NATURAL RESOURCES MONITORING IN CHANNEL ISLANDS NATIONAL PARK, CALIFORNIA

by

Gary E. Davis

ABSTRACT--Population dynamics monitoring systems are being developed for pinnipeds, sea birds, island birds, inter-tidal communities, kelp forests, island vegetation, island mammals, reptiles, amphibians, and visitation in Channel Islands National Park. A microcomputer-based data management system is being developed to archive data and prepare reports for each of the monitoring systems. During the first two years, criteria for selection of species to monitor were developed and applied to existing species lists. Sampling, analytical, and reporting techniques were designed and field tested for pinnipeds, sea birds, inter-tidal communities, and kelp forests. Design work has begun on the remaining resource groups. Long-term implementation on these monitoring systems is mandated by the law which established Channel Islands National Park (P.L. 96-199).
KEYWORDS--National park, resource management, population dynamics.

National parks in the United States are created to conserve natural ecosystems in such manner and by such means as will leave them unimpaired for the enjoyment of future generations. By prohibiting consumptive uses of natural resources, perpetuating natural processes, and minimizing human impacts in these parks, society realizes a variety of benefits. Among these benefits, the role as a dynamic ecological standard against which similar but exploited ecosystems may be compared and evaluated holds the greatest potential value and is also the least understood. The value of these parks as reservoirs of genetic material with natural diversity is also frequently overshadowed by their ability to satisfy ever-increasing demands for recreational habitat. Conditions of park resources must be monitored to know when and how recreational and other human activities in and adjacent to the parks threaten the integrity of park resources and the benefits derived from these unimpaired ecosystems. Unfortunately, regular systematic inventories of natural resources are rarely conducted in national parks. A population dynamics monitoring system is being established at Channel Islands National Park, California, to help protect the unique coastal marine and island ecosystems in the park.

Channel Islands National Park was created in 1980 by Public Law 96-199. The park consists of five oceanic islands located off the coast of Southern California and 125,000 acres of submerged land and waters surrounding the islands to a distance of one nautical mile. Lying on a biogeographical boundary between the Oregonian and Californian provinces, the park contains large numbers of species. The juxtaposition of deep oceanic basins and warm shallow coastal waters combined with frequent upwelling creates extremely productive biological systems in the park. Isolation from mainland populations has promoted speciation and resulted in high proportions of endemic taxa in both flora and fauna. These three natural features (high species diversity, productivity, and endemism) combined with protection from modern man's influence and a spectacular scenic setting, result in a national park of unparalleled beauty and scientific interest.

Threatening this park are the impacts of nearly 15 million people who live on the adjacent mainland coast, the extraction of some of the largest known offshore oil and gas deposits which border the park, and the virtually unlimited total harvest of living marine resources which is permitted from park waters. In recognition of the park's unique values and the precarious condition of it's resources, the 96th Congress directed that inventories be developed of all terrestrial and marine species which indicate their population dynamics and probable trends as to future numbers and welfare. The results of these inventories are to be reported biennially to the Congress for ten years.

Species lists, developed from published accounts spanning many years of observation, constitute the simplest form of a species inventory for Channel Islands National Park. Yet to be useful as a management tool, or to assure that park ecosystems are unimpaired for the use and enjoyment of future generations, such inventories must be conducted at regular intervals. Thorough examination of these inventories lead to the detection of introductions and extinctions of species, and provide an index to the health of park resources. Nevertheless, simply recording the presence and absence of species in the park will neither ensure perpetuation of natural ecosystems nor be useful in understanding how or why various species appear or disappear. Species population dynamics, specifically abundance, distribution, age structure, reproduction, recruitment, growth rates, mortality rates, sex compositions, and phenologies must be known in order to begin to understand how and why populations of plants and animals fluctuate and what factors influence their survival or demise.

Figure 1 depicts the actions required to develop an inventory of all terrestrial and marine species in the park which indicates their population dynamics and probable trends as to future numbers and welfare, as required by PL 96-199. The first step was to review existing information and to establish a system for keeping that information current.

A review of the extant literature was conducted (Woodhouse 1981), and a 4,000 entry key-worded bibliography was stored on a microcomputer-based data management system for efficient searching, sorting, and retrieval of information. The bibliography is updated by reviewing the Agriculture, Biology & Environmental Sciences edition of "Current Contents" (Institute for Scientific Information) which contains the contents of approximately 1,000 scientific journals.

