WINDOW TO THE SEA:
A STUDY OF THE WAIKIKI AQUARIUM

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FOREWORD

During the Seventh Session of the Legislature of the State of Hawaii, both the House of Representatives and the Senate adopted resolutions requesting the Legislative Reference Bureau to undertake a study of the Waikiki Aquarium. *Window to the Sea* is the result of those requests.

This study is in keeping with the declared objectives and roles of both the Bureau and the Legislature. It satisfies the role of "advisor to the legislature" by suggesting alternative means of action in the future development of the Aquarium. It leaves the policy making decisions to the elected body for which such decisions were intended. By offering a view of the causes and effects of various actions, it is hoped that the legislature itself may determine the future course of development of the Waikiki Aquarium.

Many individuals and agencies have been extremely helpful and cooperative in supplying the data and general information necessary for this study. The Bureau is grateful for the contributions of the Waikiki Aquarium staff, the staff at the University of Hawaii, and the numerous other individuals who were so important to the final report. The Bureau is most appreciative of the work of Dawn Suyenaga for her survey and research aid. It is also deeply indebted to Carol Lynn Kim for her tolerance and quiet perseverance during the trying period of preparation for publication, and for her competent and efficient performance of the numerous secretarial chores that contribute so much to this kind of study. To Carol, Dawn, Maizie, Shirley, Sally, and the many others who helped so much, may we express our sincere appreciation.

Samuel B. K. Chang
Director

January, 1974

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INTRODUCTION

In recent years, the awakening of knowledge about the environment in which we live has led to new efforts toward re-balancing the ecosystem and attempting to repair some of the damage that has been done. As land areas become crowded and agricultural productivity reduced, man has sought to recycle resources, stop the exploitation of minerals and the degradation of water, air, and other segments of the environment. Even further, he has turned to new sources of productivity and hitherto little explored areas such as the sea.

During the Seventh Session of the Legislature of the State of Hawaii, the Legislative Reference Bureau was requested to undertake a study of the Waikiki Aquarium. The interest in the sea and the education of the public in relation to it was one of the prime concerns of the legislators when requesting the study.

There seemed to be a feeling that a public aquarium could no longer be viewed as a temporary holding tank for live fish which were deposited, viewed by visitors, then in some cases removed a short time later because of disease or death. With the passage of time, aquariums have developed a newer, more creative and challenging role in our society: to serve man by providing him with information on marine life and resources, correlating this to human life and problems, and, if possible, noting alternative solutions which can be gleaned from the sea. These were some of the concerns expressed by legislators.

A new image of a public aquarium was developing, neither oblivious to the earth world which surrounds it, nor to the sea world which it represents. It would have the courage to expose old myths, exhibit new truths, and present controversial issues in all their harsh reality. It would develop attractive displays using all the tools of modern technology. It would educate the public, both young and old, in an enjoyable yet challenging and effective manner. It would become a living institution where students congregate, scientists explicate, people meet, and even tourists learn. It would be a science center, a fish habitat, a school, and a museum. It would call attention to urgent problems, inspire people to action, and participate in the development of a variety of interests from malacology and hobby fishing to pollution control and urban planning.

Before it could do any of these, however, background research and planning for the future would have to be completed. A clear understanding of what now exists and what might be possible for the future had to be developed. And this is one of the main purposes of this study.

CHAPTER I
AN OVERVIEW OF THE STUDY

What is the present educational, scientific, and recreational impact of the Waikiki Aquarium? And what is its potential for the future? These are some of the questions raised by the 1973 Hawaii State Legislature, and it is hoped that they may be answered in the course of this study.

Objectives of the Study

The basic purpose of this study was:

(1) To determine whether the University of Hawaii, the City and County of Honolulu, or some other agency should have jurisdiction over the Waikiki Aquarium;

(2) To compare exemplary aquarium models and to suggest a unique development pattern for Hawaii's aquarium; and

(3) To determine the feasibility of converting the Aquarium into a marine education center to be used as a teaching center for students at various levels.

In order to meet these goals, a foundation built on history, local and out-of-state surveys, comparisons of leading models, interviews, and program evaluations had to be laid.

Legislative Requests

The specific requests made by the Legislature were in the form of resolutions, House Resolution 410, H.D. 1 and Senate Resolution 151. The contents of these resolutions are as follows:

HOUSE RESOLUTION NO. 410, H.D. 1

RELATING TO THE WAIKIKI AQUARIUM

WHEREAS, an aquarium provides a normal and basic component to any institute of higher learning incorporating marine education and research; and

WHEREAS, a facility constructed around scientific and educational value along with an exhibition of marine fauna common to this State would be provided for its citizens; and

WHEREAS, it would serve and lead to a better knowledge and understanding of the whole community concerning the intricate forms of sea life that thrive in waters surrounding our beautiful islands; now, therefore,

BE IT RESOLVED by the House of Representatives of the Seventh Legislature of the State of Hawaii, Regular Session of 1973, that this body commission a feasibility study to be conducted by the Legislative Reference Bureau to determine whether the University of Hawaii or the City and County of Honolulu shall attain jurisdiction over the Waikiki Aquarium; and

BE IT FURTHER RESOLVED that the feasibility study consider present available facilities across the nation and develop one that will uniquely fit Hawaii's needs for the present and allow for future expansion so that students from Hawaii and elsewhere have access to a rich and varied collection of marine flora and fauna common to Hawaii and the Pacific for their marine education and research; and that the findings of this study be presented to the State Legislature twenty days before the convening of the 1974 Session; and

BE IT FURTHER RESOLVED that certified copies of this Resolution be transmitted to the President of the University of Hawaii, the Director of the Waikiki Aquarium, and the Mayor of the City and County of Honolulu.

SENATE RESOLUTION NO. 151

REQUESTING THE LEGISLATIVE REFERENCE BUREAU TO CONDUCT A FEASIBILITY STUDY OF CONVERTING THE WAIKIKI AQUARIUM INTO A MARINE EDUCATION CENTER.

WHEREAS, an aquarium is a logical complement to any University marine education and research program; and

WHEREAS, if the Waikiki Aquarium were to be placed under the jurisdiction of the City and County of Honolulu, the University of Hawaii would have to build similar collections of marine flora and fauna to meet educational and research needs; and

WHEREAS, in partial fulfillment of the mission of the Sea Grant Program at the University of Hawaii, it is a function of the Program to become involved in marine education and information dissemination; and

WHEREAS, the Aquarium under the jurisdiction of the University of Hawaii will provide students from Hawaii and elsewhere access to a rich and varied collection of marine flora and fauna common to Hawaii and the Pacific as part of their marine education and research, and avoid the expensive necessity of developing similar aquaria facilities and collections within the University system; now, therefore,

BE IT RESOLVED by the Senate of the Seventh Legislature of the State of Hawaii, Regular Session of 1973, that the Legislative Reference Bureau be and is hereby requested to conduct a feasibility study on the conversion of the aquarium into a Marine Education Center to be used as a teaching center for students at the University of Hawaii, for non-university level school children, and for the general public, and to report its findings and recommendations to the Legislature 20 days prior to the convening of the Regular Session of 1974; and

BE IT FURTHER RESOLVED that certified copies of this Resolution be transmitted to the Director of the Legislative Reference Bureau and the President of the University of Hawaii.

With the direction expressed by the Resolutions in mind, the study was begun.

Brief History

The Waikiki Aquarium was established in 1903 through the efforts of James B. Castle, Charles M. Cooke, and Lorin A. Thurston, board members of the Honolulu Rapid Transit Company who acted as owner-managers. At the time, there were only two other aquariums in existence in the United States, one in New York and one in Philadelphia. The Aquarium continued as a privately financed and operated institution until 1919, when the lease on their land expired and the land reverted to the Territory. The Legislature then assigned the Aquarium to the University of Hawaii.

In 1949, the Legislature approved the issuance of bonds in order to gain funds for the rebuilding of the Aquarium. The City made a new site available for the Aquarium in an exchange of lands, and the new Aquarium was opened in its present location in January, 1955.

Legal Basis

Legislative concern about the Aquarium was first expressed in 1919 with the expiration of the private land lease. Section 30431, Hawaii Revised Statutes, reading as follows, establishes the Aquarium as a state concern:

> Sec. 304-31 Aquarium and marine laboratory; site. All those certain pieces or parcels of land situated at Waikiki, city and county of Honolulu, used as an aquarium and more fully described in registered map No. 1079 as lots 127 and 128, are set aside for public purposes, to-wit: for the purposes of an aquarium and marine biological laboratory under the direction of the board of regents of the University of Hawaii. The board shall establish and at all times maintain upon such lands an aquarium for the exhibition to the public of fishes and other forms of marine life. It shall also establish and at all times maintain there a marine biological laboratory.

This section specifically requires an aquarium which exhibits fish to the public and a marine biological laboratory. Because this is the chief statutory statement relative to the intended direction of the Aquarium, it may be referred to again later in the study.

Scope and Organization of the Study

The conclusions finally reached in this study were based on a series of surveys, canvassing aquarium users and personnel both within and outside of the State, interviews, literature research, and field research. Findings are organized in the following fashion: first, a general overview of marine resources in Hawaii and the role of the Aquarium as a window to these resources; various types of model aquariums across the nation; results of an out-of-state survey of other aquariums and the development of an optimum system; an explanation and evaluation of current operations of the aquarium; what has been determined to be community needs and uses of the aquarium; an aquarium program evaluation; alternatives for action; future directions; and alternatives for future action.

CHAPTER II

THE WAIKIKI AQUARIUM: HAWAII'S WINDOW TO THE SEA

Hawaii, as an island state, holds a unique position in our nation. It is the only state divided into counties which are physically separated from each other by a large body of water, the imposing Pacific Ocean. In the days of old Hawaii, some Hawaiians referred to their homeland as "Momi o ka Pakipika", which means the "Pearl of the Pacific". Then, just as now, the ocean significantly influenced their lives.

From the sea, the Hawaiians gathered much of their food, including fish, shellfish, crustacea, salt, seaweed, and other naturally nutritious foodstuffs. It was also in this familiar element that they spent much of their recreational time. The sea was both loved and respected by the people. Ancient Hawaiians had come to Hawaii over the sea and had lived near it. They developed an amazing expertise in the art of fishing, displaying elaborate techniques and skills, as well as establishing *kapus* which operated to protect the fish during certain seasons (thereby conserving the supply). They were also expert in handling their boats and in swimming, skillfully maneuvering through the sea even when it was rough.

Today, the respect of Hawaii's people for the sea has not diminished. In recent years, the sea has offered new horizons to the setting of government policy and to private business, to the scientist and the lawyer, to the sailor and the landlubber, to the miner and the fisherman, to the strategist and economist, to the nations bordering the seas and to the State of Hawaii.

Within the depths of the surrounding seas, Hawaii can find proteins for the undernourished, water for arid areas, medicine for the sick, resources for industry, opportunities for recreation, and other benefits for mankind. In addition, a rapidly growing population, a general migration to the already crowded beach-front areas, and a rising standard of living have created problems of pollution, living space, and diminishing natural resources. For such common needs as oil, minerals, fresh water and recreation, increasingly we are being forced to turn to the sea to supplement our traditional resources on dry land.

Our ability to use the ocean, such an integral part of Hawaiian life at one time, has now fallen far behind our rapidly increasing appreciation of its potential value.

Marine scientists and engineers have made progress toward understanding the marine environment and working in it. Their efforts have added to our knowledge of the attainable benefits of the ocean, but they have been insufficient in comparison with the apparent total potential. Yet, educating the public as to the vast potential of the surrounding Pacific, explaining the research that has already been done, and generally developing a continued interest in the uses of the sea could well be the answer to impending life problems involving new sources of food and new living areas.

Resurgent interest in marine affairs as a matter of state importance was expressed in the statement of purpose contained in Act 137, Session Laws of Hawaii 1970, which established the position of marine affairs coordinator within the Office of the Governor. The support of the Legislature for marine programs was evident in this Act, as follows:

> Findings and declaration of necessity.
> The legislature finds that:
>
> (1) The marine environment is one of Hawaii's most valuable assets. It has shaped the uniqueness of the way of life in Hawaii, and it has contributed to the major elements of the State's economy. Hawaii can secure even greater benefits from the judicious use of the resources in and around the sea if it energetically coordinates the development of technology needed to exploit these resources, the promotion of marine businesses, and the establishment of programs dedicated to a better understanding and knowledge of the marine environment.
>
> (2) There is a need for a planned and concerted effort to explore and develop to their fullest potential the vast, under-utilized resources of the Pacific Ocean. In view of its mid-Pacific location, unique oceanographic environment and other advantages, Hawaii can take the lead in fostering the development of the ocean's resources, consistent with State and national goals of economic growth, international development assistance, and cooperation with neighbors in the Pacific basin.

(3) The development and utilization of marine resources require the deep involvement of state government. Responsibilities and authorities already exist in the various agencies of state government to address many of the opportunities and problems that may arise in marine affairs in the foreseeable future. However, there is no mechanism to bring a unified and coordinated approach to marine activities that cut across the responsibilities of the various agencies of state government.

(4) If Hawaii is to capitalize on the immediate and long-term opportunities for the fullest development and utilization of marine resources, it is essential that the total efforts of the State in the planning, research, development, and promotion of the marine environment must be effectively coordinated. The marine programs in existence and those being planned require a mechanism in the state government to bring about the most effective and efficient use of resources in developing the marine environment. This mechanism can best be provided through the establishment of a marine affairs coordinator in state government at a level which will make possible the coordinated management of all marine activities.

Even earlier, in a speech entitled, "Using Our Pacific Treasure", Governor John A. Burns stated,

> ...The time is at hand for specific, detailed, practical programs by the State Legislature and State Administration to study and use the rich resources of our marine environment. This is the time when a growing despoilation of our waters must cease, and when they must be restored to the crystalline cleanliness which our Hawaiian forefathers knew.... Today is the day we must set the leadership pattern in oceanography, this fast-developing area of human concern, toward which the eyes

> of all nations are only beginning to turn. Now is the time we must propose to our own Nation, and to other Pacific nations, that Hawaii is the logical--indeed, the ideal--place for oceanographic headquartering, for major ocean research projects, and for gatherings fostering international cooperation in marine affairs....

In 1972, the Marine Affairs Coordinator, John P. Craven, stated, "The overall, long-range objective of the Marine Affairs Coordinator is to make the State of Hawaii a leader in the development of ocean resources, and to assure that the State and its people derive maximum benefit from the marine environment that surrounds them.... By using this ocean space in ways that are new to use--yet completely feasible and practical with existing skills and technology--we can do much to restore and maintain an environment that is clean, uncluttered and without many of the stresses imposed upon us because of our past exclusive reliance on land-based solutions and systems...."

It is apparent, therefore, that governmental agencies in the State of Hawaii do recognize that the marine environment is one of Hawaii's most valuable assets and as such have pledged their support for the development and utilization of marine resources. However, while the results of recent scientific investigations into this area may have been supported by and reported to these government agencies, the layman or the average citizen on the street is generally unaware of developments in marine programs in the State. This does not mean that the Marine Affairs Coordinator or some other program director is not doing his job. It merely reflects one of the basic tenets of education, that knowledge requires communication. If the layman is to be educated as to developments in this area, then the government or private industry or some agency "in the know" must communicate to him its findings, its research activities, and its own general knowledge about the sea and the life in the sea around us. The problem of communication and education of the citizenry will be dealt with in greater detail later in this study.

Some citizen input into the area of marine affairs was expressed in the report entitled, *Hawaii and the Sea, A Plan for State Action*, which was written at the request of the Governor's Task Force on Oceanography by approximately one hundred volunteer professionals from all segments of the Hawaii community. Included in the group were state, federal,

university, and industry representatives together approaching the problems associated with the State's use and development of the sea and its resources. Together, they represented the people who were most informed about marine affairs in Hawaii. Thus, although the report was done by Hawaii citizens at large part because of their love for the State and for the sea around it, it is more than just citizen input, it is a document produced by professionals who make a living directly or indirectly due to marine resources.

Among the recommendations proposed in the *Hawaii and the Sea* study was that calling for an integrated marine program in which all activities dealing with marine resources in Hawaii would be organized, coordinated, and integrated. In a nutshell, it was determined:

> There is no question that the State of Hawaii, aided by the federal government and its own university and marine-oriented industry, has assets adequate to take advantage of many marine opportunities and obtain the answers to many marine problems. The least of the difficulties are the scientific and technical ones; the greatest are in planning an integrated marine program and in organizing and obtaining facilities to carry it out. This means having - as now - a state government willing to organize and carry out bold and imaginative marine activities; a university with a strong stress on marine affairs; and an industry willing to take some risks. It also requires adequate space, harbors, ships, oceanographic instruments, computers, qualified scientists and engineers, and of course adequate funds.
>
> *(Hawaii and the Sea: page 11)*

Perhaps a brief look at the study's recommendations and the resultant actions on the part of the State in these areas will provide some idea about the worth and influence of citizen input on marine resources in the State of Hawaii.

Recommendations in *Hawaii and the Sea* and some of the resultant actions are listed below:

(1) *Recommendation:* We endorse the idea of combining many of the interrelated studies, surveys, and marine research and development activities recommended in this report into a single integrated program which would be called the "Hawaii 5-M Program" for "Five Marine-Science Years".

Outcome: The "Hawaii 5-M Program" can be viewed as merely a suggestion as to a title for a coordinating program in marine affairs. The title was never adopted, but a program supporting coordination of marine research and development has been established with the creation of the Office of Marine Affairs Coordinator.

(2) *Recommendation:* We recommend the allocation of land at Snug Harbor to the University of Hawaii for an Oceanographic Expeditionary Center be made as soon as possible. Further, we recommend that $1.5 million be included in the next State Capitol Improvements Budget for construction of urgently needed facilities there.

Outcome: The Legislature has appropriated $3,300,000 for the planning and construction of this project.

(3) *Recommendation:* We recommend that the Governor urge the President and the Congress to take appropriate actions to bring the International Decade of Ocean Exploration into being.

Outcome: The Federal Office of the International Decade of Ocean Exploration has been established and was one of the sponsors of a local conference on manganese nodules in the Pacific.

(4) *Recommendation:* If the National Administration does not endorse the International Decade of Ocean Exploration, then we urge the Governor to seek a Pacific Decade of Ocean Exploration in order for the State to reap the benefits of an intensive study of the Pacific Ocean as soon as possible.

Outcome: This was endorsed on the federal level.

(5) *Recommendation:* We recommend that the State study the feasibility of an International Marine Exposition in Hawaii in 1980.

Outcome: The Legislature established a commission to plan for such an exposition in 1978.

(6) *Recommendation:* We recommend that on all publicly-owned shoreline lands which are less than fully developed, irrespective of zoning or land-use classification, there should be 300 feet of open space dedicated to public use; and that this setback be measured from the most inshore on-record line of wave action, or from the top of the *pali* landward, should that type of typography be involved.

Outcome: A shoreline setback law has been adopted and is part of our working statutes. However, the specific measurements of the setback area differs from the one recommended above.

(7) *Recommendation:* We recommend that the program of establishing underwater parks and preserves be expanded to include Maui, Molokai, and Kauai.

Outcome: Underwater parks and preserves have already been developed on Oahu and the Big Island. Others are now being planned for Maui, with future development hoped for on the other islands.

(8) *Recommendation:* We recommend that the State give high priority to its rigorous enforcement of state water quality standards.

Outcome: The State has done this in a variety of ways including the passage of new laws such as that fixing responsibility for oil spills, and more vigorous enforcement by the appropriate state agencies.

(9) *Recommendation:* We recommend that the State give increased assistance to industry and give further encouragement to the U.S. Bureau of Commercial Fisheries to accelerate their development of new fishing methods that will help Hawaiian fishermen increase their catch of skipjack tuna.

Outcome: Studies on new netting technology and bait improvement are continuing with state assistance.

(10) *Recommendation:* The State should continue to encourage research in aquaculture. At the same time, the federal government should take the lead in sponsoring research which would show how to recycle sewage into food through fish farming.

Outcome: This is continuing with a Maui fish-farming organization now supplying Maui with delicious catfish and prawns. Studies and experiments in this area are flourishing.

(11) *Recommendation:* The precious coral industry in Hawaii needs the support of the federal government to dissuade foreign coral fishermen from operating in waters near the Hawaiian Islands, and the help of the State in conducting a survey of the precious coral resources along the Hawaiian archipelago.

Outcome: A survey of coral resources was conducted with encouraging results. An estimated 4,000 pounds of coral could be harvested every year off Makapuu alone.

(12) *Recommendation:* We find that there is a definite need for an executive director for Marine Affairs in the state government. He can do his job effectively only in the Office of the Governor, and we recommend that he be placed there.

Outcome: This position was established and approved by the Legislature. Dr. John Craven is now serving in this capacity.

In the 1969 Governor's Oceanography Conference, Dr. Edward Wenk, Jr., Executive Secretary of the National Council on Marine Science and Engineering Development, listed six areas, declared by the federal government to be of top priority in the area of marine affairs. These include:

(1) Fostering wise and productive use of coastal resources through encouragement of state action for coastal zone planning;

(2) Expanding exploration of coastal and deep sea resources and strengthening weather forecasting services;

(3) Improving the competitive position of the U.S. fishing industry;

(4) Establishing national/regional laboratories and providing a stable base of support for them;

(5) Establishing a legal regime for the deep ocean floor that will encourage development of ocean resources; and

(6) Initiating a long-range federal contract program in basic marine technology.[1]

Because of Hawaii's proximity to and unique position in the Pacific, it has an unprecedented opportunity to assess its surrounding marine environment and to contribute its experience, its talents, its vision, and its resources to advance our own nation's stake in the ocean. Other conferees felt that Hawaii could be used as an observing, testing, and evaluation center to conduct programs to obtain solutions related to marine resources. The five major areas of marine science potential for sociological, geopolitical, and economical growth for the world, the nation, and the State of Hawaii were determined to be national defense, food, mineral, chemical and water resources, pollution, control of pollution, and recreation. Further, it was felt that in order to establish what Hawaii's position is, emphasis should be on establishing a relationship concerning the uniqueness of the State's resources and potentials in these five major areas.

To some extent, the report of the Governor's Task Force, entitled, *Hawaii and the Sea*, did in many ways set down these relationships and potentials. The fact remains, however, that Hawaii is a new state, and a small state with very limited natural resources. It is in a growth cycle which puts stringent demands on the limited capital which is distorting the balance of the economy. Agriculture, although numerous government-help programs are in process, is still on the decline. Local market conditions do not lend themselves to heavy manufacturing of any kind; so a new industrial base with economic sense would provide Hawaii with professional opportunities and the related advantages.

Marine resources could provide Hawaii with a new economic impetus, it could spur the economy to greater growth, and it could provide Hawaii with a place of leadership in the world

of marine affairs. Hawaii's industrial potential in marine resources is also great. Within the next 20 years, the world population is expected to increase by an estimated 50 per cent. About three to four times more gas and oil will be required annually.[2] It has been estimated that offshore sources will provide in a decade about one-third of the world's petroleum, a particularly interesting fact in view of the energy crisis and the threatened lack of fuel from Arab land sources. It also has been estimated that world-wide fish catches can be quadrupuled, and many feel there is a great potential in aquaculture for raising marine species of high economic value. Ocean mining activities could expand rapidly as technology for economic recovery and processing develops, and an interesting potential for new medicinal preparations from marine life also exists.

Profit-motivated private enterprise traditionally has provided one of the most potent avenues for growth. Providing a political and economic climate that will allow Hawaii's ocean industry to meet these needs is a challenge to the State. Two areas, in particular, hold great potential for Hawaiian industry. These are aquaculture and manganese nodule mining.

In a recent conference on aquaculture, held on the Island of Kauai, a gathering of noted scientists and economists met to discuss the aquaculture program in Hawaii. This ancient art, which has evolved through the centuries from a live storage, to supplemental feeding, to intensive culture dependent on total artificial feedings, is one of Hawaii's newest growing industries. Malaysian prawn, catfish, trout, and opihi are only a few of the potential crops to be cultivated. It was pointed out that Hawaii is five years ahead of the rest of the world in aquaculture research and experimentation, yet all the answers are not in. Much more must be done before an economical and marketable aquaculture crop industry is fully developed. If aquaculture could furnish some supplements to available aquatic resources both for the table and for sport, and do so at an attractive level of profit for those who engage in the husbandry of fresh, brackish water and marine animals, the effort would certainly thrive in the islands. The intensive culture of fish and shellfish can create the diversification of occupations, employing people and using land or landwater interface areas that do not lend themselves for other kinds of uses.

Some of the marine life that do lend themselves to commercial development are listed below, along with the deterrents to rational expansion:[3]

Malaysian Prawn. The main obstacle to expansion of freshwater ponds for them is food for the animals. They are facultative carnivores, nibbling on the morsels they ingest. There is not yet devised the proper binder that will hold the compounded feed together in the water for 12 to 24 hours. Diseases are also unknown; a study of prawn pathology is likely to be another key to the intensification of their culture.

Channel Catfish. These can be grown successfully with the technology developed in the southern U.S. and with the feeds the feed industry can provide for them. If there is to be profit from catfish growing in Hawaii it will likely come from freshwater raceway culture; that is, from keeping them in quite rapidly flowing water and great densities and simply shoveling the feed through them. Otherwise feed transportation may take up an excessive part of the variable costs of production. Others could be grown with present technology.

Oysters. These thrive in estuaries such as Pearl Harbor and will probably be harvested after certain sewage problems have been abated.

Trout. This is perhaps the easiest luxury fish to grow nowadays. As with catfish, raceway culture is most practical with large amounts of imported feed turned into many trout. Cool water requirements can be met in various sites on the Hawaiian Islands where even land, but more likely water hitherto used for sugar-growing operations may become available.

Carp. These may lend themselves to medium intensive culture, making use of natural or man-enhanced water fertility without adding feeds. They are likely to be in limited demand by certain ethnic groups in the State.

The culture potential of other aquatic animals is not as far advanced but there are a few species with which a breakthrough is likely to occur within the next five years.

The ocean industries are a heterogeneous group in various stages of development. In Hawaii, recent interest in manganese nodules has increased as a result of the latest technological advances which allow exploitation of the ocean's resources to depths of up to 18,000 feet. The depths of the ocean around the Hawaiian archipelago itself seldom run deeper than 15,000 feet. Thus, the race for the mineral wealth in the Pacific is ruled now by the question of who has the money to get the

minerals and in turn make more money. To date, no constraints have been decided for a mineral harvest whose annual yield could earn far more for the exploiters than Hawaii gets each year from defense spending, tourism, sugar, and pineapple combined. Countless of unanswered questions about such a mining operation remain, such as who would have the right to levy taxes, if anyone; whether the mining sites could or should be regulated in size and length of time on the claim, and what part of the revenue from the harvests if any should belong to others in the world. Because manganese nodules are one of the few minerals that have fast regenerative powers, however, their existence in the Pacific remains an attraction to future industrial development.

Table I, depicts the status of domestic ocean industries in two broad categories: existing and future. Included in the list are only those industries which use the oceans directly. It should be pointed out that there are great differences in present and anticipated rates of growth of ocean industries. Although all categories of ocean enterprise share common problems, distinct differences exist in their operating requirements, investment, degree of competition, and relationship with government. In addition, the needs of some industries such as fishing, vary in nature and degree from segment to segment.

No hard mineral mining of practical significance is being conducted on the U.S. continental shelves except sulfur, sand, gravel, and oyster shells. There is no mineral mining in the deep ocean. Discussion of offshore mining, such as with manganese nodules, is largely a discussion of its potential, of ways to assure that the potential will be realized as soon as economics and technology allow, and of its importance to the State. Successful ocean mining is being undertaken in other parts of the world where favorable business climates in combination with adequate geological deposits make such ventures economically attractive. Most such operations are in comparatively shallow water. While the technology for some manganese mining exists to some extent already here, how economical these techniques are has not yet been proven.

