KING RANGE NATIONAL CONSERVATION AREA AQUATIC INVENTORY

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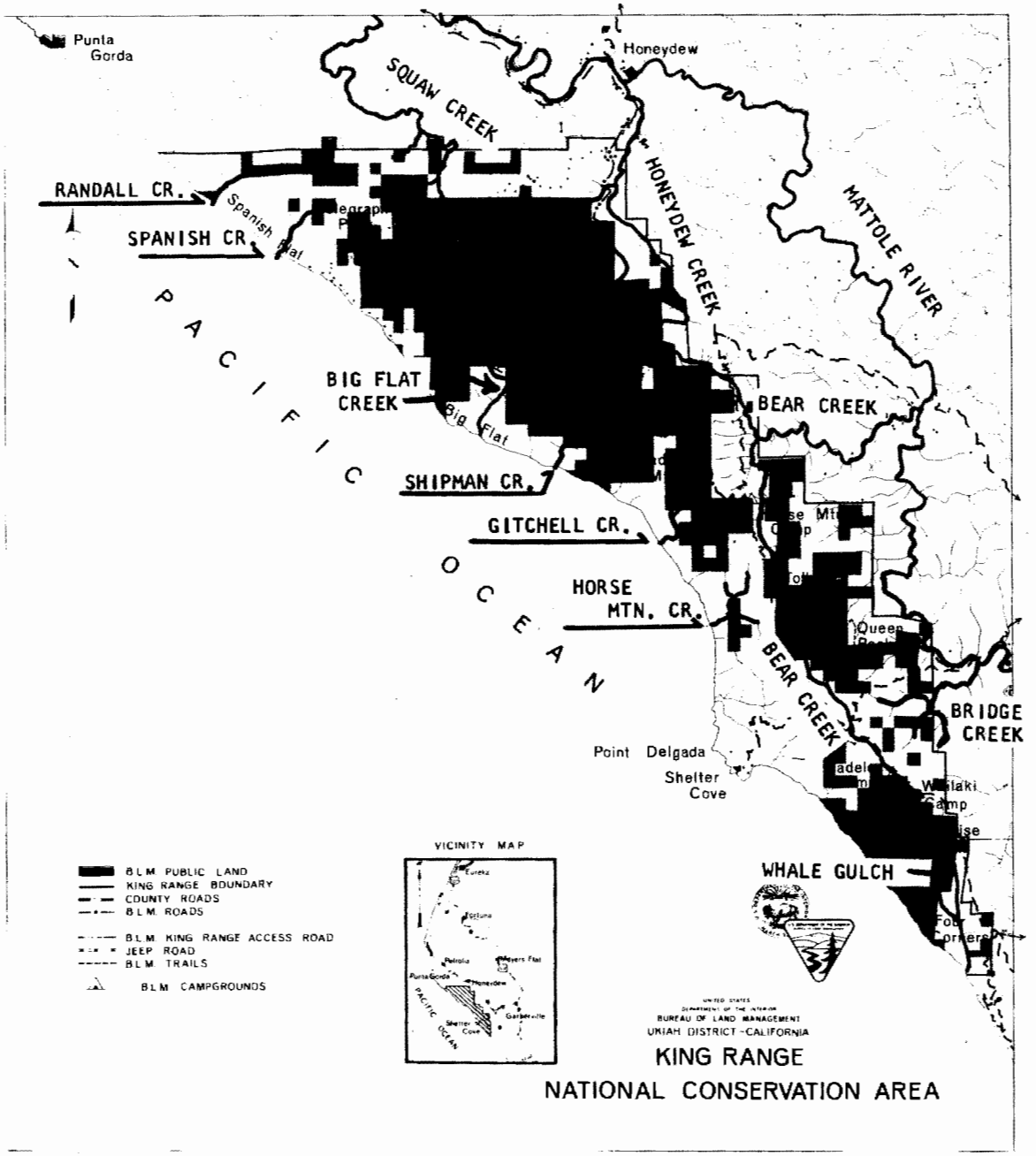
Abstract. Congress, in October 1970, created the King Range National Conservation Area, the first such area in the country, for the "purpose of conserving and developing... the lands and other resources therein under a program of multiple usage and sustained yield." Administration was assigned to the Bureau of Land Management, who was directed to develop a management program based upon the inventory of all available resources.

