

October 25, 1979

D R A F T

PLAN FOR MARINE TURTLE RESEARCH IN THE CENTRAL AND WESTERN PACIFIC
FOR UNITED STATES AND INTERNATIONAL MANAGEMENT AND CONSERVATION

EXECUTIVE SUMMARY

THE PROBLEM

The Endangered Species Act of 1973, as amended, lists the hawksbill, Atlantic ridley, leatherback, the green turtle populations of Florida and the Pacific coast of Mexico and the Pacific ridley turtle of the Pacific coast of Mexico as endangered. The Act also places all other populations of green and Pacific ridley turtles on the threatened list. Although it is generally believed that all the turtle populations worldwide are declining, the actual status of marine turtles with few exceptions is poorly known and scientific assessments are needed to accurately and precisely determine the status of the stocks or populations of all marine turtle species.

THE PROGRAM

WHAT: The Honolulu Laboratory, Southwest Fisheries Center, National Marine Fisheries Service, NOAA, proposes a multidiscipline study of turtle populations in the central and western Pacific Ocean. Initially, major program emphasis will be placed on a study of the green turtle population in the Hawaiian Archipelago.

WHERE: The research activities and projects, some of which will be conducted by cooperating agencies, will be coordinated by the Honolulu Laboratory.

WHO: In addition to scientists at the Southwest Fisheries Center, it is anticipated that researchers from the University of Hawaii, U.S. Fish and Wildlife Service, and the Hawaii State Division of Fish and Game will be involved in the various research activities and projects. Turtle experts in other agencies and areas may also be involved in various capacities.

WHEN: November 1979 to ?

HOW MUCH: \$217,000

HOW (Activities and Projects):

1. Monitor green turtle breeding assemblages at French Frigate Shoals.
2. Make plans (logistics, vessel charter, schedules) for transportation to and from French Frigate Shoals.
3. Coordinate plans with cooperating agencies.
4. Coordinate green turtle research plans with monk seal and Northwestern Hawaiian Islands research plans.
5. Sample and tag maturing and adult green turtles in resident foraging areas around the Hawaiian Archipelago.
6. Reconnoiter and survey Hawaiian Archipelago to determine other green turtle breeding and foraging sites.
7. Monitor and inventory breeding and forage sites in other areas of the Hawaiian Archipelago (other than French Frigate Shoals).
8. Review stock assessment procedures applicable to turtle stocks.

9. Determine feasibility of the use of nose or other tags for green turtle hatchlings.
10. Conduct tag shedding experiments on adult green turtles.
11. Conduct modeling and simulation studies relating to turtle populations.
12. Determine the availability of suitable "off the shelf" radio tags to track adult turtles.
13. Conduct research and development for satellite tracking of adult turtles; track green turtles using satellites.
14. Use radio tags to track green turtles on nesting grounds to determine preferred habitat of breeding turtles.
- Wow!* 15. Determine the pelagic habitat of immature green turtles; study age and growth of pelagic immature green turtles.
16. Conduct nesting and other related studies on 20 potential turtle nesting sites in the central and western Pacific.
17. Define criteria for the application of "endangered" and "threatened" designations to turtle populations.
18. Participate in the South Pacific Commission (SPC)/National Marine Fisheries Service sponsored workshop on turtles.
19. Update Hawaiian green turtle stock assessment studies.
20. Update data on life history and ecology of Hawaiian green turtles.
21. Analyze data to define preferred habitat of green turtles during nesting and breeding activities.

22. Conduct socio-economic study of the significance of turtles in Pacific island cultures.
23. Provide assistance for the documentation of the Western Samoa green turtle headstart program.
24. Contingent on results of SPC turtle workshop, participate in international tagging program.
25. Conduct trials on nose or other tags for use on turtle hatchlings.

GOALS AND OBJECTIVES

Four goals and objectives for the program were identified:

- 1) to obtain a first cut definition of the beach and water areas preferred by nesting green turtles in the Hawaiian Archipelago; 2) to determine the optimum sustainable population (OSP) of Hawaiian green turtles based on studies of life history, ecology, and stock assessment; 3) to determine the status of turtle stocks in other areas of U.S. interest in the central and western Pacific; and 4) to develop improved methodology for more accurate and precise stock assessment techniques for management and conservation of marine turtle stocks.