Industry has stated, in effect, that it is willing to take the heavy risks required by ocean mining ventures if government will provide well defined and reasonable laws relative to property rights, crew regulations, import duties, and taxes. In addition, government-sponsored services, especially surveys, and equitable treatment in many potential multiple use conflicts will be required if this new industrial potential is to be realized in the near future.[4]

Table I

PRESENT STATUS OF DOMESTIC
OCEAN INDUSTRIES

Type	Examples
Existing Industries	
Mature, healthy, and growing	Continental shelf oil and gas Chemical extraction from sea water Mining of sand, gravel, sulfur Shrimp and tuna fishing Surface marine recreation
Early stage of growth	Desalination Bulk and container transportation systems and associated terminals Aquaculture, fresh water and estuarine Underwater recreation
Mature, but static or declining	Most segments of fishing Merchant shipbuilding Merchant shipping (U.S. - flag vessels)
Future Industries	
Near-term promising (where near-term is up to 15 years)	Mining of placer minerals Oil and gas beyond the continental shelf
Long-range	Sub-bottom mining (excluding sulfur) Aquaculture, open ocean Deep water mining Power generation from waves, currents, tides, and thermal differences

Industry and Technology, *Keys to Oceanic Development*, Vol. 2, Panel Reports of the Commission on Marine Science, Engineering and Resources, Washington, 1969, P. V-7.

Because the risks are so great and because the field is so new, in the sense that it is in its infant stage of development, why should the government or the people with their tax dollars be interested in the development of marine resources and the ocean around us? The answers are numerous. The expanding population and rising standard of living will consume natural resources at an accelerating rate. Government and industry must have comprehensive knowledge of both renewable and non-renewable resource inventories, both in the ocean and on land, to manage these resources effectively and help determine international trade policy. Maintenance of reasonably stable prices and marketing arrangements requires an adequate level of proven reserves to meet future needs and a diversity of sources to establish a potential for competition. In addition, due to the predicted demand for natural resources, it is becoming increasingly important for industry to make the best possible projections and concomitant decisions concerning the most economical sources of supply. Further, on the national level, domestic production of minerals offshore yields some foreign exchange savings when contrasted to an import alternative. The resultant relatively modest savings may be offset by repercussions in markets for U.S. exports, but until the nation's overall payments problem has eased, the balance-of-payments aspects cannot be ignored. Encouragement of appropriate ocean industries by the State will contribute to the state economy in the form of capital investment, increased employment, and productivity. For these reasons, then, it is imperative that the people of the State be made to understand the necessary integration of roles between government and industry for the future development of marine resources.

The Role of the Aquarium

The role of the aquarium, like that of the museum, is to serve man. Although much of its work involves acquiring, studying, and exhibiting marine life and marine processes, its chief responsibility is to man, and in particular, communicating to man knowledge of the sea and the marine environment. If it is to serve man today and tomorrow, it needs to concern itself with the problems of today and in so doing demonstrate how man ought to live.[5]

A few colorful fish swimming around in a tank mean very little to the average man unless he can relate them or their environment to what is happening today and what may happen tomorrow. Furthermore, since visitors to the aquarium cannot be limited to the enlightened, the educated, or other similarly segregated interest groups, programs which could reach wide segments of the community are necessary. Since most people

are aware of the deep resistance in human beings to change both in ourselves and in our institutions, aquariums must resist the temptation to live with the status quo and instead develop programs with a sensitivity to the cries of modern man for a more perfect way to live and to know the truth.

It should be the aquarium's responsibility to discover the truth (what are the influences of various fish on the life of man, what similarities in fish life can be used in bettering the life of man, how can man adapt himself to the fish environment, etc.), to collect and analyze the data, and to interpret the findings in a way that all men can understand. The sterile and fanatical adherence to exhibit techniques of the past are no longer sufficient. Aquariums must make use of every new technical device to absorb the attention of the masses and to communicate knowledge.

The aquarium must change from a passive collector and specialized scholarship to an active participant in meeting today's challenges. It must employ not only new methods but also develop itself into a new intermediary that will be unafraid to face the complex problems of today, including pollution, overpopulation, poor housing, food shortages, drugs, urban planning, disease--all aspects of human life. In addition, it should be the role of today's aquarium to help find the solution to some of these problems. Exhibits should be designed to present information on these problems and lead to solutions which can be gleaned from the sea, correlating, for example, the effects of mercury pollution on fish and those that eat fish.

In terms of the Waikiki Aquarium, the key to developing into an exemplary aquarium of this kind would depend on its receiving support from a source that was willing to take risks and that would permit it to develop freely without interference in its efforts to meet the needs of the community and the people of the state it serves. Only with that kind of commitment can the Waikiki Aquarium be successful in establishing a style of its own and move toward fulfilling its potential as the aquarium of the future.

The aquarium cannot be oblivious to the earth world surrounding it, as well as the sea world it represents. It must have the courage to expose old myths, exhibit new truths, and present controversial issues in all their harsh reality. It must make use of the sponsoring institution or agency and its rich resources for operational purposes, research data, interpretation, analysis, and correlation of information. The aquarium must make use of the expertise available, whether it

is from university personnel, visiting aquarists, or other sources; but these should merely be supplementary to its own knowledgeable and expert staff.

An aquarium of this type, that is one which can fulfill the role discussed previously, must also focus its displays on the problems, life, and general environment of its constituents. In the case of the Waikiki Aquarium, a notable tropical reef fish collection has already been developed which gives viewers some idea of the type of reef life in the islands. In the past they have also presented exhibitions on the life cycle and fishing methods of local food fish, tracing a course from infancy in the sea to tuna in the can. The reality that such common food comes from the nearby ocean was made quite evident and thereby relevant to visitors. As the aquarium increases its understanding and awareness of its function and role, the community also begins to discover its identity through the aquarium, to comprehend the value of the work of the local scientific community, and to take pride in that identity and scientific accomplishment. Their sense of community broadens.

The aquarium, then, begins by collecting, analyzing, and studying marine life and interpreting the findings by posing the problems together with alternative solutions. The end result is the exhibit which is the medium whereby people are obliged to see marine life as it is, as what it can become, as it is in relation to themselves, and what action they can take. The aquarium must be a living institution, not merely a place where the living fish are deposited for a short period of time. It must be a place where students congregate, scientists explicate, people meet, and even tourists learn. It should call attention to urgent problems, inspire people to action, and participate in the development of a variety of interests from malacology and hobby fishing to pollution control and urban planning.

Acceptance of such a role would result in an aquarium with a new, creative, and challenging outlook, with broadened interests and expanded functions together forming a most appropriate window to the sea and to the world around us. The Waikiki Aquarium may well become Hawaii's window to the sea.

CHAPTER III
EXEMPLARY AQUARIUMS FROM WHICH TO LEARN

In view of Hawaii's proximity to the sea and its general policies regarding marine resources, it seems imperative that the Waikiki Aquarium be developed into an exemplary institution. Before any plans for development are discussed, however, it would be well to consider what is currently available in the realm of aquariums in other parts of the world.

A survey of aquariums in the nation was sent out early in the study to gather general data on operations. A few of those surveyed stood out as worthy of further study and exemplary institutions--each in their own right. These were the John G. Shedd Aquarium in Chicago, the Vancouver Public Aquarium in British Columbia, the Steinhart Aquarium in San Francisco, the T. Wayland Vaughan Aquarium, part of Scripps Institute of Oceanography, and as a means of comparison, Sea World of San Diego. Each of these aquariums have colorful and attractive displays of fish as well as some aspect of their operations which is particularly interesting.

John G. Shedd Aquarium

The John G. Shedd Aquarium, located in Chicago, is housed in a massive building with very high ceilings and a general feeling of roominess. Upon entering, visitors are immediately captivated by a stunning re-creation of a living coral reef and the thousand colorful fish that make this type of habitat their home. Included in the circular tank, which measures 40 feet in diameter and contains 90,000 gallons of sea water, are over 75 species of fish set against a background of coral, sea fans, sponges, and sea whips. The french angelfish, damselfish, chubs, grunts, and spadefish swim in the same tank as the barracuda, moray eels, triggerfish, groupers, tarpon, snappers, and others. Together, they constitute an appealing exhibit, housed behind a two and one-fourth inch thick glass, which effectively demonstrates the inter-relationships of varied life forms on a reef.

Following the easy pattern leading toward the display tanks, one is soon engrossed in the numerous marine exhibits, each species framed in their natural habitats. There is a gigantic jewfish, with the notice that these fish can grow to weigh 500 pounds. The crabs and lobsters sometimes peer back from behind their glass-walled homes. The trout swim around

their tank, while elsewhere a large octopus clings to a side-wall, a penguin waddles around, or a seal glides smoothly through the water.

Marine life from every part of the world, ranging from the tropics to the arctic are displayed. A brochure describing the aquarium states, "Sturgeon from Russia, trout from the streams of Wisconsin, a lungfish from Australia...see the rest of the world at the Shedd Aquarium."

Each tank represents a small part of the marine world. For northern specimens, there is refrigerated marine water. For tropic specimens, there is more temperate water. The water is transported to the aquarium for its use, since it is not near any salt water supply. Each tank appeared clean, roomy, and easy to service. There were appropriate samples of flora in many tanks, some growing under water, and others extending even above the water. The sand and coral lining the floors of the tank made them appear even more attractive. One interesting tank display was that of an intertidal pool in which wave action would occur every three minutes. Children were particularly attracted to this by the rumbling sound and splashing of the water followed by the notice of fish and other fauna in the thusly formed tidal pools.

The labeling system designed for Shedd Aquarium by their own Exhibits Department was intended to satisfy current needs with up-to-date display methods. A previous attempt at revising their old labeling system had ended ultimately in failure, even though the whole layout had been planned by a professional design studio.[1] (See Exhibit A.) The time and effort of museum staff, as well as the studio expenses proved prohibitive.

The new label was divided into three sections: the first (A), showing the various names of the fish (family name, scientific name, and common name, if applicable). In addition, section A was color coded, with various colors denoting the

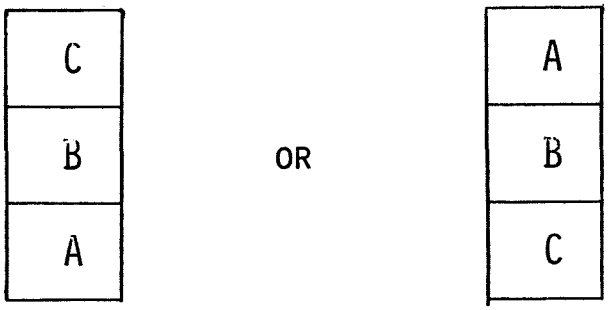
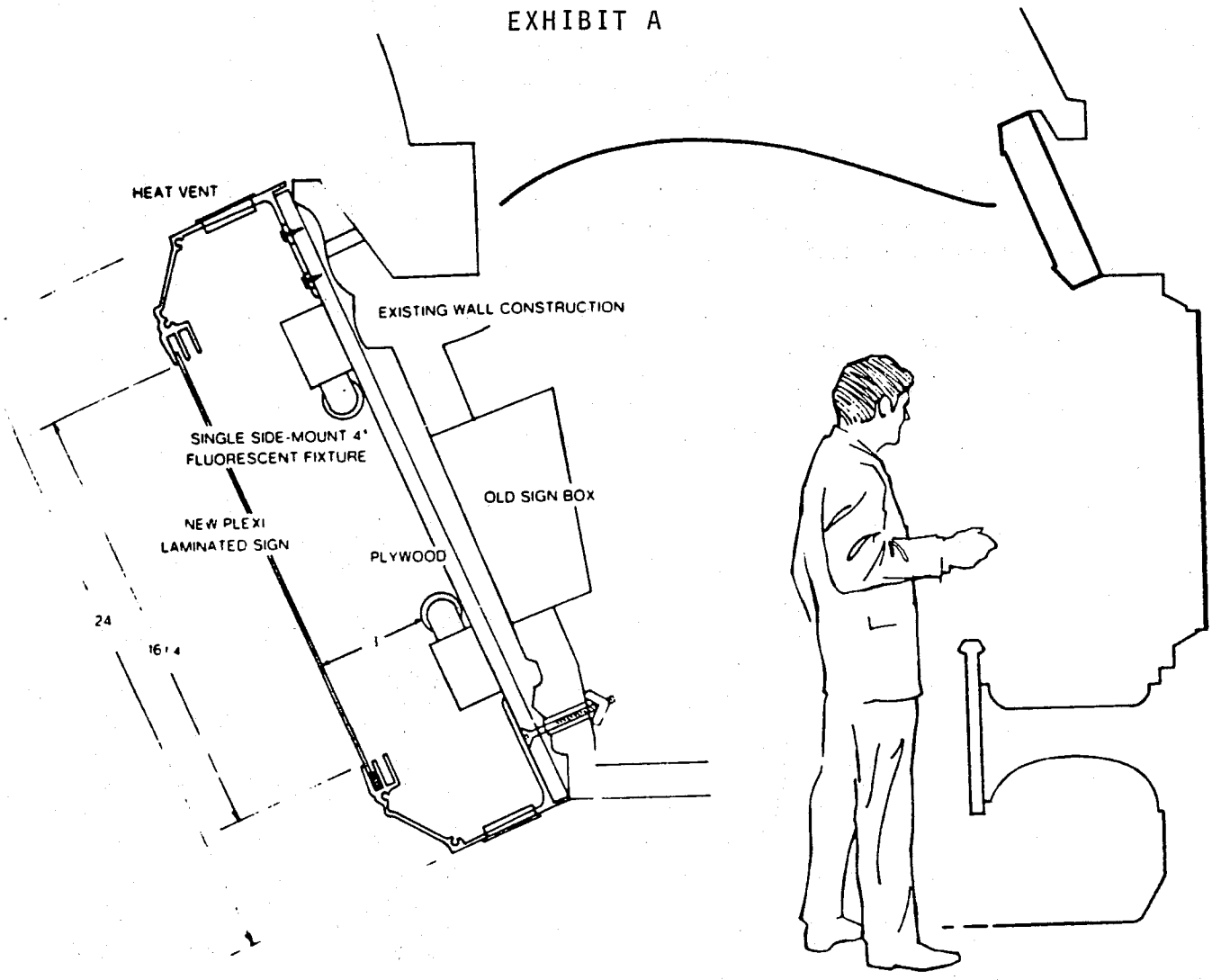
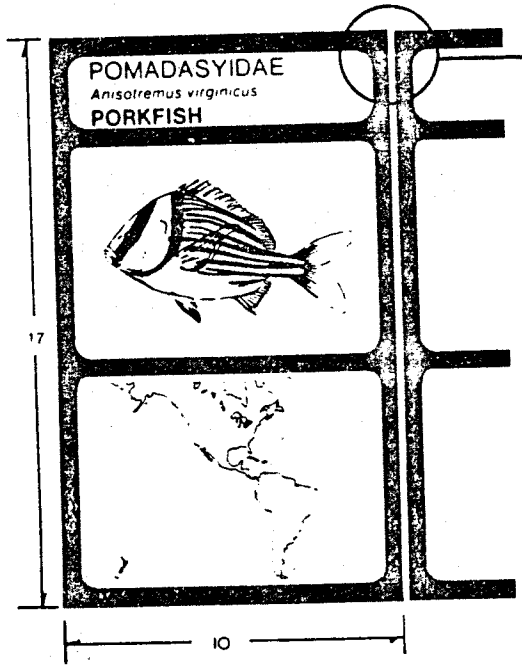
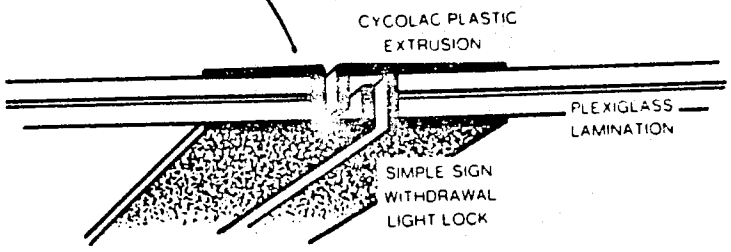


EXHIBIT A





Example of basic square format. Many variations in positive or negative are possible.



Detail of light lock and attaching joint between adjacent labels.

Source: Emanuel Ledecky-Janecek, "New Labeling System at John G. Shedd Aquarium," in Drum & Croaker, no. 1, pp. 21-

type of water (marine or fresh), and the water temperature (warm, temperate, or cold). The Addressograph-Multigraph Headliner #810 and an opaque label film, 3M Super Black, were used to process the labels.

The second section, section B, was made up of full color transparencies of the fish as photographed. The color transparencies make identification much easier for those unfamiliar with the fauna. The method by which the fish are photographed at the Shedd is as follows:

> If the fishes are small, they are moved to a special photo tank. Sometimes a plexiglass restricting frame is used inside the photo tank to inhibit the movements of particularly active fishes. Neutrally colored and textured fiberglass diorama, is used for others. Large fish are photographed in the exhibit tanks. Background panels are inserted to eliminate distracting features of the exhibit landscaping.[2]

A Mamiya RB 67 camera and high speed daylight Ektachrome film were used in the photography.

The final section, section C, was used in several different manners. It could appear as a range map, showing the areas of the world in which the specimen lived; a written descriptive paragraph, explaining some interesting facts about the specimen; another photo showing sexual or juvenile differences in form; or as a diagram. The Shedd is building an inventory of these signs, anticipating future needs, and keeping things in good working order.

The Shedd Aquarium was opened in 1930, and it is still the largest in the world. It was built and completely stocked by John Graves Shedd for the people of Chicago. The City provides the land on which the aquarium stands, in perpetuity. Also from the City, comes a 19 per cent share of a museum tax which is shared by six institutions, including the Art Institute, which is next door to the aquarium. This tax revenue is used for the operating budget, but other sources of funds include admissions, souvenir sales, memberships, and endowments.

Mr. Shedd built the aquarium for Chicago and turned it over to the City only under the strict conditions that the City Park District, under which the aquarium was placed, would

first, in no way interfere with the operation of the aquarium and would, second, assure the aquarium of its operating budget. A share of the museum levy was part of the City's answer, and so far the policy of non-interference has been adhered to--each policy contributing greatly to the success of the John G. Shedd Aquarium.

Although the aquarium is not directly associated with any college or university, a good relationship exists between them and those in the surrounding area. While Shedd staff members do carry on research of their own, they also welcome other scientists to use their facilities. Offering them sea water, tanks, etc. with the only stipulation being that their actual research support funds be provided on their own. The aquarium does not have the funds to support outside research on a continual basis, but they are most willing to open their facilities for the use of others. This policy is not much different from that at any college or university, where most research funds come from outside sources.

Shedd also conducts formal, structured classes for over 2,000 high school students per year. These classes are given upon the requests of teachers. In addition, there exists a special program for metropolitan high school students in which students spend two and one-half days each week at the aquarium, followed by a one week stint on the Shedd collecting boat in Florida. College students are usually used to teach these courses, but they do have two full-time and two part-time educational specialists on their staff.

Shedd operates on a budget of approximately $1,300,000, as follows:

REVENUES		
Tax Revenues	$825,000	
Endowments	150,000	
Admissions	300,000	
Memberships	20,000	
Souvenir Sales	50,000	
Miscellaneous	5,000	
TOTAL		$1,350,000
EXPENSES		
Operations	$1,034,800	
Major Repairs	100,000	
Capital Improvements	205,500	
TOTAL		1,340,300
BALANCE		$ 9,700

Last year's visitor count was set at 885,700. Of this number, 243,573 were in study groups or classes operated by the museum. Aside from Christmas and New Year's Days, the aquarium is open every day of the year, usually eight hours a day. On Fridays, they stay open until 9:00 p.m. Friday is also the day on which admission is free for everyone. Members are admitted free at all times, and school and social service groups are admitted free. Needless to say, the generous hours of operation account in part for the large attendance figure.

The program and operations of the Shedd Aquarium are indeed exemplary of the fine leadership provided by its director, Mr. William P. Braker. The excellent exhibits, notable research, and general operations make it one of the best display aquariums in the nation. It is hoped that the Waikiki Aquarium, with the proper leadership, will be able to adopt the generous hours of operation policy, develop similar educational programs, consider the manner of financing, and display as notable a collection of marine fauna as that displayed at the John G. Shedd Aquarium. Moreover, its method of financing, through the City, memberships, public contributions, and admissions, offer valuable lessons to other aquariums in need of financial assistance.

Vancouver Public Aquarium

A second public oriented aquarium is the Vancouver Public Aquarium in Vancouver, British Columbia, Canada. Like the Shedd Aquarium, it is a nonprofit institution, in this case directly affiliated with the Vancouver Public Aquarium Association. Located on the grounds of beautiful Stanley Park, it is easily one of the largest, most exciting aquariums in North America. Over 8,400 specimens, representing 595 different species, are seen in attractive tank displays by visitors. The fish range in size from large killer whales living in tanks containing 480,000 gallons of water, to tiny coral reef dwellers, the colorful inhabitants of tanks with beautiful coral displays.

The Vancouver Aquarium activities include a number of things not normally seen by the public. These include education, research, collecting, food preparation, water filtration, and water temperature control. In addition, a series of newsletters, informational pamphlets, films, and teacher preparation booklets are also distributed by the aquarium.

Upon entering the aquarium, visitors are greeted by life-sized models of marine fauna. A basking shark, leatherback sea turtle, and killer whale are among the life like models. Outdoors is a whale pool with an underwater viewing area, as well as outside seating facilities. Inside, the aquarium is divided into three sections: one features marine life common in surrounding waters; a second features freshwater fauna; and a third includes tropical displays as well as fish from many other parts of the world.

The history of the aquarium is described in the visitors guide, as follows:

> The Aquarium is run by a nonprofit society, the Vancouver Public Aquarium Association. It began in the mind of a Vancouver businessman, Carl Lietze, who conceived the idea of an aquarium in Vancouver devoted to display of aquatic animals, research and education. The idea took root in 1951, and the cooperation of local citizens and organizations, as well as three levels of government, resulted in a small Aquarium opening in 1956.
>
> It was an instant success! Crowds of visitors came to view the displays, and in 1964 the Aquarium achieved world recognition with the capture of Moby Doll, the world's first captive killer whale. In the next few years great expansion occurred. The Foley Pacific Ocean Foyer, the B.C. Hall of Fishes, the Rufe Biggs Hall, and the B.C. Tel Outdoor Pool were opened to the public in 1967. At this time also, the original building was renovated and became the H.R. MacMillan Tropical Gallery.
>
> With the addition of the new whale pool, officially opened by Prime Minister Trudeau on May 1, 1971, the Vancouver Aquarium ranks as one of the world's finest aquariums. The high quality of its displays, and its research and education programs make it an important part of the Vancouver community.

One interesting display in the B.C. Hall of Fishes was the wavewash tank, with crashing waters giving visitors a feeling of true wave action, as well as the aquatic plants and animals found nearby. A nearby reef tank included a variety of fish that live together in the subtidal reefs. But the one display that appeared to have the greatest attraction to visiting children and adults alike was the "touch pool" which allowed people to feel such things as sea urchins, crabs, sea cucumbers, and squids. This gallery, dedicated to the diverse fauna which can be found in nearby waters, educates visitors about the sea around them. The philosophy and intent of the aquarium behind the displays is that, "those who view the various displays will acquire a greater respect for the sea and realize that, as our population expands, we must take steps to preserve these same rich waters".

In the freshwater fish display gallery, a variety of fish found in freshwater rivers, lakes, and streams can be seen. Sturgeon, salmon, bass, and perch are each displayed with notes on their natural habitat and life habits. The commercial import of the various fish is also described. In the fall months, spawning salmon are displayed in the stream tank. The eggs are then transferred to an adjacent nursery area and the visitor can watch them progress to fry and fingerlings. This particular display is not only interesting and attractive, but most educational in a pleasurable manner. Another attraction in this gallery is a series of short films presented by one of several young guides in the aquarium. The audience is seated, then the guide begins the film and acts as narrator. The short films cover such subjects as seals, fish, or some variety of sea life in general.

Unlike many other aquariums, the Vancouver Aquarium employs a number of uniformed guides stationed in various locations throughout the aquarium. They answer visitor's questions and direct them as to tank displays and aquarium activities. They are most friendly, greeting visitors with a warmth that only energetic youth can usually manage. They are a welcome attribute of aquarium operations.

The tropical gallery includes a large variety of fish gathered from the warmer oceans of the world. The colorful fish are displayed, along with various reptiles, in attractive display tanks, many of which depict their natural habitat.

The aquarium, to collect many of their notable specimens, uses their own twenty-seven foot boat, Nautichthys. They use such collecting methods as angling, set lining, otter trawling, beach and pole seining, gill and dip netting, and diving. Staff members have traveled the world in search of new specimens for display in Vancouver.

The combination of fauna located in a well-run facility and adequate facilities makes the aquarium an important place for behind-the-scenes research. Often, this research is conducted by scientists from neighboring universities who have a good open working relationship with aquarium personnel. The water system at the aquarium itself attracts the interest and use of the scientific community. The visitor's brochure describes this water system as follows:

> Mechanical facilities in the basement are very complex. The various salt and freshwater animals need continuously flowing water, at temperatures comparable to those of their native habitats. The larger mammals have chlorine added to their water, and the latter is filtered through special diatomite filters.
>
> Seawater is pumped from Vancouver Harbour at a rate of up to 600 gallons per minute into four "sand filters" and then into a distribution reservoir.
>
> In our public displays water constantly enters and leaves the tanks, keeping them clean and clear. Water that leaves the displays is not totally discarded, however, but most is refiltered and used again. Gradual replacement from the sea eliminates dissolved wastes.
>
> Marine animals in the Aquarium have their own specific needs; so the seawater supply is divided into five main parts, according to temperature, salinity, waste removal and chemical treatment.

The educational program at Vancouver is quite extensive. It includes over a hundred "docents", volunteers trained by the staff, who give guided aquarium tours to elementary school classes as well, as a slide-lecture which proves informational to both teachers and students. Extensive educational materials are provided to teachers before any visit. In this way, each class is prepared for the tour and better able to understand the marine life they will be viewing. Also, as mentioned before, trained guides, usually university students, are used during the summer months to answer questions, narrate the whale show, and give short informative talks.

The educational program was developed by the aquarium's Education Department, which includes an education supervisor and an education assistant. The docents, however, are used to man the classes developed by the Education Department for use throughout the year. The Vancouver Public Aquarium Newsletter, a publication of the department, interprets information about marine life. It is distributed bi-monthly to aquarium members, school libraries, and aquariums and zoos throughout the world.

Also working with the Education Department is the Women's Auxiliary. This group was formed in 1965 and can usually be counted on to organize tours for the handicapped, help organize educational programs, purchase equipment and books for the Education Center, help at social events, sell memberships, organize volunteers, and buy items for the aquarium gift shop.

The department offers seven different educational programs designed to supplement class studies and to open new fields of interest for students and teachers. The classes are intended to give students an in-depth view of various types of aquatic animals and cover such things as whales, reptiles, marine invertebrates, secrets of survival, and the aquatic realm. Bulletins announcing the aquarium offerings are posted in the local schools with blurbs about the subject area and directions as to how to register. Note the following samples on whales and other classes:

EXHIBIT I

Whales

Through the centuries man has been intrigued and mystified by whales. This program, for a limited number of science classes, is specifically designed to give the students an understanding of these highly specialized marine mammals. The class will hear an illustrated lecture centering on the killer whale, but also covering the various whales of the world--the baleen whales, sperm whales, beluga whales, narwhals and dolphins. Topics discusssed will be the evolution of whales, their adaptations to the aquatic environment, the whaling industry, the biology of whales, and the part the killer whales played in Indian legends. The windows of the lecture room look directly

into the killer whale pool, giving a unique situation--whales in the classroom!

