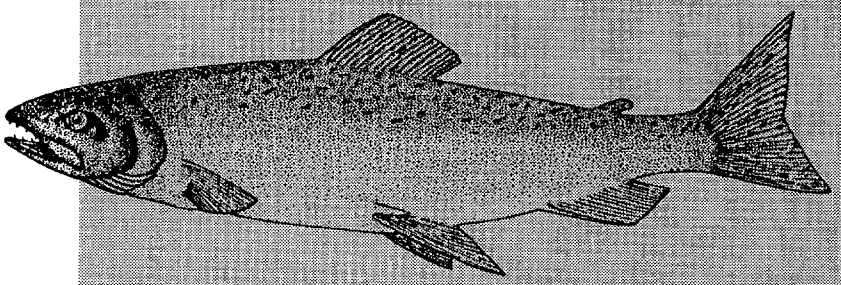
Comments Concerning Status of Mid-Columbia River Summer Chinook Salmon



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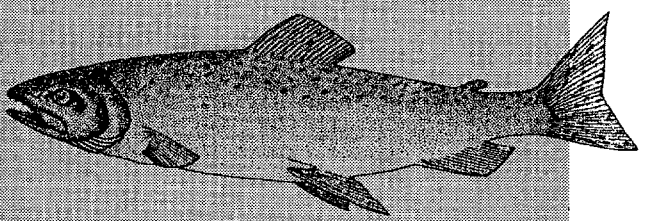
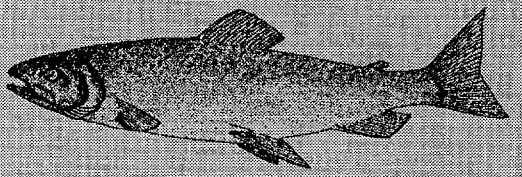


Alaska Department of Fish and Game
Division of Commercial Fisheries Management of Development
Douglas, Alaska

March 1995



COMMENTS CONCERNING STATUS OF MID-COLUMBIA RIVER SUMMER CHINOOK SALMON

By

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and

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Regional Information Report No.[1] 1J95-07

Alaska Department of Fish and Game
Division of Commercial Fisheries Management and Development
Douglas, Alaska

March 1995

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PREFACE

On June 3, 1993, the National Marine Fisheries Service (NMFS) received a petition to list mid-Columbia River summer chinook and to designate critical habitat under the Endangered Species Act of 1973 (ESA). NMFS determined that the petition presented substantial scientific information indicating that the petitioned action may be warranted. On September 3, 1993, NMFS published a Notice of Status Review of and request for information on mid-Columbia River summer chinook salmon (58 FR 46944). Staff of the Alaska Department of Fish and Game developed a scientific analysis to determine if the listing of mid-Columbia River summer chinook was justified based on the best available scientific and commercial data, the standard required for ESA listing decisions. The Alaska Department of Fish and Game scientific analysis was forwarded to the National Marine Fisheries Service on October 25, 1993, by Commissioner Carl L. Rosier. This Regional Information Report includes Commissioner Carl L. Rosier's cover letter and the Alaska Department of Fish and Game's scientific analysis.

AUTHORS

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

October 25, 1993

Merritt Tuttle, Chief
Environmental and Technical Services Division
National Marine Fisheries Service
911 N.E. 11th Avenue, Room 620
Portland, OR 97232

Dear Mr. Tuttle:

Re: Alaska Department of Fish and Game comments concerning the listing of mid-Columbia River summer chinook salmon (58 FR 46944) as a species under the Endangered Species Act of 1973

The Alaska Department of Fish and Game has prepared the enclosed comments for inclusion in the administrative record in response to the National Marine Fisheries Service request for information concerning the status of mid-Columbia River summer chinook salmon and whether or not this stock qualifies as a species under the Endangered Species Act (58 FR 46944).

The decline of the mid-Columbia River summer chinook salmon stock is a tragic legacy of intentional development of the Columbia River for hydropower, irrigation, transportation, flood control, and other endeavors. While many residents of the Pacific Northwest have greatly benefitted from this development, fishermen from Oregon, Washington, Canada and Alaska have paid a truly heavy price. By 1965, all targeted commercial harvests of mid-Columbia River summer chinook salmon were eliminated. Today, restrictive harvest quotas are in place through the Pacific Salmon Treaty from Canada to Alaska to limit impacts on summer chinook and similar stocks that have been adversely impacted by rampant habitat degradation in the Pacific Northwest. We are deeply troubled by the consequences fishermen have borne coastwide to limit their impacts on summer chinook salmon in the hopes of rebuilding production only to see these magnificent fish die in unsuitable riverine habitat as they migrate to and from their natal streams. The consequences of continued neglect to rectify the habitat problems in the Columbia River basin are unacceptable to Alaska and all those who depend upon these once productive salmon resources. To that end, we are sympathetic to the petition by American Rivers et al., to list the mid-Columbia summer chinook salmon as an

endangered or threatened species; the petition itself is ample evidence of a long-standing problem that simply has not been addressed at its source. However, as the enclosed technical paper explains, the available information simply does not support a listing. Because this avenue for redressing restoration of mid-Columbia River salmon appears to be closed, I hope and trust other avenues are available and will be used. Certainly the fact that a stock does not technically qualify for listing as an endangered or threatened species does not preclude collective governmental and private sector actions to improve the biological status of the depressed stock.

Sincerely,

Carl L. Rosier
Commissioner

Enclosure

CLR/JHC/KH
cc: John N. Clark, CFWDD, ADFG

COMMENTS CONCERNING STATUS OF

MID-COLUMBIA RIVER SUMMER CHINOOK SALMON

BACKGROUND

These comments and analysis were prepared by staff of the Alaska Department of Fish and Game in response to the National Marine Fisheries Service's (NMFS) request for information regarding status of mid-Columbia River summer chinook salmon (*Oncorhynchus tshawytscha*). On June 3, 1993, NMFS received a petition to list mid-Columbia River summer chinook salmon and to designate critical habitat under the Endangered Species Act of 1973 (ESA). NMFS determined that the petition presented substantial scientific information indicating that the petitioned action may be warranted. On September 3, 1993, NMFS published a Notice of Status Review of and request for information on mid-Columbia River summer chinook salmon (58 FR 46944). Comments and analysis prepared by staff of the Alaska Department of Fish and Game are intended for inclusion in the Administrative Record concerning the pending federal decision as to the listing of mid-Columbia River summer chinook salmon as a threatened or endangered species under the Endangered Species Act of 1973.

QUALIFICATION OF MID-COLUMBIA RIVER SUMMER CHINOOK SALMON AS A SPECIES UNDER THE ESA

NMFS policy is that a population of Pacific salmon must be an evolutionarily significant unit of the biological species to be accorded protection under the ESA. According to Waples (1991) and according to 50 CFR Part 222 published on November 20, 1991:

> *"A salmon stock will be considered a distinct population , and hence a "species" under the ESA, if it represents an evolutionary significant unit (ESU) of the biological species. The stock must satisfy two criteria to be considered an ESU: (1) It must be substantially reproductively isolated from other conspecific population units; and (2) it must represent an important component in the evolutionary legacy of the species. Only Pacific salmon stocks that meet these criteria will be considered by NMFS for listing under the ESA."*

It is clear that the remaining mixed-stock aggregate of summer chinook salmon that inhabit the mid-Columbia River do not meet the ESU criteria.

