STATE OF CALIFORNIA

DEPARTMENT OF FISH AND GAME

INTRAOFFICE CORRESPONDENCE

DATE January 27, 1955

TO: REGION III, ATTENTION: WILLIS A. EVANS

FROM: LEONARD 0. FISK, SACRAMENTO

SUBJECT:

Enclosed is a preliminary draft of a report on the Navarro River to be submitted to the Division of Water Resources. This is to present the views of the Department of Fish and Game. I would appreciate any comments you care to make on subject matter covered, or any additional data you think should be included.

Leonard 0. Fisk

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Assistant Fisheries Biologist

LOF:am
Enc.

P. S. Would appreciate an early return.
L.O.F.

Recommendation for the Development of the Navarro River Basin to Benefit Anadromous Fishes

INTRODUCTION

Several California rivers are being considered for water developments that would be detrimental to the Anadromous fishes using them. To compensate for this loss, several North Coastal streams have been set aside for possible developments to increase the runs of these fishes. These streams include the Gualala, Garcia, Navarre, Big, Noyo, Ten Mile, Mattole, and South Fork of Eel Rivers, and Redwood Creek. The present report will consider developments to enhance the fisheries of the Navarro River.

The Navarro River drainage encompasses 316 square miles of territory in lower Mendocino County. Most of the area is mountainous, with only 11 square miles classified as valley type. Most of the latter type area is known as Anderson Valley, and is located near the center of the drainage. This small area limits the amount of agriculture possible and, consequently, the need for irrigation water. A large part of the agriculture of Anderson Valley is orchard crops, namely apples. The two other main industries on the watershed are sheep raising and lumbering.

STREAM FLOW

The mean annual runoff of this watershed is estimated to be 375,000 acre-feet. This runoff, however, is quite seasonal and in dry years can be insufficient to maintain the fish population in the stream. The Water Resources Division of the Geological Survey has maintained a stream flow gaging station on the Navarro River from November, 1950, to the present time. This station is located 5.4 miles upstream from the Mouth of the river. The records for the three-year period 1950-53 show a range of 7.4 to 17,200 cubic feet per second flow at the gage. The mean monthly flows range from 8.4 to 3,760 cfs. The low flows were recorded in September and the high flows in December and January. The mean monthly flows for the three-year period are given in Table 1.

Table 1. - - Mean monthly flows in cubic feet per second of Navarro River at gaging station for period 1950-53.

Month	1950-51	1951-52	1952-53
October	260	21.3	9.4
November	520	201	32.0
December	1,563	2,636	158
January	2,302	2,777	3,760
February	1,528	1,625	298
March	883	1,256	740
April	145	223	333
May	177	99.1	214
June	46.7	54.2	109
July	22.3	29.1	37
August	12.9	13,8	22
September	8.4	12.0	X7
Averages	620	748	603

Estimates of the runoff for the Navarro drainage have been calculated from a gaging station on the Eel River for the period 1916-17 to the present. Table 2 gives these estimates.

Table 2. - - Estimates of the runoff in acre-feet of Navarro River drainage for the period 1916-17 to 1952-53.

Year	runoff	Year	runoff	Year	runoff
1916-17	307,310	1929-30	250,710	1942-43	404,820
1917-18	161,790	1930-31	114,820	1943-44	160,580
1918-19	377,670	1931-32	257,590	1944-45	339,550
1919-20	100,990	1932-33	259,120	1945-46	429,580
1920-21	555,800	1933-34	176,810	1946-67	186,660
1921-22	265,470	1934-35	361,510	1947-48	338,990
1922-23	196,110	1935-36	409,860	1946-49	295,060

Year	runoff	Year	runoff	Year	runoff
1923-24	61,820	1936-37	254,510	1949-50	293,430
1924-25	513,450	1937-38	765,190	1950-51	510,490
1925-26	233,280	1938-39	190,830	1951-52	571,610
1926-27	559,580	1939-40	519,690	1952-53	509,360
1927-28	328,690	1940-41	487,160		
1928-29	135,730	1941-42	57,550		

The average of the last three years estimates (1950-51 to 1952-53) is 530,553 acre-feet. It can be seen that in only three previous years were the estimates above this average figure. These years are 1920-21, 1926-27, and 1937-38.