Recommended for students enrolled in grade 10 Science, grade 11 or 12 Biology
Limit: 40 students per visit and only three classes from any one school during the school year.
Dates: November 20 through June 1.
Days: Monday, Tuesday, Wednesday, Thursday
Time: 1:00 - 2:30 p.m.
BY APPOINTMENT ONLY
For information and reservations call or write:

EXHIBIT 2

Sharks

The shark is an animal much feared by man, and it is this fear which often causes people to overlook the fascinating aspects of this fish. The shark should be appreciated for its streamlined beauty, acute senses and physical differences to bony fishes. Various species of sharks and their relatives (skates, rays, ratfishers) will be discussed as the students observe them in the Aqurarium tanks. Some of the larger species, which are not displayed in the Aquarium, are represented by life-size models. Topics such as shark attack and the shark industry will be discussed and the children will be able to handle shark jaws and shark skin. (The killer whale show will be seen during the visit.)

Recommended for grade 4 classes
Limit: 40 students
Dates: January 22 through April 19
Days: Monday, Tuesday, Wednesday, Thursday
Time: 1:00 - 2:30 p.m.
BY APPOINTMENT ONLY
For information and reservations, please call or write:

EXHIBIT 3

The Salmon Story

Throughout the history of British Columbia, from the days when the Indians first inhabited our coast to the present, the salmon has been exceedingly important economically. This program will attempt to familiarize the children with this magnificent fish and to make them aware of the dangers facing the species because of our industrial society. The students will learn about the five kinds of salmon through an illustrated lecture and by watching live spawning salmon and living juvenile stages of this fish. The children will compare modern fishing methods with those used by the West Coast Indians in the past. They will even get a chance to taste some salmon. (The killer whale show will be seen during the visit.)

Recommended for Grade 4 classes
Limit: 40 students
Dates: October 23 through December 14
Days: Monday, Tuesday, Wednesday, Thursday
Time: 1:00 - 2:30 p.m.
BY APPOINTMENT ONLY
For information and reservations please call or write:

EXHIBIT 4

Secrets of Survival

Every species of fish living in the oceans, lakes and streams has predators--other fish, amphibians, reptiles, birds, mammals. "Secrets of Survival" deals with the ways in which various fishes avoid being eaten. Some are spiny and, thus, difficult to swallow; others have poison glands; a few give off an electric shock; many are armoured; a number are shaped and coloured so that they blend in with their surroundings and thus avoid detection. The students will observe living fishes in the Aquarium tanks which illustrate several mechanisms of protection, and see slides of

some of the more exotic fishes of the world. (The killer whale show will be seen during the visit.)

Recommended for grade 6 classes
Limit: 40 students
Dates: February 12 through April 19
Days: Monday, Tuesday, Wednesday, Thursday
Time: 1:00 - 2:30 p.m.
BY APPOINTMENT ONLY
For information and reservations please call:

See Appendix A for sample lesson plans for some of the classes offered. It is apparent that most of these classes could easily be adapted to Hawaiian marine fauna and offered at the Waikiki Aquarium, if adequate staff were available.

The laboratory session for grade 11 biology students centers on marine ecology. There is lab space for 30 students, each provided with live marine animals, instruments, and dissecting microscopes. They are required to answer a set of written questions based on their experiments and examinations of living specimens. Headphones and tapes describing certain species are also made available for certain class activities. Before the students visit, their teachers are required to spend an evening at the aquarium performing the same laboratory experiments as their students. Each session lasts an hour and a half, is conducted without charge to school or student, and is given with the complete cooperation of local school boards. These classes provide the students with an invigorating introduction to certain marine life and are undoubtedly responsible for numerous hours of continued classroom activity following each visit. Educational programs of this kind are both enjoyable and well retained in the minds of busy students.

Like the Shedd Aquarium, Vancouver is open seven days a week during the summer months. Its 603,800 annual visitors are permitted to view the aquarium from 9:30 a.m. to 9:00 p.m. every day of the week. A full-time staff of 26 helps operate the aquarium, aided by 34 part-time members, and volunteers who donated 10,000 hours of service last year. Over 15,000 students participated in classes there during the year. Admission fees of $2 for adults and 25 cents for children, with varied special and group rates, are enforced. The income for aquarium operations can be summarized as follows:

INCOME

Municipal Government	$ 45,000
University	2,100
Endowment & Contributions	42,900
Admission Fees	586,000
Store, membership, investments, other	133,500
TOTAL	$809,500

It is interesting to note that over half of the income generated by the aquarium can be attributed to admission fees.

Steinhart Aquarium

Located in San Francisco's Golden Gate Park, the Steinhart Aquarium is the home of hundreds of species of fish, invertebrates, amphibians, reptiles, and aquatic mammals. The aquarium was a gift to the City from Ignatz Steinhart in 1923. Although it is administered by the California Academy of Sciences, it is almost exclusively funded by the City. Because the people of the City enjoy it, it is openly supported with tax revenues. In addition, a portion of the admission fees, paid for entrance into the Academy's complex of aquarium-museum-planetarium, is also given to Steinhart for its use. Last year, a total of $300,000 in admission fees were collected, with $10,000 of that amount assigned to the aquarium.

Due to a tragic diving accident, the aquarium lost its director early in the year. It then came under the leadership of Glenn Burghardt, senior aquatic biologist, who managed operations well until a new director took over in September. It is the director's job to make sure that all goes smoothly. He oversees research, educational programs, fund raising, fish feeding, disease control, and every part of aquarium operations. As such, he is essential to any improvement plans or overall goals. The Waikiki Aquarium has been without a director since the end of 1972, and there is no way that it can be said that the Aquarium has not suffered from it. However, the entire question of aquarium directors and general leadership will be discussed in subsequent chapters.

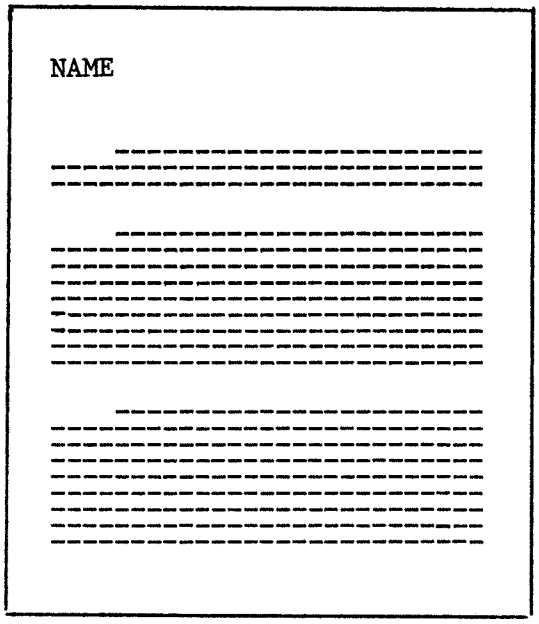
One interesting aspect of the Steinhart situation is the staff employment policy. Because Steinhart is associated with the City of San Francisco, much of their staff is covered by civil service laws. At times they have reported that this has

proved unfortunate, because the operation of aquariums is such a specialized field that it is very difficult to adequately test for aptitude in this area. In fact, as in many specialized fields, there is little substitute for experience. Unless careful hiring under civil service laws is practiced, therefore, the chances are great that unqualified people may occupy civil service positions on the aquarium staff. Ultimately, this could work to the detriment of the hiring aquarium. Thus, when alternatives proposing city, state, or other jurisdiction are considered, personnel hiring practices must also be considered.

Although the aquarium is a part of the California Academy of Sciences, it is not primarily a research institution. However, as with most institutions dealing with living beings, everyday is a learning experience with continuous discoveries about the various aquatic fauna. In addition, volunteer veterinarians and physicians often spend their spare time conducting research or working on special problems at the aquarium. The Aquarium Society also contributes much time and effort to aquarium projects, such as conducting symposiums and making themselves an indispensable part of the aquarium.

Docents also have become an integral part of the Steinhart educational program. They assist the schools in their career education activities, manage to interest them in marine fields, and encourage them to take part in the student summer volunteer program, in which students actually work at the aquarium for the summer. The outlook of the aquarium appears to be based on a philosophy of subtle education, of the freedom of researchers to use their facilities (but not live animals, if the research would be detrimental to them), and of attractive marine displays which demonstrate a relationship between man and the living sea.

As one walks through the galleries, the colorful fish and natural looking tanks are appealing. One tank, in which starfish were housed, was lined on three sides by what looked like a stonewall. The labels were both easy to understand and easy to read. They usually appeared in the following format:



- Facts about their habits, what they eat, etc.
- Interesting notes about the tank, etc., if applicable (For example, a description of the whirlpool tank.)
- Information on the species (For example, the note that Koi were developed in Japan specifically to be viewed from above where one can see the best colors.)

One innovative tank was called the "whirlpool tank". The water in this tank is circulated either to the left or to the right, at any desired speed. By moving the water in this quick manner, fast-swimming fish can survive in a small tank.

Also in the galleries is a microthreater showing brine shrimp larvae which had been hatched only hours earlier. The larvae are the size of a pinhead but can be viewed by the visitor after being greatly magnified.

Many of the tanks were quite attractive and well designed even though the aquarium does not yet employ any professional graphic designers or display artists. One tank held an old submerged wooden cabinet which appeared to be a most comfortable home for the resident eel. Colorful coral adorned other tanks, and the dolphin tank could be viewed along with a taped message describing the habits of the dolphin and playing the sounds that dolphins make. Still others, included signs saying that the fish in the tank were gifts of commercial businesses, such as United Air Lines. Gifts of this nature can be a valuable resource for aquariums, allowing them to expand their collections without going into debt.

Like most other notable aquariums in the nation, Steinhart is open on weekdays, weekends, and holidays. Despite being located approximately five miles from a source of salt water, salt water is piped to the aquarium for its use. There are 23 full-time staff members, in addition to the many volunteers,

who help to make the aquarium a rewarding place to visit. Last year, 1,300,000 people managed to walk through the Steinhart Aquarium's colorful marine galleries.

T. Wayland Vaughan Aquarium-Museum (Scripps Institute of Oceanography)

The T. Wayland Vaughan Aquarium-Museum is a part of Scripps Institute of Oceanography, University of California at San Diego. It is located on the ocean at La Jolla, California. Unlike the previously described aquariums, the Vaughan Aquarium is quite small. However, size does not detract from the appealing exhibits.

Upon entering the aquarium, visitors are greeted by a sign politely requesting a donation which, as it is explained, will be used for general aquarium projects, including the construction of new exhibits and the collection of aquarium specimens. This is the only kind of "entrance fee" at the aquarium, and it has been reported to be quite successful as a means of soliciting funds for aquarium use. Specific figures on revenue, however, were not provided by the aquarium.

The labeling procedures at the Vaughan Aquarium are rather simple and straightforward. The labels usually appear to the side of the display tanks. The common name and the scientific name of the fish are noted first. Following that is a brief explanation about where these specimens are found, something about their habits, or other miscellaneous information.

EXAMPLES:

(1) "This is a common shark along the California coast in bays and shallow water...."

(2) "No, they're not stuck...these moray eels are in the crevices because they like to be there...."

(3) In a tank containing poisonous fish, the label provides additional information, including how the fish sting and what the best first aid treatment might be.

The easy, conversational signs make reading them a pleasant surprise for the visitor and changes his experience from an aesthetic one to an educational one.

In addition to the descriptions of the fauna, many tanks, which also have interesting vegetation like kelp, or colorful coral displays, have bits of information on these exhibits. A tank with coral explained how coral grew, how it gets its color, and what it is. In another area, a story about the California kelp beds, where they were, what was in them, and possible future uses, also appeared.

The exhibits themselves were most engaging. The bottoms of the tanks were lined with sand while the sidewalls were covered either with stones, logs, or some other attractive background material. Shells and coral were often included, adding to the beauty of the marine environment. Many displays were directly linked to local marine conditions, thus giving visitors a feel for the nearby ocean realm.

In a report[3] on the educational program at the Vaughan Aquarium, its director stated that because most teachers do not prepare properly for field trips, the aquarium developed a special educational program for visiting students. It includes prepared pre-visit and post-visit lessons to be given by the teacher in the classroom, an introductory talk at the aquarium by a volunteer docent, and guide sheets for a self-guided tour. Lessons are aimed at various levels ranging from kindergarten to junior college.

Another method of education available to the public in general is evidenced in the tank displays. Some tank labels offer editorials as well as scientific data, which undoubtedly evoke some thought in the mind of the viewer. One such tank berated viewers for polluting our oceans with litter. The label on this tank, which included discarded beer bottles, a rubber boot, and miscellaneous trash, as well as fish, read as follows:

SEA FLOOR LITTER

Is this the way our bays should look?
Litter and garbage thrown from boats
and wharves is turning the bottom into
a garbage dump.

Help keep the sea floor clean!

Such displays easily catch the eye of visitors, perhaps providing them a valuable lesson that may make them think before polluting seas again.

One fascinating area of the aquarium was the Hall of Oceanography. It was this area of the aquarium which truly distinguished it from the run-of-the-mill aquarium. Exhibited here were numerous scientific research projects which explained in simple terms, the findings of various researchers, most of whom were from Scripps Institute. A display on wave action permitted visitors to generate waves in an enclosed transparent case and watch the resulting action. Another explained the Cousteau diving saucer. Others allowed visitors to press buttons or otherwise interact with the displays in such a manner that gained his interest and educated him at the same time.

The series covered a wide range of topics: diving, waves, deep sea fish that are never exposed to light, the ambergris process, kelp bed habitat, deep submersibles, sand beaches, sea urchin fertilization, manganese nodules, deep sea drilling projects, and many others. In describing the research on lead pollution, one sign explained:

> Scripps scientists have shown that
> the anti-knock additives used in
> automobile fuels are the direct cause
> of increase in toxic lead isotopes....

then they proceed to show graphically how the scientists reached this conclusion. The effect of this Hall is that of a miniature science fair, showing visitors the results of recent local research projects and the latest in scientific discovery. Furthermore, it gives them a better understanding of university endeavors and helps develop a closer relationship between their own lives and that of the sea. Any aquarium would do well to consider the development of similar displays in future expansion plans.

Sea World

The last aquarium model is different from all of the previous models in one important way: it is a private aquarium-oceanarium run for profit. Located in San Diego, California, right on Mission Bay, it provides a wide range of activities

for the thousands of visitors that go there. The expansive grounds house a number of viewing areas which overlook whale pools, dolphin pools, turtle pools, seal pools, and even a tide pool. There were a number of delightful shows presented at the different areas with trained dolphins, whales, and other show animals. Gift shops and eateries abound throughout the grounds. The landscaping and architecture further contribute to the pleasing marine presentations at Sea World.

Although the exhibits are obviously "commercial" they are appealing and do stimulate some interest in marine activities. Aside from the commercial shows, however, there are several educational aspects of Sea World operations which could be applied to other aquariums. The first is a "touch pool" exhibit where visitors are allowed to feed and pet dolphins or other marine animals. The deep interest and total excitement with which children approach these "touch pools" should make them a matter of serious consideration for other aquariums.

The Vancouver Aquarium, which does have a "touch pool" for smaller marine life, found this to be one of their most popular displays. At Sea World, smaller marine animals are housed in a "tide pool"--which consists of a large central pool, approximately 15 feet in diameter and 30 inches deep, with a central island. Surrounding this central pool are four smaller, shallow pools built to be within easy reach of children. At the central pool, a person narrates or a tape is played to describe the animals on display. The large pool contains those animals which are more sensitive to handling, such as the lobsters, abalone, crabs, etc. The small, open pools contain the stronger sea cucumbers, starfish, sea urchins, and others.

In a report on the "tide pool" display, Dave Powell, curator of fishes, states:

> In general, the animals do very well although there has been some loss of small starfish and hermit crabs to unthinking persons who take them as souvenirs. The following sign has recently been added in an effort to curb those with sticky wet fingers.
>
> > "Help protect our seashore life. These tide pools are for your pleasure and education. You are welcome to handle the animals gently but please do not take them. Return them to their pool for other visitors to enjoy."

> We have been very pleased with the public reaction to this new display. Because of our favorable climate, our pools are situated outdoors but a similar type of display would be equally suitable for indoor aquariums in areas where marine animals are readily available.[4]

Another engaging exhibit is located inside Sea World's own small aquarium. The aquarium itself is much like any other. The beautifully colored fish, coral, and other marine flora and fauna are tastefully displayed; but one tank has an additional attraction. Here the visitor, merely by pressing a button, is allowed to view the changes that occur in the marine environment at different depths underwater. Mr. Powell describes the project as follows:[5]

> Seawater, as well as the sediment and planktonic organisms that it contains, acts as a light filter with the result that at a depth of around five hundred meters, little or no light of any kind remains. However, the different wave lenths of white light are not filtered out uniformly: with red light being removed first, followed by yellow, green, blue and finally indigo.
>
> Depending upon its organic and in-organic content there is considerable variation in the light filtering properties of seawater such that on objects seen at a depth of twenty meters in the Sargasso Sea will appear both quantitatively and qualitatively different from the same object at the same depth along the coast of California....
>
> For our display, a tank of 250 gallon capacity was selected containing rocks that were collected from a depth of about fifteen meters. These rocks were encrusted with a wide variety of animal and plant growth, such as anemones, coral, gorgonians, coralline algae, sponges, tunicates, etc. In addition, the tank contains several species of rockfishes [Sebastes], which are predominantly red in color when viewed under surface illumination. Above the tank are four 150

watt incandescent floodlights that are approximations of the illuminations at the surface and depths of 8 meters, 15 meters and 30 meters.

Needless to say, inside the aquarium, this innovatively designed tank is popular with the visitors and can easily be adapted to public aquariums as well.

CHAPTER IV
OUT-OF-STATE SURVEY

Background and Procedure

A questionnaire was developed for the purpose of eliciting information about the general operations and educational impact of aquariums throughout the country. They were mailed to addresses compiled from the *Directory of the Public Aquaria of the World*.[1] The initial mailing was completed in June 1973 with the follow-up on nonresponses finished by August 1973. The follow-up included additional mailings, telephone calls, and contacting appropriate regional personnel for assistance in obtaining responses from certain nonrespondents.

The questionnaire served two important purposes:

(1) To screen aquariums and their operations as to which seemed outside the scope of the study; and

(2) To gather information on operations and educational impact.

The screening process was the key to which questionnaire responses were included in the data analysis. Only those responses exhibiting qualities which were listed as part of the criteria for selection were included in the data universe. The following criteria for selection were used:

The aquarium--

(1) Was administered by a municipal or county government, a college or university, or a privately supported society or organization.

(2) Was nonprofit.

(3) Included a professional staff or formal academic research.

(4) Exhibited objects in at least one of the following categories:

  (a) Fish of any kind,

  (b) Crustacea,

  (c) Shells, or

(d) Teaching exhibits

(5) Was open to the general public at stated hours, at least 20 hours per week and 10 to 20 months per year.

Data on the operations which were considered outside the scope of the study are not reflected in the study. The largest group thus excluded are privately owned commercial operations strictly run for profit. Since a commercial operation is not a practical alternative for consideration in this study, and since these operations most often were without a scholarly base, this group was determined to be out-of-scope.

For ease of reference and comparability, the results of the survey will be discussed in terms of percentages and proportions. However, it should be noted that there were forty-eight responding aquariums out of a total of one hundred and eight questionnaires mailed to aquariums which appeared to conform to the criteria established for the study. This resulted in a survey response rate of 44 per cent.

When percentages are referred to in the following charts and discussion, they denote percentages of the data universe, i.e., of those aquariums responding to the questionnaire with answers that were considered to be within the scope of the study. These percentages do not refer to all aquariums in existence, many of which did not reply to the questionnaire.

Governing Authority of Responding Aquariums

Of the aquariums sampled, specific information on the type of agency or operation under which the aquarium operated was requested. Those that were commercially operated for business and profit were excluded from the data universe. Because the Waikiki Aquarium is a publicly owned and operated facility (government as opposed to private enterprise), and because none of the alternatives for future improvement include selling it to private interests for private profits, the private commercial facilities were excluded as incomparable facilities. Although methods of collection, display techniques, and other technical aspects of private operations could be useful to the Waikiki Aquarium, actual business structures would be inappropriate.

A second differentiation was made between foreign aquariums and those situated in the United States which were the chief survey respondents. It was felt that comparing the responding aquariums with only one segment, such as foreign respondents, may result in some interesting information. Again, the similarities in technical operations and so forth will greatly out-weigh the differences, whether the aquarium is foreign or not. However, the comparison does provide another measure of judgment and a further tool for learning.

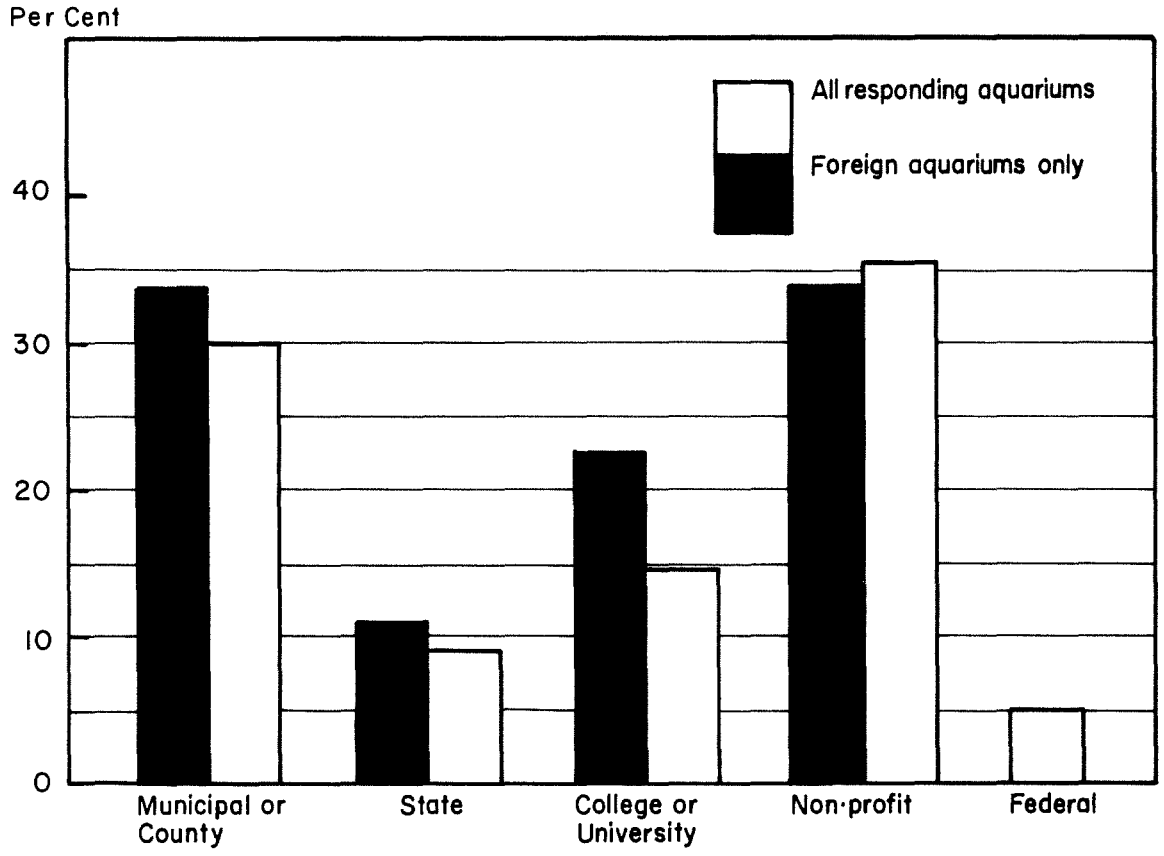
Among the combined aquariums, 35 per cent were operated by nonprofit organizations or corporations administered in the public interest. The term "nonprofit" was defined in the questionnaire as having "no part of net earnings [which would] benefit any individual". In foreign countries, 33 per cent of the aquariums were operated by nonprofit organizations and 33 per cent were operated by municipal or county governments. There were slightly less municipally operated aquariums in the combined group, they being 30 per cent of the total. These two groups, nonprofit and municipal, accounted for the greatest number of aquariums in the survey. The state-operated ones totalled 11 per cent in foreign countries and 8 per cent in the U.S. University run aquariums accounted for 22 per cent of the foreign total, but only 14 per cent of the combined total. The only federally operated aquariums reporting came from the U.S. and represented merely 5 per cent of the aquariums. The greatest difference between the combined and the foreign aquariums appeared to be in the area of university-operated facilities. However, since the number of foreign aquariums reporting was small, and since the difference between the two groups was not great (22 per cent as compared to 14 per cent) the inconsistencies are not highly significant. (See Figure 1 for graphic information.) On the whole, the foreign and the combined aquariums are comparable, and of these, the municipal and nonprofit facilities comprise the majority, with the university-operated ones not far behind.

Aquarium Facilities and Resources

Part of the questionnaire was directed at procuring information about aquarium facilities and resources. Since aquarium facilities range all the way from large oceanariums to tiny research-oriented centers, discussion on the kinds of facilities being operated seemed appropriate. Because many of the aquariums have more than one of the listed facilities, the facility counts do not represent discrete institutions exclusive of each other.

Figure 1

PER CENT OF AQUARIUMS BY GOVERNING AUTHORITY



The most frequently found aquarium facility was the exhibit building, or space within a building, which was defined as being significant chiefly for preservation or exhibition of collections. Such buildings were present among 60 per cent of the respondents. Zoological parks (professionally designed compounds where live animals are kept for display and study) were present in 51 per cent of the aquarium responses. In addition, the large oceanariums, most often found in private, profit-making facilities, were also included in 22 per cent of the public aquariums.

Aquariums which were primarily display-oriented heavily outnumbered those which concentrated on research activities, 38 per cent as compared to 14 per cent. Separate laboratory facilities were available in 14 per cent of the aquariums. And nature/conservation centers were present in 11 per cent of the respondents. Among foreign respondents, every aquarium included a building (100 per cent), 56 per cent were in zoological parks, and 33 per cent included oceanariums. (See Figure 2.)

The questionnaire distinguished between collections and exhibits and made provision for reporting them separately. "Collections" were defined as "objects or specimens maintained principally for the preservation or exhibition of significant material or for the support of research studies." The classification of these collections were segregated as follows:

Display--Materials are collected primarily for display purposes because of their aesthetic and attracting qualities.

Local --Materials are collected primarily with the intent of interpreting local marine conditions.

Science--Materials are collected primarily to demonstrate or interpret physical and biological phenomena and research findings, including their laws and applications.

