AQUATIC RESOURCES REHABILITATION, REDWOOD NATIONAL PARK

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ABSTRACT

Development of the aquatic resources program at Redwood National Park has departed from traditional fisheries enhancement programs. National Park Service policy provides for a balanced, self-propagating community that is representative of the undisturbed system. No one species or group of organisms is managed to maximize production, and the program has developed within this framework.

INTRODUCTION

In 1968, Redwood National Park (RNP) was established to preserve outstanding examples of virgin redwood forest, including the world's tallest measured tree. However, conflicting land uses continued adjacent to the park threatening park resources. This ultimately resulted in expansion of the park in 1978 by approximately 48,000 ac. The expansion legislation also directed that a rehabilitation program be developed for these newly acquired lands which had suffered the adverse effects of timber harvesting and road construction (Agee 1980).

The major thrust of the early rehabilitation program was to control erosion within these new areas (USDI, NPS, DSC 1981). As such, the rehabilitation staff was composed almost entirely of physical scientists. However, as the program developed, restoration of other ecosystem components was considered and other specialists were added to the staff. The aquatic resources portion of the rehabilitation program began in mid-1980.

The purpose of this presentation is not to provide specific data on the early work of the aquatic program but rather to briefly outline the framework within which the aquatic resources program at Redwood National Park has developed, and to generally describe early work. The program itself may be a departure from what might have been expected, that is, a fishery enhancement program aimed at maximizing production of anadromous salmonids. Certainly these resources have suffered from intensive land use. Techniques that have been developed to provide artificial spawning and rearing areas have contributed significantly to the maintenance and enhancement of salmonid populations in the Pacific Northwest. Usually, the lead in the development and implementation of these techniques has been taken by federal land management agencies mandated to provide multiple uses of the resource under their jurisdiction. Each legitimate land use may affect another. For example, logging can directly impact the successful use of streams by fish that contribute to sport and commercial industries. To allow timber harvest and still provide for the maintenance of fish stocks often requires intensive management. Agencies such as the U.S. Forest Service have had success in developing programs that will enhance fish production in the shortest possible time.

In contrast, National Park Service (NPS) policy (USDI, NPS 1978) indicates that management will provide for a balanced, self-propagating community of organisms representative of the natural, undisturbed system. Multiple use is not a factor and no one species or group of organisms is managed to maximize production. Where other agencies may choose to populate an historically barren stream as mitigation for damage elsewhere, NPS policy would generally preclude such an action. Furthermore, management policy states that the need for regulating animal populations shall be documented and evaluated by research studies. The aquatic resources rehabilitation program has developed within this framework.

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DETERMINATION OF EXISTING CONDITIONS

Rehabilitation implies resource damage and knowledge of existing conditions. Therefore, before alternatives for in-stream rehabilitation can be developed, existing conditions of the various environmental components must be determined. We asked ourselves, "What can we look at that will tell us what the conditions of a stream are?"

Invertebrate Studies

The objectives of these studies were simply to determine the species that may be found in the park, to determine their availability as fish food organisms within various streams, and, more importantly, to determine if certain community structures are representative of particular stages of watershed recovery.

Invertebrates have been used before as environmental indicators with some limited success. But what we wanted to do was to see if the invertebrate community structure could be used as an indicator. Sampling techniques were evaluated. After looking at the advantages and disadvantages of the devices available, artificial substrate samplers were selected. These are basically wire baskets filled with rocks, and placed in a stream. The details of our artificial substrate sampling devices are presented elsewhere (Harrington 1983).

Basically, we met our initial objectives of the invertebrate program: that is, to determine fish food availability and to show that perhaps different community structures may be associated with different stages of stream recovery. With this information, the second year involved work of an experimental nature, determining the effects to the invertebrate community of a specific rehabilitation project. The project involved removing fill from stream channel crossings. The acute impacts to community structures were determined (Harrington 1983).

Fishery Studies

To understand the rehabilitation potential of a watershed in terms of its fisheries resources, it is necessary to understand how each life history stage of a fish species in question may be affected by that watershed. With anadromous fishes, it is helpful to consider the watershed as a pair of "subsystems" representing requirements of 1) spawning, and 2) rearing habitat. Both of these subsystems acting on the different life history stages of fish determine the overall success of a watershed to produce anadromous salmonids.

The first step in evaluating potential rehabilitation of spawning habitat is to determine site quantity and site quality. Also, are there other areas suitable for spawning but presently unavailable because of barriers to migration? This is important because within the context of NPS policy, streams with natural barriers would not be considered to have rehabilitation potential for anadromous salmonids; however, man-caused barriers may be removed. Again, this is a good example of how Park Service policy differs from that of other agencies (e.g., Forest Service).

The rearing habitat subsystem may be divided into the upstream component and the estuary component. Where chinook salmon may be present, an evaluation of estuarine conditions is considered essential (see Reimers 1973). Upstream rearing areas are best evaluated during summer when factors such as temperature and flow may be most limiting. Estuarine conditions should be evaluated during the same period when maximum utilization by juvenile chinook might be expected. The estuary should also be evaluated in the fall and winter months when up-migrating adults may be utilizing the area.

To evaluate the rearing habitat, two studies were begun. These were a basin-wide nursery area study and the Redwood Creek estuary study. The nursery area study first involved electro-fishing the tributaries and mainstem of Redwood Creek during summer low flow conditions. Each tributary was surveyed in this manner in an upstream direction until a barrier to fish migration was encountered. The type of barrier, natural or man-caused, amount of cover, and substrate conditions were noted. More intensive sampling of selected streams was later accomplished monitoring fish populations and invertebrate drift and substrate communities.

This study provided information such as the number of streams available for spawning, whether barriers were natural or man-caused, a qualitative survey of available spawning habitat and an analysis of the quality of upstream rearing areas. It also provided much needed baseline information from which we may evaluate future changes in watershed conditions. This survey also revealed that of the streams tributary to Redwood Creek within the park boundary, only three have any potential for fisheries enhancement work. The others have natural barriers to migration near their mouths. The specific details and preliminary conclusions of the nursery area study are being presented elsewhere (Anderson and Brown 1983).

In addition, a summer steelhead survey which involved snorkeling the creek was also accomplished, revealing a small remnant population. This race of steelhead is declining throughout California and is considered to be in danger of elimination. Its presence in Redwood Creek (heretofore unnoticed) may require special management considerations. Another significant finding regarding rearing habitat is the discovery of what we have called "cold pools" (Keller and Hofstra 1983). These areas represent refugia for juvenile salmonids from increased summer water temperatures now found in the mainstem of Redwood Creek.

The estuary study completes the rearing habitat inventory. It was designed to gather information relating to existing and potential estuarine productivity. The study was composed of three general parts designed to 1) determine seasonal patterns in changes of water quality, 2) compare present patterns of inundation, seasonal morphological changes, and sediment sources with historic information, and 3) determine abundance, distribution and seasonal timing of use of the estuary by fish species. Data being obtained from this study (Ricks 1982, Larson et al. 1983) indicate that the estuary is serving to limit production of chinook salmon in the watershed and that the development of rehabilitation alternatives is warranted.

CONCLUSIONS

Data gathered from our studies are providing the basis for making decisions regarding the level of aquatic resource rehabilitation feasible within park streams. It has allowed us to answer questions like: "Where can we start actual rehabilitation and is it warranted? Do we enhance upstream spawning areas when we know the results of our labors are severely compromised by estuarine conditions? Are the numbers of fish present representative of what the watershed can support at this time so that fisheries enhancement activities would require long-term maintenance or other commitments?" National Park Service policies require careful consideration of such questions before implementing major resource management activities.

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