A comparison of the estimated runoff with the recorded runoff for the three year period 1950-51 to 1952-53 indicates that the estimated figures are too high (Table 3).

Table 3. - - Estimated and recorded runoff in acre-feet of the Navarro River for the period 1950-51 to 1952-53.

Year	Estimated	Measured
1950-51	510,490	448,500
1951-52	571,810	542,700
1952-53	509.360	436.600
Averages	530,553	475,933

That these figures are above average is readily apparent by comparison with the mean estimated runoff of 375,000 acre-feet.

SPAWNING AREAS

It is unfortunate that it has not been possible to map all spawning areas of the river. It is known, however, that most of the tributaries with a reasonable flow are used for spawning purposes. Since the two species of anadromous fishes using the river, silver salmon and steelhead rainbow trout, both spawn

in relatively small reaches of streams, it is apparent that with reduced summer flows, many young fish become stranded. This has been especially true on Rancheria Creek. Most of the other tributaries used for spawning normally have enough summer flow to support a limited population of young fish, or the fish move down into the lower reaches of the streams where there is a continuous flow.

Adequate spawning gravel is found in most of the tributaries, and is not considered to be a limiting factor. Extensive beds are found in most of the tributaries and upper reaches of North Fork, Indian Creek, Anderson Greek, and Rancheria Creek. Probably the most heavily used spawning .area at the present time is on Anderson Creek above the town of Boonville.

There are no records of the number of fish caught in this river, or of the angler use. The Department of Fish and Game has started intermittent creel census checks on the area, but no figures are available as yet.

Several fish collections have been made in the drainage. These collections have been taken below Dimmik Park, on North Fork, and on Anderson Creek above and below Boonville. These collections were made in June, August, and October. Small trout were taken at all of the stations, while silver salmon were taken only from stations in the lower part of the drainage; no salmon were taken in Anderson Creek. It is not known whether salmon do not use Anderson Creek, or whether the salmon had migrated to the lower reaches of the stream before the collections were made.

UNDESIRABLE CONDITIONS OF STREAM

Several undesirable conditions are present in the watershed at the present time. Possibly the greatest single hindrance to fish life is the logging operations, especially on the North Fork. Much of the slash is left on the ground and some is washed into the streams, thereby contributing to log jams and barriers. Large amounts of silt and debris are also washed into the stream from cut-over areas and logging roads. This debris covers spawning gravel and reduces food

organisms. This tributary formerly was utilized to a large extent by both salmon and steelhead trout for spawning purposes. Although there is still a limited amount of spawning in the North Fork, the use has diminished in the past few years. The Masonite Corporation has built a road along areas of both the North and South branches of the North Fork, and on some of their tributaries. This road system has, in many cases, restricted the channels of the streams. Shoulders of this road periodically sluff off into the stream during heavy rains, thereby contributing large amounts of sand and silt which is deposited along the bottom of the stream. Much of this silt is carried along in the water and undoubtedly contributes to the decreasing depth of the lagoon at the south of the river. Logging operations are also being conducted on the upper portions of Rancheria Creek. These operations have not, as yet, become as extensive as those on the North fork.

Rancheria Creek is used rather heavily by both salmon and steelhead for spawning. While there are relatively large spawning areas present in the upper reaches of the stream, conditions are poor for survival. During the summer the flow is greatly reduced and many small fish would be lost each year were it not for fish rescue operations. Table 4 summarizes the results of fish rescue operations on this stream during the years 1948-52 inclusive.

Table 4. - - Fish rescued from Rancheria Creek during the years 1948-52 inclusive.

Year	Steelhead Trout	Silver Salmon	Total
1948	26,750	36,814	63,564
1949	37,230	35,420	72,650
1950	75,777	5,045	80,822
1951	76,506	51,466	127,972
1952	118,659	1,684	120,343
Totals	334,922	130,429	465,351

RECOMMENDATIONS

Since the purpose of this report is to make recommendations for conditions to enhance the fisheries of the river, little consideration will be given developments for other purposes.

Developments

There are four tributaries on which stream flow maintenance dams that would be of great benefit to fish could be constructed. Rancheria Creek seems most susceptible to this type of development. There are several possible dam sites on this creek, but the one that would be of greatest benefit is located about five miles below the Hulbert Ranch in Section 30, T 12 N, R 12 W, Mt. Diablo Meridian and baseline. A dam at this point would eliminate little spawning area, yet would benefit approximately 60 miles of stream.