Most aquariums, 87 per cent, own and maintain collections, in addition to displaying exhibits. The type of collections maintained were quite varied, however. The greatest percentage of collections having nearly equal emphasis on display, local, and science (30 per cent). Collections which were predominantly display-oriented and those with equal emphasis on display and local each accounted for 14 per cent of the data universe. Display and science collections,

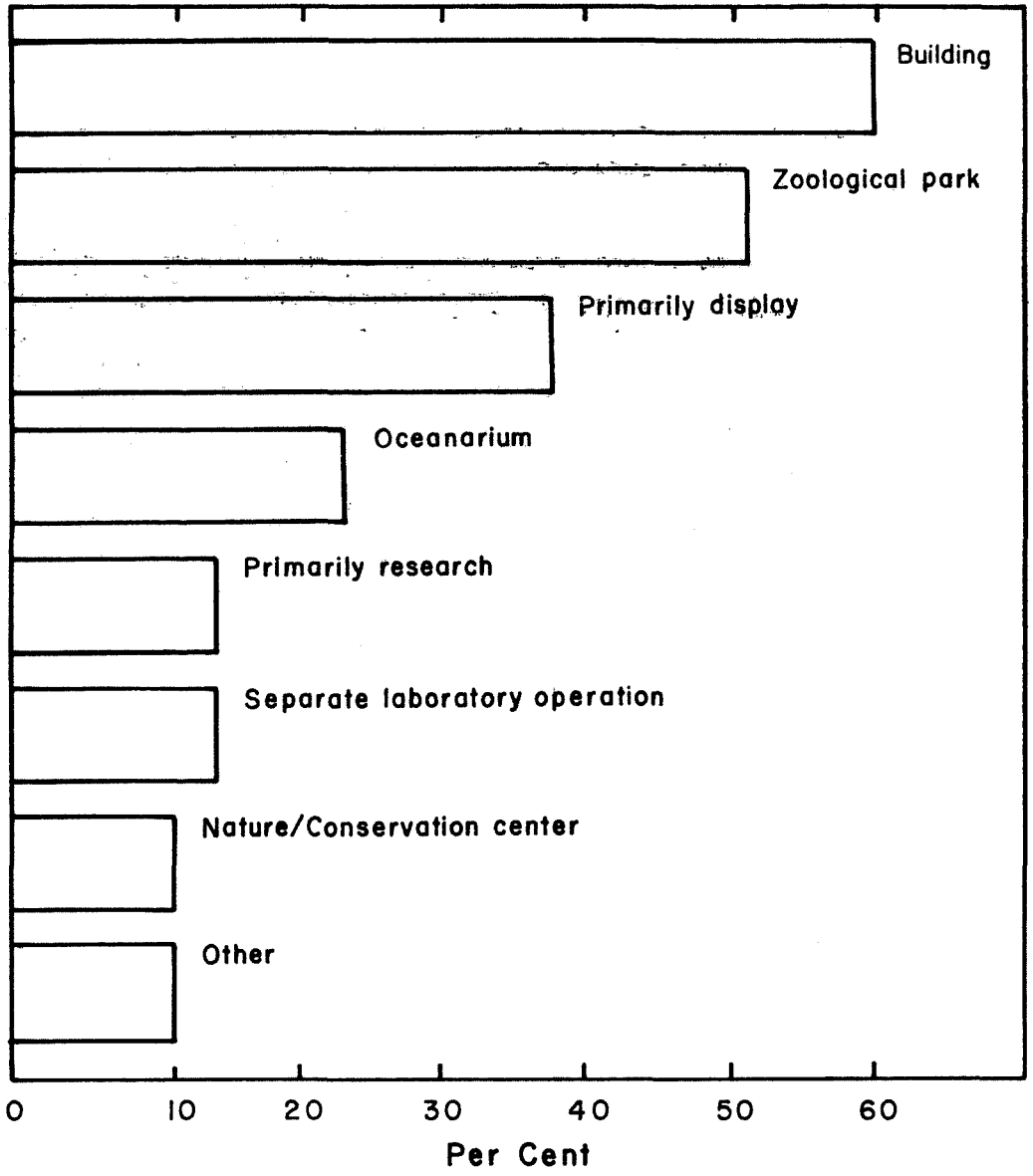


Figure 2

PER CENT OF AQUARIUMS WITH VARIOUS INSTITUTIONAL FACILITIES

equally emphasized, were present in 22 per cent of the aquariums; while exclusively local and exclusively science collections appeared in only 3 per cent of the cases.

The great majority of the aquariums did permit their collections to be used for research by scholars, outside of the aquarium staff. This was allowed in 65 per cent of the institutions. Therefore, it is safe to say that even in non-university operated aquariums, research ties among various institutions can be established, and research by marine scholars can readily be conducted.

The study questionnaire defined an "exhibition" as "an assemblage of objects of display, local, scientific, or technological nature, through which visitors move from unit to unit in a sequence designed to be meaningful, instructionally or aesthetically. Accompanying labels or graphics are planned to interpret and explain." As with the collections, most aquariums had exhibitions--84 per cent of the total.

The exhibitions were classified in the same manner as the collections, using the same terms and definitions. Once more, the combination of display, local, and science predominated, appearing in 30 per cent of the aquariums. Twenty-two per cent placed equal emphasis on display and science, and 19 per cent exclusively on display. Exclusively local and exclusively science were 3 per cent and 6 per cent of the population, respectively. Equal emphasis on display and local appeared in 6 per cent of the aquariums, while equal emphasis on local and science was present in only 3 per cent. Figure 3 depicts the relationships and distribution of both collections and exhibitions more clearly.

The majority of the exhibitions, 62 per cent, were designed and installed by persons specifically trained in exhibition display techniques. With the growing realization that proper display can make the difference between a successful exhibition and a failure, more aquariums are appropriating funds for the hiring of trained display artists. Mobile unit exhibitions, however, such as in trucks and trailers, were present in only 6 per cent of the aquariums.

Although 70 per cent of the aquariums did include libraries, only 11 per cent of these were open at regular hours for use by the general public. Another 46 per cent were open to any interested person by appointment only. Circulating exhibitions, those for use by at least two other institutions, were available in only 11 per cent of the aquariums.

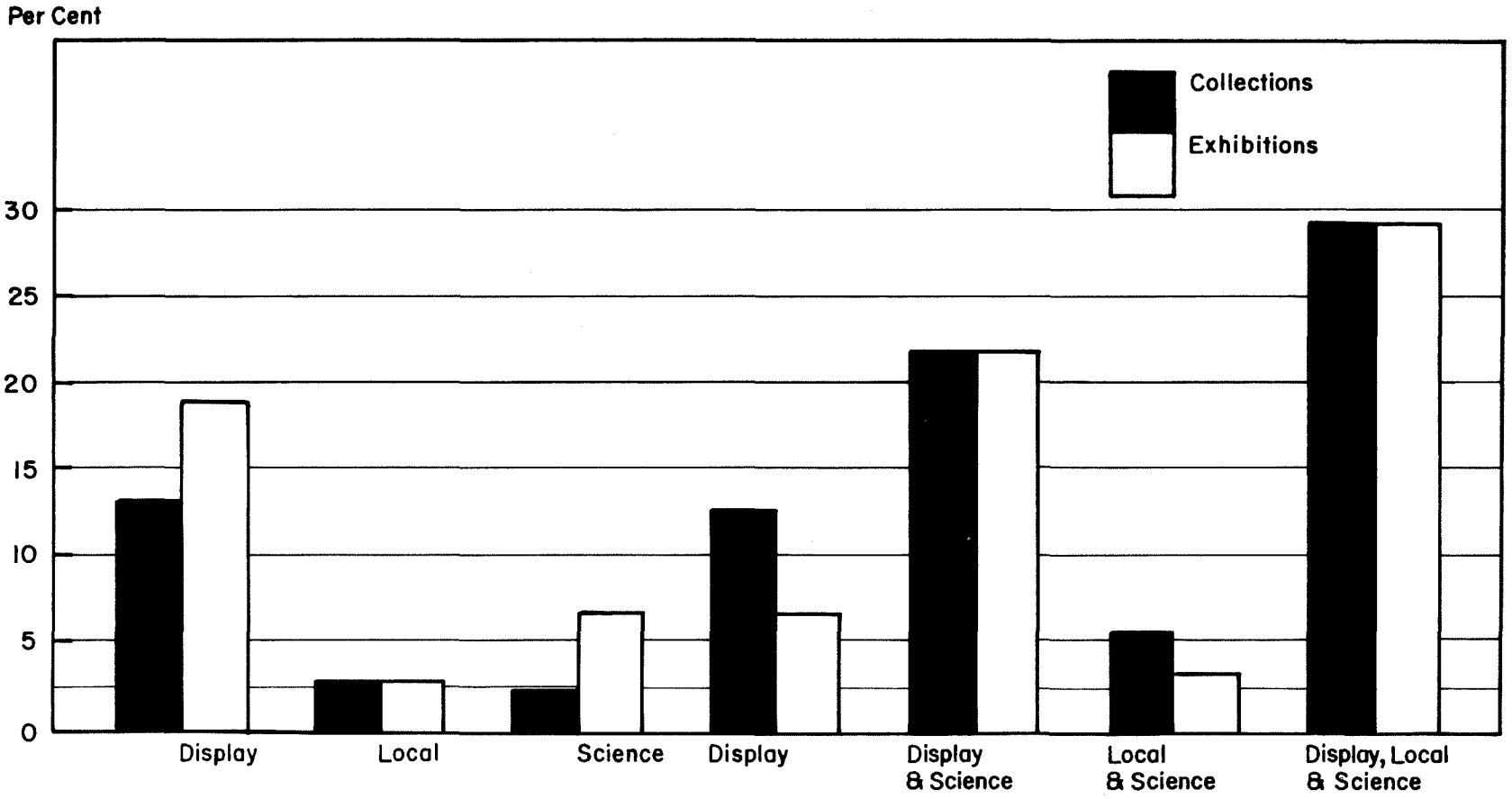


Figure 3

PER CENT OF AQUARIUMS CLASSIFIED ACCORDING TO COLLECTIONS AND EXHIBITIONS

Aquarium Staff

The questionnaire asked for data on aquarium staffing in terms of "professional" and "other" staff members, and by full-time and part-time status.

Competencies of professional staff members range from subject-matter specialties to exhibit design and installation. They may or may not have completed a specialized training course or have a related college degree. The following definition of "professional staff" was used in the questionnaire:

Professional Staff--Paid employees doing work that requires education, training, and skill in the academic or scholarly aspects of the institution's program, as distinct from the merely mechanical and clerical aspects.

Such employees would usually have at least a bachelor's degree in a relevant subject, or post high school education and appropriate experience equivalent to a bachelor's degree.

Other paid employees not fitting the definition of professional staff were considered as "other" staff. Custodial and clerical personnel would be in this category. Among reporting aquariums, the number of full-time paid professionals was heavily outnumbered by the full-time "other" staff. In percentages, these were 16 per cent full-time paid professionals as compared to 84 per cent "other". The university and the nonprofit operated aquariums differed only slightly from the combined total, with 18 per cent "professional" and 82 per cent "other" in both types.

When all staff members are considered, including both full time and part time, as well as "professional" and "other", it is obvious that a wide range of staff members are employed by the aquariums. Approximately 31 per cent employed staff ranging in size from 5 to 9 members, while another 31 per cent reported a range of 10 to 24 members. The proportion of aquariums employing only one person was 3 per cent, while 14 per cent employed 50 to 100 individuals and 9 per cent employed 2 to 4 individuals. About 6 per cent of the aquariums were in the 25 to 49 staff range, while a comparable proportion employed over 100 persons.

"Professional" staff, as distinguished from "other" staff, were reported by 84 per cent of the aquariums. The most frequent size of professional staff was one. Thus it

might be concluded that when only one person was employed, it was more frequently a professional.

Volunteers play an extremely important role in many aquarium operations. However, because of the difficulty in computing the number of volunteer hours, accurate statistics on their role were not compiled. Suffice it to say, then, that the role of volunteers in aquariums is a significant one, and this is substantiated by the thousands of hours of service reported by the various institutions they served. The greatest use of volunteers was in nonprofit and government (municipal, state) sponsored aquariums, while the least use of volunteers was in university-run aquariums.

Operating Expenditures

The extreme difficulty in obtaining valid financial data from the aquariums seems to result largely from the peculiar nature of many fiscal arrangements. When an aquarium is an integral part of a larger operation, such as a zoological park, a museum, or a scientific academy, the subsidiary operation may not have specific budget line items such as utilities or rent. Consequently, even when operating expenditures were known to exist, it was not always possible to report them. Expenditures varied greatly among the aquariums, ranging anywhere from $4,000 to $2 million. Not included in these figures, however, was the substantial utilization of volunteer services. No attempt was made to put a value on volunteer services, which, if secured through the labor market, would have amounted to an appreciable sum. Because the figures were so varied and depended so heavily upon the methods of financing, sources of revenue, and size of the aquarium, no statistical calculations on actual expenditures were run. Furthermore, because of the small sample size, few conclusions could be drawn about expenditures in general.

Revenues

Specific information on the sources of revenue was elicited from the questionnaires. Nearly half of the respondents obtained a substantial amount of their revenues from admission fees, 46 per cent. Another 30 per cent were supported by municipal or county governments, and 14 per cent received funds from state governments. The proportion of aquariums receiving funds from endowments and contributions was 18 per cent, and those receiving federal funds were only 8 per cent. The smallest funding group appeared to be colleges

and universities which provided revenues to only 3 per cent of the responding aquariums. It should be noted here that because revenue sources may overlap, with one aquarium receiving funds from several sources, these catagories are not mutually exclusive. Therefore, conceivably, a single aquarium receiving federal, county, and university funds would be reflected in each of the total category percentages. (See Figure 4.)

Program

The program of the aquariums was determined through a series of questions relating to school relationships, special affiliations, training, activities, and program directives. On the whole, aquarium programs are meant to be appealing to all age groups, educationally satisfying, and open to study by various segments of the community. The majority of the aquariums, 51 per cent, characterized their relationship with local elementary and secondary school districts as being very informal, with much personal contact. Because young students are such an important segment of the aquarium visitors, the school-aquarium relationship is an important one. Yet, in 16 per cent of the cases, no significant working relationship was reported. On the other hand, 14 per cent of the aquariums have schools represented on their advisory committees for educational programs, and an even smaller 3 per cent have schools represented on their own boards. In approximately three-fourths of the responding aquariums a good working relationship exists between themselves and the local schools.

An even larger percentage of respondents divulged that they had some kind of joint program or special affiliation with colleges and universities. This included 78 per cent of the aquariums, of which 46 per cent supported research at the graduate level and 30 per cent at the undergraduate level. Once more, the kinds of programs and affiliations available in the institutions are not mutually exclusive, so overlapping will occur. Work experience in the aquariums, for credit at the graduate and the undergraduate level, were available in 19 per cent of the facilities, while work experience without credit was available in 22 per cent. College credit courses taught in the aquarium facilities were present in 14 per cent of the cases, and such courses taught by the resident professional staff (in any location) were present in 24 per cent of the cases. At least 30 per cent of the respondents did lend supplies and provide the use of their facilities to colleges and universities. The proportion providing inservice courses for classroom teachers was 8 per cent and that

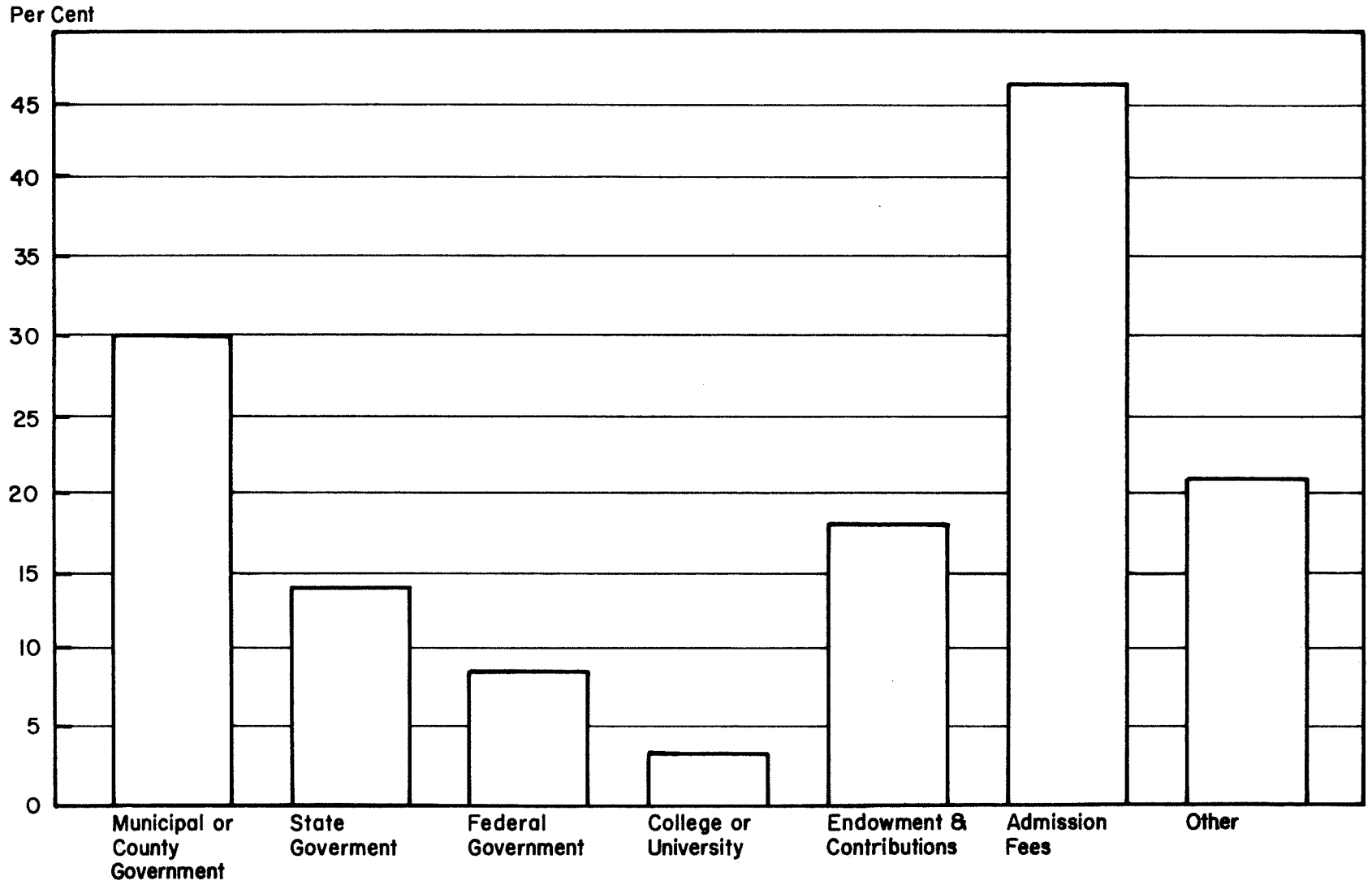


Figure 4

PER CENT OF AQUARIUMS RECEIVING VARIOUS SOURCES OF REVENUES

providing for observation or participation in programs by teacher trainees was 14 per cent.

Very few aquariums had any formal planned programs specifically designed for training professional aquarium workers to educate the public, university associates, or students at any level (such as in giving lectures, conducting tours, etc.). Similar programs for nonprofessionals were also lacking. In each case, only 19 per cent of the facilities answered affirmatively to having such programs. More widespread, however, were training programs for volunteers (often called "docents"). The proportion of aquariums with volunteer training programs was 54 per cent.

Programs directed specifically at children or youth were present in 30 per cent of the facilities, while those aimed at adults appeared in 8 per cent. The greatest proportion of aquarium facilities planned programs which would be of general interest to all segments of the community, no matter what the age or the background; these programs were present in at least 65 per cent of the aquariums.

Only 24 per cent of the aquarium staffs lead field excursions for the public to sites of marine or scientific interest. Most of these excursion groups were school classes (19 per cent), but community groups (11 per cent), members (11 per cent), families (5 per cent) and others also participated. Aquarium staffs were responsible for educational-cultural activities on a regular schedule, however. These activities included guided tours for classes, special lectures, study groups, and loan services of special materials and collections. Figure 5 graphically demonstrates the distribution of such activities.

In the area of publications, the formal annual report was the most common, available in 43 per cent of the aquariums. Another 35 per cent of the respondents published membership newsletters, calendars, flyers, etc., while 24 per cent published both technical and popular books and pamphlets, some of which were based on research findings. Regular periodicals were present in 19 per cent of the aquariums, but only 3 per cent had exhibition catalogues with extensive annotations. Of course, one aquarium could well have more than one kind of publication.

Although research was a primary function of only 14 per cent of the reporting aquariums, 43 per cent did engage in formal research projects. The questionnaire defined "formal research project" as an "investigative project which is

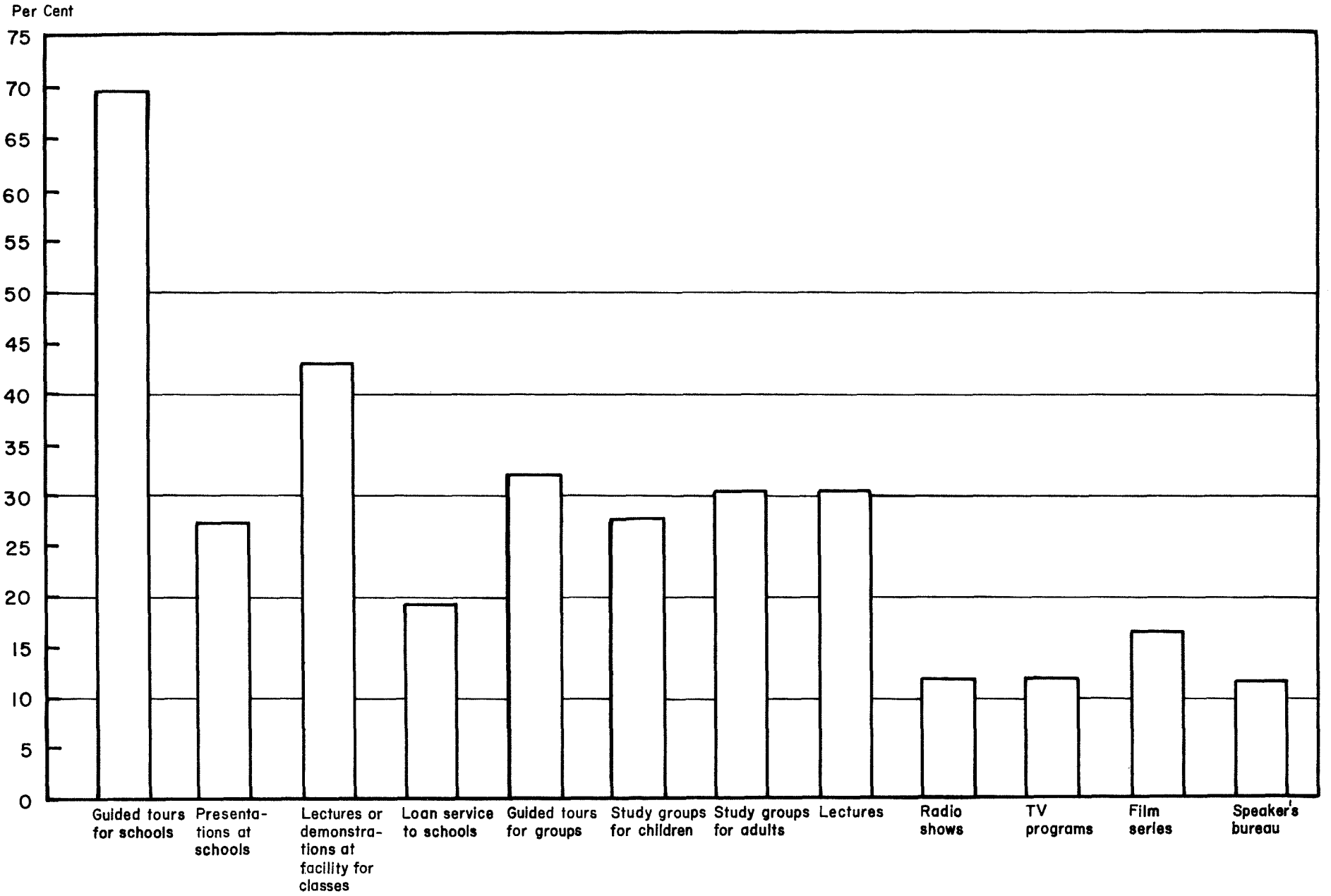


Figure 5

PER CENT OF AQUARIUMS WITH VARIOUS TYPES OF EDUCATIONAL-CULTURAL ACTIVITIES

carefully designed, executed, and reported on to provide specific needed information for the museum staff, and whose outcome would be of interest to the aquarium field". Most of the reported research projects could be classified either as general marine research or as research directly related to aquarium activities.

Hours, Attendance, and Fees

"Attendance" was defined as the "actual count or careful estimate of the number of visits made to the institution, including those made for participation in special program activities. Judging from the number of reported visits, which ranged from 19,000 all the way up to 5 million, aquariums can be considered very important educational-cultural entities.

Two factors which may significantly affect attendance are the hours of operation and the policy on charging admission fees. At least 97 per cent of all reporting institutions opened their facilities to the general public at stated hours without advance arrangements. All of the facilities stayed open ten to twelve months every year. The proportion of aquariums which were open 56 hours or more per week, on the average, was 70 per cent. Another 26 per cent stayed open from 41 to 55 hours per week, and a mere 4 per cent opened from 25 to 40 hours per week.

The number of hours that a facility remains open has a direct bearing on the number of visitors who can attend it. However, opening during hours when most people are not busy at work, studying in school, or otherwise occupied, also makes a difference. Approximately 87 per cent of the aquariums make it a practice to open their facilities to the general public all day Saturdays, all day Sundays, and all day on holidays. This high percentage indicates the recognition and widespread acceptance of the belief that aquariums are for everyone to enjoy at the times when they can most conveniently get there. Weekends and holidays are obviously most convenient for the majority of the population.

The second factor that influences attendance figures is the charging of admission fees. The average fee charged for adults was a little over a dollar, while that for children was less than half. The charge for children was most frequently 25 cents or completely free. One aquarium, which did not charge standard admission fees, did have a donation box which strongly encouraged visitors to give. The revenues from these admission fees were most often designated for aquarium use.

However, when the aquarium was only part of a larger institution (like a zoological park or a museum complex), the admission fees were sometimes deposited in a general fund not earmarked for aquarium use. As noted before, the admission fees are a valuable source of revenue and could contribute much to the overall success of the aquarium.

In view of the kinds of facilities and operations currently available in the aquariums under study, it may be helpful to point out those characteristics which are indicative of a quality aquarium or which most often appeared in aquariums of good reputation. The following seemed to be characteristic quality indicators:

(1) Professionally designed exhibits;

(2) Professional staff;

(3) Educational-cultural activities;

(4) Library;

(5) Substantive publications;

(6) Published annual reports;

(7) Formal research programs;

(8) Open 56 or more hours per week on the average; and

(9) Open on Saturdays, Sundays, and holidays.

It is these qualities and policies, then, that must be kept in mind when planning for the future development and improvement of any aquarium facility.

CHAPTER V
CURRENT WAIKIKI AQUARIUM OPERATIONS

The status of operations at the Waikiki Aquarium might be described as "simply making the best of things". They are understaffed, in need of funds, and still operating without an appointed director. Even with these appalling handicaps, however, the Aquarium has managed to keep its doors open to the public with a reasonable display of marine life and has actively labored to improve the facility.

The Waikiki Aquarium is part of the greater University of Hawaii system. It has been with the University, under various departments and deans since 1919. Although the relationship between the two has been stormy at times, greater rapport appears to be developing. The Aquarium is now under the auspices of the Dean of Marine Programs, a position currently held by Dr. John Craven. Its position at the University is best illustrated by Figure 6.

Although not identified with any major research program, the Aquarium is viewed as another research facility under the Marine Science Program. The effects of this outlook on the Aquarium itself can be viewed in two ways: first, it gives the Aquarium the aura of a scientific research facility; and second, it has resulted in the assignment of valuable work space to other University departments, even though the space is desperately needed by the Aquarium itself. This problem will be further discussed later in the study.

Some of the problems that the Aquarium has experienced may have been the result of the geographical separation of its facilities from the University campus at Manoa. This physical division has hampered efforts toward close coordination and integrated activities of different organizational units. For example, while Spencer Tinker was director of the Aquarium, he attempted to gain support from University officials for changes and additions to his program. Even though his requests often received legislative support, for various reasons they were usually hamstrung at the University level. What followed was a virtual standstill in communications between the two facilities, and what later developed at the University was a philosophy of letting the Aquarium function on its own with very little input from the Manoa Campus.