The aquatic inventory was divided into two parts, freshwater and marine. Physical surveys and other studies were conducted in the area July to December 1972. The biologically productive marine areas are limited to a few inshore areas because of steep offshore slopes. Forty-five species of marine algae, 32 species of marine invertebrates, 15 species of marine fish, and 4 species of marine mammals have been identified. The freshwater inventory covered 21 coastal and inland streams. Anadromous salmonids are the most important users of these streams. Studies indicate that erosion, from both natural causes and logging damage, is the prime factor adversely affecting the streams. Future plans are aimed towards managing and improving all aspects of the aquatic environment within the framework of the King Range management plan.

INTRODUCTION

Congress, in October 1970, established the King Range National Conservation Area, the first such area in the country, for the "purpose of conserving and developing... the lands and other resources therein under a program of multiple usage and sustained yield." The task of implementing terms of the bill was assigned to the Bureau of Land Management. As administrator, the Bureau was to manage the available resources while preserving the natural features and resources for future generations. A final management plan was to be based on "an inventory and evaluation of the available resources and requirements for such resources...taking into consideration total requirement and total availability of resources, irrespective of ownership and locations." (Kings Range National Conservation Area Act, Public Law 91-476). All lands, whether public or private, were to be inventoried, with a final management plan to include resources for the entire area. This report covers the aquatic part of the inventory.

Figure 1. Location of the King Range National Conservation Area and the major fishery streams present.



Location

The King Range National Conservation Area lies in southwestern Humboldt County and northwestern Mendocino County on the northern California coast. The western boundary is formed by 25 miles of Pacific Ocean coastline, beginning just south of Punta Gorda, as shown in Figure 1. The Conservation Area includes 50,000 acres, of which 31,000 were public at the time the area was set aside. Through purchase and land exchanges, the amount of public land is expected to increase as holdings within the area are consolidated.

Topography

A pair of generally north-south ridges are the dominant feature of King Range. Running along the coast is the King Mountain Range, from which the area derives its name. Highest point in the mountain range is King's Peak at 4,089 feet. Westward it drops in steep slopes to the ocean, three or less miles away. In the northeast, the mountains slope much more gradually to the Mattole River Basin near the town of Honeydew. To the east and southeast, the King Mountain Range is separated from the Mattole River by Wilder and Paradise Ridges, which have as their highest point Queen's Peak at 3,000 feet. Separating the two ridges is a series of creeks which cut a north-south valley before turning east between Wilder and Paradise Ridges to enter the Mattole. The whole eastern part of the Conservation Area is within the basin of the Mattole River, largest river in northern California between San Francisco and Eureka. The Mattole itself actually flows within the boundaries of King Range for only about 3/4 miles, but it plays a dominant role in the aquatic habitat of the area, providing the primary travel route for anadromous fish in inland streams.

PROCEDURES

The inventory of the King Range National Conservation Area was divided into two parts, freshwater and marine. Most of the effort was centered in the freshwater, both because of its relatively greater importance in overall planning, and because of the lack of needed equipment. The surveys were run in February, and July to December 1972.

Freshwater

Prior to beginning any detailed studies, it was decided to restrict the freshwater inventory to those streams capable of sustaining populations of salmonids. Excluded were streams which, because of low flows in summer or steep terrain, did not offer suitable habitat. The decision on which streams to study was based on aerial and ground observations.

The majority of the physical survey in the streams was made on foot, walking from the mouth to the upper limits of fish use potential or human access. In the Mattole and Squaw Creek, which have most of their drainage outside King Range, surveys were begun upstream near where they entered the King Range. In addition to ground surveys, helicopter flights were made over stream systems, with emphasis on those areas not readily reachable by other means. During the surveys, notes were made on the physical condition of the stream and the surrounding terrain. Photographs were taken to illustrate the general conditions and specific problems. Data collection was made on field survey forms developed and used by State and Federal agencies in Oregon. On these forms the streams were broken down into quarter mile segments, with each quarter mile being further subdivided into 4-110 yard sections. Data on gravel, percentage of pool and shade, and numbers of fishes were recorded for each 110 yard section, then summarized for each quarter mile. In addition, the temperature, flow, stream width, and streamside cover were recorded for every quarter mile. Notes were made on the general appearance of the stream, the bottom material, topography of the surrounding terrain, and the presence of any special conditions such as slides, jams, or falls. Human and animal uses of the drainage were also recorded. A code system was developed, based on the 110 yard sections and quarter mile segments, which was used to key all reports, photographs and maps used in summarizing the results of the inventory.

