interactions with local or non-native hatchery fish, or artificial selection (e.g. through selective harvest or habitat modification). These directional effects pose two major types of risk for natural populations:

Loss of fitness: Has interbreeding or artificial selection reduced fitness of natural populations to the point that this is a significant extinction risk factor?

Loss of diversity: Has there been a substantial loss of diversity within or between populations?

For both types of risk, it may also be important to ask the following question: Even if such interactions are not occurring at present, have past events substantially affected fitness and/or diversity of natural populations within the ESU to the extent that long-term population sustainability is compromised?

Other risks

Are there other factors that indicate risks to the sustainability of the ESU or component populations? such factors may include disease prevalence, predation, and changes in life history characteristics such as spawning age or size.

Recent events

This category was included to recognize events (natural or human-induced) that have predictable effects on risk for the ESU, but which have occurred too recently to be reflected in abundance, trend, genetic, or other data considered by the BRT. Examples might include recent changes in management (such as harvest rates or hatchery practices), human-induced changes in the environment (habitat degradation or enhancement), or natural events (such as floods or volcanic eruptions). Recent changes in management were only considered where they were already fully implemented and had reasonably predictable consequences.

SCORING CATEGORIES

Levels of Risk--Individual Factors

Risk from individual factors were ranked on a scale of 1 (very low risk) to 5 (high risk):

1) Very Low Risk. Unlikely that this factor contributes significantly to risk of extinction, either by itself or in combination with other factors.

2) Low Risk. Unlikely that this factor contributes significantly to risk of extinction by itself, but some concern that it may in combination with other factors.

3) Moderate Risk. This factor contributes significantly to long-term risk of extinction, but does not in itself constitute a danger of extinction in the near future.

4) Increasing Risk. Present risk is Low or Moderate, but is likely to increase to high risk in the foreseeable future if present conditions continue.

5) High Risk. This factor by itself indicates danger of extinction in the near future.

Levels of Risk--Recent Events

The "Recent Events" category does not represent specific risk factors, but rather factors that may alter the overall risk score for an ESU from the conclusion based on data available to date. This category was scored as follows: "++" - expect a strong improvement in status of the ESU, "+" expect some improvement in status, "0" - neutral effect on status, '-' - expect some decline in status, "--" - expect strong decline in status.

Levels of Risk--Overall Summary

The summary score of overall risk uses categories that correspond to definitions in the ESA: in danger of extinction, likely to become endangered in the foreseeable future, or neither. (Note, however, that these scores do not correspond to recommendations for a particular listing action because they are based only on past and present biological condition of the populations and do not contain a complete evaluation of conservation measures as required under the ESA.)

This summary score is not a simple average of the risk factors for individual categories, but rather a judgement of overall risk based on likely interactions among factors. A single factor with a "High Risk" score may be sufficient to result in an overall score of "in danger of extinction," but such an overall score could also result from a combination of several factors with low or moderate risk scores.

Table A.1. Example of a blank risk matrix for a single ESU. Each Biological Review Team member filled out scores on a separate form for each ESU.

Risk Factor	Comments	Risk
Abundance Small Population Risks Distribution Habitat Capacity		
Trends/Productivity/Variability Population Trends Productivity Risk Agents		
Genetic Integrity Loss of Fitness Loss of Diversity		
Other Risks		
Recent Events		
Summary: Overall Risk level		
Concerns:		