Several possible dam sites are present on the North Fork. The one of greatest advantage to fisheries is on the South Branch near Nivens Ranch in Section 22, T 15 N, R 14 W. Another site on this branch is located below Castle Garden, in Section 18, T 15 N, R 14 W. This site would eliminate about five additional miles of stream, plus several tributaries that are used for spawning, and so is not considered as satisfactory as the one at Nivens Ranch. Another possible dam site is on the Little North Fork, just below the confluence of Sawyer Creek in Section 36, T 16 N, R 15 W. These two developments would benefit approximately 35 miles of the North Fork tributary, exclusive of the lower nine mile stretch of river to the mouth.

Indications are that a limited amount of water will be needed for irrigation in Anderson Valley. A dam site that has been considered for this purpose is on Anderson Creek, several miles above Boonville. However, a barrier at this point would eliminate some of the best spawning gravel to be found in the drainage. It is strongly recommended that another site be found for this

development, one possible site is on Soda Creek. This tributary has a moderate flow and should be capable of producing all the water needed for irrigation. There is a barrier in this creek at present over which fish cannot ascend, so that a dam at this point or farther up the canyon would have no detrimental effect on the salmon or steelhead. This dam could be located in Section 5, T 13 N, R 13 W. In addition to providing water for irrigation, releases of water from this reservoir would benefit fish in about 12 miles of tributary stream.

The mouth of the Navarro River has been closed by a sand bar every summer during periods of low runoff for many years. Some development should be made to keep the mouth open so that early-spawning fish could enter the river and not be lost in case fall rains are late. In the late 1800's and early 1900’s, a jetty was present and the mouth was always open. Boats and barges had access to the lagoon at that time. This jetty was burned in 1914, and the mouth has been closed for periods each year since then. It is recommended that a channel be dredged near the cliff on the north side of the mouth and a jetty be constructed to keep this channel open. If this development is not considered practical, perhaps a concrete lined tunnel could be constructed that would permit fish to enter and leave the lagoon at will. A tunnel of this type has been in operation on Soquel Creek in Santa Cruz County and has proved to be satisfactory at that location.

Stream Flow

It is very difficult to recommend a certain minimum stream flow on a river system such as the Navarro because there are so many factors that are influenced by different flows of water. Some of these factors are production of food organisms, spawning areas, temperature, hiding places, "living space", compaction of gravel, flushing of silt, and many others. All of these factors must be evaluated in the final analysis before a certain flow can be agreed

upon that will be of the greatest benefit to fish life, yet will be possible to maintain without unreasonable expenditures. Table 5 gives the suggested minimum flows for this river.

Table 5. - - Minimum flows to maintain in cubic feet per second at various points in Navarro River drainage.

Station	July 1-lst Rain	1st Rain – Feb. 1	Feb. l-Apr.15	Apr. l5 – July 1
Dam on Rancheria Creek	10 cfs	60 cfs	50 cfs	Gradually reduce to 10
Dam on Soda Creek	5 cfs	10 cfs	10 cfs	Gradually reduce to 5
Dam on Little N. Fork	5 cfs	50 cfs	40 cfs	Gradually reduce to 5
Dam on South Branch, N. Fork	5 cfs	50 cfs	40 of •	Gradually reduce to 5
Mouth of River	25 cfs	250 cfs	200 cfs	Gradually reduce from

These suggested flows are based upon the following considerations:

July 1 - first rain; 25 cfs at the south is considered minimum to keep an opening throughout the summer. The suggested flows at each dam are the minimum amount that will sustain a population of young fish in lower portions of the stream.

First rain - Feb. 1; These flows are considered minimal to provide enough spawning gravel for silver salmon and the hatching of their eggs.

Feb. 1 – April 15; These flows are needed for steelhead trout spawning and the incubation of the eggs. Most of these eggs will have hatched by April 15.

April 15 - July 1; Adequate flows are needed during this time to permit young steelhead to migrate to lower reaches of the streams. This migration should be completed by July 1.