Historically, summer chinook salmon migrated up the Columbia River as far as Windermere Lake in British Columbia (Fulton

1968). In 1941 when the Grand Coulee Dam was completed, chinook salmon were prevented from migrating into the upper portions of the Columbia River drainage. Between 1939 and 1941, summer chinook salmon were intercepted at Rock Island Dam as part of the Grand Coulee Fish Maintenance Project. A portion of these fish were transplanted into the Wenatchee, Entiat, Methow, and Okanogan rivers and the remainder were used for artificial propagation of summer chinook salmon at Leavenworth, Entiat, and Winthrop hatcheries. The hatchery produced summer chinook salmon were subsequently released into mid-Columbia River waters, primarily as fry into the Entiat River. Howell et al. (1985) states:

> *"Native summer chinook runs in these tributaries, if they existed, were virtually eliminated by the time of the relocation program. Historical affidavits and other records indicate a negligible native run returned to the Wenatchee system and possibly the Methow River (J. Mullan, USFWS, personal communication). The existence of a native summer chinook run in the Entiat River is disputed. The Okanogan system contained native summer chinook (Fulton 1968)."*

Thus, the summer chinook population that currently spawns in the mid-Columbia River Basin can be presumed to be a mixed-stock aggregate, formed from populations that previously spawned in geographically isolated areas upstream from Rock Island Dam. This mixed stock aggregate is one panmictic population of summer chinook salmon. An array of genetic data, collected from independent studies, supports this hypothesis (reviewed in Utter 1993).

Further, Utter (1993) provides an exceedingly strong argument that the extant summer chinook salmon are not "substantially reproductively isolated." Rather, they appear to be a part of a genetic continuum formed with fall chinook salmon from the mid-Columbia River (see also genetic data and phenograms in Shreck et al. 1986; Hershberger et al. 1988; Utter et al. 1989; and, Waples et al. 1991). Additional support for this argument comes from observations that:

(1) summer and fall chinook salmon intermingle in spawning areas upstream from Rock Island Dam (Mullan 1987);
(2) separations between summer and fall-run mid-Columbia River chinook salmon are often arbitrary, resulting in incorporation of the early component of the fall run into the brood stock of summer chinook at Wells Hatchery (which was/is stocked into areas of natural spawning of summer chinook in the mid-Columbia River (Utter et al. 1989); and,
(3) hatchery records apparently indicate that fall-run stocks have been transferred into brood stocks at summer-run facilities; and returning fall-run adults, later

identified by coded wire tags, were incorporated into summer-run brood stocks at hatcheries (reviewed in Utter 1993).

The abundance of the population of chinook salmon that now spawns in the mid-Columbia River and enters the river during the month of June is seriously depressed in comparison to its former abundance prior to construction of the hydroelectric facilities of the Columbia River basin. However, the preponderance of genetic and other biological information indicates that this population is not "substantially reproductively isolated." Based largely on genetic arguments, staff of the Alaska Department of Fish and Game believe that this population (mid-Columbia River summer chinook salmon) is not an ESU of and in itself, but is instead part of a larger ESU that includes fall-run chinook salmon that spawn in the mid-Columbia River basin. As a consequence, staff of the Alaska Department of Fish and Game recommend that NMFS **not list** mid-Columbia River summer chinook salmon as a "threatened" or "endangered" species.

STOCK STATUS OF MID-COLUMBIA RIVER SUMMER CHINOOK SALMON

This status review for the mid-Columbia River stock of summer chinook salmon will include an evaluation of the likelihood of extinction. Although compelling genetic and other biological evidence argues for including fall chinook within the ESU (e.g., Chapman 1993), the NMFS Biological Review Team may have access to information supporting the hypothesis that summer chinook alone form the ESU. We offer the following comments on the likelihood of extinction of the stock, summer chinook salmon, should the latter determination be made.

Summer chinook salmon returning to the mid-Columbia River currently spawn in the Wenatchee, Methow, Okanogan, and Similkameen (a tributary of the Okanogan) rivers as well as being reared at several hatcheries. The Entiat River stock is considered extinct. Since the completion of the Grand Coulee Dam in 1941, which blocked access to the upper Columbia River for summer chinook salmon; and since the initiation of the Grand Coulee Fish Maintenance Project which was implemented to relocate these fish into the Wenatchee, Entiat, Methow, and Okanogan rivers and to supplement natural spawning in these rivers with hatchery produced fish, seven other major developments (erection of dams) have further restricted and affected the ability of this stock of chinook salmon to successfully migrate through the Columbia River system. In the lower Columbia River, the McNary Dam was built in 1953, the Dalles Dam was built in 1957 and the John Day Dam was built in 1968; all three of these major development activities exacerbated migration difficulties already encountered by summer chinook salmon returning to the mid-Columbia River to spawn due to the Bonneville Dam which was built

in 1938. In the mid-Columbia River (above the confluence of the Columbia and Snake rivers), four dams were constructed following the loss of upper river habitat for use by summer chinook salmon due to construction of Grand Coulee Dam: (1) Priest Rapids Dam was built in 1959; (2) Rocky Reach Dam was built in 1961; Wanapum Dam was built in 1963; and, (4) Wells Dam was built in 1967. These major in-river developments have restricted the ability of adult summer chinook salmon to successfully reach spawning areas in the Wenatchee, Methow, and Okanogan rivers and these structures have also restricted the ability of juvenile summer chinook salmon of the mid-Columbia River to successfully migrate to saltwater.

In order to evaluate current population status of mid-Columbia River summer chinook salmon, it is necessary to select a time-frame for examination of trends wherein at least major habitat and migrational obstacles are in a somewhat steady state and reflect current conditions. In that the last dam was constructed in 1967 (Wells Dam) and that 98% of the mid-Columbia River summer chinook salmon return at age 5 or younger (Howell et al. 1985), we believe that the appropriate time frame to evaluate stock status of mid-Columbia River summer chinook salmon is 1972 to the present. Selection of the 1972 to present time-frame provides a period after which major development of hydro-electric facilities were completed and a period in which returns of mid-Columbia River summer chinook salmon were subjected to a similar state of migrational conditions during their entire life cycle.

In addition to defining a time frame for evaluating stock status, selection of an appropriate data set to evaluate is important. NMFS (1992) states:

> *"The primary objective of the ESA is the conservation of species in their natural ecosystems. Therefore, evaluations of species' status for ESA listing and delisting focus on natural fish populations (i.e., those composed of fish spending their entire life cycle in the natural ecosystem). Fish that, at the time of listing are in a hatchery or have been in a hatchery sometime during their life cycle will not be included for ESA protection unless a compelling reason justifies their specific inclusion."*

This standard makes selection of a data set for evaluation of status of mid-Columbia River summer chinook salmon problematic because: (1) virtually all of the present day mid-Columbia summer chinook salmon are descendents of fish transplanted into the Wenatchee, Entiat, Methow, and Okanogan rivers during the original relocation program between 1938 and 1941 or from fish released from hatcheries since that time; and, (2) it would be very difficult to determine if summer chinook salmon naturally spawning in the Wenatchee, Methow, and Okanogan rivers since 1972 were descendants from fish that also naturally spawned or were

returns from hatchery releases. Furthermore, natural spawning escapements are not completely enumerated; instead, the available data consists of redd counts in various sections of streams used by mid-Columbia River summer chinook salmon, counts of summer chinook salmon used in hatcheries, and counts of adult summer chinook salmon past dams. Because of these difficulties, the Alaska Department of Fish and Game decided to evaluate three data sets; each of these data sets has limitations.

First Data Set - Expanded Redd Counts

The first data set evaluated was based upon aerial counts of redds in the Wenatchee, Methow, Okanogan, and Similkameen rivers. These counts were expanded by a factor of 3.1 (Meekin 1967) to obtain **minimum** numbers of natural spawning summer chinook salmon in the mid-Columbia River. These natural escapement estimates are considered minimums because: (1) not all redds are observed in stream sections during aerial surveys (in 1992 for instance, the peak aerial count of redds in the section of the Wenatchee River surveyed was only 1,173 redds, whereas, a ground survey counted 2,328 redds, almost a two-fold increase); (2) not all potential spawning areas are surveyed; (3) some summer chinook salmon that would naturally spawn in mid-Columbia waters are removed each year for hatchery programs; and , (4) aerial counts are sometimes hampered because of poor viewing conditions due to inclement weather or due to poor water visibility conditions. Although this data set is considered to be a very conservative estimate of the number of naturally spawning summer chinook salmon in the mid-Columbia River, Alaska Department of Fish and Game staff recognize that not all of these fish necessarily spent their entire life cycle in the wild and some of these fish were likely hatched at Wells, Eastbank, or one of the several other hatcheries in the area and thus, the data set does not explicitly meet the NMFS standard quoted above.