The physical separation may have been a factor in the breakdown of communications, for the lack of proximity did not encourage cooperation. In addition, a spirit of camaraderie

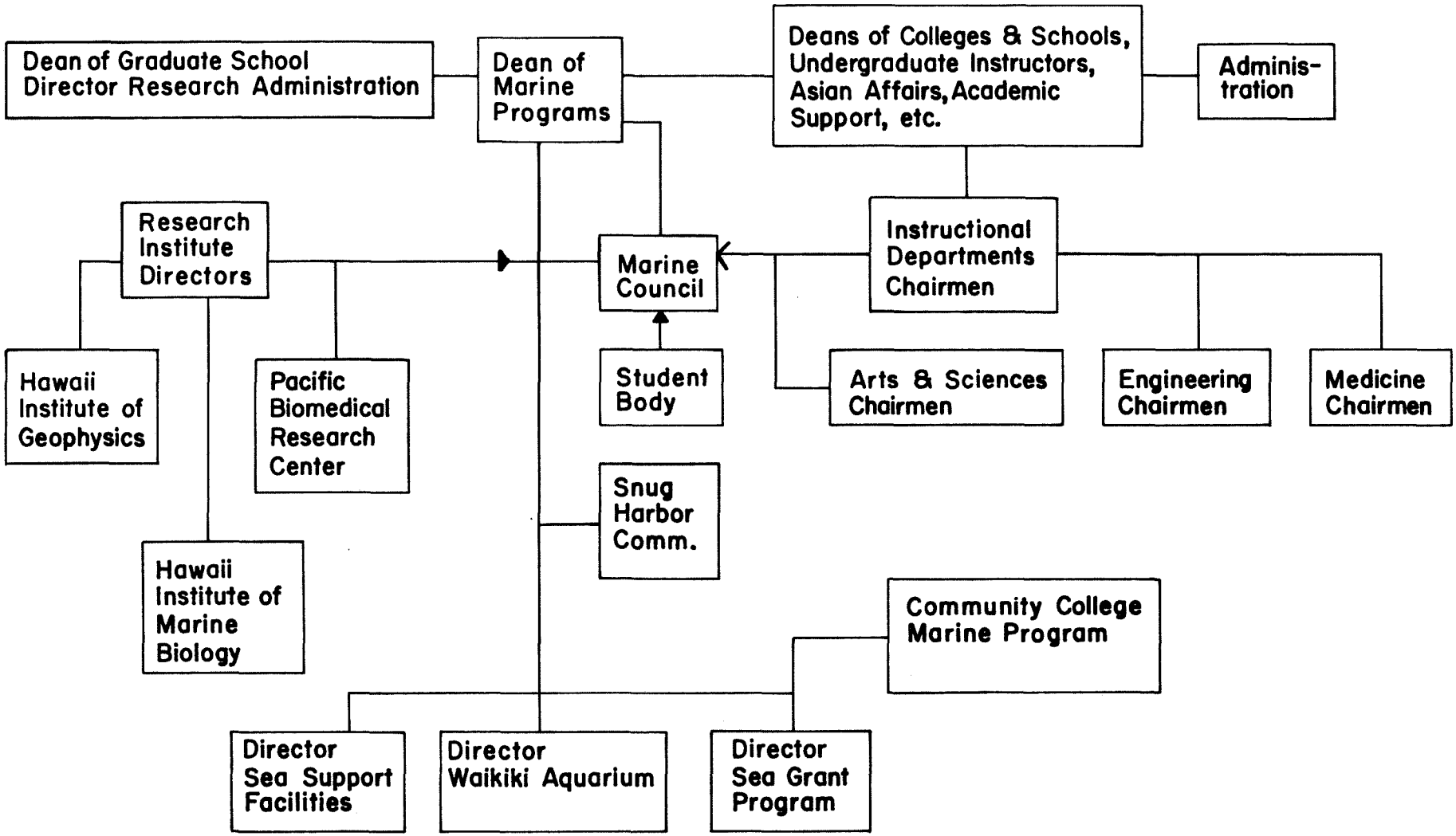


Figure 6

WAIKIKI AQUARIUM AS PART OF THE MARINE PROGRAMS AT THE UNIVERSITY OF HAWAII

and professional liaisons never materialized in the same way as they undoubtedly would have had the Aquarium been an integral part of campus activities. On the other hand, it should also be noted that other off-campus facilities, such as the Hawaii Institute of Marine Biology, have developed very successful working relationships with their central campus colleagues.

The hierarchical structure, showing the channels of communication, might be depicted as in Figure 7. This structure also illustrates the chain of command running from the Aquarium through the University system. These channels have sometimes proven cumbersome to the Aquarium, actually hampering their attempts to improve facilities or programs. In some cases these channels have been stumbling blocks rather than open-minded sounding boards sincerely concerned about the Aquarium. Therefore, the staff has, on occasion, been known to act without going through the established channels depicted above.

This system is not as adaptable and flexible as it could be. It makes a cumbersome, paper heavy task of receiving approval for relatively simple changes. One result may be that the Aquarium has been made to suffer financially, lacking the ability to communicate its needs in a convincing manner high enough up the chain of command. Again, the geographical separation also made this process inconvenient.

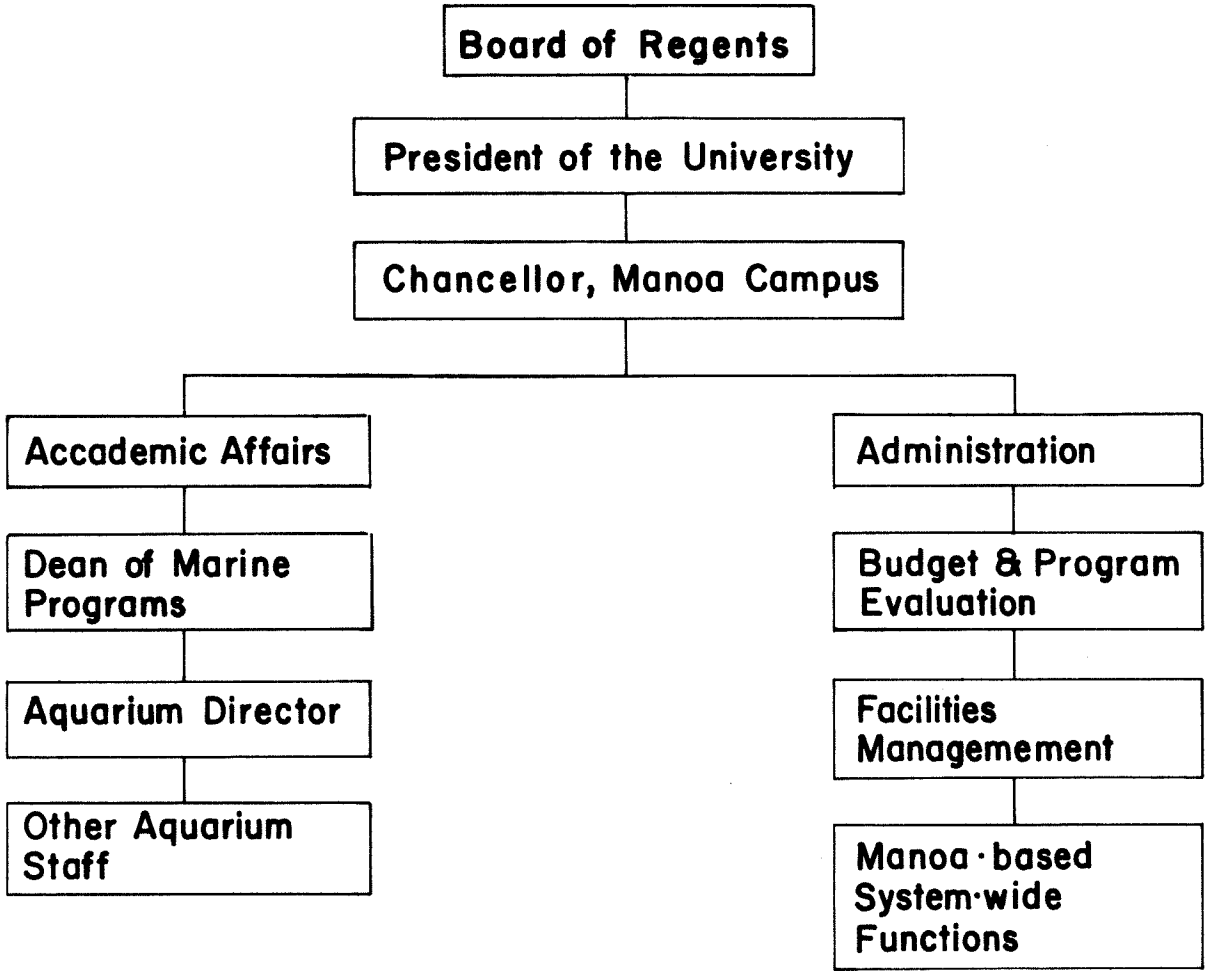
Written Directives for the Aquarium

Statutorily, the main purpose of the Waikiki Aquarium was determined to be the "exhibition to the public of fishes and other forms of marine life".[1] Later, University policy toward the Aquarium was expressed in a 1964 report entitled, *An Academic Development Plan for the University of Hawaii/ January 1964*. It was prepared by a committee of faculty members, headed by Chairman Robert W. Hiatt who was then Vice President for Academic Affairs. The Plan describes the Aquarium as "an important educational exhibit in itself, [but] the aspect of the Aquarium most closely related to the University's objectives and programs is the classroom and research space comprising the Waikiki Branch of the Hawaii Marine Laboratory".[2] Since this Plan was written, the Hawaii Marine Laboratory became the Hawaii Institute of Marine Biology and moved into new facilities located on Coconut Island in Kaneohe Bay and at Kewalo Basin, Honolulu.

The space they left at the Aquarium was assigned to the Pacific Biomedical Research Center, which has also withdrawn from these quarters in favor of new facilities located at

Figure 7

CHANNELS OF COMMUNICATION BETWEEN THE WAIKIKI AQUARIUM AND THE UNIVERSITY



Kewalo Basin. During personal observations at the Aquarium for the period of the study, these quarters remained empty and virtually unused, although assigned to the Zoology Department at the University. This area has been closed to Aquarium personnel in spite of the fact that they are in dire need of additional space and this vacant area comprises an estimated one-fifth of the total structure.

The office and laboratory space has been a matter of dispute since the time when the new Aquarium facilities were first constructed. University officials have contended that this space is essential for research in the field of Marine Biology. Evidence, in the form of memorandums to the University, indicate that Aquarium personnel have begged for the much needed space to expand their own exhibitions and programs for some time. (See Appendices B and C.) In March of 1972, the Aquarium Director sent a memorandum to the Dean of Marine Programs requesting more space. It stated in part:

> This letter is a request that your office issue or arrange to have issued a letter authorizing the Waikiki Aquarium to occupy and to use the "laboratory" section of the Aquarium building, which is currently occupied by the Pacific Biomedical Research Center, at such time as they move to their new building....[3]

Although the Aquarium did receive a small part of the vacated area, much of it has been reassigned and still remains a matter of contention. It is now assigned to the Zoology Department's Dr. John Simpson who contends that it is used daily for research by various students and faculty. The Aquarium reports that they seldom observe any activity in the assigned facilities. Regardless of its use by zoology personnel, however, the propriety of using significant Aquarium space for research that could be conducted in other University facilities on the Manoa campus or at the Kewalo laboratories remains the question. This practice becomes even more questionable in view of the statements in the Academic Development Plan which supposedly laid down the future of the University:

> For many years students and research workers in the field of marine biology

> have used a portion of the Aquarium building. If plans for development of an oceanographic center at Kewalo Basin should materialize, the instructional and research aspects of the University's program would be shifted to this more suitable facility, leaving the space now occupied at the Honolulu Aquarium available for expansion of activities related to the Aquarium's exhibits....[4]

The written policy of the University, as expressed in the Plan, is to return that space to the Aquarium upon completion of the Kewalo Basin facilities. Yet, these facilities have been completed, and instead of returning them, occupancy has been granted to the Departments of Zoology and Botany. Responsibility for this reassignment ultimately rests with the Dean of Marine Programs. It was he that granted the Aquarium use of part of the space vacated when the Pacific Biomedical Research Center moved to their new facilities. It was also he, in an attempt to develop greater interest in the Aquarium among other University departments, that granted the use of the space to Zoology and Botany. Botany, without giving formal notice to the Aquarium has moved out of their quarters. The Aquarium is now using this area even though it was never officially released by the Botany Department. Because of the need for space and the misunderstandings of the interested parties, this question deserves the immediate attention of the Director of Marine Programs. A decision as to the use of the space must be made and a satisfactory explanation given to all parties concerned. However, such a decision should be based on the expressed policy of the University, the well-being of the Aquarium itself, and consideration for the full use of resources for the purposes intended.

A valid question may be raised as to what the intended purpose of the Waikiki Aquarium is. Section 304-31, Hawaii Revised Statutes, states that lots 127 and 128 on registered map No. 1079 shall be used:

> ...for the purposes of an aquarium and marine biological laboratory under the direction of the board of regents of the University of Hawaii. The board shall establish and at all times maintain upon such lands an aquarium for the exhibition to the public of

> fishes and other forms of marine life. It shall also establish and at all times maintain there a marine biological laboratory.

The law which originally established the Aquarium in this location and in this form was passed in 1919. Since that time, lands have been traded and new laws passed.

Act 401, Session Laws of Hawaii 1949, appropriated $400,000 for a new "Aquarium and Equipment". At this point, no mention was made of any laboratory at all and a controversy about it still brews today.

Spencer Tinker, former Director of the Waikiki Aquarium and now retired, contends that the University misused funds in the building of the new Aquarium facilities. The University indicates that they acted quite properly. The chief questions are whether the definition of "Aquarium and Equipment" could include a marine biological laboratory and in other terms whether money appropriated for a specific purpose could be construed to include uses other than those specified.

In various Attorney General Opinions over the years, similar questions were broached:

> Op. 60-48 May 19, 1960
>
> The objects of appropriations by the territorial legislature are always determined by application of the appropriate territorial statutes and precedents. It has long been a maxim of Hawaiian law that the legislature's appropriations must be expended directly for the purposes and in the manner stated by the Act concerned. In an opinion of this office applying that rule, Opinion #1562 dated July 23, 1930, there is cited, amongst other cases, *Potter vs. Fowzer*, 78 Cal. 493, 21 Pac. 118 (1889) wherein is stated "the rule being that public moneys can be used only for the purposes and in the manner prescribed by law."

> Op. No. 1653 June 21, 1937
>
> The intention of the legislature is *the intention expressed in the statute* and when

the meaning of the language used is plain it must be given effect by the expositor, for, otherwise, he would be assuming legislative functions. 59 C. J. 953-956, 1017; *Honolulu Rapid Transit Co. v. Wilder*, 30 Haw. 685; *Irwin v. Ahia*, 29 Haw. 1; *Territory v. Wills*, 25 Haw. 747, 753.

The word "equipment" was defined in the case of *Landau v. Sykes*, 54 So. 3, Ann. Cas. 1913-B, 197, to mean:

> "***The word 'equip' means 'to furnish for service, or against a need of exigency; to fit out; to supply with whatever is necessary to efficient action in any way.' And the word 'equipment' means 'whatever is used in equipping; ***the collective designation for the articles comprising an outfit.' Websters New Int. Dict. The establishment which the company maintained for conducting the business in which it is engaged was equipped, not only with the machinery necessary for the manufacture of oil and ice and for the ginning of cotten, but with such office furniture as would enable it to conveniently keep a record of its various transactions. Books must be kept letters written, and numerous other things done in connection with such a business, which could only be conveniently done by the maintenance of an office equipped with the necessary furniture. The articles in question, therefore, constitute a part of the company's equipment."

See, also, *National Bank v. Gulf etc. R. Co.*, 66 S. W. (Tex.) 203; *Choctow, O. & G. R. Co. v. Zwirtz*, 73 Pac. (Okla.) 941, 942; *United States Rubber Co. v. Washington E. Co.*, 149 Pac. (Wash.) 706; *Midland Special School Dist.*

v. Central Trust Co., 1 F. (2d) 124; *Y. D. Lumber Co. v. Refuge Cotton Oil Co.*, 120 So. 447....In *Elliott v. Payne*, 239 S. W. (Mo.) 851, 23 A. L. R. 706, 712, the court said:

> "The term is one that is applied more to personal and movable property than to fixed or real property. See note in Ann. Cas. 1913B, p. 198; People ex rel. Cantrell v. St. Louis, A. & T. H. R. Co. 179 Ill. loc. cit. 522, 35 L. R. A. 656, 52 N. E. 292; Rubey v. Missouri Coal & Min. Co., 21 Mo. App. 159. The term 'is not broad enough to include structures like machine shops, roundhouses, and the like.' National Bank v. Gulf, C. & S. F. R. Co. 95 Tex. 176, 66 S. W. 203. Under the authorities a depot platform does not fall within the meaning of the term 'other equipment'."

Op. No. 1543 October 4, 1929

The appropriation of public money and the granting of authority to expend the same is purely a legislative function, and the manner and conditions under which it may be used rest entirely with the Legislature. Therefore, when the Legislature has appropriated public money for a specific object, the fund thus established can be used only for the purpose specified in the appropriation. (*Appeal of Dellaripa*, 92 Atl., 116 and note, Ann. Cas., 1917B, 864.)

It is the general rule that "where money is appropriated from general revenues for a specific purpose, it cannot be used for any other purposes either permanently or temporarily until the purpose for which it was intended has been fully accomplished" (42 Am. Jur., *Public Funds*, Sec. 79, p. 775; Op. No. 70-4, March 5, 1970).

Because of this rule, it appears that the laboratory might indeed be an illegal adjunct with evidence of the misuse of funds. However, there is an exception to the rule. Such spending would not be considered a diversion of funds "where the money is used for an incidental part of the improvements for which the funds were intended, especially where the incidental part of the work would have been included in the purpose for which the original fund was created (42 Am. Jur. Sec. 79, p. 776; Op. No. 61-61, June 5, 1961). This exception was the basis for the 1950 opinion issued by the Attorney General in regard to the Aquarium questions in which he replied to the Superintendent of Public Works in answer to the request, "Kindly advise if it was the intent of the Act to include a Biological Laboratory as a part of the appropriation for the Aquarium". (See Exhibit B.)

This prompted a chain of correspondence among various government personnel, most of which are included in Appendix D. However, the key ones are those by Ackerman, as Attorney General and the ones that follow.

The rationale for making the laboratory a "necessary adjunct" was expounded by Dr. R. W. Hiatt, Chairman of the Department of Zoology and Entomology in a 1950 memorandum to President Sinclair. (See Exhibit C.) It was chiefly on the basis of Hiatt's statement that the University progressed with the plans for the laboratory.

Finally, in 1953, a letter was written to Mrs. Alice Spalding Bowen, in response to her question about the propriety of building a laboratory with Aquarium funds. (See Appendix E.) And here the matter rested until Mr. Tinker's recent inquiries into the matter. Although he still feels there was an injustice done, the last word from the Attorney General's Office explicitly condoned the action. Until a new opinion, disputing or correcting the earlier one, is issued, it would seem that the State's official interpreter of the law would have to take precedent over Mr. Tinker's opinion.

In 1964, the Academic Development Plan suggested:

> When the Kewalo site is developed, the University should transfer control of the Aquarium to a city or state agency, which would be more suitable than having the University develop and manage it as a public educational and recreational exhibit.

EXHIBIT B

WDA:lnc
1079:38

May 3, 1950

Honorable R. M. Belt
Superintendent of Public Works
Territorial Office Building
Honolulu, Hawaii

Dear Sir:

In reply to your letter of March 29, 1950, I wish to advise you that in my opinion funds appropriated by Act 401, S.L. 1949, for an aquarium, can be used for the construction of a marine biological laboratory only if such a laboratory is a necessary or common adjunct of the aquarium to be constructed, and then only to the extent that it is incidental thereto.

For your information, a laboratory of such an incidental nature would not satisfy the needs or desires of the University of Hawaii.

Very truly yours,

WALTER D. ACKERMAN, JR.
Attorney General

EXHIBIT C

C
O
P
Y

June 9, 1950

Memo To: President Sinclair

Re: Biological Laboratories Attached to Marine Aquarium.

In response to the letter of May 3, 1950, written by the Attorney General, Walter D. Ackerman, to Mr. R. M. Belt, Superintendent of Public Works, may I reply to the following quotation "... funds appropriated by Act 401, S.L. 1949, for an aquarium, can be used for the construction of a marine biological laboratory only if such a laboratory is a necessary or common adjunct of the aquarium to be constructed and then only to the extent that it is incidental thereto."

During my recent visit to all the principal aquaria in the United States, including Marineland Studios, Florida, Shedd Aquarium, Chicago, and the Steinhart Aquarium, San Francisco, I was impressed by the fact that those of a size comparable to that proposed for Hawaii maintained a research laboratory as a necessary adjunct to their operation. Such problems as fish diseases, parasitism, aeration, rearing of rare fish, feeding experiments, etc., are handled in these laboratories. All administrators considered the laboratory to be an integral part of the business of operating a modern aquarium. Portions of such laboratories often are used to provide facilities for students studying marine life. In this way the laboratory and the aquarium supplement each other in an educational program.

In view of the above remarks, it is evident that the inclusion of laboratory facilities is essential for efficient operation of a modern aquarium, and therefore that a marine laboratory is a necessary adjunct of the proposed aquarium to be built by funds appropriated under Act 401, S.L. 1949.

Very truly yours,

S/Robert W. Hiatt, Chairman
Dept. of Zoology & Entomology

Again, included in the Current Program Plan for fiscal years 1970-71 through 1978-79 was the following description of Aquarium functions and objectives:

The Principle Objective of the Aquarium.

The Waikiki Aquarium is a state-owned and state-operated museum which specializes in aquatic exhibits. The purpose of the Aquarium is to provide a natural science center which will serve as a source of education, recreation, and inspiration for Hawaii's residents and tourists. This purpose is achieved through the maintenance of a museum building displaying and maintaining aquatic exhibits and a program centering around it.

Secondary Objectives of the Aquarium. The secondary objectives of the Aquarium include the following:

To develop among resident adults and children a greater appreciation of the sea.

To encourage among resident adults and children the use of the sea as an area of serious study, a vocational interest, and wholesome recreation.

To provide a community resource in Hawaiian natural history for Hawaii's schools.

To provide Hawaii's children and adolescent young people with a wholesome, worthwhile, educational activity for their leisure time.

To provide a community resource for the dissemination of popular information on aquatic life.

To provide Hawaii's residents with a preview of some of the aquatic animals from other areas of the world.

To provide visitor satisfaction for Hawaii's tourists.

To provide Hawaii's tourists with a preview of Hawaii's marine life and that of the tropical western Pacific Ocean.

CURRENT WAIKIKI AQUARIUM OPERATIONS

During the 1973 legislative session, expressions of intent were included in House and Senate Resolutions. House Resolution No. 410 requested the development of an aquarium which would:

> ...uniquely fit Hawaii's needs so that students from Hawaii and elsewhere have access to a rich and varid collection of marine flora and fauna common to Hawaii and the Pacific for their marine education and research....

Standing Committee Report No. 750-73 continued:

> An aquarium provides a normal and basic component to any institute of higher learning incorporating marine education and research. The facility would be constructed around scientific and educational value along with an exhibition of marine life common to this State as well as the Pacific Ocean Basin and be provided for each of its citizens.

Finally, in Standing Committee Report No. 588-73, it is reported:

> The purpose of this resolution is to request the Legislative Reference Bureau to conduct a feasibility study of converting the Waikiki Aquarium into a Marine Education Center to be used as a teaching center for students at the University of Hawaii, for non-university level school children, and for the general public.

The general views on Aquarium functions might be summarized as follows:

(1) An aquarium for the exhibition of fishes and other forms of marine life;

(2) A public educational center;

(3) A natural science center;

(4) A source of inspiration for visitors;

(5) A recreational facility;

(6) A marine research center; and

(7) A teaching center for students at all levels and for the general public.

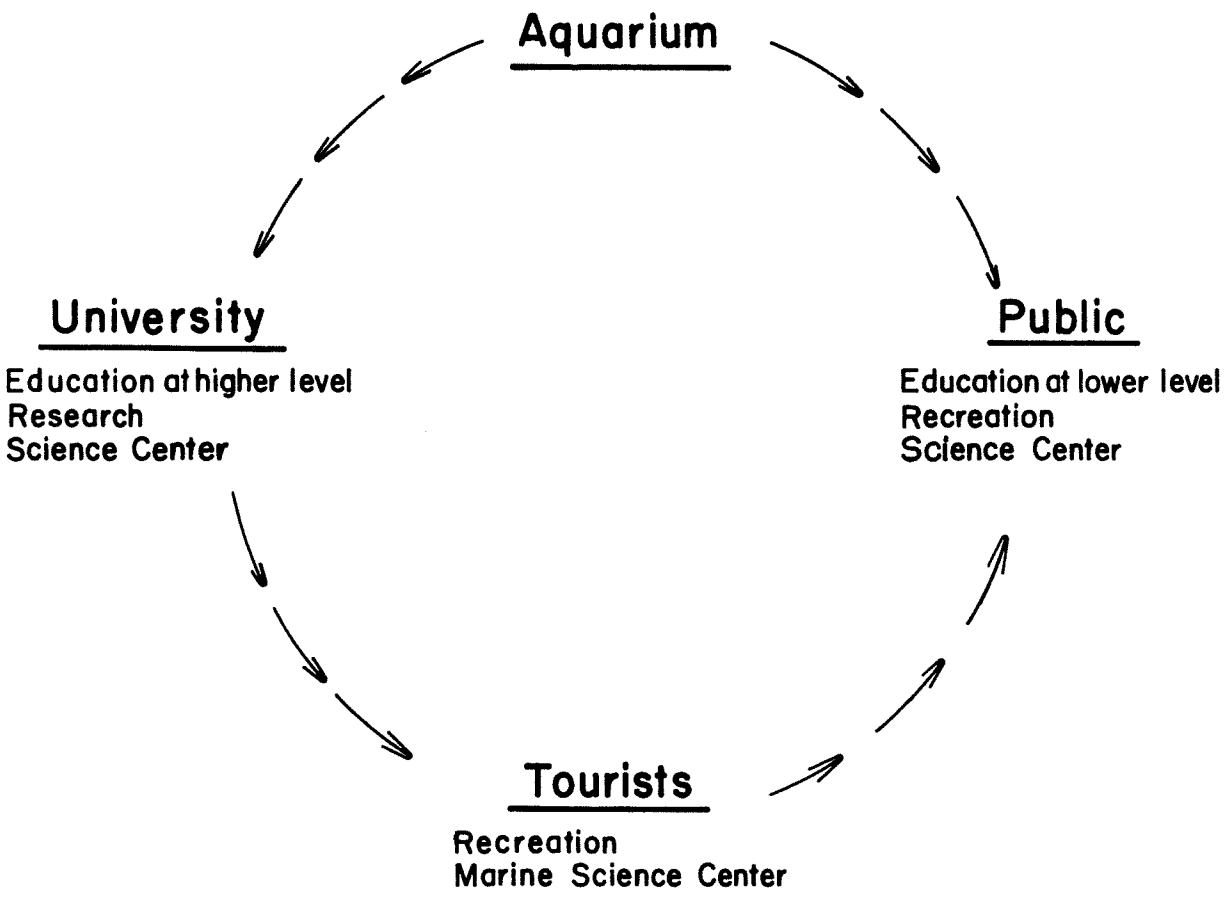
Although these policy outlooks are realistic, generally well-defined, and understood by most of the affected people, they have not been adequately enforced or implemented. The current program at the Aquarium would qualify as an exhibition of fishes and other forms of marine life, a display of aquatic exhibits, and a source of recreational pleasure. However, it is not a teaching center for students at all levels, nor a natural science center, nor a model of marine education and research. True, grade school children do visit the facilities. Yet, how much of an educational experience this is for them is not very clear. They recognize a variety of marine life, note the beautiful colorations, but learn little more. The potential for making their visit a rich learning adventure has not yet been reached at the Waikiki Aquarium.