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Excluding some exceptions, the status of marine turtle populations is poorly known, although it is generally thought that the populations worldwide are declining. The hawksbill turtle, Eretmochelys imbricata, leatherback turtle, Dermochelys coriacea, and Atlantic ridley turtle, Lepidochelys kempfi, are listed as endangered under the Endangered Species Act of 1973. In 1979 the Act was amended to also list the green turtle, Chelonia mydas, in Florida and the Pacific Coast of Mexico and the Pacific ridley turtle, L. olivacea, as endangered. And the loggerhead turtle, Caretta caretta, and all other populations of the green turtle and Pacific ridley turtle were listed as threatened. This action was prompted by a study conducted by the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) which determined that the loggerhead, green, and Pacific ridley turtles are at the least threatened in all or a significant part of their ranges based on one or more of the following factors: 1) the present or threatened destruction, modification, or curtailment of habitat or range of the species; 2) overutilization for commercial, sporting, scientific, or educational purposes; 3) disease or predation; 4) the inadequacy of existing regulatory mechanisms; and 5) other natural or manmade factors affecting the continued existence of the species.

In the summer (31 July-2 August) of 1979 a "Planning Workshop for NMFS Research on Marine Turtles in the Central and Western Pacific," sponsored by NMFS, was held at the Honolulu Laboratory, Southwest Fisheries Center, NMFS (Appendix A). The purposes of the workshop were to review the status of knowledge on the turtle populations in the Hawaiian Archipelago and in areas of U.S. jurisdiction and interest in the central and western Pacific and to aid the development of a planning document which will identify long-term research needs, provide a time frame required to undertake the research, and establish priorities, and estimate costs. Based on the results of the workshop, four basic goals and objectives were identified for a marine turtle research program in the central and western Pacific. Also, 25 related activities and research projects needed to achieve the goals and objectives were determined. The estimated costs and time requirements by activity and project are shown in Table 1 and a chart showing time schedules including the relationships between and among all activities and projects is presented in Figure 1.

OBJECTIVES

- I. To obtain a first cut definition of the beach and water areas preferred by nesting green turtles in the Hawaiian Archipelago. These are the areas in which man's activities will have the most adverse effects on marine turtles.
- II. To determine the optimum sustainable population (OSP) of Hawaiian green turtles based on studies of life history, ecology, and stock assessment.

- III. To determine the status of turtle stocks in other areas of U.S. interest in the central and western Pacific.
- IV. To develop improved methodology for more accurate and precise stock assessment techniques for management and conservation of marine turtle stocks.

DESCRIPTION OF ACTIVITIES AND RESEARCH PROJECTS
(Not in any particular order)

1. Monitor green turtle breeding assemblages at French Frigate Shoals.

Most population estimates of marine turtles are based on counts of nesting females on beaches from which the total population size is extrapolated, based on an assumed sex ratio of 1:1.

French Frigate Shoals in the Northwestern Hawaiian Islands (NWHI) has the largest breeding colony of green turtles in the Hawaiian Archipelago. The number of female green turtles nesting annually at French Frigate Shoals during a 7-year period from 1973 through 1979 has been determined. It is important to continue these observations to determine trends in population size and reproductive cycles.

2. Make plans (logistics, vessel charter, schedules) for transportation to and from French Frigate Shoals.

French Frigate Shoals, a part of the NWHI, is located nearly 600 miles from Honolulu. The NWHI as a whole are mostly remote, uninhabited islands that are off the normal shipping lanes and are thus not easily accessible. Scientific personnel traveling to these islands in the past have used government or private (chartered) ships

and aircraft, including the NOAA vessel Townsend Cromwell. Access to French Frigate Shoals and other islands in the chain will have to continue to be through these modes of transportation. Plans will have to be coordinated with cooperating agencies for transportation and other logistics to gain access to French Frigate Shoals.