From the stream gage records, it was computed that 2,668 acre-foot of water would have been required to maintain a flow of 25 cfs at the mouth in 1951, and 2,920 acre-feet in 1952. From the estimated runoff records, it was calculated that maximums of 5,400, 5,300, and 5,200 acre-feet of water would have been needed for the years 1924, 1929, and 1939, respectively. A minimum of 390 acre-feet would have been needed in 1948. These figures are for the period July 1 until the first rains. It is assumed that runoff in the areas behind the dams would more than compensate for water released at the dams from the first rains until spring, and that the reservoirs impounded by the dams would not be drawn upon until April at the earliest, and possibly not until June or July. It is recommended that all decreases in flow be made gradually, not to exceed 2 cfs per day at any dam site. This is during controlled flows, and is not to be considered when water is overflowing the reservoirs.

The large flows, or floods, which usually occur in December or January, are not to be harnessed completely. It is recognized that these floods would produce large amounts of water for the reservoirs, but it should be borne in mind that they also churn up the spawning gravels and prevent then from becoming too compacted. They also wash downstream much of the silt and debris that has been accumulated during periods of low flow.

Recreation

At the present time, there are two State parks in the Navarro River system. Dimmik Park is located in a redwood grove at the junction of North Fork with the main Navarro River nine miles upstream from the mouth. Indian Creek State Park is situated 25 miles above the mouth.

The entire lower portion of the river, from the town of Navarro to the mouth could be developed for recreational uses. All of this area is heavily timbered, with attractive redwood groves covering most of it.

Several campgrounds could be developed in this area.

The mouth of the river, including the beach and lower lagoon, could be made into a very desirable state park. The beach would be especially attractive if the logs and debris presently covering much of it were removed. Surf fishing could become a popular sport here, in addition to salmon and steelhead fishing.

Hunting on the watershed is presently restricted to deer and quail. Most of the land is privately owned, and much of it is closed to hunting. Little change could be expected either way in the hunting potentialities by any developments this report is concerned with.

EFFECT OF DEVELOPMENTS ON FISH

Various effects could be expected if the proposed developments were carried out. A few of these will be discussed briefly.

Increased flow in summer

The proposed summer flows would be of great benefit to the young salmon and steelhead. It should no longer be necessary to rescue fish from any of the main tributaries, a project of major importance at the present time on Rancheria Creek. A moderate flow during this part of the year would keep many riffles flowing with water and produce more food organisms, a factor which would permit greater production of fish. A continuous flow of water in the streams would reduce temperatures to a limited extent.

Decreased flow in winter

Storage water for these reservoirs would, of necessity, be collected during the winter months in periods of high runoff. This would reduce the extreme high flows, especially in areas immediately below the dams. Although certain minimum flows are to be maintained, it would be quite desirable to have several

large flows released from the dam sites. These flows would churn up the spawning gravel and prevent its compaction, a condition often encountered in streams where developments have reduced large flows. It is quite possible that several large flows would naturally occur each year from heavy rains after the reservoirs had been filled.

Decreased spawning areas

The dams considered in this report would eliminate certain areas now used for spawning. Although these areas are rather small, they are heavily used at present. To compensate for this loss, the areas below the dams must be improved to the extent that they would produce many more fish than are lost from the upstream areas. If this condition could not be attained, it would be impractical to make any developments on the river.