Interest and effort are not lacking on the part of the staff. The reasons for the underdeveloped state of the Aquarium are chiefly due to financial and personnel problems. In these days of escalating prices and nationwide inflation, aquarium funding has been cut to less than it was for the past several years, reduced from $153,000 in 1972 to $134,000 in 1973. Personnel vacancies have not been filled (because of the hiring freeze and the lack of money), leaving the Aquarium without a third of its staff. The director's position, even though a similar position in any other organization would be deemed essential to its success, has been vacant for nearly a year. Under these conditions, it is no wonder that the stated policies, functions, and objectives of the Aquarium are not being met. Furthermore, it is not surprising that the full use of its resources are not meeting the purposes intended.

It is clear from the views of the various policy-making bodies that the desired functions of the Aquarium lie in three areas: Education, Recreation, and Research. (See Figure 8.) If it is viewed by administrators only as a desirable rather than necessary part of the University, weak fiscal support can be expected to continue. How these functions are approached in the future depends upon legislative, as well as university, thinking and decision making.

Figure 8

AQUARIUM FUNCTIONS AND INTERACTIONS



CHAPTER VI
NEEDS

The formulation of Aquarium programs depends in large part upon what is determined to be the needs and desires of those who use or visit the facilities as well as residents in the community at large. In an attempt to elucidate some of these needs, several surveys and numerous interviews were conducted. The University faculty, Department of Education teachers, and actual visitors to the Aquarium were asked to answer a survey questionnaire relating to usage, needs, and desires. Copies of these questionnaires appear in the appendices to this report.

It should be noted that for ease of reference and comparability, the results of the surveys will be discussed in terms of percentages and proportions. Information on actual numbers will be included at the beginning of each section which discusses a particular survey.

University Survey

The survey of Aquarium use by University personnel, which will be referred to as the "University survey", was sent out in mid-May 1973. It was mailed to faculty members at the Manoa Campus who met the following criteria:

(1) Was of Assistant Professor rank or above;

(2) Served principally as an undergraduate instructor, graduate instructor, or researcher; and

(3) Worked in the fields of science and/or engineering.

Administrators were omitted because it was felt that they would have little student contact, and therefore little relationship to the Waikiki Aquarium. Engineers were included because several engineering faculty members had commented on their use of the Aquarium as a source of sea water and ocean-related research information. Of the questionnaires that were sent, 45 per cent were returned for processing. In terms of numbers, 309 questionnaires were mailed and 142 responses received and analyzed.

Judging from the history of the University-Aquarium relationship, the results were rather predictable.

It was first determined that of the group surveyed, by far the largest were assigned a combination of academic functions. Some 34 per cent reported their principal academic function as a combination of graduate teaching and research. Another 22 per cent combined undergraduate teaching, graduate teaching, and research. Over half, then, combined teaching with research as their main academic endeavors. Others reported the following: 15 per cent in undergraduate teaching, 7 per cent in graduate teaching, 13 per cent exclusively doing research, 3 per cent in undergraduate and graduate teaching, and 3 per cent in undergraduate teaching and research. (See Figure 9.)

To clarify the relationship of the University and the Aquarium and to better determine the importance of one to the other, the following survey question was asked: "How many times have you used the Aquarium in the last year?" The results were not surprising. A little more than three-fourths of the respondents made no use of the Aquarium whatsoever (76 per cent), 12 per cent used it one to two times, 5 per cent used it three to five times, 5 per cent used it more than ten times, and 1 per cent used to it six to ten times. (See Figure 10 showing the percentage visiting the Aquarium during 1972, according to the number of trips made.)

When the sample was divided into engineering and science functions, it was noted that 88 per cent of the engineering and 73 per cent of the science faculty made no use of the Aquarium. However, 4 per cent of the engineering and 5 per cent of the science group did make more than ten trips to the facility in 1972.

Of those using the Aquarium, nearly equivalent numbers used it for research, as a source of sea water, fish, or other supplies, as a teaching model, and for recreation. Even among students in science and engineering, the usage was low. The faculty reported that 65 per cent of their students never used the Aquarium, 11 per cent made some use of it, and only 4 per cent used it more than ten times in the last year.

The reasons that the Aquarium were not used proved quite interesting. Location of the facility at a distance from campus did not appear to be a very influential factor. Only 4 per cent reported that to be a reason for their non-usage, with 1 per cent giving "no transportation" as their reason and 3 per cent listing "inaccessibility (too far from school,

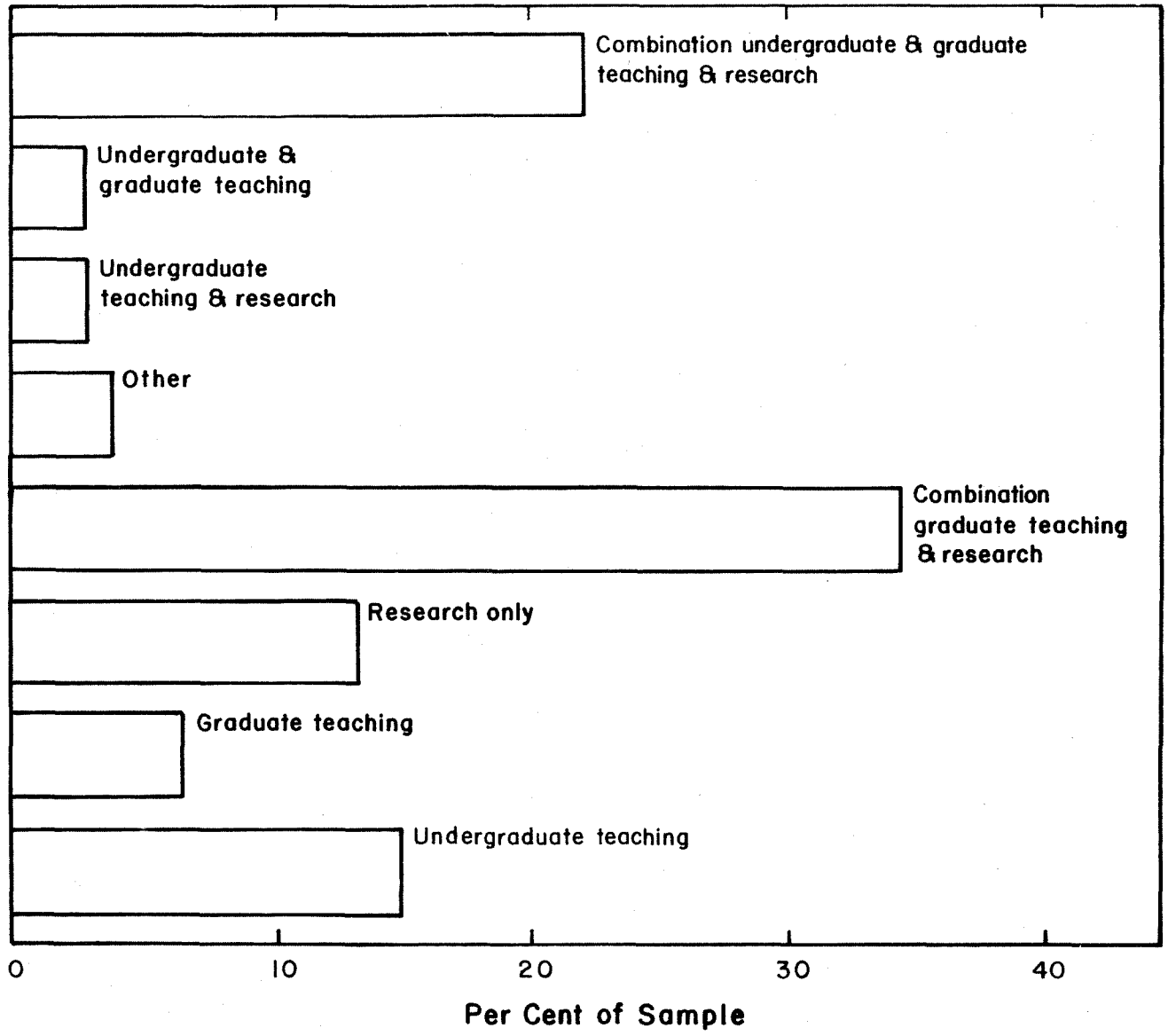


Figure 9

PRINCIPAL ACADEMIC FUNCTION IN PERCENTAGES

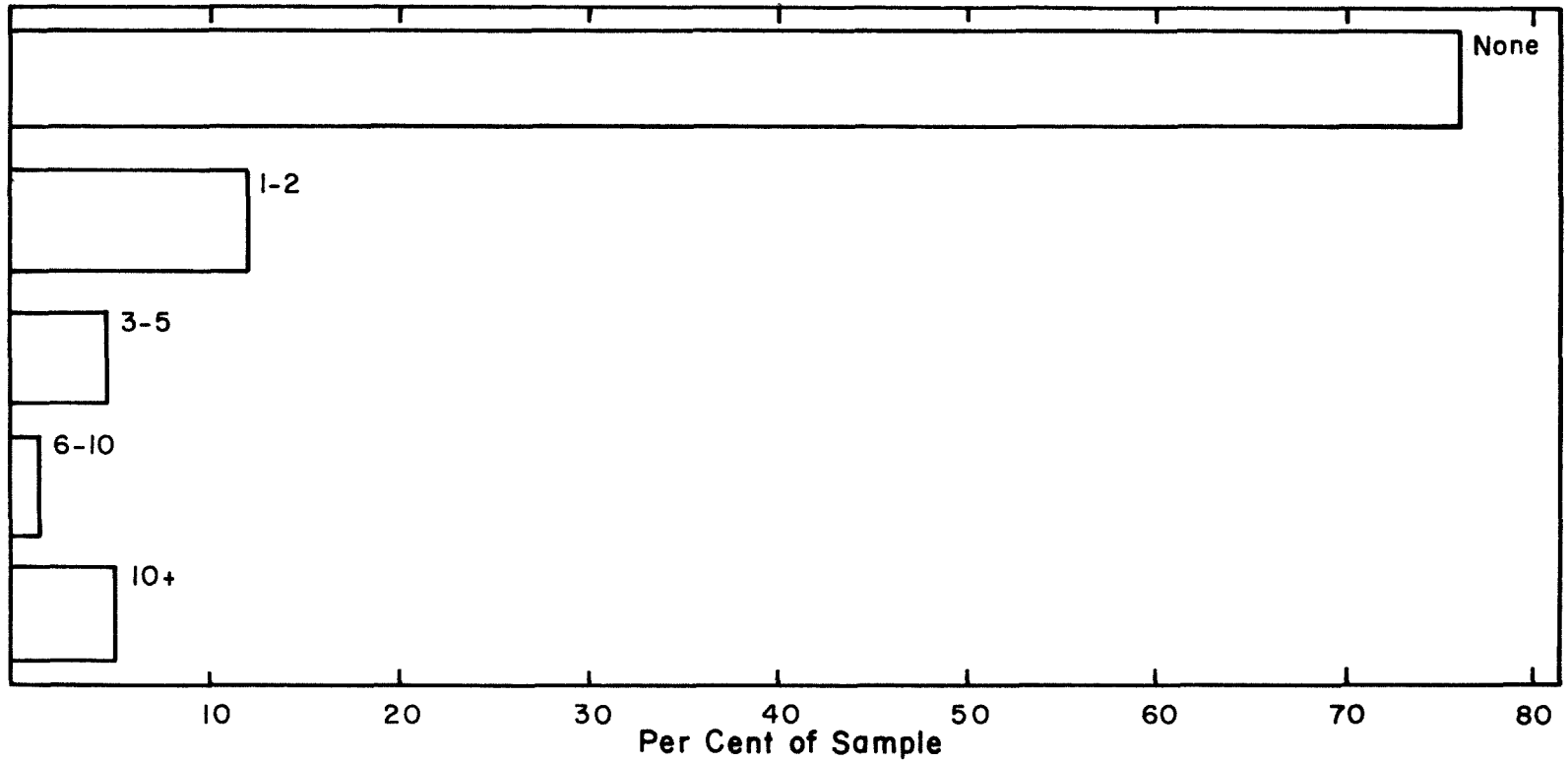


Figure 10

PER CENT VISITING THE AQUARIUM DURING 1972 ACCORDING TO THE NUMBER OF TRIPS MADE

etc.)" as theirs. The vast majority found that the Aquarium visits were not applicable to their teaching program (67 per cent), and another 9 per cent replied that they were dissatisfied with the Aquarium services. (See Figure 11.) None of the engineering faculty reported any dissatisfaction with Aquarium services.

When asked about satisfaction within Aquarium programming, most reported no knowledge of the programs and therefore explained that they were unable to offer any suggestions or declare any judgments. Of those expressing dissatisfaction with the programming, there were several categories of answers given, each relating to the programs on research, education, and supplementary services. The most common reasons for dissatisfaction with the research program were:

(1) Poor staff cooperation and disenchantment with the former director often being declared;

(2) Inadequate facilities;

(3) Ignorance about facilities, programs, and capabilities.

In commenting on the response expressing disenchantment with Aquarium personnel, Mr. Spencer Tinker, former director, declared:

> Disenchantment by University personnel with the staff of the Aquarium is understandable. Consider the following:
>
> 1. University faculty members are not granted free admission under Regents rules unless accompanied by a class. They pay for a football game, but grumble about paying the admission fee for the Aquarium.
> 2. The Aquarium has resisted attempts by various departments to force the Aquarium to pay for their activities.
> 3. Various University personnel have expected the Aquarium to supply them with specimens for their special activity. This is in direct competition to the Aquarium's needs.
> 4. One department wanted the Aquarium to manufacture and supply fish traps for their deep water activities.

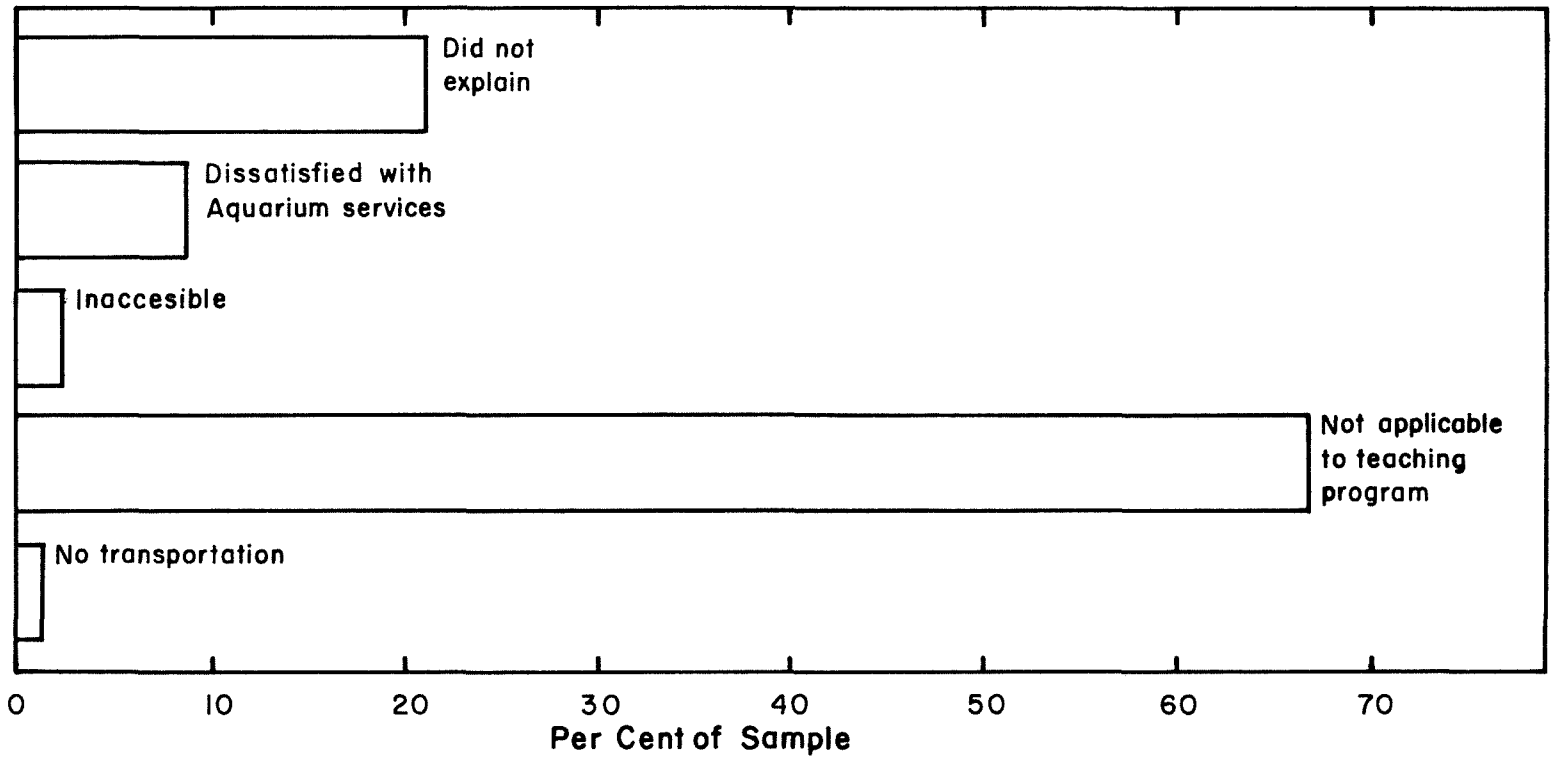


Figure 11

REASONS AQUARIUM WAS NOT VISITED BY UNIVERSITY FACULTY

5. Various administrators have requested or attempted to force the Aquarium to hire their friends or relatives.
6. An Aquarium request to borrow a model for an exhibit was denied although the Aquarium had supplied that individual specimens for three or four years.
7. One researcher was stealing exhibit fish from the Aquarium tanks for his project. When he was denied access to the back of the exhibit area, he wrote a letter to various University administrators complaining of lack of cooperation, etc.
8. "Laboratory" personnel were careless in issuing keys. The result was a large number of people had access to the joint aquarium-laboratory shower rooms and parking area. They came for collecting, bathing, recreational park use, often with friends, and sometimes with children. One of these children turned off the power switch to the Aquarium. Much of this could have been handled by the Public Baths. They often used up parking space needed for Aquarium visitors.
9. Most research types require a large amount of personal service and attention because they are relatively helpless; the Aquarium did not have the staff to wait upon them. These problems should have gone to the Hawaii Institute of Marine Biology; they had more space, more personnel, and more collecting facilities, in addition to being the department engaging in biological research in the sea.

Others felt that disease control and nutrition procedures had to be improved and staffing increased so that meaningful research could be conducted. Another stated, "The State has two research facilities (Coconut Island and Kewalo) and it is not clear that need for a third exists." Still another declared, "The only research is by outside people such as myself. Their own facilities are too poorly curated to allow research."

Finally, a response which was submitted "on behalf of the Department of Botany" explained, "Facilities not appropriate for Botany research program." This response is all the

more interesting when the fact that the Botany Department was given part of the Aquarium building for its use is considered. When the Chairman of the Department was contacted for permission to quote from their questionnaire response, he clarified their position. He felt that the Aquarium facilities were no longer suitable for their current programs, and that was the reason that they no longer use the facilities. Although they did vacate these facilities, the Dean of Marine Programs has given Aquarium personnel the right to use the space only on a temporary basis. If the Botany Department again finds some use for it, the Aquarium staff must relinquish the area.

The comments on the educational program were similar, the common ones being:

(1) Displays are very poor (don't take advantage of local fish, invertebrates, ecology, relevant research, pollution, etc.);

(2) Understaffed, needs more imaginative leadership;

(3) Poor labelling, not enough interesting information given;

(4) Poor public relations efforts, nobody knows what's going on down there.

Many felt that the educational programs were strictly for younger students, but even those were lacking. One suggested that ETV might work out a program with the Aquarium which would result in good publicity, generating interest in the facility, and hopefully a better program. This idea has merit and should be explored further. However, it should also be noted that University classes were never denied admission, the use of the Aquarium auditorium, or a lecture on a marine topic.

In the area of supplementary services, the chief complaint revolved around the lack of appropriate communication of the available facilities. Others noted that the sea water service was excellent, but they also wanted to be able to call on the Aquarium for research and class material. In addition, it was generally proposed that knowledgeable staff members make themselves available to answer questions about reef life, ocean animals, or anything else that might come up.

The consensus of the vast majority of the University faculty is that most staff members and their students have no

use for or any contact with the Waikiki Aquarium. Those who do use it recognize the need for improvement and have offered some suggestions as to how this can be accomplished. Poor displays, poor physical facilities, lack of staff cooperation, lack of educational materials, and poor publicity were all listed as reasons for dissatisfaction. However, the feeling was also expressed that an increase in funds and some dynamic leadership would go a long way toward improving the Aquarium.

Teacher's Survey

The survey of Aquarium use by teachers employed by the Department of Education will be referred to as the "teacher's survey". From the complete listing of all teachers in the department, a random number were selected and questionnaires were mailed to each of them. They were mailed in late May so that they would be received by the teachers before the close of school in June 1973.

In terms of numbers, 1,791 questionnaires were mailed and 1,068 responses were received and analyzed. The response rate for teachers was a little higher than that of University faculty, displaying a 60 per cent return. Of these, however, more than half the replies were from elementary school teachers whose teaching programs were exclusively or predominantly science. The responses will be analyzed mostly in terms of responses from the teachers as a whole and in comparison to the elementary science teachers as a group.

The first question was asked to determine how often classroom teachers take their students to the Aquarium. The answers were somewhat surprising. Of all the teachers surveyed, 82 per cent did not visit the Aquarium at all in the last year. Among elementary science teachers, 73 per cent made no visits to the facility, while secondary science teachers displayed an even higher proportion of 88 per cent. Almost all of the respondents who did go to the Aquarium, did so only one or two times during the year. Generally, they regarded the trip as a regular classroom activity, although a few did make the trip as part of a special project or as an extracurricular activity with clubs or hobby groups.

The reasons that these excursions to the Aquarium were not taken were many. For secondary teachers in public schools, curriculum and scheduling is departmentalized, making a full day away from school very difficult to arrange. The most common reason expressed in the questionnaires was

that it was not applicable to their teaching programs (43 per cent of all teachers and 50 per cent of secondary science teachers). However, only 23 per cent of the elementary science teachers gave this reason. For them, inaccessibility (such as too far from school, not on island, etc.) was just as much of a problem. Another 23 per cent listed inaccessibility as their reason, with 26 per cent of the secondary science teachers and 23 per cent of all teachers agreeing. Transportation was a problem for only 4 per cent of the teachers, and an additional 4 per cent cited dissatisfaction with Aquarium services as their complication. (See Figure 12.)

On the whole, teachers reported that they did use the Aquarium predominantly for education (34 per cent of all teachers and 50 per cent of elementary science teachers). However, almost as many used it predominantly for recreation: 30 per cent of all teachers, 31 per cent of the secondary science teachers, and 29 per cent of the elementary science teachers. Since the educational programs at the Aquarium were supposedly geared toward K-12 students, it is alarming that so many teachers merely used the facility for recreational purposes.

One conclusion that might be drawn from this, however, is that the educational programs have been ineffective, and, in fact, are virtually non-existent now. If an educational program involving lesson plans, teaching materials, and pre- and post-trip activities were developed, there is no doubt that the proportion of teachers using the Aquarium as an educational facility would drastically increase. Of those who reported some dissatisfaction with the educational program, the lack of educational materials was the biggest factor affecting their attitudes. The lack of cooperation from Aquarium staff and the poor physical facilities were also mentioned by a few respondents as reasons for dissatisfaction.

Once again, when respondents were asked which area of Aquarium operations needs improvement most, the educational program was specified. Some 36 per cent of the teachers mentioned the educational program, with 17 per cent listing staff services, 14 per cent facilities, 6 per cent displays, and 5 per cent collections. Another 28 per cent reported that they were unfamiliar with the Aquarium programs and were therefore unable to offer any opinion. (See Figure 13.) As a group, it was interesting to note that 41 per cent of the teachers felt that the Aquarium operations were meeting their needs as teachers, 25 per cent felt they are not, and 39 per cent were undecided mostly because they weren't familiar with the Aquarium.