Howell et al. (1985) provides estimates of the minimum natural spawning escapements of summer chinook salmon based on redd counts in the Methow, Okanogan, and Similkameen rivers for the years 1970-1984 (Table 1). The Howell et al. (1985) estimates of escapement are based upon 3.1 times the number of redds counted from: (1) river mile 2.0 to 50.0 in the Methow River; (2) river mile 26.2 to 77.4 in the Okanogan; and (3) river mile 3.0 to 5.0 in the Similkameen River. Larrie LaVoy of the Washington Department of Fisheries (personal communication) provided counts of summer chinook salmon redds for the Methow, Okanogan, and Similkameen rivers for the years 1985-1992 (Table 1) and stated that 1993 data are not yet available. LaVoy also provided Washington Department of Fisheries and Chelan PUD aerial counts of summer chinook salmon redds in the Wenatchee River (river mile 0.5 to 46.0) during the years 1972-1992; and, the higher of the two counts for each year is referenced in Table 1. During the

Table 1. Minimum natural spawning escapements for summer-run chinook salmon returning to the mid-Columbia River based upon redd counts.[1]

	Minimum Natural Spawning Population Based on 3.1 x No. of Redds:					
			Okanogan System:			Total
Year	Wenatchee River	Methow River	Okanogan River	Similkameen River	Combined System	Spawning Population
1972	4,228	1,008	564	171	735	5,971
1973	3,546	1,135	428	198	626	5,307
1974	3,581	691	350	403	753	5,025
1975	2,868	1,339	846	623	1,469	5,676
1976	3,429	592	332	415	747	4,768
1977	4,232	1,132	856	431	1,287	6,651
1978	6,064	1,606	605	831	1,436	9,106
1979	5,264	1,928	536	428	964	8,156
1980	6,274	1,070	366	533	899	8,243
1981	4,554	605	171	406	577	5,736
1982	3,534	440	71	183	254	4,228
1983	2,241	202	112	177	289	2,732
1984	4,129	502	729	933	1,662	6,293
1985	3,280	508	428	930	1,358	5,146
1986	4,098	524	611	930	1,541	6,163
1987	6,278	654	623	508	1,131	8,063
1988	4,631	381	350	592	942	5,954
1989	5,732	391	415	685	1,100	7,223
1990	6,513	710	273	291	564	7,787
1991	5,654	372	171	211	382	6,408
1992	3,636	282	109	149	258	4,176

[1] Data Sources: Howell et al. (1985) for the Methow, Okanagan, and Similikmeen counts for the years 1972-1984; and, Larry Lavoy (personal communication), Washington Department of Fisheries, Wenatchee, Washington for the Wenatchee River counts and for the Methow, Okanagan, and Similikmeen counts for the years 1985-1992.

1972-1992 period, minimum estimates of naturally spawning mid-Columbia River summer chinook salmon ranged from a low of 2,732 fish in 1983 to a high of 9,106 fish in 1978 averaging 6,134 fish during this 21 year period (Figure 1).

In order for staff of the Alaska Department of Fish and Game to make a recommendation to NMFS concerning whether or not to list summer chinook salmon returning to the mid-Columbia River as "endangered" or "threatened", criteria concerning the minimum viable population (MVP) size had to be determined. The paper entitled: Determining Minimum Viable Populations Under the Endangered Species Act authored by Thompson (1991) was reviewed to make these determinations. Thompson (1991) on page 36 states:

> *"As noted in the Introduction, it is unfortunate that the ESA does not define endangerment with much precision. In the absence of further guidance, perhaps the best decision for "endangered"* **p** *and* **t** *values is to accept the conventional wisdom that sets* **p** *= 0.95% and* **t** *= 100. In other words, at the "endangered" level, MVP is the population size that gives a 95% chance of extinction over the next 100 years."*

Thompson goes on further on page 36 to say:

> *"While the ESA is decidedly vague regarding the definition of endangerment, it does give some indication of how "threatened"* **p** *and* **t** *values should relate to their "endangered" counterparts. Since a threatened species is defined as one which is "likely to become endangered within the foreseeable future," one need only interpret the terms "likely" and "foreseeable future" to relate the "threatened" MVP to the "endangered" MVP. A reasonable interpretation of a "likely" event would be one which has at least a 50% chance of occurring. Quantifying "foreseeable future" is not so straightforward, but perhaps something like 10 years would be satisfactory. In other words, the "threatened" MVP is the population size that gives a 50% chance of reaching the "endangered" MVP within 10 years."*

Lacking any other guidance in setting criteria for determining "endangered" or "threatened" levels, the Thompson (1991) recommendations concerning minimum viable population sizes for "endangered" and "threatened" status for species seemed reasonable to staff of the Alaska Department of Fish and Game and hence were used as standards to evaluate stock status of the summer run of chinook salmon in the mid-Columbia River.

Given that an appropriate time period to evaluate stock status was selected, that appropriate standards concerning minimum viable population sizes were selected, and given that the best options for choosing data bases concerning abundance were selected, we had to select an analytical tool or model to use in

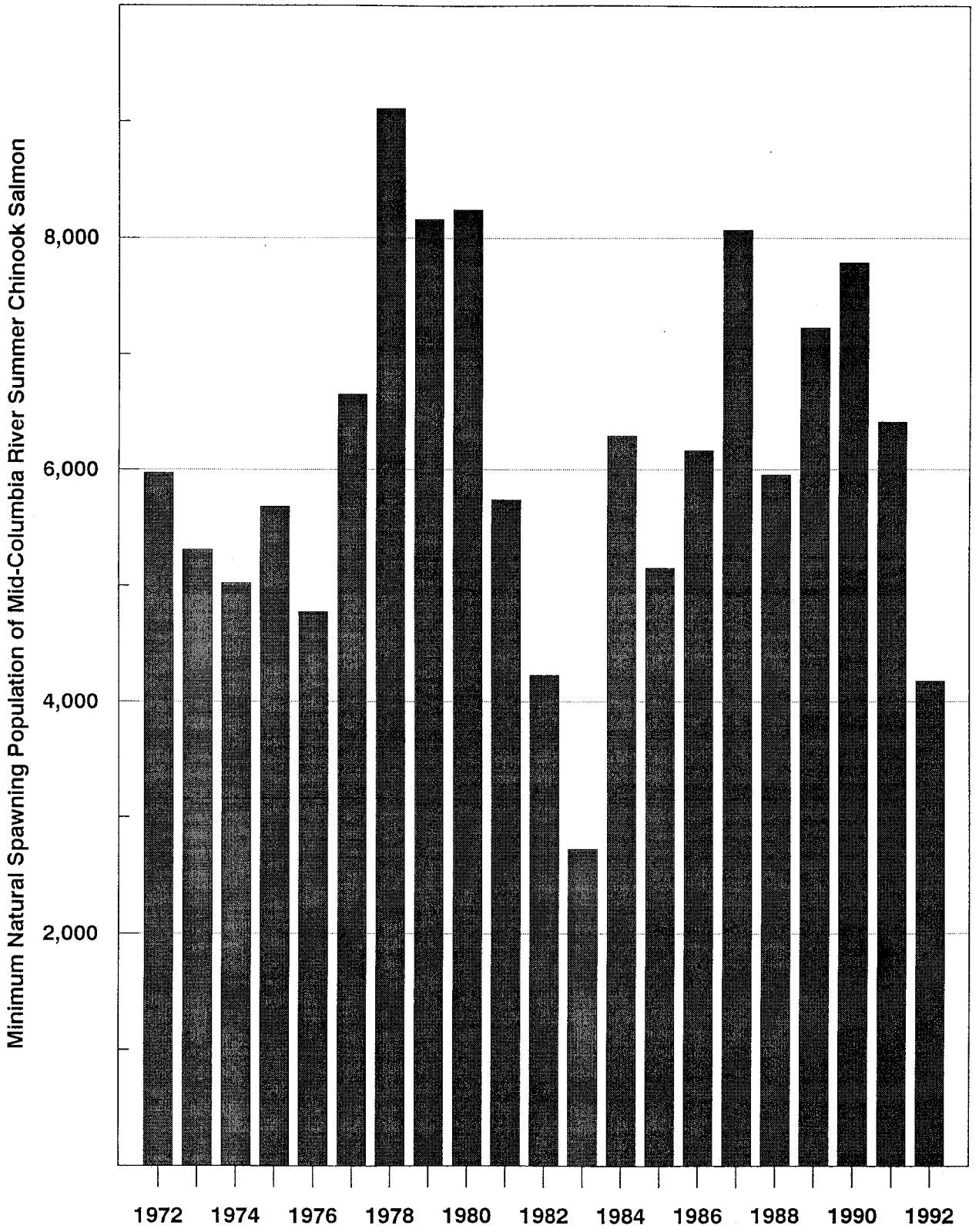

Figure 1. Estimated minimum natural spawning escapement of mid-Columbia River summer chinook salmon based upon redd counts.