3. Coordinate plans with cooperating agencies.

In 1978 a "Tripartite Cooperative Agreement for the Survey and Assessment of the Living Resources of the Northwestern Hawaiian Islands" was signed by the National Marine Fisheries Service, NOAA, U.S. Department of Commerce, the Department of Land and Natural Resources, State of Hawaii, and the Fish and Wildlife Service, U.S. Department of the Interior. The purpose of the agreement is to provide a detailed survey and assessment of the biological resources of the NWHI which will form the basis for management decisions concerning long-range uses and preservation of these living resources.

To focus on areas of possible cooperative research effort, and to avoid duplication of effort and for informational purposes, monthly ad hoc meetings have been held among the research agencies of the signatories to this agreement. Cooperating agencies will be kept informed on plans for marine turtle research in the NWHI and areas for possible cooperative research will be explored.

4. Coordinate green turtle research plans with monk seal and Northwestern Hawaiian Islands research plans.

In accordance with the provisions of the Tripartite Cooperative Agreement, the Honolulu Laboratory has embarked on a 5-year field

program to assess the fishery and other biological resources of the NWHI. The Honolulu Laboratory was also assigned the responsibility for research on the Hawaiian monk seal, Monachus schauinslandi. To make efficient use of the available field survey schedule, marine turtle research plans will be coordinated with that of research on Hawaiian monk seal and marine resources of the NWHI.

5. Sample and tag maturing and adult green turtles in resident foraging areas around the Hawaiian Archipelago.

Accumulated data indicate that the Hawaiian green turtle hatchlings return from an unknown pelagic environment to take up residence in resident foraging areas along coastal areas where they possibly remain throughout their entire lifetime, except for migrations for reproduction. However, there are also instances of the regular disappearance of turtles from resident foraging areas for several weeks and possibly even months. Tagging turtles in resident foraging areas will provide data to clarify the resident nature of the green turtle and also provide data on age and growth.

6. Reconnoiter and survey the Hawaiian Archipelago to determine other green turtle breeding and foraging sites.

A number of green turtle breeding and foraging sites have been identified in the Hawaiian Archipelago. However, there are indications that other breeding and foraging sites remain to be discovered. Attempts will be made, e.g., by interviews with knowledgeable fishermen and other individuals and by field surveys, to identify as many of

these sites as possible. Since marine turtle censuses are usually made on beaches or close to shore, and the resulting data used for population estimates, it is important that all breeding and foraging sites are identified.

7. Monitor and inventory breeding and forage sites in other areas of the Hawaiian Archipelago (other than French Frigate Shoals).

Presently French Frigate Shoals is the most important breeding site for green turtles in the Hawaiian Archipelago. However, green turtles utilize other areas in the chain for foraging and breeding. Following the completion of the reconnaissance and survey of new breeding and foraging sites (or concurrent with the reconnaissance and survey), monitoring and inventory taking activities will be carried out in as many of these sites as possible.

8. Review stock assessment procedures applicable to turtle stocks.

This project will review all the available stock assessment methodologies to determine their applicability to marine turtle stocks. In assessing the status of fish stocks, methods utilizing data from the fishery are ordinarily used, e.g., the familiar stock production model. The difficulty with using fishery dependent models may be that (1) they may not be applicable to turtle stocks and (2) because the marine turtle stocks are not protected, fisheries are presumably not operating on turtle stocks.

9. Determine feasibility of the use of nose or other tags for green turtle hatchlings.

One of the unsolved problems in marine turtle research is the development of a suitable tag for use on hatchlings. Because of the size of hatchlings on their emergence from nests, the usual tags and tagging methods cannot be used on hatchlings. The feasibility of the use of nose tags similar to that used in tagging fingerlings of salmon and other species will be investigated. The possibility of the use of other types of tags will also be explored.

10. Conduct tag shedding experiments on adult green turtles.

In spite of the long history of work on tagging and marking marine turtles, there still exist tag shedding and marking problems. For example, the Monel¹ tags used on Hawaiian green turtles were subject to considerable corrosion and were thus deemed unsatisfactory. Tags fabricated from Inconel 625 alloy are presently being used on Hawaiian green turtles and so far no signs of corrosion have been found. However, these results are only preliminary and further experiments on the retention of tags will be made.