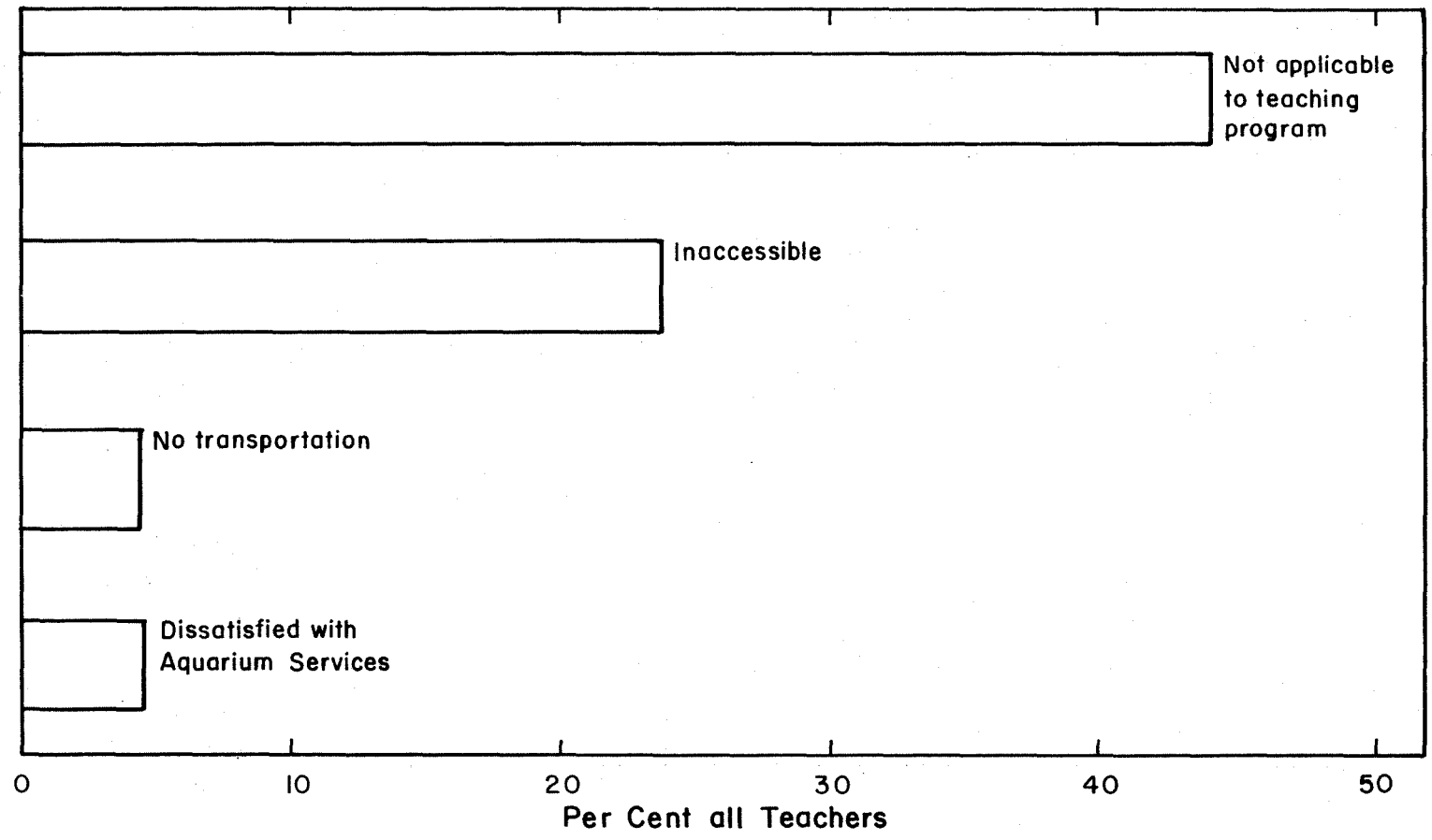
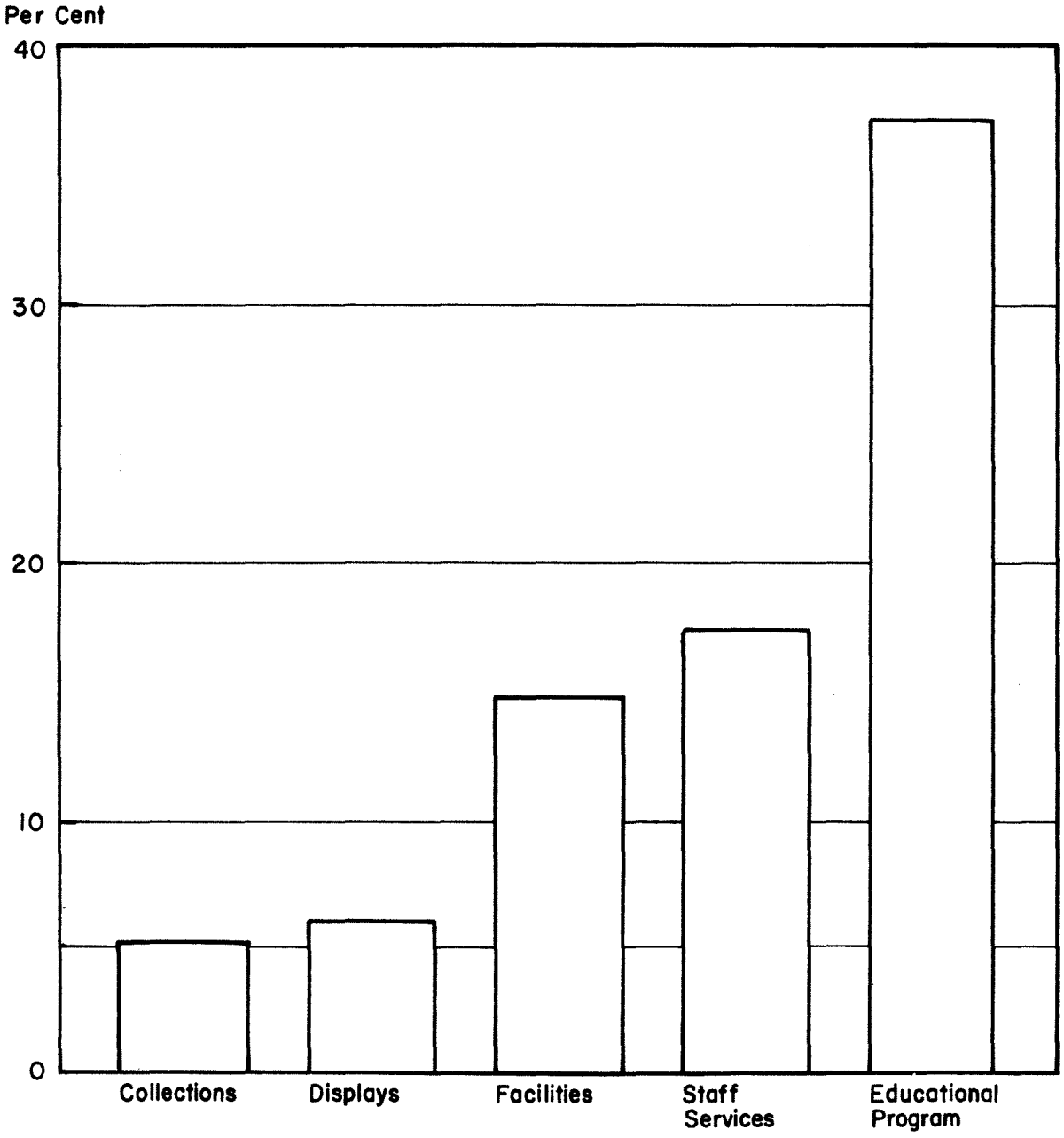


Figure 12

REASONS EXPRESSED BY PUBLIC SCHOOL TEACHERS FOR NOT VISITING THE WAIKIKI AQUARIUM

Figure 13

AQUARIUM OPERATIONS WHICH TEACHERS FEEL NEED IMPROVEMENT



The last series of questions in the survey were intended to uncover information on the effects of location on future visitation patterns. Since one proposal has been to move the Aquarium to the zoo grounds, the question was asked, whether the two are now visited on the same day or not. The teachers' responses indicated that 36 per cent do visit both facilities on the same day, while 31 per cent do not. A second question was asked, "If the Aquarium were not located in close proximity to the zoo, would your class visit the Aquarium as often?" The responses divulged that 26 per cent would visit as often, but 40 per cent would not. The indication, then, is that the zoo helps to attract student visitors to the Aquarium, with both facilities sometimes being visited on the same day.

The last question gave specific alternative locations for the Aquarium; however, to an estimated 39 per cent of the teachers, location made no difference and would not affect the number of times they visited. Among the others, 24 per cent said that they would visit it more if it were located at the zoo, 10 per cent felt it would be more accessible if it were located in a rural area of Oahu, and 7 per cent declared Ala Moana Park as their choice site. (See Figure 14.)

Generally, the teachers survey produced the following information:

(1) The vast majority of the public school teachers did not visit the Aquarium even once during the last year;

(2) Those who did visit usually made no more than two trips;

(3) Inapplicability to the teaching program and inaccessibility were common reasons for eliminating the Aquarium visit from the school program;

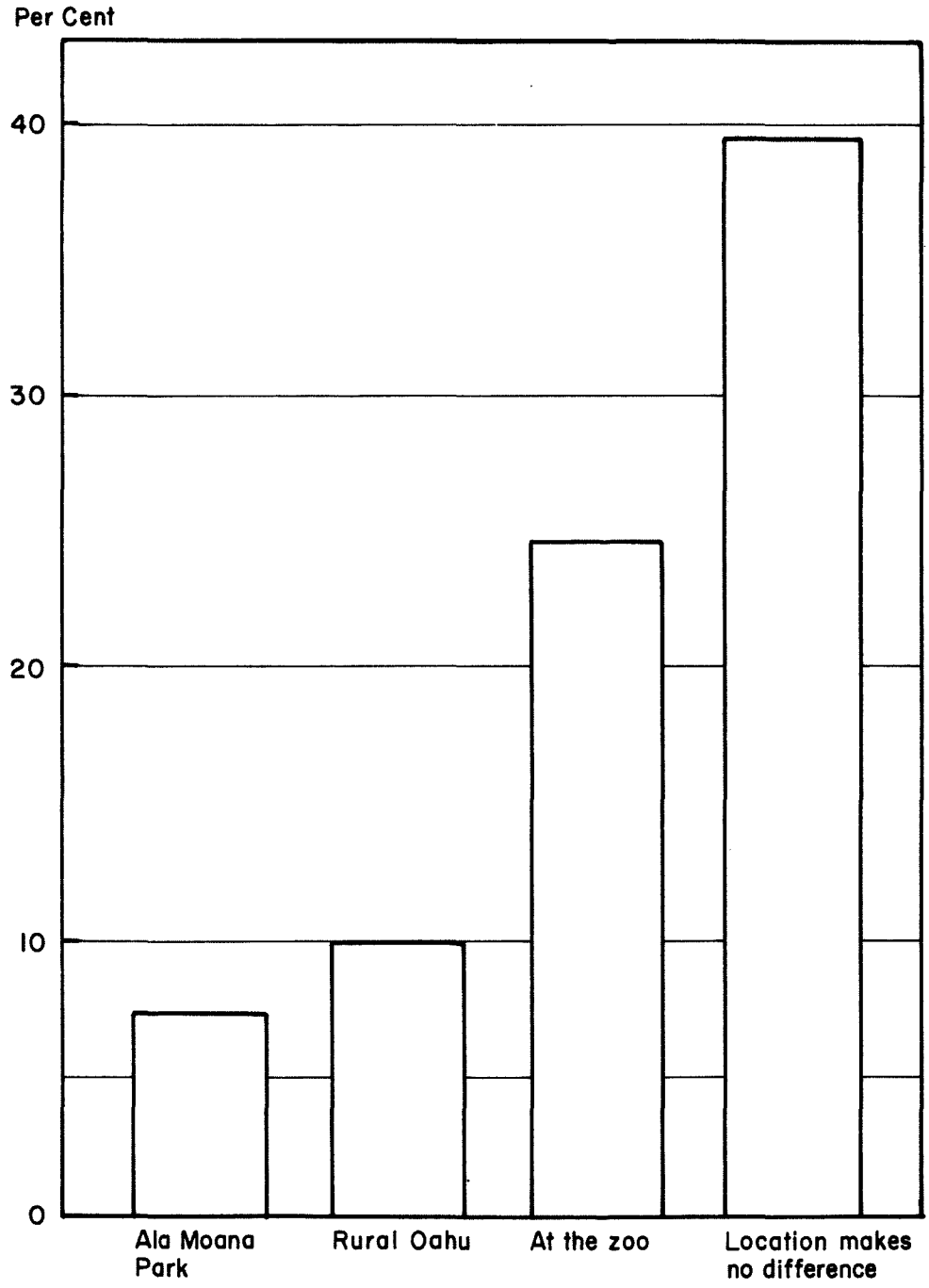
(4) The Aquarium facilities were used almost as much for recreation as for education;

(5) The Aquarium's educational program was cited as most in need of improvement; and

(6) Finally, to most teachers, the location of the Aquarium made no difference, but its proximity to the zoo was a point of attraction.

Figure 14

PREFERENCES FOR AQUARIUM LOCATIONS EXPRESSED BY PUBLIC SCHOOL TEACHERS



Special Interests

The Malacological Society and the Salt Water Aquarium Society of Hawaii are two of the special interest groups with ties to the Waikiki Aquarium. For the most part, their relationship entails using Aquarium meeting rooms for the societies' meetings. However, it is also with groups such as these that a workable docent program might be developed. Their members have an immediate interest and direct tie to the facility, thus their members could be viewed as a source of willing volunteers for the future.

In March 1973, Mr. Herbert Green, President of the Salt Water Aquarium Society, wrote that his members "have been concerned about poor conditions existing at the Waikiki Aquarium".[1] A partial solution, as viewed by Mr. Green, follows:

> We realize that funds for aquarium improvements are in short supply, due to the cut back in state funds. However, it would seem that much could be done with good planning, management, creative effort, and a minimum of money. Other aquariums, in particular Steinhart Aquarium in San Francisco, have made excellent use of non-paid volunteer help. These persons, who range from high school students to professional men and women in the community, collect fish in Calif., Mexico and Hawaii, clean and arrange tanks, work on displays, conduct tours, and build equipment used by the aquarium. This was discussed at our last SWASH meeting and a number of those present are actively willing to support a program of this type. Our members feel that a well maintained, education oriented public aquarium is important to the people of Hawaii and are anxious to help in working toward this goal.

It is evident that even these groups have not found the Aquarium completely satisfying, yet their willingness to help improve it is quite encouraging. So far, the docent program which was developed sometime before the Salt Water Aquarium Society expressed an interest in the project, has been progressing nicely. Volunteers have begun preparing lecture materials for school groups, supportive slides, teaching materials, and auditorium space. It is also encouraging to

note that the Aquarium staff has been working with the Hawaii Science Teachers' Association to develop a program of lectures and laboratory space for science teachers and their classes. However, classroom space is badly needed if such programs are to develop successfully. Unless additional existing space is returned for Aquarium use, temporary classrooms will have to be built on the grounds to house such classes.

Like others in the community, Mr. Green and the members view the Aquarium as in need of improvement:

> In addition to being an exciting attraction for visitors and islanders, our aquarium should educate many about the marine life surrounding our islands. There should be displays showing a more complete cross section of our fish and invertebrates in settings representative of their natural habitats and exhibits showing the results of marine research. Hopefully, it could play an important role in making the public more aware of the ocean environment, its potentials, and the need to protect it.

It is hoped that it will soon develop into a facility which satisfies this description.

User's Survey

A questionnaire was distributed to actual visitors to the Aquarium in an attempt to elicit information from those who actually use the facility. On two separate occasions, one weekday (a Thursday) and one day of the weekend (a Saturday), researchers spent the day at the Aquarium. They distributed questionnaires to all adults who entered, and collected the completed forms from them before they left. A total of 693 questionnaires were distributed and 573 responses received and analyzed.

Because of the personal contact with respondents, the response rate was quite high; 83 per cent for the "Users' survey", as compared to 45 per cent for the University survey and 60 per cent for the teachers' survey. By far the greatest number of nonrespondents could be described as foreign-language speaking tourists, many of whom were Japanese. Of course,

some visitors simply refused to respond to the questionnaire, but there were only a limited number of them.

The first thing that became apparent from the survey responses was that weekday visitors and weekend visitors possessed different characteristics. The former group was comprised mostly of tourists with some local parents bringing their young children to visit. The latter group had a greater number of local respondents. On the weekday, only 21 per cent of the visitors to the Aquarium were "local" residents while 79 per cent were classified as tourists. The classification "local" includes residents of Oahu and the Neighbor Islands. The term "tourist" includes visitors from the mainland, as well as from foreign countries. On the weekend, the proportion of visitors was more evenly divided: 46 per cent local and 54 per cent tourist. (See Table II.) It is evident that most people who live here adhere to the five-day work week. Accordingly, it is not until the weekend that they would find time to visit the Aquarium on their own. Those who did go on the weekday were usually housewives or residents escorting tourists on a trip to various scenic spots.

Among the foreign visitors, many were either from Canada or Japan. Canadians comprised 51 per cent of the foreign respondents and Asian visitors 7 per cent. However, most Canadians do speak English and were therefore able to participate in the survey. Many of the Japanese do not speak English and so were not included among the respondents. The survey researchers were able to report from visual observations that many of the nonrespondents could be classified as Japanese tourists.

On both survey days, nearly the same number of children (free admissions under 16 years of age) attended. The weekday visitors included 131 children, 76 of whom were part of an elementary school class. The weekend brought 126 children who came with their families, in small groups, or alone.

During the survey, it was noted that the Aquarium may have a problem in actually counting the numbers of admissions. Two separate turnstiles must be passed upon entry. The one on the right is intended for paying adults. The one on the left is intended for nonpaying children. There is no sign posted to explain this, so on some occasions children go through the wrong turnstile and various other problems occur. It does not appear that a completely accurate count is being kept by the Aquarium staff, therefore, all of the survey counts were done by hand. Perhaps if a sign explaining the use of the turnstiles were installed, fewer entry problems would be encountered.

TABLE II

CHARACTERISTICS OF VISITORS TO THE WAIKIKI AQUARIUM

	PER CENT OF WEEKDAY VISITORS	PER CENT OF WEEKEND VISITORS
LOCAL		
OAHU	20%	42%
NEIGHBOR ISLAND	1%	4%
TOURIST		
MAINLAND	61%	46%
FOREIGN*	18%	8%

*FOREIGN LANGUAGE SPEAKING TOURISTS NOT INCLUDED IN THIS FIGURE.

Visitors to the Aquarium discovered it in various ways. Most of the local residents simply knew about it and decided to visit, although 26 per cent of them did report that they found out about it in school and 17 per cent found out about it from friends. The largest percentage of tourists (40 per cent) learned about it from a travel brochure. Another 31 per cent of the tourists reported that they actively sought it themselves. Other means of discovery which were listed included hotel directors and through happenstance (noticed it as they were passing by). It appears that travel brochures would be an effective means of reaching tourists, and schools would be appropriate for reaching local residents in any future attempts to publicize the Waikiki Aquarium and increase visitor attendance.

Since the admission policy has often been a matter for controversy in past years, one item in the questionnaire was included to solicit information directly from the people who use the facility as regards their feelings on admission fees. Three-fourths of all the visitors (both local and tourist) were willing to pay increased fees for admittance. The fee that most were willing to pay (47 per cent of the local group and 43 per cent of the tourists) was 50 cents. A total of 73 per cent of the local group and 78 per cent of the tourists responded that they would pay 50 cents or more for entry privileges. (See Table III.) It appears that entry fees could be doubled without very much resistance from the people using the Aquarium.

It should also be noted, however, that some people are of the opinion that any fee at all will stop adolescent youths from enjoying the facility and that free admission is thus the only answer. The argument that such fees would act as deterrents to low-income adults and children could be averted if a plan for additional free admissions were developed. In this way, more people would be allowed to enter the Aquarium without charge, but others would be paying more. The cost-benefit to the facility would undoubtedly be a positive one, bringing in double the revenues and making the collecting chores worthwhile.

The question of whether or not the Aquarium should be moved to the zoo grounds was broached in an indirect manner. An item was included to determine how many of the users visit the zoo and the Aquarium on the same day. The rationale for correlating the two was that if both are visited on the same day, then placing the Aquarium on the zoo grounds would make it more accessible and therefore even more people would visit it. The survey results indicated that 35 per cent of the

TABLE III

ENTRY FEES WHICH AQUARIUM USERS ARE WILLING TO PAY

Fee	Local	Tourist
LESS THAN 50¢	25%	12%
50¢	47%	43%
75¢	13%	15%
$1.00	11%	17%
$2.00	2%	3%

local residents and 60 per cent of the tourists would visit both on the same day. Conversely, 62 per cent of the local group and 35 per cent of the tourists would not. Tourists, usually on a limited time schedule, probably find the proximity of the facilities conducive to same-day visits. Local residents, however, seem to prefer enjoying one facility at a time, thoroughly and at their leisure. It is evident that the zoo does help to attract some people to the Aquarium as well. However, parking facilities, available land area, general land use, and building congestion are other factors that must be considered.

The means of travel to the Aquarium differed according to whether or not a person was a visitor or a local resident. Most tourists walked there (49 per cent), while the local residents tended to use their own cars (84 per cent). (See Table IV.) Still another 10 per cent of the tourists came by city bus, while others used rental cars, taxis, or bicycles.

One conclusion that might be drawn from these figures is that the Waikiki location attracts visitors because of its convenience and accessibility. However, to 38 per cent of the local people and 58 per cent of the tourists, location makes no difference. (See Table V.)

Almost all of the Aquarium users rated it as a good facility, with the majority of them classifying it as "very good". Even though it is small, understaffed, and in need of repair, visitors are charmed by the current display. Nevertheless, several means of improvement were suggested. The area of displays elicited the most comment, with 30 per cent responding that displays should be improved with better tanks, larger animals, more plants, and more local fish, and another 37 per cent responding that displays should include a wider selection of marine life, from other regions, etc. (See Table VI.) Only 1 per cent of the respondents felt that shows or entertainment should be added to the Aquarium program, leading to the conclusion that the Sea Life Park program is adequate for handling commercial programming without any interference from government-supported facilities. Many of the users did visit both the Aquarium and Sea Life Park, and the majority did prefer Sea Life Park (more than 50 per cent); however a sizeable number reported that they liked the Aquarium better (approximately 25 per cent), and still others felt that they were incomparable--each doing a good job in its own realm.

The various surveys were illustrative of the views of different segments of the Aquarium user population. They helped to point out problems, offer solutions, and contribute

TABLE IV

METHOD OF TRANSPORTATION TO THE AQUARIUM

Method	Local	Tourist
Walked	5%	49%
Own Car	84%	14%
Rental Car	--	16%
Taxi	--	2%
City Bus	3%	10%
Bike	--	1%

TABLE V

POSSIBLE SITE LOCATIONS FOR AQUARIUM AND THEIR EFFECTS ON VISITATION PRACTICES

	Effect on Visitation Pattern					
	LOCAL			TOURIST		
Site Location	More Often	Less	No Difference	More Often	Less	No Difference
In the rural area of Oahu	23 (12%)	51 (28%)	82 (44%)	8 (2%)	57 (15%)	236 (61%)
On the zoo grounds	52 (28%)	19 (10%)	90 (48%)	57 (15%)	6 (2%)	253 (65%)
Near Fisherman's Wharf	10 (5%)	43 (23%)	96 (52%)	14 (4%)	47 (12%)	237 (61%)
Outside the Waikiki	24 (13%)	31 (17%)	92 (49%)	12 (3%)	54 (14%)	235 (61%)
Location makes NO DIFFERENCE		70 (38%)			225 (58%)	

TABLE VI

SUGGESTED METHODS FOR AQUARIUM IMPROVEMENTS AS REPORTED BY RESPONDENTS IN AQUARIUM USERS SURVEY

a.	Add guided tours	13%
b.	Improve displays (tanks, etc.)	30%
	Add more displays (with larger animals, marine plants, local fish)	1%
	Improve explanations (with soundtrack, better signs, etc.)	2%
c.	Alter facilities	5%
	Clean facilities, add light, improve ventilation, play music, etc.	3%
d.	Display wider selection of marine life, from other regions, etc.	37%
e.	Increase staff services	5%
f.	Enlarge area, expand	3%
g.	Add show, more entertainment (include Tours off reef)	1%

to the overall improvement of the facility. With this information, a unique and workable program may be developed for the future. Copies of each survey are included in Appendices F through I.

CHAPTER VII
PROGRAM EVALUATION

In order to meet the needs of the community, a program designed to satisfy Aquarium users from various segments of the community must be developed. To best determine how the present program is succeeding in meeting its objectives, an evaluation of the current program at the Aquarium seemed an appropriate measure. Much information was garnered from a questionnaire submitted to the Aquarium management. (See Appendix J.)

Ordinarily, the Aquarium is open to the public 312 days during the year, with the following schedule:

Tuesday through Saturday.	10:00 a.m. to 5:00 p.m.
Sunday.	1:00 p.m. to 5:00 p.m.
Monday.	Closed
Holidays.	Closed

Until the summer of 1973, when the Aquarium closed an additional two days per week, it had been on the schedule for several years. Financial difficulties forced them to close until additional funds were received in September 1973. In the past, the Aquarium did remain open on holidays, however when it became necessary to pay employees working on holidays in cash for overtime, rather than in compensatory time, the Aquarium chose to stop the practice.

Adults pay an entry fee of 25 cents while children under the age of 16 enter without charge.

Internal Operations

A 1968 report on the Aquarium describes its chief operations as follows:

Maintain the exhibits--

By collecting, purchasing, exchanging, etc., of specimens, and

By care of existing specimens including the supplying of food, water, air, treatment, etc.

Operate, maintain, and repair all physical facilities, including--

Mechanical equipment and installations related to the Aquarium including pumps, compressors, refrigerators, vehicles, plumbing, etc.

Physical facilities relating to the building including the building, water lines, toilets, electric lighting, ventilation, furniture, etc.

Perform janitorial, custodial, and groundskeeping maintenance in the building and on the premises.

Carry out the admission policy established by the Regents including the charging of the admission fee and the accounting and handling of the receipts.

Engage in educational activities associated with the Aquarium including--

Lecture to schools and other groups at the Aquarium and in the community.

Assist hobby groups meeting at the Aquarium with programs, arrangements, etc.

Continue work upon publications in progress.

Continue to prepare educational materials upon the Hawaiian fauna and disseminate it in schools and the community depending upon need, use, cost, availability of funds, and other factors.

Prepare labels for all Aquarium exhibits.

Act as consultant for a wide variety of problems.

Again, because of the vacancies, not all of these functions are currently being performed.

Internal Organization

Internally, the Aquarium is divided into several sections: the aquarium management section, the office management section, the aquarium operations section, and the information-education section. In reality, however, the functions of the personnel in these sections overlap and cannot be arbitrarily divided. One person may have duties in several sections, particularly since the job vacancies at the Aquarium have not been filled.

Generally, the functions of each section include the following: (See Figure 15.)

1. Aquarium Management Section

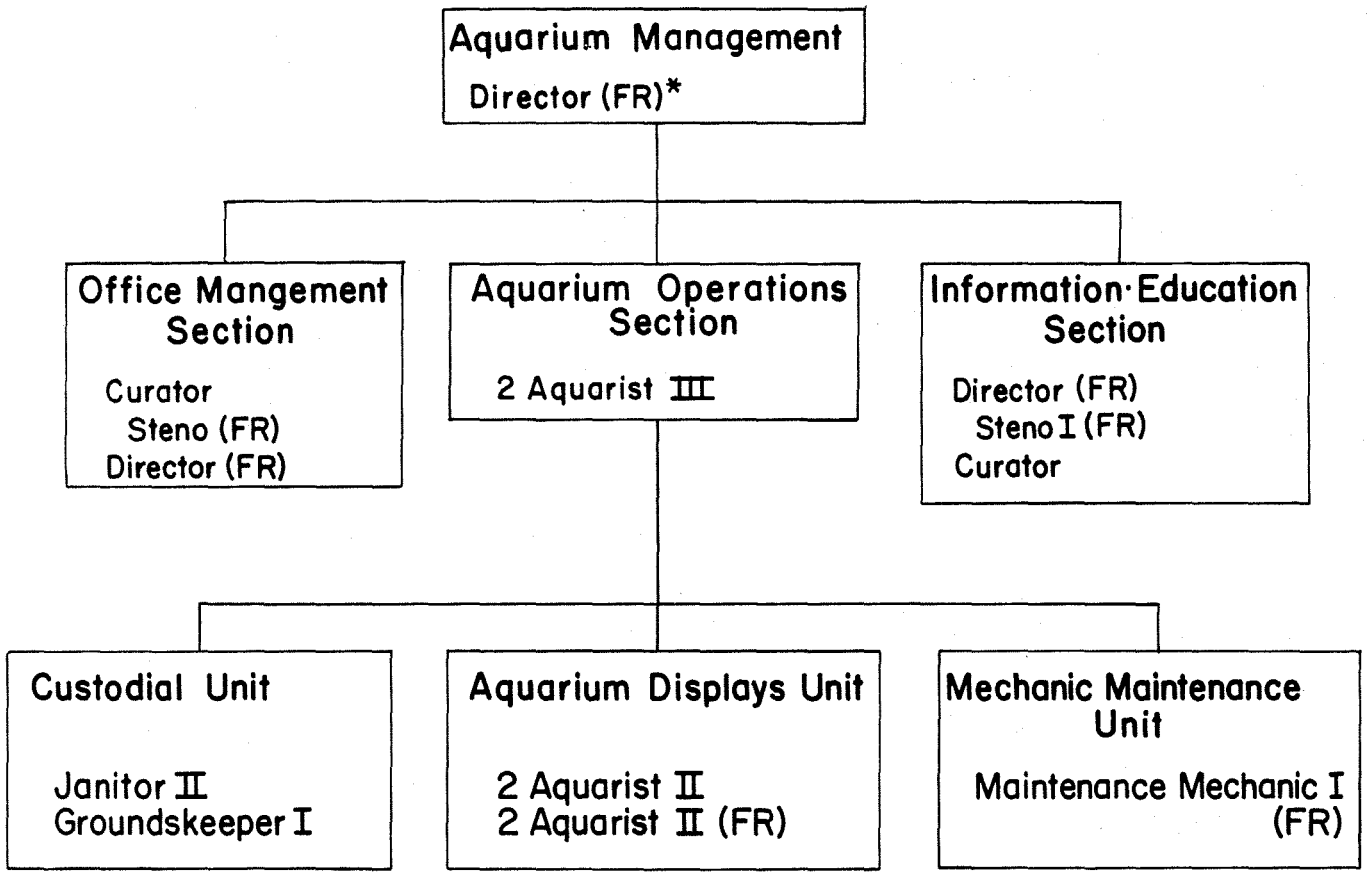
   This is the job of the director, and it includes overseeing, or when short-staffed actually doing, every job in the Aquarium. Because the director's position is still vacant, the curator has assumed the responsibilities of the director. As such, during periods of aquarium observations for this study, it was noted that the acting director did everything from collecting the fees and feeding the seals to submitting the annual budget and supervising Aquarium operations.