In addition to the physical survey of the streams, a program of water quality studies was initiated. At least one sample was taken from each stream and analyzed for carbon

dioxide, total hardness, total nitrogen, oxygen, pH and turbidity. On two of the most important drainages, a series of 10 permanent water quality monitoring stations was established. Initial plans call for monitoring these stations at least once a month to establish yearly fluctuations in water quality. All tests were made using a Hach portable water testing kit.

Three other studies were initiated early in the inventory, but to date have not progressed far enough to produce any results. These include determination of the numbers and distribution of immature and adult salmonids; determination of the quality and quantity of bottom organisms; and the description of climatological and hydrological conditions in King Range. Fish population studies include physical surveys for adults and shocker studies to determine juvenile populations. A Surber Sampler was used to take a transect of bottom organisms at each water quality station and other selected sites. To date, only a preliminary collection and analysis have been carried out. The climatological and hydrological data for King Range now available are based on USGS data from in or near King Range, although BLM studies using portable weather and water study equipment have been initiated.

Marine

Most of the information regarding the aquatic marine habitat is based on visual observation and random field collections. During the month of August, regular weekly helicopter flights were conducted to inventory marine birds, mammals, and other marine life along the full length of the King Range coast. In addition, notes were taken on these flights of rocks, reefs, and kelp beds that could serve as biologically productive areas close to shore. Later, all the coast, with the exception of a stretch of southern coast inaccessible because of lack of beach, was surveyed on foot at regular intervals. Collections were made of marine plant and animal life from reefs and rocks, and washed up on the beach. Most of the algae were delivered to California State University, Humboldt, for identification; all other plants and animals were identified by BLM personnel. No other marine studies are known for this area.

RESULTS

Freshwater

A total of 21 streams were surveyed, eight inland in the Mattole Basin, and 13 flowing directly into the Pacific Ocean. In length, the stream systems ranged from 1.25 to 25 miles. The inland streams were of longer average length with more forks and a larger drainage area. All were typical mountain streams, originating high on the slopes of King's Mountain Range and Paradise Ridge. They followed the typical mountain stream profile, with a steep headwaters area moderating in slope as the stream nears its mouth.

Rocks and rubble were the predominant bottom materials, with many boulders and much silt and fine material, especially in the coastal streams. Most of the good spawning gravel was concentrated in the larger inland streams. Considerable exposed bedrock was also present. Siltation and extensive alluvial material was common, most of it traceable to natural erosion or logging operations.

Altogether, 85 miles of stream were surveyed on foot, of which 23 were coastal and 62 inland. A total of 47,876 square yards of gravel suitable for salmonid spawning was counted, along with over 200,000 square yards of pool useable for rearing area. The coastal streams, with about a quarter of the accessible stream length, contain only 5% of the available spawning area and less than 1% of the available pool area. Thus the coastal streams contain a significant proportion of the available watershed but have a relatively insignificant proportion of the useable spawning and rearing area in King Range. The distribution of spawning and rearing area was reflected in the distribution of fish; inland populations were considerably greater than coastal.

The predominant fish species in King Range is the steelhead (Salmo gairdneri). The majority of the King Range population are concentrated in three large inland drainages, Bear Creek, Honeydew Creek and Squaw Creek, but they are found in all 21 streams surveyed. Adults enter the rivers and larger streams following the first major rains of late October and November, with spawning peaking in late January and February. Reports of spawning into late April and May have yet to be confirmed.

Two other anadromous salmonids, silver salmon (Oncorhynchus kisutch) and chinook (O. tshawytscha), are also present in the larger drainages. Numbers are small, limited mainly to the lower part of Bear Creek, Honeydew Creek and Squaw Creek. The fish spawn in late November and early December.

In addition to the salmonids, three other fish species were observed; lampreys (Entosphenus tridentatus), sticklebacks (Gasterosteus aculeatus) and Pacific staghorn sculpin (Leptocottus armatus). There are small numbers of resident rainbow trout (Salmo gairdneri) in the larger streams and in the headwater areas inaccessible to anadromous fish because of natural barriers. BLM and California Department of Fish and Game have investigated reports of brown trout (Salmo trutta) and searun cutthroat trout (Salmo clarkii), but none were caught with seine or chocker sampling.