11. Conduct modeling and simulation studies relating to turtle populations.

Because marine turtle populations are protected, stock assessment studies based on empirical experiments to alter fishing mortality are

¹Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

not feasible. Furthermore, since fisheries for marine turtles are no longer allowed (notwithstanding active fisheries in some parts of the world) the concept of maximum sustainable yield (MSY) such as in a stock production model is not applicable for turtle stocks. In accordance with these constraints, generalized, theoretical modeling and simulation studies will be carried out as they relate to turtle populations.

12. Determine the availability of suitable "off the shelf" radio tags to track adult turtles.

Much work has been done to date on tracking marine and terrestrial animals by the use of radio tags. Through literature searches, correspondence, and other means, a determination will be made of the availability of proven radio tags for possible use on adult turtles. It should be emphasized that these radio tags will not be prototype models but tags that have been tried and proven reliable and are readily available from manufacturers.

13. Conduct research and development for satellite tracking of adult turtles; track green turtles using satellites.

Much information on the biology, behavior, and movement of marine turtles can be gained by standard tagging and radio tagging experiments. Information on longer term movements and behavior of marine turtles can be obtained by use of satellite tracking methods. Experiments to determine the feasibility of using satellites to track marine mammals are in progress at the La Jolla Laboratory, Southwest

Fisheries Center. Similarly, research and development activities will be carried out to develop technology for use of satellites to track marine turtles.

14. Use radio tags to track green turtles on nesting grounds to determine preferred habitat of breeding turtles.

Marine turtles are most vulnerable to adverse effects from man's activities when they come close to shore for breeding purposes. Radio tags will be used to track adult green turtles to determine the behavior of females, in particular, in and around breeding sites during the egg-laying season. The radio tags should provide detailed data on short-term behavior and movement of turtles during the breeding season including the number of times an individual female will come ashore to lay a clutch of eggs, the resting period between egg laying, and environmental requirements.

15. Determine the pelagic habitat of immature green turtles; study age and growth of pelagic, immature green turtles.

The Hawaiian green turtle hatchlings, like hatchling green turtles in other areas, are lost to almost all human contact from the time they enter the water from their nests to the time they reach approximately 35 cm in carapace length. It has been suggested that oceanic shear lines (temperature discontinuities, etc.) along which pelagic organisms tend to collect, maybe areas in which green turtles less than 35 cm may congregate. Plans will be made and attempts made, wherever possible, to determine the presence of turtles less

than 35 cm in areas around oceanic shear lines. If found, attempts will be made to capture and tag these turtles for age and growth studies.

16. Conduct nesting and other related studies on 20 potential turtle nesting sites in the central and western Pacific.

During the "Planning Workshop for NMFS Research on Marine Turtles in the Central and Western Pacific," 20 sites in the central and western Pacific were identified as possibly important nesting areas for green turtles. Because of the remoteness of many of these sites, which contributes to logistical problems, this project will be carried out at an "opportunistic" level.

17. Define criteria for the application of "endangered" and "threatened" designations to turtle populations.

As discrete activities and projects are completed, e.g. activity/project 7 and 10, an attempt will be made to define criteria to describe the terms "endangered" and "threatened," as they apply to turtle populations. It is believed that, presently, these terms are loosely defined and not consistently applied to all turtle populations.

18. Participate in the South Pacific Commission (SPC)/National Marine Fisheries Service sponsored workshop on turtles.

In addition to the fact that the United States is generally committed to the conservation and preservation of marine turtle stocks

throughout the world, the U.S. has direct interest in the turtle stocks of many island areas in the central and western Pacific. In line with this commitment and interest, NMFS together with SPC is cosponsoring a marine turtle workshop to be held in Noumea, New Caledonia in December 1979. Plans have been made for the active participation of the Honolulu Laboratory at this workshop.