order to determine if the listing of summer chinook salmon returning to the mid-Columbia River was appropriate at this time. The growth and extinction model published by Dennis et al. (1991) and used by Waples et al. (1991) to evaluate stock status of Snake River fall chinook salmon was selected for use in making recommendations to NMFS concerning the listing of summer chinook salmon returning to the mid-Columbia River basin. Time series data was geometrically averaged over a five year period prior to application of the Dennis et al. (1991) model.

The results of applying the Dennis et al. (1991) model to the minimum estimated natural escapements of mid-Columbia River summer chinook salmon based upon counts of redds in the combined spawning areas of the Wenatchee, Methow, Okanogan, and Similkameen rivers (data listed in Table 1) are presented in Table 2 and Figure 2. Based upon these results, the minimum estimated abundance of mid-Columbia River summer chinook spawners in the year 2093 (100 years hence) is 15,554. There is an increase in the 1988-1992 average redd count from the initial 1972-1976 average redd count, resulting in an estimated (though not significant) increasing trend (0.00915) in redd counts. The probability of the population declining to 1 fish by 2093 is substantially less than 0.00001. Based upon the criteria as quoted above from Thompson (1991) and this data set, the mid-Columbia River summer chinook salmon population should **not be listed as "endangered"**. Further, the probability of this population reaching a population size of 614 or fewer fish (the abundance that would trigger a listing of "threatened") by the year 2003 is also substantially less than 0.00001. As a consequence, and based upon the criteria as quoted above from Thompson (1991) and this data set, the mid-Columbia River summer chinook salmon population should **not be listed as "threatened"** even if the stock is determined to be an ESU.

Second Data Set - Maximum Estimates of Natural Escapements

The second data set evaluated was based upon counts of summer chinook salmon at the Rock Island, Rocky Reach, and Wells dams. The count of summer chinook salmon at the Wells Dam provides an estimate of the number of fish returning to the Methow and Okanogan rivers. The count of summer chinook salmon at Rock Island Dam minus the count of summer chinook salmon at the Rocky Reach Dam provides an estimate of the number of fish returning to the Wenatchee River. The combination of these two estimates provides a **maximum** estimate of the number of naturally spawning summer chinook salmon in the mid-Columbia River.

These estimates of the natural spawning escapement are considered **maximums** because: (1) some of these fish may fall back below Wells Dam and die or reascend, in either case providing overestimates of the numbers of fish potentially spawning in the

Table 2. Estimation of extinction parameters for the mid-Columbia River summer-run of chinook salmon based upon a running geometric mean of the data presented in column 7 of Table 1. All equations are developed and presented in Dennis et al. (1991) and parameter estimates are referenced by the equation number presented in that report.

Statistic	Equation	Parameter
Mean of Wiener-Drift Model	[24]	0.00915
95% Confidence Limits	[31]	
Lower		-0.04465
Upper		0.06295
Variance of Wiener-Drift Model[1]	[25]	0.01060
95% Confidence Limits	[32]	
Lower		0.00679
Upper		0.02336
Expected Population Size in 2093	[73]	15,554
Probability of Population Declining to 1 Fish by 2093	[16,17, 84][2]	<0.00001
Escapement Needed in 2003 to Become Endangered[3]		614
Probability of Population Becoming Endangered by 2003[4]	[16,17]	<0.00001

[1] Maximum likelihood variance, not the unbiased estimate of [26]; however, Dennis et al. (1991) use the maximum likelihood variance in all subsequent calculations.

[2] The probability is too small to use the approximations in the appendix of Dennis et al. (1991). Probabilities calculated using equation [17] are summed for all years 1994-2093 which is equivalent to equation [16]. "Endangered" is defined as a probability of 95% that the population will decline to 1 fish within 100 years (Thompson 1991).

[3] Escapements are inserted for the year 2003, changing the mean (variance is assumed to be the same) until the probability of realizing only one fish in the escapement by the year 2003 is 95% and hence the population becomes endangered in 2003. "Threatened" is defined as a 50% chance that the population will become endangered in 10 years (Thompson 1991).

[4] Probability of achieving an escapement of 614 or fewer fish in 2003.

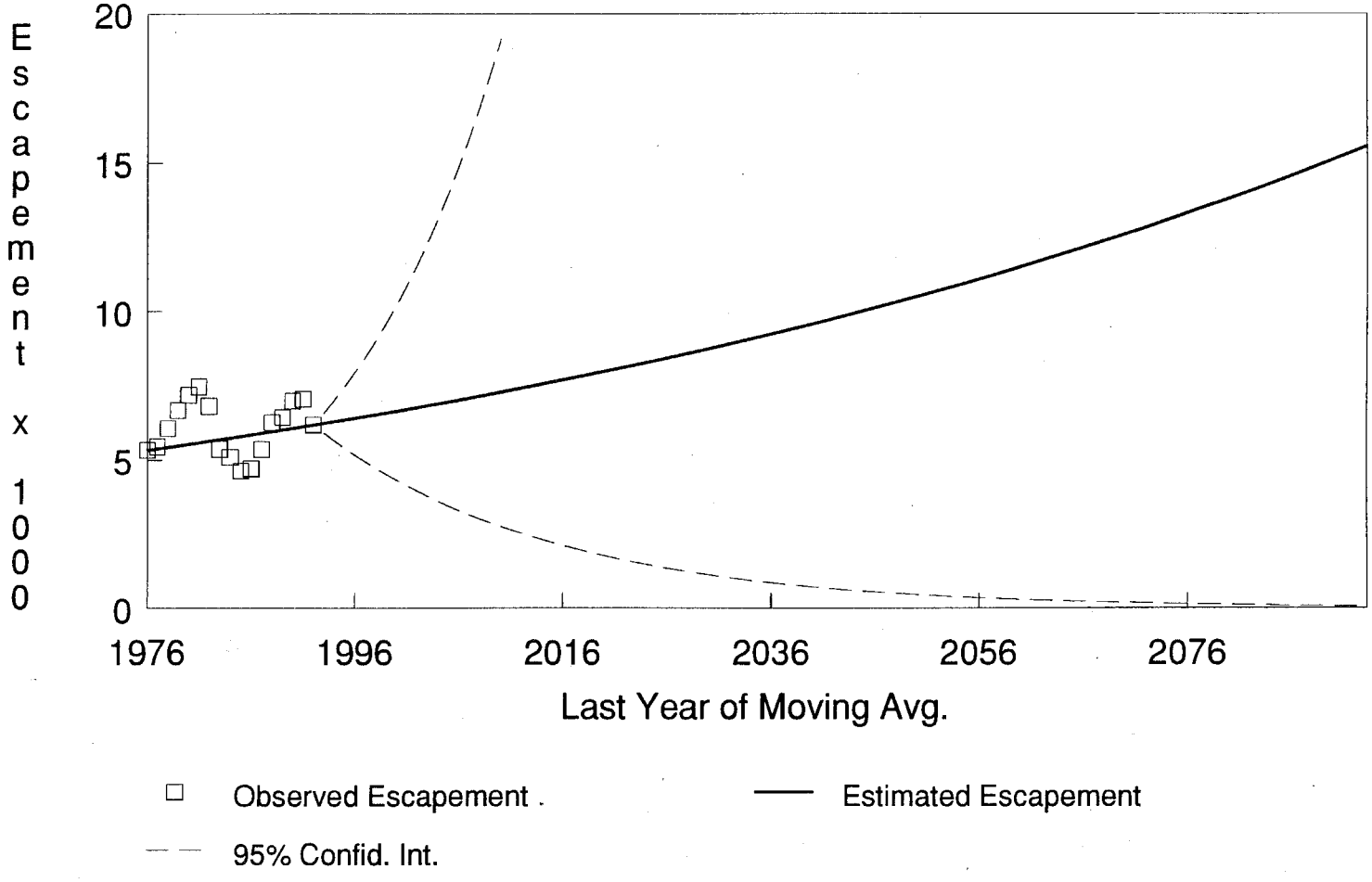

Figure 2. Predicted minimum natural spawning escapement of mid-Columbia River summer chinook salmon based upon redd counts modeled with the Dennis et al. (1991) method.