Barrier removal at mouth

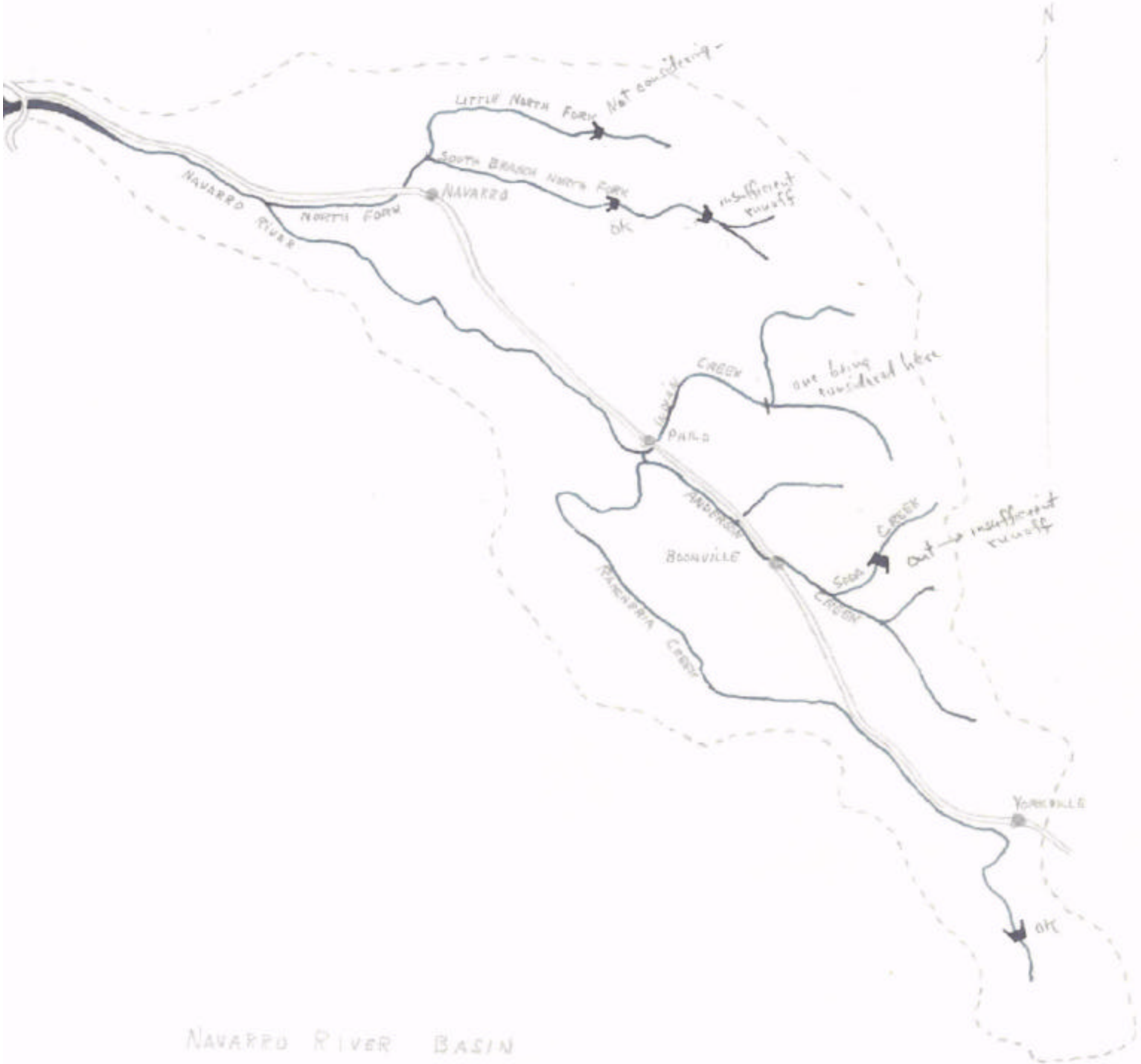
Although there seems to be a difference of opinion on the merits of keeping the mouths of coastal streams open, it appears that the mouth of the Navarro could be kept open with beneficial effects. An opening would permit early-spawning fish to enter the river at will. Some of these fish would undoubtedly be caught by anglers, however, this can be considered good conservation because they may have been lost during years of late rains. Young fish using the lagoon as a nursery ground before entering the sea would still have a sizeable portion in which to live. Although it would undoubtedly be more saline in the summer than at present, it would also contain many more small fish which would find their way in from the ocean. Increased salinity would also contribute to higher production of invertebrates, which would be used as food by young salmon and steelhead. The young salmon and steelhead would also have free access to the ocean, and would not have to wait for the rains to open the bar.

SUMMARY

The Navarro River is being considered for developments to enhance the fisheries presently found here. The species of fish prevent are silver salmon and steelhead rainbow trout. The developments are of two forms; streamflow maintenance dams and opening of the mouth in late summer. Four possible sites for dams are given. These are located on the North and South branches of North Fork, on Soda Creek, and on Rancheria Creek. Recommendations for minimum flows to be released from each dam are given. Two possible methods of maintaining an open mouth of the river are given. These are construction of a tunnel, and a dredged channel with an adjacent jetty to protect it.

Undesirable conditions, mainly resulting from logging operations, are briefly described. Some of these conditions should be remedied before developments are begun.

Possible recreational developments are briefly discussed, however these can be more thoroughly treated after adoption of the major developments of this report.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