19. Update Hawaiian green turtle stock assessment studies.

It is anticipated that with the completion of the various activities and research projects, enough data will be accumulated to allow an update of the Hawaiian green turtle stock assessment studies. First, presumably an appropriate stock assessment methodology for marine turtle stocks would be available. Second, all the necessary life history and population dynamics parameters for Hawaiian green turtles will be on hand. With the completion of this update the major goal or objective, "to determine the optimum sustainable populations (OSP) of Hawaiian green turtles based on studies of life history, ecology, and stock assessment," (Objective II) will be in part achieved.

20. Update data on life history and ecology of Hawaiian green turtles.

One of the background documents (Balazs, G. H. 1979. Synopsis of biological data on the green turtle in the Hawaiian Islands. Contract Rep. 79-ABA-02422, 180 p. Southwest Fish. Cent. Admin. Rep. H-79-24, Natl. Mar. Fish. Serv., NOAA, Honolulu, Hawaii) prepared

for the turtle workshop in Honolulu included all the data available to date on the Hawaiian green turtle. The report also identified gaps and shortcomings in the accumulated data on the Hawaiian green turtle. The various activities and projects described in this program will provide data to fill the gaps and correct the shortcomings in the data. These new data, combined with data previously collected, will be used to prepare a comprehensive update on the life history and ecology of the Hawaiian green turtle. With the completion of this project, Objectives I and II, in part, will be achieved.

21. Analyze data to define preferred habitat of green turtles during nesting and breeding activities.

With the completion of activity/project 13 and 15 data will be available for the analysis required to determine the preferred habitat of green turtles during their nesting and breeding activities in the Hawaiian Archipelago. It will be possible to determine (1) environmental requirements of the green turtle on the beaches and in the surrounding ocean habitat, and (2) the precise seasonal nature of the environmental requirements.

22. Conduct socio-economic study of the significance of turtles in Pacific island cultures.

Marine turtles are reportedly a major source of food for many Pacific island inhabitants and also play a major role in their traditional culture. The shells of certain species of turtles have traditionally been used in the creation of artifacts and decorative jewelry. This

study will determine how significant a part the marine turtle plays in the economy and culture of the Pacific islanders.

23. Provide assistance for the documentation of the Western Samoa hawksbill turtle headstart program.

It was brought to the attention of the marine turtle workshop in Honolulu that a hawksbill turtle headstart program has been operating in Western Samoa. The details of the program are not well known and the program has not been documented in the scientific literature. Assistance will be provided the government of Western Samoa to document the headstart program so that information on the program would be made widely available.

24. Contingent on results of the SPC turtle workshop, participate in international tagging program.

It is anticipated that an international marine turtle tagging program will be a subject of discussion at the workshop to be held in Noumea, New Caledonia in December 1979. If the consensus of the workshop is that an international tagging program is needed, the Honolulu Laboratory will be ready to participate in such a program.

25. Conduct trials on nose or other tags for use on turtle hatchlings.

Should the feasibility study on the use of nose or other tags for hatchling green turtles prove fruitful, a project to conduct trials on such tags will be carried out. The development of a successful

tag for hatchling marine turtles will provide a major breakthrough
in marine turtle research.

Table 1.--Budget estimates

Activity/Project	No. of man-months required		Cost (\$K)	Time frame (Months needed to complete activity/project)
	Honolulu Lab.	Contract		
11	1	3	6	6
8	1	6	12	7
9	--	--	2	1
3	1	--	--	1
6	--	2	6	12
2	1	--	4	1
4	1	--	2	1
1	--	2	5	2
17	¹ 1	--	2	6
7	--	1	5	3
5	1	6	15	12
10	1	2	6	36
25	1	--	5	24
22	1	6	20	12
19	2	--	4	2
20	--	2	4	3
12	1	--	2	2
14	2	1	12	6
21	2	--	1	3
15	<1	3	4	13
13	Undetermined	Undetermined	20	12
18	do	do	10	Undetermined
23	do	do	10	do.
24	do	do	10	do.
16	1	1	60	do.
Total = 217				