Methow and Okanogan Rivers; and, (2) some of these fish may fall back below Rock Island Dam and die or reascend, in either case providing overestimates of the numbers of fish potentially spawning in the Wenatchee River. It is also possible that some of these fish may fall back below Rocky Reach Dam and reascend, in which case the numbers of fish potentially spawning in the Wenatchee River would be under-estimated. Fish reared and released from hatcheries certainly make up a portion of the overall counts of summer chinook counted at Rock Island, Rocky Reach and Wells dams. We consider these estimates of the number of mid-Columbia River naturally spawning summer chinook salmon to be liberal estimates of the actual abundance of spawners; further, the data set does not explicitly meet the NMFS standard of only considering natural fish (i.e., those fish spending their entire life cycle in the natural ecosystem).

Howell et al. (1985) provides estimates of the natural spawning escapements of summer chinook salmon in the mid-Columbia River Basin based upon dam counts for the years 1970-1984 (1972-1984 counts provided in Table 3). Bob McClure of the Columbia River Inter-Tribal Fish Commission (personal communication) provided similar counts from the Wells, Rocky Reach and Rock Island dams for the years 1985-1993 (Table 3). During the 1972-1993 period, maximum estimates of naturally spawning mid-Columbia River summer chinook salmon ranged from a low of 5,900 fish in 1983 to a high of 17,650 fish in 1979 averaging 11,215 fish during this 22 year period (Figure 3).

The model presented by Dennis et al. (1991) was run with the maximum estimates of naturally spawning mid-Columbia River summer chinook salmon (data listed in Table 3) and results of this analysis are presented in Table 4 and Figure 4. Based upon the second set of modeled data, the maximum estimated abundance of mid-Columbia River summer chinook salmon spawners in the year 2093 (100 years hence) is 20,547. There is an increase in the 1989-1993 average escapement from the initial 1972-1976 average escapement, resulting in an estimated (though not significant) increasing trend (0.00663) in escapement numbers. The probability of the population declining to 1 fish by 2093 is substantially less than 0.00001. Based upon the criteria suggested by Thompson (1991) and this second data set, the mid-Columbia River summer chinook salmon population should **not be listed as "endangered"**. Further, the probability of this population reaching a population size of 946 or fewer fish (the abundance that would trigger a listing of "threatened") by the year 2003 is also substantially less than 0.00001. As a consequence, and based upon the criteria as given by Thompson (1991) and this data set, the mid-Columbia River summer chinook salmon population should **not be listed as "threatened"** even if the stock is determined to be an ESU.

Table 3. Estimated abundance of adult runs of summer-run chinook salmon returning to the mid-Columbia River.[1]

Year	Natural Escapement	Priest Rapids Dam Count of Summer Chinook
1972	11,000	13,400
1973	8,000	12,200
1974	6,850	12,900
1975	11,250	18,900
1976	11,150	17,200
1977	9,650	16,300
1978	17,450	19,200
1979	17,650	20,300
1980	13,200	16,000
1981	7,950	11,600
1982	6,300	8,800
1983	5,900	8,500
1984	13,200	16,200
1985	13,143	15,900
1986	13,561	16,200
1987	12,707	14,100
1988	12,747	13,400
1989	15,887	19,700
1990	12,518	15,600
1991	8,952	14,800
1992	6,967	8,500
1993	10,713	16,400

[1] Data Sources: Howell et al. (1985) for natural escapements (Wells Dam count plus the Wenatchee River escapement (Rock Island Dam count minus the Rocky Reach dam count) for the years 1972-1984; Bob McClure (personal communication), Columbia River Inter-Tribal Fish Commission, Portland, Oregon for the years 1985-1993; PFMC (1993) for Priest Rapids Dam counts for the years 1972-1992; and Priest Rapids Dam count for 1993 obtained from Mike Matylewich (personal communication), Columbia River Inter-Tribal Fish Commission, Portland, Oregon.

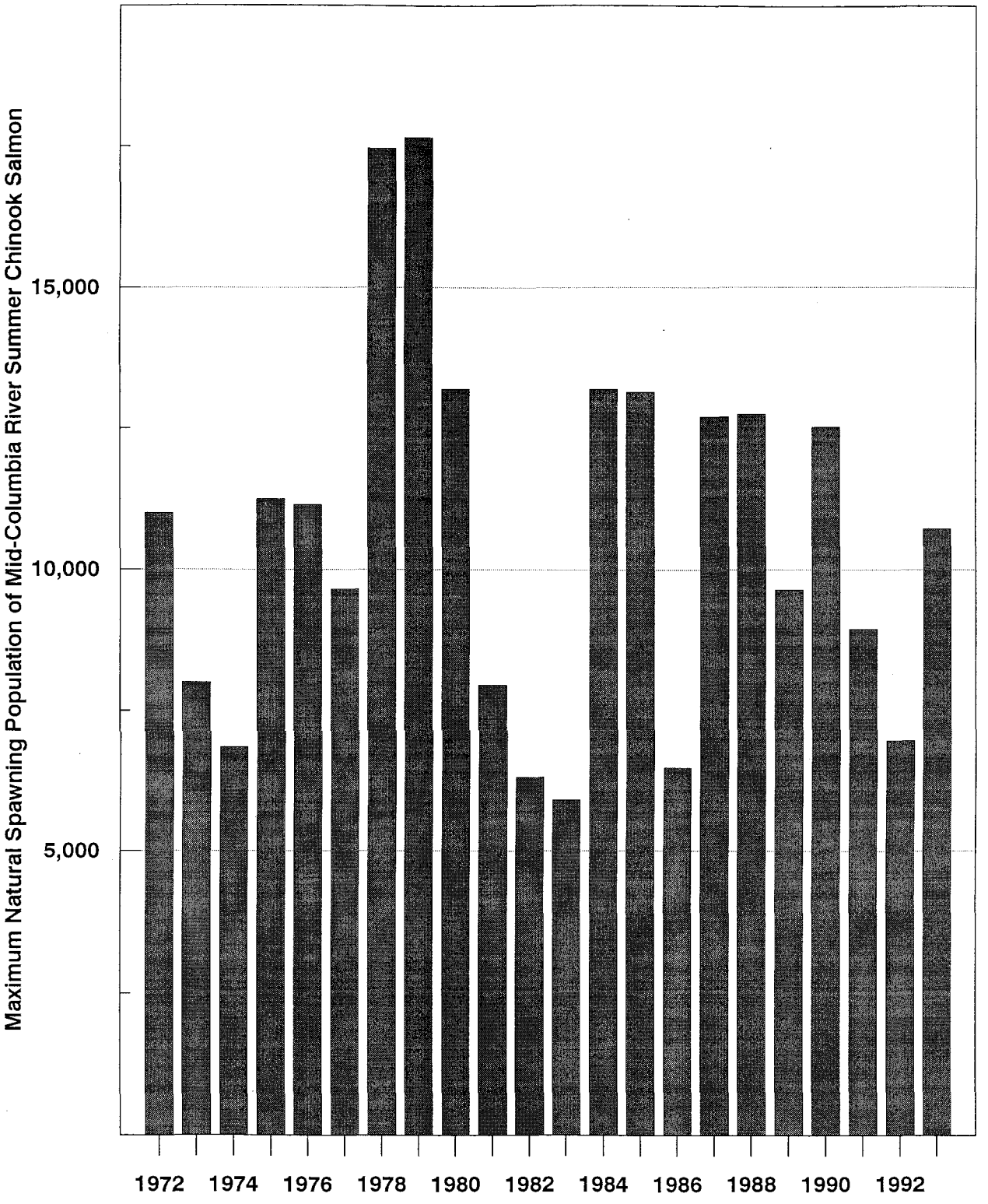

Figure 3. Estimated maximum natural spawning escapement of mid-Columbia River summer chinook salmon based upon dam counts (Wells Dam count plus [Rock Island Dam count minus Rocky Reach Dam count]).