The water in King Range is relatively pure, high in oxygen and low in nutrients. Oxygen values taken in the September-December period ranged from 8 to 12 mg/L, depending on water temperatures, with little variation from stream to stream. It was never limiting during the test period. Carbon dioxide and total nitrogen were uniformly low. The pH averaged around 8.5 with only two streams yielding slightly acidic results. The greatest diversity in water quality values were noted in turbidity and total hardness. Turbidity showed marked changes during high flows; values increased to several hundred JTU's as a result of erosion. With total hardness, coastal values were consistently 100 mg/L higher than inland streams. This is presumably due to their source as seeps and springs from rocky canyon and cliff areas.

Marine

The most notable feature of the coastline of King Range is the lack of onshore biologically productive areas. The steep terrain evident in the coastal hills of the King Mountain Range continues out to sea. There is practically no continental shelf. At one point the 200 fathom line is less than two miles off shore and it is seldom more than six miles off shore. As a result, there is little terrain close to shore that would permit development of an extensive benthic community. The only three exceptions are the reef area around Point Delgada, the kelp beds at the mouth of Shipman, Buck and Gitchell Creeks; and the zones of alluvial material at the mouths of the larger streams. There are few rocks or other onshore formations capable of sustaining any type of aquatic life. The beaches are narrow, composed typically of sand and rock, with large stretches submerged at high tides. In some areas, no beach exists, with surf reaching the base of the hills at all but extremely low tides.

To date some 45 species of marine algae, 32 species of marine invertebrates, 13 species of marine fishes and 4 species of marine mammals have been identified off King Range. Most of these were collected or observed in the area of Point Delgada. The fist noted were taken primarily by sports fishermen launching out of Shelter Cove, the only public access to the ocean. There is a beach launching facility in a protected harbor with no other improvements except for a walk ramp down to the beach. Yet, 3,871 boats were launched from May 27 to October 2, 1972. An estimated 9,363 persons caught 4,000 salmon and large numbers of bottom fish. Primary bottom fish caught were ling cod (Ophiodon elongatus), greenling (Hexagrammos decagrammus), cabezon (Scorpenichthys) and various species of Sebastodes.

DISCUSSION

In general terms, the King Range Conservation Area streams are typical for the type and geographical area. In appearance, biota and water quality they show no unusual patterns or features. As anticipated, steelhead are the main inhabitants of the streams. Fish populations at the present time are low. In most of the smaller streams, especially on the coast, conditions in the streams would not permit maintenance of any sizeable numbers of fish. The larger inland streams are capable of producing much larger populations of salmon and steelhead. Historically, these populations were much larger than at present, but have declined sharply in the last 20 years. As is so often the case, the main cause in their decline has been the destruction of habitat by the actions of man.

Intensive logging began along the Mattole in 1952, peaking in 1954-55. Since then, nearly all of the eastern half of King Range and much of the coastal area has been subjected to clear cutting. Conducted in the atmosphere of a boom time operation, the logging operations were carried out with little regard for the streams or surrounding terrain. The streams, being the flattest terrain in an otherwise steep country, were utilized as logging roads and skid trails. Road construction was temporary in nature, with no care taken to prevent breakdown and erosion. The results were predictable; canyon bottoms became flat gravel bars devoid of vegetation as pools filled in and spawning areas were covered with debris and silted over. Stream flows became highly erratic, with periods of high, muddy water. Fish populations fell off rapidly.

At the present time, logging operations have declined to the point where only limited logging is being carried out on private lands. Yet the results of past operations are still highly visible in the many remaining log jams, flat canyon bottoms, extensive streamside erosion and small fish populations.

This is not to imply that all logging is caused by man; severe natural erosion occurs in many areas throughout King Range. In the northern coastal areas, in particular, slides and extensive erosion areas are highly visible. But in terms of damage to stream habitat the actions of man have been more destructive than natural deterioration.

Erosion, natural or man-caused, is the singlest greatest problem in the freshwater habitat in King Range. This is due in large measure to a number of environmental factors that make erosion likely to occur and compound the damage when it does. These factors contribute directly to natural erosion and make severe erosion more likely when the natural conditions are disturbed by man.