Monitoring species' population dynamics in the park requires that species be selected, methodologies for monitoring be developed, and a monitoring program implemented. [illegible], species lists were developed from the literature review. It is virtually impossible to monitor the population dynamics of the nearly 2,000 species known to occur in the park. Nor is simply monitoring their presence or absence adequate to protect them. Rather, some species must be selected for intensive monitoring. The criteria used for this selection in Channel Islands National Park are species that: 1) have special legal status, such as those listed as threatened or endangered, 2) constitute critical habitat for species with special legal status, 3) are harvested in the park, 4) are park endemics, 5) are exotic or feral, 6) dominate or are characteristic components of major park ecosystems, or 7) are highly visible.

The literature review also revealed that even rudimentary information was lacking for amphibians, reptiles, and terrestrial invertebrates (insects and mollusks) in the park. Before any species selections could be made in these groups, field surveys to determine presence and distribution would be required. For the remaining groups of plants, animals, and environmental factors to be monitored, initial selections could be made based on existing knowledge.

With the literature review completed, methodologies for determining population dynamics of a wide array of taxa are being developed and standardized, and the procedures institutionalized. A research project was defined for each of the fifteen groups of plants, animals, or environmental factors shown in Figure 1. Each project consists of five major tasks: 1) review and summarize the existing information on population dynamics of the selected species; 2) design sampling techniques, based on historical approaches whenever appropriate; 3) design a system for routine analysis of the data provided by the selected sampling techniques; 4) design a system for routinely archiving and reporting the results of the data analyses; and 5) field test the sampling techniques, and demonstrate efficacy of the analytical and reporting systems using actual data. The priorities of the projects are indicated in Figure 1.

The pinniped monitoring system was developed and implemented by the National Marine Fisheries Service, Southwest Fisheries Center. A combination of aerial surveys,