Table 4. Estimation of extinction parameters for the mid-Columbia River summer-run of chinook salmon based upon a running geometric mean of the data presented in column 2 of Table 3. All equations are developed and presented in Dennis et al. (1991) and parameter estimates are referenced by the equation number presented in that report.

Statistic	Equation	Parameter
Mean of Wiener-Drift Model	[24]	0.00663
95% Confidence Limits	[31]	
Lower		-0.04866
Upper		0.06192
Variance of Wiener-Drift Model[1]	[25]	0.01190
95% Confidence Limits	[32]	
Lower		0.00857
Upper		0.02541
Expected Population Size in 2093	[73]	20,547
Probability of Population Declining to 1 Fish by 2093	[16,17, 84][2]	<0.00001
Escapement Needed in 2003 to Become Endangered[3]		946
Probability of Population Becoming Endangered by 2003[4]	[16,17]	<0.00001

[1] Maximum likelihood variance, not the unbiased estimate of [26]; however, Dennis et al. (1991) use the maximum likelihood variance in all subsequent calculations.

[2] The probability is too small to use the approximations in the appendix of Dennis et al. (1991). Probabilities calculated using equation [17] are summed for all years 1994-2093 which is equivalent to equation [16]. "Endangered" is defined as a probability of 95% that the population will decline to 1 fish within 100 years (Thompson 1991).

[3] Escapements are inserted for the year 2003, changing the mean (variance is assumed to be the same) until the probability of realizing only one fish in the escapement by the year 2003 is 95% and hence the population becomes endangered in 2003. "Threatened" is defined as a 50% chance that the population will become endangered in 10 years (Thompson 1991).

[4] Probability of achieving an escapement of 946 or fewer fish in 2003.

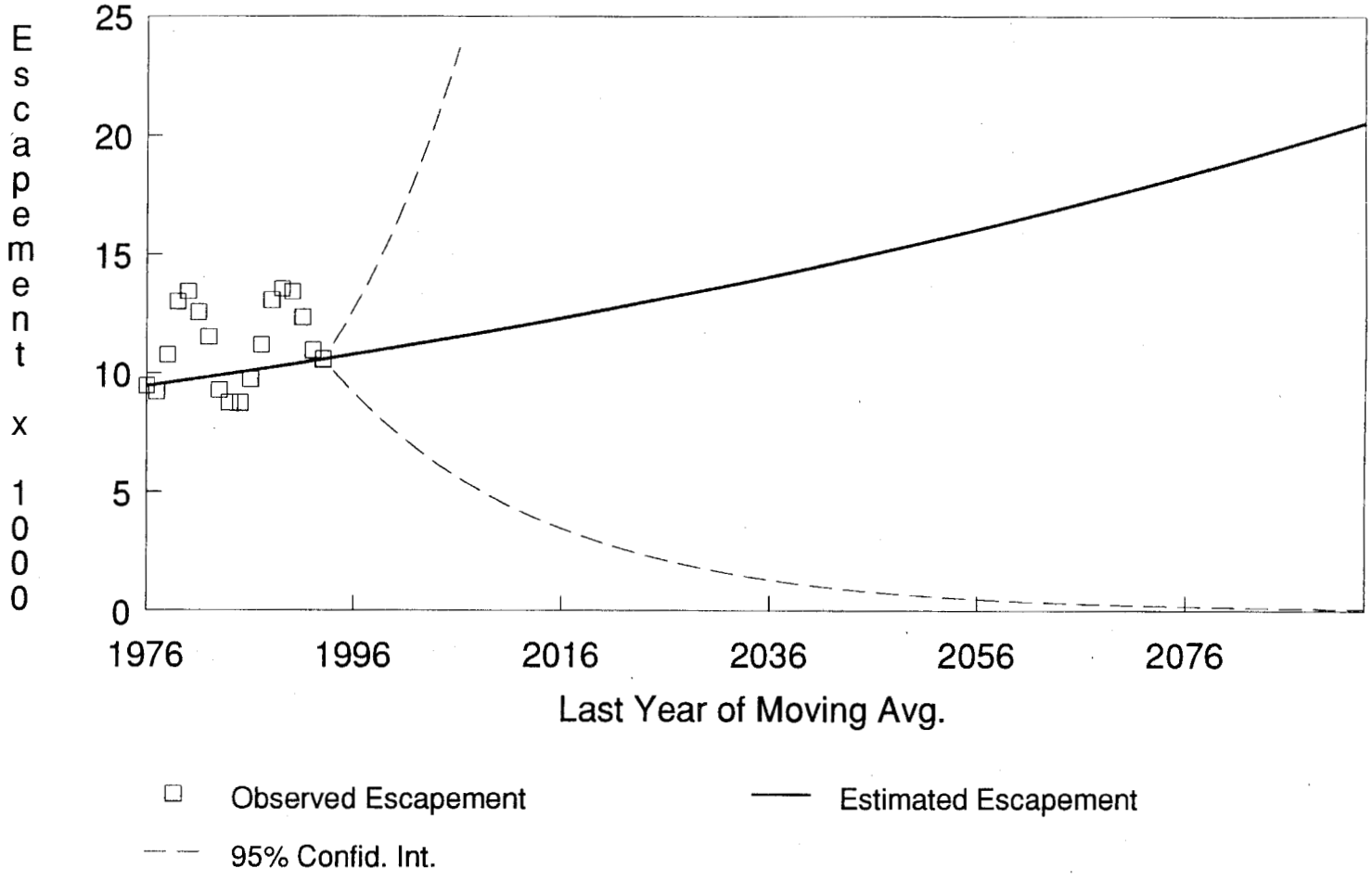

Figure 4. Predicted maximum natural spawning escapement of mid-Columbia River summer chinook salmon based upon dam counts modeled with the Dennis et al. (1991) method.

Third Data Set - Priest Rapids Dam Counts

The third data set evaluated was based upon Pacific Fishery Management Council (PFMC) estimates of the number of adult summer chinook salmon escaping into the mid-Columbia River (PFMC 1993). The PFMC data for this stock is the Priest Rapids Dam count for the years 1971-1992. The Priest Rapids Dam count of summer chinook salmon in 1993 was obtained from Mike Matylewich, Columbia River Inter-Tribal Fish Commission, Portland, Oregon (personal communication). Priest Rapids Dam counts of summer chinook salmon for the years 1972-1993 are provided in Table 3.

The Priest Rapids Dam is the lowest dam in the mid-Columbia and hence the count at this site represents the numbers of summer chinook salmon returning to the mid-Columbia River. However, this count does **not** represent the number of fish likely to spawn because: (1) some of these adult fish are killed when they attempt to pass Wanapum, Rock Island, Rocky Reach, and Wells dams as they migrate upstream to spawn; (2) some of these fish may fall back downstream below Priest Rapids Dam without spawning; and ,(3) some of these fish are taken for hatchery programs at Wells, Eastbank or other upstream hatcheries. Fish reared and released from hatcheries certainly make up a portion of the overall counts of summer chinook at Priest Rapids Dam. We realize that this data set does not meet the NMFS standard to only consider natural fish (i.e., those fish spending their entire life cycle in the natural ecosystem). The Priest Rapids Dam counts do, however, reflect the annual numbers of summer chinook salmon that return to the mid-Columbia River Basin.