King Range is geologically very active. A major fault runs through Point Delgada; this is either the San Andreas Fault or a major fault parallel to and five miles east of the San Andreas. In addition, there are other fault lines in the area, especially to the east in the neighboring Eel River Valley. The mountains themselves are of very recent origin and still very active. Their natural unstableness is easily affected by quakes and tremors in the area. During the 1906 San Francisco earthquake, the largest single land movement in California was reported to have occurred in the Point Delgada area. One result is a series of natural slumps and erosion in the steepest part of the King Mountain Range. Many of these were created by the 1906 earthquake and have never healed over. The earth movements created comparatively unstable conditions that shift with major quakes and which are more easily upset by the actions of man.

The soils, as would be expected in a geologically new area, are quite shallow, generally five feet or less on the upper slopes. They are for the most part fine, loose soils moderate to rapid in permeability and runoff characteristics. The predominant types in the area of flowing water in King Range are Hugo, Kneeland, Maymen and Unclassified. These shallow soil types exhibit high erodibility when their vegetative cover is removed. Kneeland, for instance, is common on the northern slopes. It supports only a sparse grass cover which has proven ineffective in retarding erosion started by earth movements

While no study of the ground water in the area has been conducted, the presence of many springs and seeps indicates an extensive underground aquifer. All along the streams, and particularly the coastal streams, seepage springs are an important addition to stream flows. Seepage on steep hillsides, especially where vegetation has been removed by logging or fires, creates unstable subsurface conditions that lead to large soil slumps and slides. Many of these, in size to over 10,000 square yards in area, are evident throughout King Range. These slumps may wash quickly into the stream leaving behind a denuded slope, or may gradually move downward into the canyon bottom as the lower portions are eroded away by the stream.

Contributing to the erosion problems is the seasonal nature of the precipitation. On the coastal side of the King Mountain Range, an average of 60 inches of rain falls in a year; inland, a few miles away, the average is in excess of 100 inches. Most of this precipitation falls as rain in the October-April period. Because of the moderating influence of the ocean, very little snow falls in the area. The rains tend to be sporadic, falling heavily as weather fronts pass through the area, then ceasing.

This leads to sharp changes in stream flows. While yearly figures are not available for streams in King Range, the USGS station at Petrolia on the Mattole River gives some indication of the range of flows. The Mattole reaches a summertime low flow at the station of 25 cfs. At the same station, winter time flows are generally several hundred cfs, with peaks well in excess of 90,000 cfs. As a result, flows can increase almost 1000% then decline by the same amount in a matter of a few days. Although flow amounts are much less in other King Range streams, the same type of fluctuation is present.

The nature of the soils and hydrology, and the geologically active nature of the King Range terrain make it susceptible to severe erosion when surface protection is disturbed. This has occurred in many areas through natural causes, but by far the greatest source of erosion has been logging operations. Wide fluctuations in stream flow, with severe flooding and scouring at peak runoff, help keep conditions unstable and contribute to the slow recovery of fishery habitat. As logging has declined in recent years, the healing processes have helped stream habitat to recover somewhat, but remnants of past operations, combined with the nature of the streams and surrounding terrain, retard the process.

Future plans call for rehabilitation in the area to hasten the recovery process. Removal of logging debris and seeding of exposed areas will hasten the natural recovery of the stream habitat. Possible planting is being considered as one way of helping to bring back fish populations. In order to prevent further damage to the streams strict controls on logging, road construction and other activities have been proposed.

Too little is known at present about the marine habitat to make detailed proposals for its management and control. The potential for other than sport fishing for salmon and bottom fish is not great. The restricted onshore biologically productive areas render the coast unsuitable for all but nonconsumptive use.

Any proposals for the aquatic habitat of King Range will, of necessity, be made within the framework of the enabling legislation, being considered along with proposals for other resources. As the area becomes better known and more accessible, greater human use can be anticipated. Planning now can provide for the needs of future visitors, while at the same time fulfilling the terms of the King Range Act by preserving the features that make it unique.

TABLE I

Potential Spawning & Rearing Area
Summary for King Range Conservation Area

	Distance Surveyed (Miles)	Gravel (Sq. Yds.) Total	Good	Marginal	Pool Area (Sq. Yds.)
Coastal	22.58	2,146	221	1,925	21,015
Inland	62.16	45,730	19,995	25,735	115,206*
Total	84.74	47,876	20,216	27,660	136,221*

* Total does not include N. and S. Fork Bear Creek nor Nooning Creek for which no figures are available.