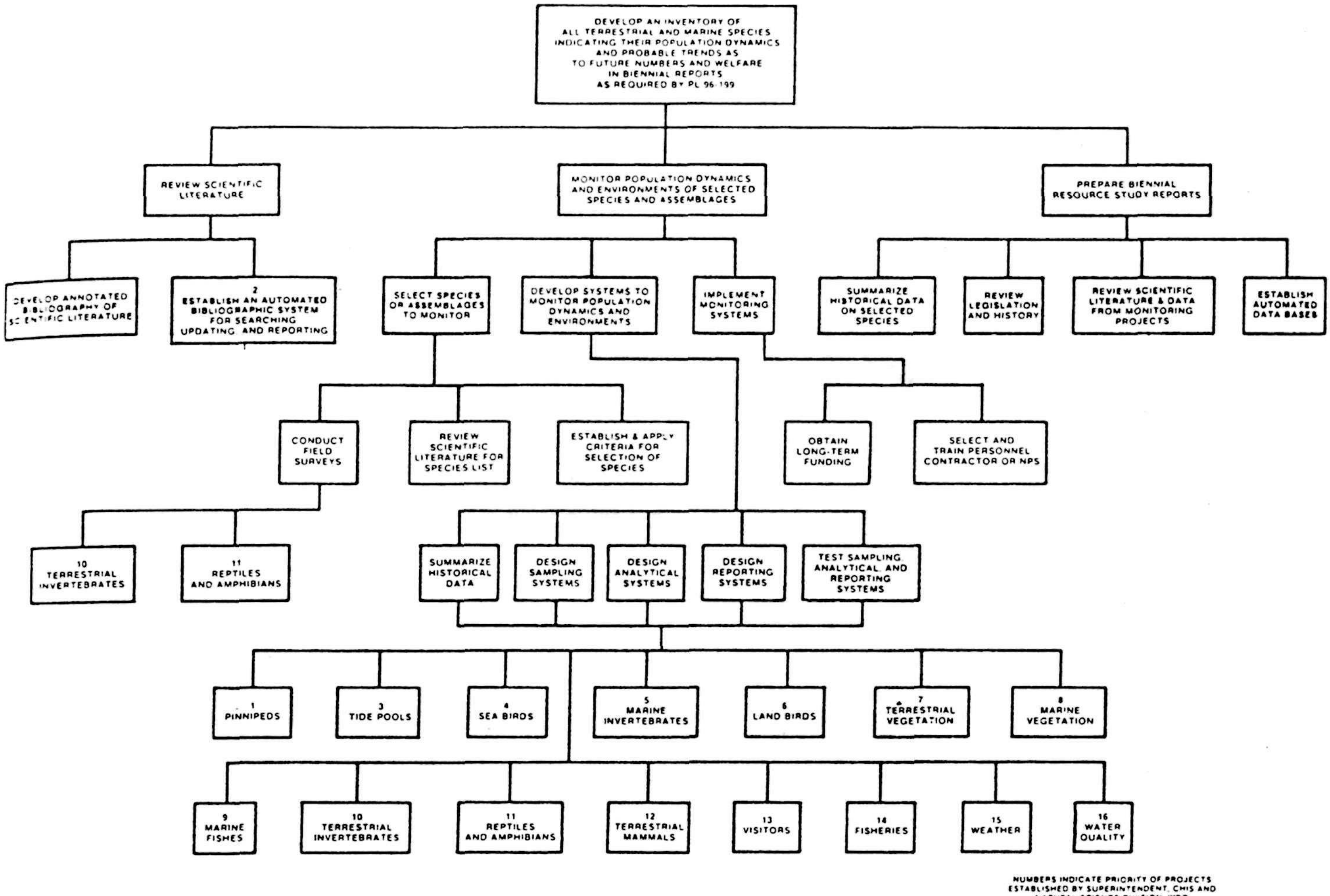

FIGURE 1. Step-down plan for natural resources monitoring at Channel Islands National Park, California.

photogrammetry, and rookery observations are used to sample five species of seal and sea lions that breed in the park. This intensive sampling in the park compliments a larger scale coastal marine mammal monitoring program, and provides detailed information on pinniped distributions that will allow park managers to assess the effects of visitation within the park on wildlife populations.

A system utilizing photographic quadrats based on techniques from previous studies (Littler 1980) was developed to monitor population dynamics and visitor impacts on tide pools in the park. This monitoring

species, and, supplemented by manipulative experiments, will allow managers to evaluate the relative impacts of a few large or many small groups of visitors on intertidal communities.

Eleven species of sea birds breed in the park. Using the established criteria, five species were selected for monitoring: the Western Gull, California Brown Pelican, Double-crested Cormorant, Cassin's Auklet, and Xantus' Murrelet. Censuses of breeding colonies are used to monitor abundance and distribution of adults and their reproductive efforts and success. These data provide an important indication of the productivity of adjacent marine ecosystems as well as the status of the sea birds themselves.

Over one-third of the giant kelp forests in southern California occur in the park. A cooperative program between the National Park Service and the California Department of Fish and Game has been initiated to design a kelp forest monitoring system in the park. From a list of nearly 1,000 species, 70 indicator species were selected for monitoring, multispr scanner and standard photogrammetric techniques were evaluated for determining extent of kelp canopy. Twenty-four permanent 100 meter-long transects were established that represent the diversity kelp forests in the park. Underwater color video transects, baited station observations, and electrofishing techniques are being evaluated for estimating fish abundance. Band transects, 1.0 m^2 quadrats, 1 X 2 m random point contact quadrats, and 20 m^2 photographic grids are used to determine abundance and distribution of benthic invertebrates and plants.

An automated data management system to store, retrieve, and report bibliographic and population dynamics data was developed using an Apple II-plus microcomputer with a CP/M operating system. The 4,000-entry bibliography is accessed using a data management system called MDBS (Micro Data Base Systems, Inc.). Population dynamics data and species lists are managed as DB Master (Stoneware Inc.) and Data Factory (Micro Lab Inc.) files. Textual material is

Virtually all use of the park occurs from boats. A model for monitoring boating activity, based on daily observations at selected anchorages in the park, was developed from aerial surveys using step-wise multiple regression analysis and Visicalc (Personal Software Inc.) on the Apple II-plus microcomputer. In 1982, 32,299 boat-days of use occurred in the park. There was an average of 142 boats per day in the park during the summer and 79 boats per day during the rest of the year. This model allows managers to optimize personnel and equipment allocations for resource protection and interpretive activities.

Field work has begun on the designs of island bird and vegetation monitoring systems, but specific techniques have not yet been selected and described. The remaining projects are scheduled for funding in 1984 and 1985.

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THE AUTHOR

Gary E. Davis is a research scientist with the National Park Service, Channel Islands National Park, 1901 Spinnaker Drive, Ventura, California 93001.