During the 1972-1993 period, the number of adult summer chinook salmon that returned to the mid-Columbia River ranged from a low of 8,500 fish in 1983 and in 1992 to a high of 20,300 fish in 1979 averaging about 14,825 fish during this 22 year period (Figure 5).

The model presented by Dennis et al. (1991) was run with the Priest Rapids Dam counts of summer chinook salmon (data listed in Table 3) and results of this analysis are presented in Table 5 and Figure 6. Based upon the third set of modeled data, the estimated abundance of mid-Columbia River summer chinook salmon (at Priest Rapids Dam) in the year 2093 (100 years hence) is 13,198.

There is a decrease in the 1989-1993 average dam count from the initial 1972-1976 average dam count, resulting in an estimated (though not significant) decreasing trend (-0.00092) in dam counts. The probability of the population declining to 1 fish by 2093 is substantially less than 0.00001. Based upon the criteria suggested by Thompson (1991) and the third data set, the mid-Columbia River summer chinook salmon population should **not be listed as "endangered"**. Further, the probability of this

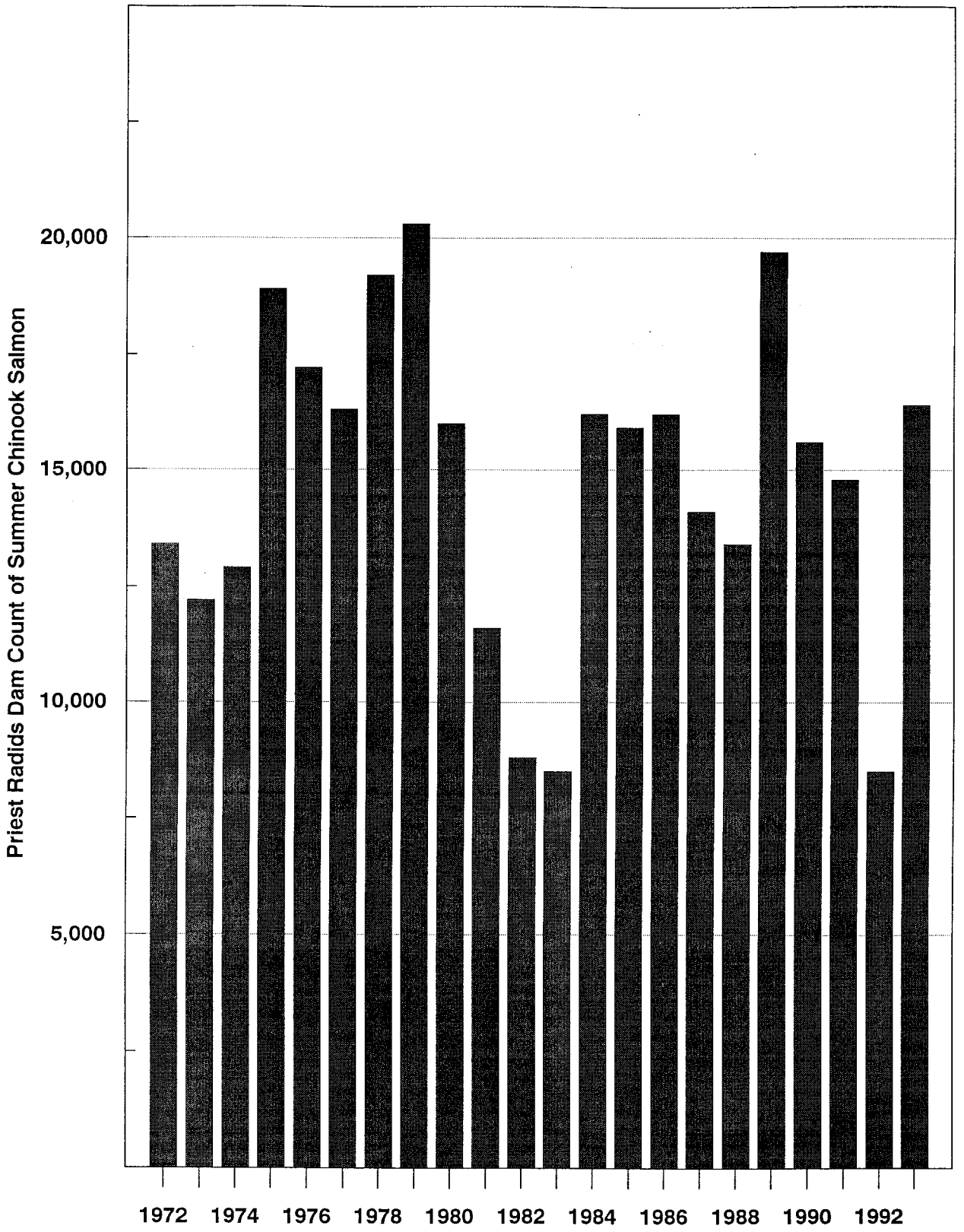

Figure 5. Estimated returns of adult summer chinook salmon to the mid-Columbia River based upon counts at Priest Rapids Dam.

Table 5. Estimation of extinction parameters for the mid-Columbia River summer-run of chinook salmon based upon a running geometric mean of the data presented in column 3 of Table 3. All equations are developed and presented in Dennis et al. (1991) and parameter estimates are referenced by the equation number presented in that report.

Statistic	Equation	Parameter
Mean of Wiener-Drift Model	[24]	-0.00092
95% Confidence Limits	[31]	
Lower		-0.04066
Upper		0.03882
Variance of Wiener-Drift Model[1]	[25]	0.00615
95% Confidence Limits	[32]	
Lower		0.00443
Upper		0.01312
Expected Population Size in 2093	[73]	13,198
Probability of Population Declining to 1 Fish by 2093	[16,17][2]	<0.00001
Escapement Needed in 2003 to Become Endangered[3]		1,477
Probability of Population Becoming Endangered by 2003[4]	[16,17]	<0.00001

[1] Maximum likelihood variance, not the unbiased estimate of [26]; however, Dennis et al. (1991) use the maximum likelihood variance in all subsequent calculations.

[2] The probability is too small to use the approximations in the appendix of Dennis et al. (1991). Probabilities calculated using equation [17] are summed for all years 1994-2093 which is equivalent to equation [16]. "Endangered" is defined as a probability of 95% that the population will decline to 1 fish within 100 years (Thompson 1991).

[3] Escapements are inserted for the year 2003, changing the mean (variance is assumed to be the same) until the probability of realizing only one fish in the escapement by the year 2003 is 95% and hence the population becomes endangered in 2003. "Threatened" is defined as a 50% chance that the population will become endangered in 10 years (Thompson 1991).

[4] Probability of achieving an escapement of 1,477 or fewer fish in 2003.