¹Southwest Region

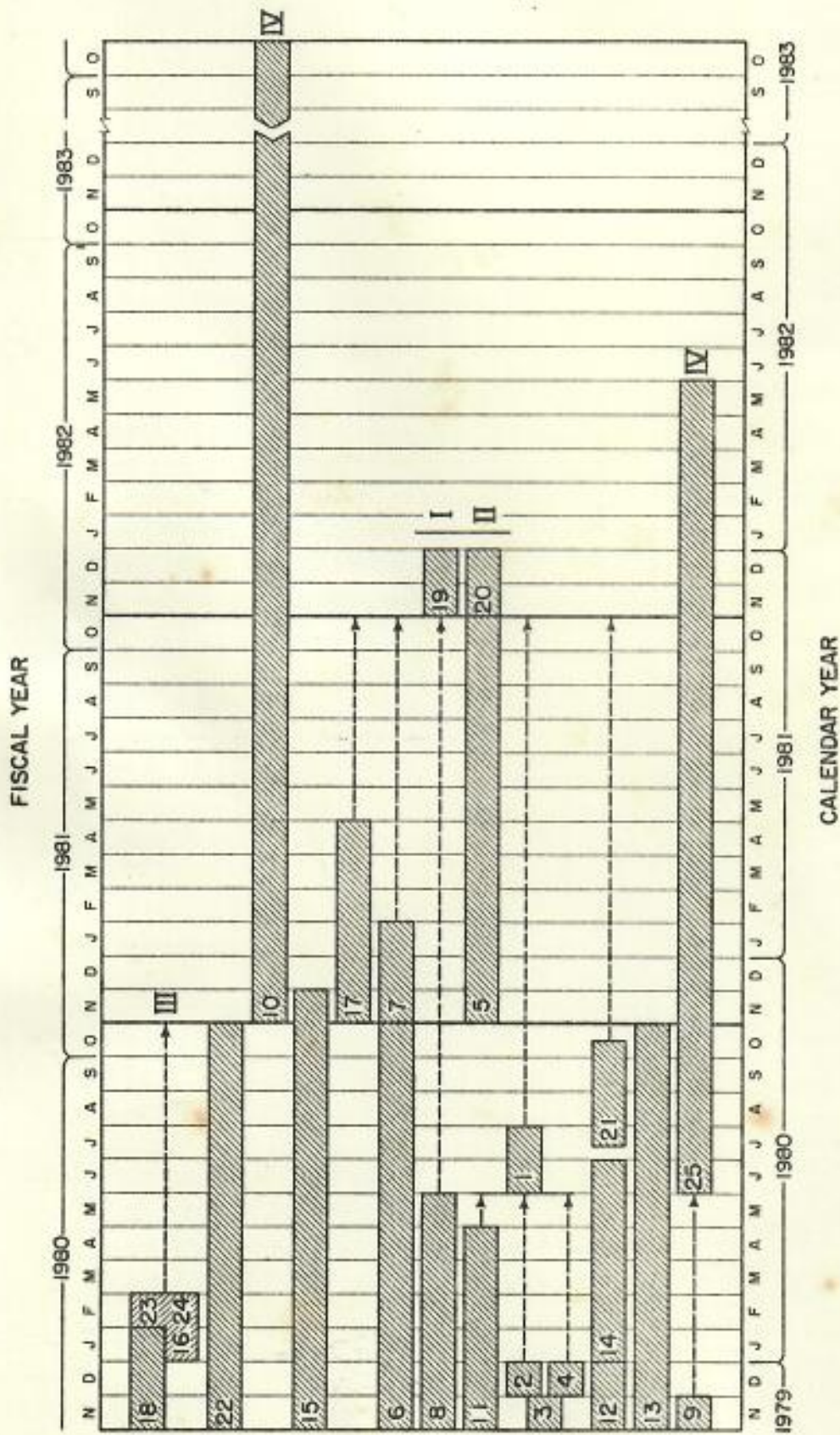


Figure 1.--Schedules of activities and projects. Numbers correspond to activity and project numbers. Roman numerals signify the attainment of the corresponding objectives.