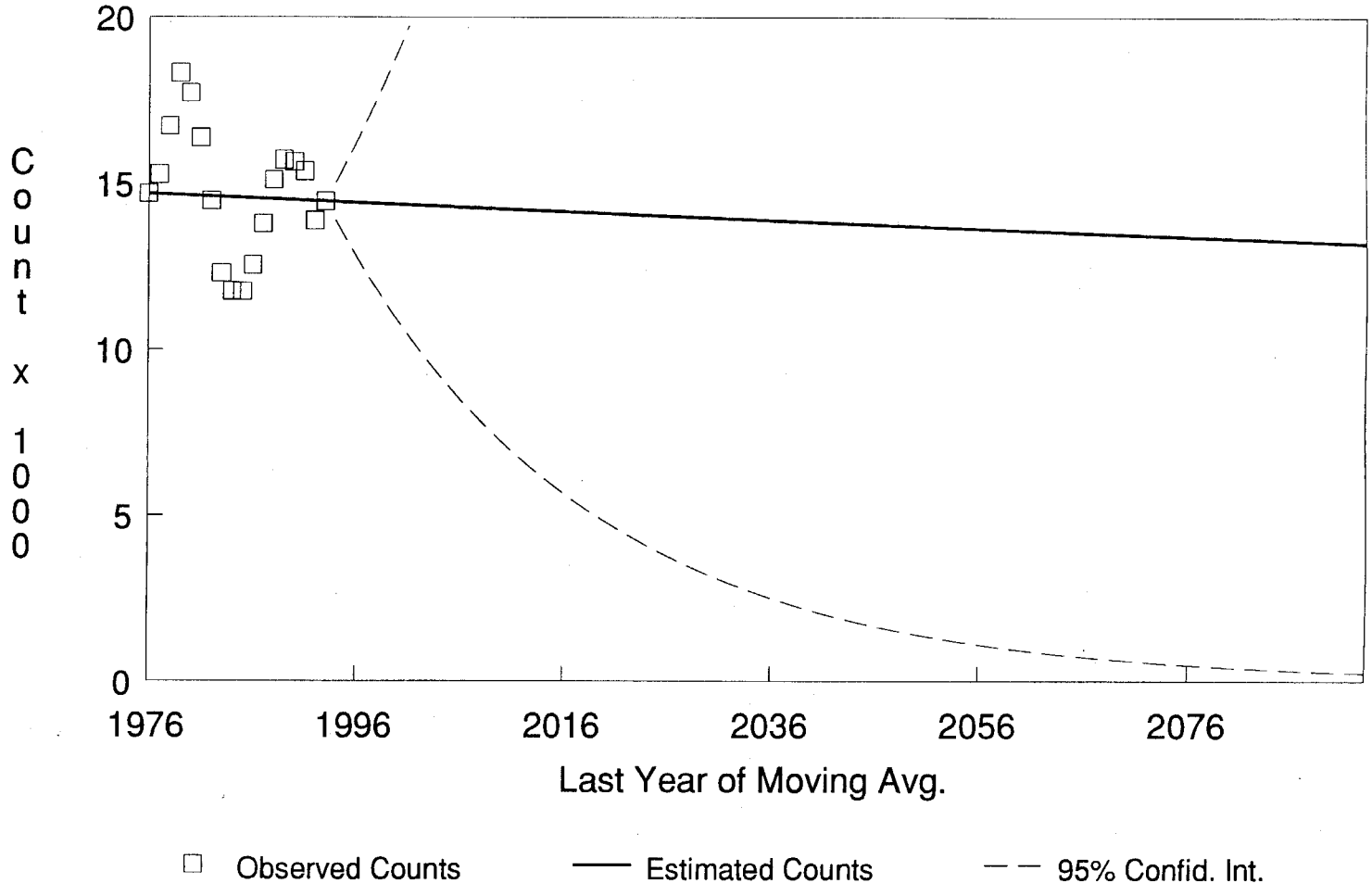

Figure 6. Predicted returns of adult summer chinook salmon to the mid-Columbia River based upon counts at Priest Rapids Dam modeled with the Dennis et al. (1991) method.

population reaching a population size of 1,477 or fewer fish (the abundance that would trigger a listing of "threatened") by the year 2003 is also substantially less than 0.00001. As a consequence, and based upon the criteria as given by Thompson (1991) and this data set, the mid-Columbia River summer chinook salmon population should **not be listed as "threatened"** even if the stock is determined to be an ESU.

CONCLUSIONS REGARDING STATUS OF MID-COLUMBIA RIVER SUMMER CHINOOK SALMON AS "ENDANGERED" OR "THREATENED" UNDER THE ENDANGERED SPECIES ACT OF 1973

After review of several genetic and other studies of Columbia River chinook salmon populations, staff of the Alaska Department of Fish and Game believe that the mid-Columbia River summer chinook salmon stock is not an ESU of and in itself, but is instead part of a larger ESU that includes fall-run chinook salmon that spawn in the mid-Columbia River basin. As a consequence, staff of the Alaska Department of Fish and Game recommend that NMFS **not list** mid-Columbia River summer chinook salmon as a "threatened" or as an "endangered" species under the Endangered Species Act of 1973.

Further, staff of the Alaska Department of Fish and Game have modeled three data sets indicative of the abundance of summer chinook salmon of the mid-Columbia River basin and have found that the probability of this stock becoming extinct within the next 100 years is substantially less than 0.00001, indicating that even if this stock is determined to be an ESU, **the stock is not "endangered"**. Also, the probability of this stock of chinook salmon being "threatened" is also substantially less than 0.00001. **The petition to list mid-Columbia River summer chinook as "threatened" or "endangered" under the Endangered Species Act of 1973 should be rejected.**

LITERATURE CITED

Dennis, B., P. L. Munholland, and J. M. Scott. 1991. Estimation of growth and extinction parameters for endangered species. Ecological Monographs 61: 115-144.

Chapman, D. W. 1993. Mid-Columbia River chinook as a distinct population segment under the Endangered Species Act. A report to the Grant, Douglas, and Chelan Public Utility Districts by Don Chapman Consultants Inc., 3653 Rickenbacker, Ste 200, Boise, Idaho 83705. 31 pp.

Fulton, L. A. 1968. Spawning areas and abundance of chinook salmon (*Oncorhynchus tshawytscha*) in the Columbia River Basin - past and present. U.S. Fish and Wildlife Service. Special Scientific Report - Fisheries No. 571.

Hershberger, W. K., D. Dole, and X. Guo. 1988. Genetic identification of salmon and steelhead stocks in the mid-Columbia River. Final Report to Don Chapman Consultants, Inc.

Howell, P., K. Jones, D. Scarnecchia, L. LaVoy, W. Kendra, and D. Ortmann. 1985. Stock assessment of Columbia River anadromous salmonids, chinook, coho, chum, and sockeye salmon stock summaries volume, Final Report to U. S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife, Contract No. DE-A179-84BP12737, Project No. 83-335. p 440-451.

Meekin, T. L. 1967. Report on the 1966 Wells Dam chinook tagging study. Washington Department of Fisheries. Original not reviewed, information used was cited in Howell et al. 1985.

Mullan, J. W. 1987. Status and propagation of chinook salmon in the mid-Columbia River through 1985. U.S. Fish and Wildlife Service Biological Report Number 87. 184 pp (cited in Utter 1993; original not reviewed).

NMFS. 1992. Pacific salmon and artificial propagation under the Endangered Species Act. Draft document prepared by: Coastal Zone and Estuarine Studies Division, Northwest Fisheries Center, 2725 Montlake Boulevard East, Seattle Washington 98112 and Environmental and Technical Services Division, Northwest Region, 911 N.E. 11th Avenue, Portland, Oregon 97232. Dated: May 26, 1992. 33 pp..

Schreck, C. B., H. W. Li, R. C. Hjort, and C. S. Sharpe. 1986. Stock identification of Columbia River chinook salmon and steelhead trout. Final Report to Bonneville Power Administration under Agreement DE-A179-83BP13499. 184 pp.

Thompson, G. G. 1991. Determining minimum viable populations under the endangered species act. U.S. Department of Commerce, NOAA Technical Memorandum NMFS F/NWC-198: 1-78.

Utter, F. M., G. B. Milner, G. Stahl, and D. Teal. 1989. Genetic population structure of chinook salmon, *Oncorhynchus tshawytscha*, in the Pacific Northwest. Fisheries Bulletin 87:239-265.

Utter, F. M. 1993. A genetic examination of chinook salmon populations of the upper Columbia River. Report to Don Chapman Consultants, Inc. 3653 Rickenbacker, Suite 200, Boise, Idaho 83705. 18 pp. Report obtained from author, 19424 10th Ave. N.E., Seattle, Washington 98155.

Pacific Fishery Management Council (PFMC). 1993. Review of 1992 ocean salmon fisheries. Pacific Fishery Management Council, Metro Center, Suite 420, 2000 S.W. First Avenue, Portland, Oregon 97201. p. B-18.

Waples, R. S. 1991. Definition of "species" under the Endangered Species Act: application to Pacific salmon. U.S. Department of Commerce, NOAA Technical Memorandum NMFS F/NWC-194:1-29.

Waples, R. S., R. P. Jones Jr., B. R. Beckman, and G. A. Swain. 1991. Status review for Snake River fall chinook salmon. U.S. Department of Commerce, NOAA Technical Memorandum NMFS F/NWC-201: 1-73.

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