2. Office Management Section

   The duties in this section are normally assigned to the director, curator, stenographer, and student workers.*

Figure 15

ORGANIZATION



*(FR) = Position is currently frozen and thus vacant.

Duties:

a. *Receptionist-stenographer*

Handles mail
Answers questions for aquarium visitors
Maintains correspondence files, bulletins, periodicals, etc.
Answers the telephone
Operates the intercom and public address system
Records and distributes messages

b. *Cashier*

Collects the admission fee
Deposits the receipts
Keeps attendance records

c. *Managerial*

Supervises Aquarium operations
Purchases services, supplies, and equipment
Procures, exchanges, and ships specimens
Prepares payrolls
Prepares and controls budget
Acts as "substitute" for any jobs that need to be done
Answers and initiates correspondence

*Note: The duties are divided into categories, such as receptionist, managerial, etc., but no one person is responsible for each category. The categories merely denote the type of activity required, but these jobs can be done by any of the staff.

3. Aquarium Operations Section

The duties in this section are usually supervised by two Aquarist IIIs.

Duties:

a. *Aquarium Displays* (staffed by one Aquarist III and two Aquarist IIs--although this would normally include four Aquarist IIs when fully staffed)

Collects live specimens for Aquarium exhibits
Transports specimens to and from the Aquarium
Maintains living exhibits, including cleaning tanks, feeding specimens, and treating disease
Repairs water lines
Supplies filtered salt water to the public
Prepares specimens for shipment to other aquariums

b. *Custodial* (staffed by a Janitor II, a Groundskeeper I, and students)

C Cleans and services the Aquarium building
Cleans and maintains the grounds, walks and driveways around the building

c. *Maintenance* (usually staffed by Maintenance Mechanic II, however, this position is now vacant)

Supervises the operation of Aquarium machinery
Services machinery and equipment including trucks, gas and electric pumps, refrigeration, air conditioners, fans, etc.
Maintains the building, including painting and minor repairs

4. Information-Education Section*

The duties in this section are usually assigned to the director, curator, stenographer, and students.

Duties:

a. *Education*

Prepares Aquarium labels and labels all exhibits
Prepares slides and other lecture materials
Gives lectures on Hawaii's fauna to school and community groups both at the Aquarium and in the community.

b. *Information*

Assists various natural history hobby clubs
Identifies specimens for the public
Supplies general information
Prepares popular publications

*Note: This section has suffered considerably because of the lack of personnel and the long period of time during which Aquarium jobs have remained vacant. Lectures, club work, and extra informational services have, out of necessity, been severely curbed.

Current Vacancies

As staff positions have become vacant over the past months, due to retirement, employees quitting, or lack of funds, no replacements have been approved. These positions are, in efffect, frozen. At the present time, the following positions still remain to be filled: (See Figure 16.)

(1) Aquarium Director

(2) Maintenance Mechanic

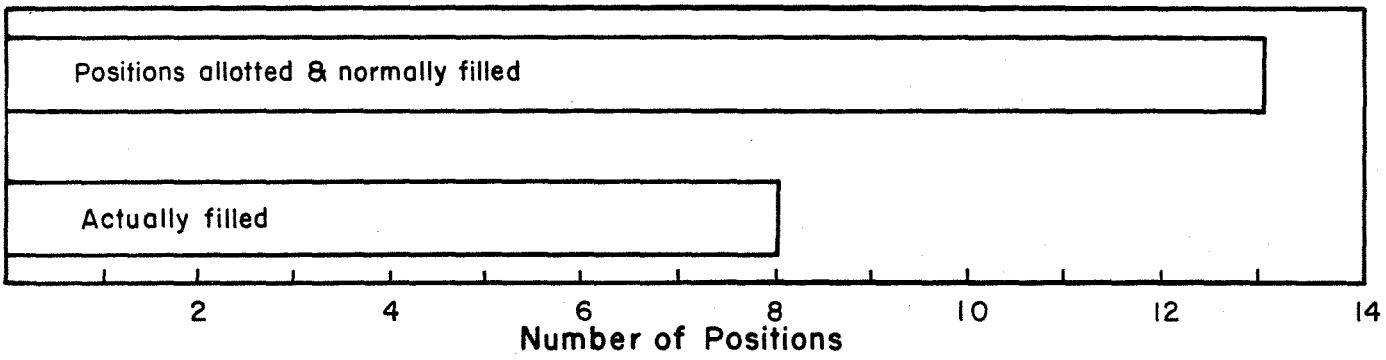
(3) Aquarist I (2 positions are open)

(4) Steno-Cashier I

These five vacant positions comprise over one-third of the total Aquarium staff. Another Aquarist position is expected to be vacated at the end of 1973. The fact that they remain vacant has resulted in a severe handicap to normal Aquarium operations. Even though the director and the curator are the only employees appointed by the University of Hawaii's Board of Regents, the rest holding civil service status, the State's hiring freeze has affected all vacant positions. The Aquarium is even further constrained, however, by the lack of adequate funds for hiring even if a position were to be unfrozen.

Figure 16

STAFF EMPLOYMENT AT THE WAIKIKI AQUARIUM



Staffing

The Waikiki Aquarium is now operating at two-thirds staff and without enough money allotted to meet personal service requirements for fiscal year 1973-1974. The current budget includes $63,477 for personal services. This is $5,691 less than the amount needed merely to meet present salary levels. (See Table VII which lists the salary ranges for each position.)

When compared with similar institutions in the nation, the salary ranges at the Aquarium appear to be adequate. They are higher than many smaller aquariums, approximately 10 per cent lower than personnel at Steinhart Aquarium, and at a comparable level with personnel at the Honolulu Zoo. Although the University is expected to supply the funds necessary to meet the payroll, no additional personal services funds have yet been received.

Because of the understaffing problem, the Aquarium has come to depend heavily upon University students as supplementary employees. Five University students, employed on a budget of $10,000 for the year, are now working there. This compares to an allotment of $11,940 for the fiscal year 1972-1973. When the budget for fiscal year 1974 was submitted, the amount of $13,000 was requested for the hiring of University students. The University saw fit to allot only $8,000 for this purpose. However, since the Stenographer-Cashier position had been frozen, the Aquarium relied on these students, as well as the curator, to man the cashier's post. Without them, the Aquarium closed its doors to the public an additional two days a week, these days being Monday (on which it is ordinarily closed), Tuesday, and Wednesday.

The additional closings were in force from July 1, 1973 to September 11, 1973. Because of the numerous complaints and obvious disgust of potential Aquarium visitors during the "closed" days in August, Aquarium personnel proposed an alternative plan to keep its doors open. They suggested that visitors be allowed to enter free of charge on Tuesdays and Wednesdays, without having anyone to man the cashier stand or to answer informational questions. In this way, the Aquarium would operate just as it normally does on the days when it is not open to the public, i.e. since it deals with live inhabitants, it is a 24-hour a day, 7-day a week operating facility, even though the public isn't always permitted entry. The proposal for the free entry was directed to the Dean of Marine Programs Office and from there to the University President's Office with a request for action by the Board of Regents.

TABLE VII

SALARY RANGES FOR PERSONNEL AT THE WAIKIKI AQUARIUM

Position	Employees	Filled or Vacant	Approximate Salary Range
Director	1	Vacant	$19,000-$28,000
Curator	1	Filled	11,000- 16,000
Aquarist III	2	Filled	7,000- 10,000
Aquarist II	4	2 Filled 2 Vacant	6,000- 9,000
Maintenance Mechanic I	1	Vacant	7,000- 9,000
Groundskeeper I	1	Filled	5,000- 6,000
Janitor II	1	Filled	5,000- 6,000
Stenographer I	1	Vacant	5,000- 8,000

By September 11, 1973, the University Budget Office, acting under the direction of President Cleveland, was able to provide the Aquarium with an additional $2,000 for their student worker allotment. This money made it feasible for the Aquarium to reopen its doors to the public on Tuesdays and Wednesdays, with students handling the cashiering duties as well as other odd jobs.

The question of whether collecting fees of only 25 cents is worth all the effort expended is a continuing one. However, judging by the salary range allotted to the Steno-Cashier ($5,000-$8,000), a preliminary judgment can be made. If a cashier were hired, given a salary of $8,000, and required only to collect fees at the Aquarium, the facility would make a net profit which would be more than double the allotted salary. Annual income from fees has averaged approximately $30,000 per year. If the director or a curator were required to do this job, however, the exercise becomes costly. Therefore, it would pay to hire a Steno-Cashier assigned the job mainly of collecting fees, but also capable of answering the phone and doing various other chores. Despite the stated benefit to the facility, no actual benefit can be suggested when the funds from the fees are not returned for Aquarium usage. Under these circumstances, the cashier's position is still costly.

Because of the additional monies and the resultant reopening, however, the question of free admissions was never broached by the Regents. And while the Aquarium is staying open, it is still suffering from lack of funds. When the $2,000 supplement runs out, they have been promised more; but judging from past Aquarium experience with the University personnel, they cannot be assured of any further increases.

Student Workers

The Aquarium employs nine student workers on a part-time basis. Of these, five are from the University of Hawaii, as mentioned above. These students are used as cashiers, aquarists, security guards, fish haulers, information officers, and janitors. In describing their capabilities, the curator said, "These students are invaluable to us and can be given a great deal of responsibility." Observations during the study reinforced this statement, for without the student help, the Aquarium would probably be closed.

Three students, part of the Neighborhood Youth Corps, are also employed at the Aquarium. The Neighborhood Youth Corps

program is federally funded, but administered by the City and County of Honolulu. Disadvantaged high school dropouts between the ages of 16 and 17 are admitted to the program for a period of two years. They are paid $1.65 an hour for 30 hours each week. Ten of those hours are spent on basic education and the rest is devoted to acquiring a skill. Because most of the enrollees do suffer emotional problems, their employers must spend careful hours of training to acclimate them to their jobs. Consequently, the benefits to the employers, which include free workers, since the students are paid with federal funds, are tempered by the amount of time that they must spend in training and cautious treatment of their employees. Those employed at the Aquarium are assigned responsibilities including feeding the seals, janitorial chores, and cashiering duties. While they do fill a need, under the present circumstances of the Aquarium, their activities can in no way be equated to those of the University students. (See Table VIII.)

Another student, at the high school level, spends approximately six hours a week at the Aquarium. This student's responsibilities include feeding the baby sea turtles and the carp. While working there, she has increased her knowledge in the area of oceanography and has been judged "very helpful" in her activities. Still others sometimes contribute time, but strictly on a volunteer basis. (See Appendix K.)

Other Manpower Resources

Other manpower resources were sometimes made available by special interest groups, in this case the Malacological Society. A program had been planned which would use "docents", i.e. volunteer workers from the Society and other similar groups, to guide educational tour groups, through the facility, perhaps lecture for a short period, and otherwise make the trip a more meaningful and educationally profitable one. Unfortunately, although interest at the University level was demonstrated in the docent program, it never was consummated. If an administrative University official actively supported it and the Aquarium staff received practical advice and more financial support to develop the program, its chances of success would have been considerably greater. The probabilities of receiving volunteer aid, from the community in general, University students (such as those in the Marine Options program), and other service groups are encouraging, but unless the program is actively directed by knowledgeable personnel, it will be difficult to get it started. The benefits of such a program, as far as upgrading the educational program at the Aquarium, are considerable and worth the effort.

TABLE VIII

USE OF STUDENT EMPLOYEES*

(All figures are in hours of work)

STUDENT HELP

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Weekly Total	Yearly Total	Each Holiday	Twelve Holiday Total	Vacation Replacement	Vacation Total	Extra Weekly Summer Load Jun-Jul-Aug	Summer Total 12 Weeks	Yearly Total (Hours)
I. Laboratory & Technical **																
1. Exhibit Preparation, Label and Repair.....								25	1300							1300
2. Scientific Illustrators								20	1040							1040
II. Clerical, Secretarial, and Fiscal																
1. Cashier.....		4	4	4	4	8	6	30	1560	6	66	8 hr x 21 days	168			1704
2. Sales Clerk.....																
III. General Service																
1. Janitor.....							8	8	416	8	96	8 hr x 21 days	168			680
2. Yardman.	5	5	5	5	5	10	10	45	2340	10	120	8 hr x 21 days	168	Water 3 x 7=21	252	2880
3. Park Lot.....		3	3	3	3	7	5	24	1248	6	72					1320
4. Doorman.....		5	5	5	5	8	5	33	1716	6	72			T-F 2 x 4 = 8	96	1884
5. Hauling from Keehi....	3	3	3	3	3			12	624							624
6. Collecting of Specimens w/boat.....		8		8		8		24	1248							1248
IV. Others																
TOTALS									11,492		426		504		348	12,770

*UH Budget Request Summary Sheet, Fiscal Year 1971-1972.

**See Appendix D for definition of jobs.

Financial Resources

Financial resources have been a difficulty in recent months. State funds, as was mentioned earlier, were severely limited. Those that were allotted, however, are still inadequate to meet payroll. County support, mainly in the area of maintenance aid and physical contributions, may be a possibility in view of the proximity of the Aquarium to the zoo and the maintenance services provided it by the City and County of Honolulu's Department of Parks and Recreation. Since these two facilities have similar functions and needs, an agreement might be worked out which would be inexpensive yet very useful for the Aquarium.

Federal funding, through the Sea Grant Program, may be available for the development of educational projects at the grade-school level. Support for the production of educational materials, as well as an educational officer at the Aquarium, has been suggested and may very well be given. However, the Aquarium has to show some initiative of its own. Currently, educational production is at a standstill due to the understaffing and poor financial situation. It would undoubtedly benefit the Aquarium to approach the Sea Grant Program with a feasible proposal in this area. Again, the lack of personnel makes this just "another job" that has to get done when time permits. To date, time has not permitted too much more than keeping the Aquarium functioning at the status quo.

Still another source of financial aid which has not yet been explored, is that of contributions. Almost all of the model aquariums included in this study made provisions for community support through a system of public contributions. If the Aquarium could build a more attractive image, as an efficient marine science center and a model of local marine conditions, it might be able to attract considerable local support and contributions. This source has not received enough attention in the past.

Other Budget Matters and Monetary Affairs

For the fiscal year 1973-74, the Aquarium is operating on a budget of $103,477. This is $5,691 short of expected expenditures for the year. (See Table IX.) This compares with an allotment of $163,168 for the 1970-71 fiscal year--A decrease of nearly $60,000 during a three year period which has seen steadily rising prices. Although the University was a victim of the severe budget cuts instituted by the State after last year's budget deficit, the question as to why the Aquarium should suffer so drastically in hard times without

TABLE IX

QUARTERLY EXPENDITURE PLAN, WAIKIKI AQUARIUM
1973-74

Character of Expenditure	Total Allotment	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	All Quarters	Projected Surplus or (Deficit)
A. Personal Services	(8.00) 63,477	17,292	17,292	17,292	17,292	69,168	(5,691)(Deficit)
A. Non-reg. Personal Services	--						
A-1. Student Help	8,000	2,000	2,000	2,000	2,000	8,000	
B. Other Current Expenses	32,000	9,000	7,000	7,000	9,000	32,000	
C. Equipment	--						
M. Motor Vehicles	--						
TOTAL REQUIREMENTS	(8.00) 103,477	28,292	26,292	26,292	28,292	109,168	(5,691)

notably profiting during the good ones remains a valid one. Aquarium personnel feel that it is because they do not have an academically oriented facility, similar to a Department of Chemistry or a Department of English. Neither do they have a notable research facility such as the Hawaii Institute of Marine Biology or the Pacific Biomedical Research Center. Therefore, the reason that the Aquarium is viewed as a fringe item, not essential to the operation of a flourishing University. It suffers accordingly.

While this may be a significant factor in the Aquarium's budgetary problems, it isn't the only one. As mentioned earlier, the entire State was running at a deficit. Communications and relations between the former director and University officials have long been strained. Geographical separation, the lack of any director at all during this critical rebuilding period are all factors which have contributed to the problem.

Another prominent obstruction to smooth financial seas has been written into the law itself. Section 304-32, Hawaii Revised Statutes, states:

> The board of regents may charge the public for admission to the aquarium a fee not to exceed 25 cents for adults, and 10 cents for children; provided that school children shall be admitted free, if accompanied by a teacher, one day of each and every week, such day to be set by the director of the aquarium.

The collection of fees has resulted in a sizeable source of revenue. At the same time, however, it has meant that personnel must be made available to collect those fees during the hours that the Aquarium is open to the public. This means an expense of both work time and money to collect these revenues. The question of cost-benefit arises (as was explained earlier), particularly in view of the following statute:

Section 304-33, Hawaii Revised Statutes, states:

> The board of regents shall pay into the state treasury all receipts of the aquarium and all such moneys are <u>appropriated for the use of the university</u>....

There is absolutely no provision for the return of these revenues to the Aquarium for its own use. Accordingly, the facility, in reality, generates no usable income and assumes the role of a welfare recipient among University programs. Some feel that this has put the Aquarium into a position where it must beg for its needs from an administration which has not always regarded it as an integral part of its system. On the other hand, revenues do not come near actual expenses. Thus it may be said that the University does return all revenues with additional funds as well. (See Table X.) However, guaranteeing them the freedom to use revenues for certain purposes would do much to improve relations between the University and the Aquarium without costing the University very much in terms of funds or effort.

Admission Fees

The controversy over the advantages and disadvantages of admission fees has brewed ever since they were first imposed. Over the years, former Director Spencer Tinker, has espoused the theory that these fees deter visitors, cut the proficiency rate of the Aquarium and conflict with the legislative direction that the Aquarium be an educational facility open to all. A copy of Mr. Tinker's survey of attendance in other parks and museums is included in Appendix L. However, the results of the survey of actual visitors to the Aquarium indicate that they would be willing to pay a higher entry fee. This would not be viewed as an obstacle to parents who couldn't afford the fees if adjustments in the admission policy were made.

First, a system of annual passes could be established, in which people would be allowed to purchase passes which would allow them entry on any day and for as many times as they wished during the year. This would be particularly attractive to local residents who took visitors or children to the Aquarium several times a year. Second, free entry could be granted to all students up to age 22, and others with student identification if they are older. This would provide encouragement for the educational aspect of the facility. Finally, any adult accompanied by a child could be granted free admission or admission at a reduced rate. In this way, parents or others with children in tow face no financial barriers and might be more willing to bring their children to visit the Aquarium. If an admission policy based on these or similar ideas were instituted, the increased general admission could be viewed as a potential source of increased revenues.

TABLE X

FEE REVENUES FOR WAIKIKI AQUARIUM, ACTUAL AND ESTIMATED 1969-1973

Revenue Base: 138,142 adults (16 years and older) who visited the Aquarium

Fee Charged: 25¢ for adults
Children under 16 years are free

Year Since Fees Were Last Charged: 1952

	Revenues					
	Actual 1969-1970	Estimated 1970-1971	Total Estimated 1969-1971	Estimated 1971-1972	Estimated 1972-1973	Total Estimated 1971-1973
	$34,582.75	$35,000	$69,582.75	$36,000	$37,000	$73,000

Capital Improvements and Physical Facilities

The Aquarium building is nearly twenty years old now, and like many other buildings that age, it's beginning to deteriorate. In fiscal year 1967-68, it was substantially reroofed. Today, much of the roof area is being used by the staff for such things as the storage of brine shrimp. In 1972, a new lavatory wing was completed. Part of the yard sprinkler system was also replaced at this time with the work being done by Aquarium staff. Other underground waterlines are in a state of constant repair. In 1973, three new 60-gallon tanks were added to the facilities. A carp pond, built entirely by the staff (including the acting director), was also completed. The staff has also had to renovate the old laboratory and classroom space which they were given and construct a new walk-in freezer room. Since the Maintenance Mechanic position is vacant, these physical jobs were done by aquarists, foremen, students, curator, and any other able bodies that happened to be around at the time. Again, limited funds and no physical support were the cause. It is obvious that the Aquarium staff has learned not to wait around for action by the University. Although their labors may not be within their job descriptions, or even within the letter of the law, they have found the old maxim to be true: If you want something done, do it yourself.

While the staff has attempted to refurbish areas, the lack of funds is obvious. Little things, like adequate paint, window dressings, air conditioning, and furniture need to be supplied before a top job can be accomplished. Furthermore, the generally crowded conditions throughout the Aquarium-used areas of the facility, make it difficult to beautify.

The storage of valuable documents has been deemed adequate by the staff. Yet the facility is quite open and would be of little challenge to a thief who might jump the wire fence from the beach. The staff is attempting to eliminate dated files from their cabinets in order to make more room for current documents. However, without a stenographer, this tedious job is another that will be done very slowly. Another result of the lack of clerical help has been that records are not all properly labeled and in chronological order. They are not completely up-to-date, so some man-hours are lost if records have to be found for a certain purpose. On a few occasions during the period of the study, it was suggested that researchers look elsewhere for materials rather than attempt the Aquarium files. The cramped office areas, including a "library" which is actually used as the main office, make it difficult to find things at a moment's notice.

An adequate number of fire extinguishers do offer protection in the partly concrete-partly wood building. The wooden areas are termite ridden and quite susceptible to fire.

Much work still needs to be done. A dolphin tank has been requested both by visitors and the staff themselves. A reef tank would also be a notable addition. Another static display building and laboratory space to be used by the Aquarium are also future needs that remain unmet. A shark tank and new turtle pool are badly needed, and though the staff is vitally aware of these needs, their only plausible solution in the near future is to again attempt some of these projects themselves. This is a rather unfortunate situation for the staff, but it may serve as a model for other state departments with financial difficulties.

Programs

One of the major roles of the Aquarium must be to develop an appreciation of the Hawaiian marine environment among the people of Hawaii. This does not mean merely the knowledge of the beautiful colors and fauna typical of the area, but an understanding of the integration of marine and continental life, of the influences on our lifestyle, and of the knowledge that we can apply to make our lives better. The science center, educational model, and community learning-recreation mecca, would all play an important part in fulfilling this role.

The current programs at the Aquarium have not been successful in completing these objectives, however. Educationally, the understaffing has resulted in the inability of personnel to meet the needs of Hawaii's schools. In the past, lectures, slide shows, and greater interaction between students and Aquarium staff were a common practice. These activities have had to be curtailed recently. In addition, the classes that visit the Aquarium receive very little guidance while in the facility. (See Appendices M and N for samples of educational brochures provided by the Aquarium.)

Elementary classes were observed during their visit. Their teachers seemed to let the students roam about the Aquarium, at will, looking at the various exhibits on their own then meeting an hour or so later for a picnic in the park. There was no coordinated guided tour. The exhibits could not have been very meaningful or informational to them, and they undoubtedly gained little knowledge about native marine ecology.

The staff did have to reprimand several children and remind the entire class to quiet down. But when teachers allow their students to run, scream, and play on a supposedly educational field trip, then the staff's concern for the comfort and enjoyment of others in the building is understandable and their scolding well-warranted. The potential for meaningful education now exists at the Aquarium, but so far this potential has not been tapped and probably can't be without additional funds.

A research program is virtually non-existent. Without laboratory space or resident scientists, little in this area can be expected. Whatever research is conducted on the Aquarium grounds is done so by University personnel and students and usually has little to do with Aquarium activities.

The displays and general upkeep of the collection have also suffered because of the shortage of funds. A more innovative attitude, in which attractive labels with colored photographs and interesting texts would be the rule, cannot be developed without financial aid. The model aquariums all have well-marked exhibits that are both attractive and informational. Yet those at the Aquarium remain rather passive. Perhaps even a change in groupings, showing the kinds of things that live in similar environments, or other more impelling combinations, would be helpful. Generally, dynamic leadership to develop an attractive, meaningful, and effective display is needed.

Finally, community-oriented programs also require further development. The docent program, which was discussed earlier, still has to be implemented. The malacological and salt water aquarium groups have been given meeting space there, allowing a warmer relationship between the Aquarium and the community to grow. Other lecture programs which might be of interest to the public, such as hobbyists, homemakers, and students should also be instituted. At the present time, not enough is being done to cultivate a strong community-aquarium relationship. If a strong bond were established, chances of greater community support would be considerably increased.

The programs that exist now are fairly good, but with more forceful leadership, adequate funding, and strong community and University support, much better programs could be developed.

In summary, it must be noted that the Aquarium is suffering a deficit of funds and every effort should be made to insure that it can operate at the same level of productivity as in previous years.

CHAPTER VIII
Alternatives

It should be evident by now that the Waikiki Aquarium has divergent needs. Depending on the objectives that are set for this facility, one of many paths may be taken. The ultimate decision on the future direction of the Aquarium will have to be made by the State Legislature. This study can assist in the policy decision by pointing out some of the options open.[1]

The Aquarium has been suffering with a greatly reduced budget and vacant staff positions for many months. Like many other government agencies, they felt the pinch of the State's deficit problems. They managed to keep their doors open, for the most part, and continued operations by doing jobs themselves which would normally be contracted out to professional builders. During the period of this study observations of Aquarium operations were made and several surveys were conducted to help determine the needs, desires, and opinions of those who actually use the facility. Based on all previous information gathering, it appears that Aquarium functions can be divided into several functional areas:

(1) Recreation, public Aquarium;

(2) Marine museum;

(3) Teaching facility; and

(4) Science research center.

Alternatives for the future will be discussed in terms of each of these functions.

One other alternative will be discussed first, however. This is the most obvious--maintaining the status quo. The option to do nothing is often the only one that is ever seriously considered particularly because of resistance to change. For many years, while the Aquarium was still under the direction of Spencer Tinker, this was the official attitude of the University. A year has gone by since Mr. Tinker's retirement and few obvious changes and improvements have been instituted. Some of the complaints in the "Users" and other surveys specifically noted the "crowded, dark, and smelly" conditions of the physical facility. Also, with the staff and budget deficiencies, keeping the normal public viewing hours in tact may again become a problem (as was mentioned earlier,

the Aquarium closed an additional two days per week during the summer). If, in light of the governmental recognition of the importance of the sea to Hawaii, the Aquarium is to be a model of this new philosophy, then opting to maintain the status quo is not a viable alternative.

Recreation — Public Aquarium

The first function to be considered involves the Aquarium's role as a public Aquarium and recreational facility. In 1971, the Aquarium attracted 231,149 visitors. (For comparisons to other similar institutions see Appendix L.) From the "Users" survey, it is evident that a large proportion of the visitors are school-aged children and tourists. They usually view the Aquarium as a recreational facility from which they can learn about the life found off Hawaii's shores and reefs in a low-keyed, no-pressure manner. To fulfill this function, the Aquarium must provide an esthetic, fulfilling, unique marine experience imparting information about the Hawaiian marine environment in a recreational manner. It would also have to instill in the people of Hawaii a feeling for their harmonization and integration with the sea.

Facility Needs. Aquarium displays would have to be enlarged in terms of both number and size of tanks. A dolphin pool, shark tank, and turtle habitat would add considerably to public awareness and enjoyment of sea life without moving into the realm of competition with a private facility like Sea Life Park. Non-public tanks for acclimatization, treatment, and holding would be needed, as well as increased space to house this equipment.

Implementation Alternatives

(1) Continue under the University but considerably expand facilities and revamp the program. [University]

> The present Aquarium is not adequate to handle very many increases in displays or exhibits. The largest tanks are still rather small; there are not enough display tanks to

exhibit habitat groupages; there are no special purpose tanks; and the large pool tank is not sufficient for large mammals, reptiles, and fish. A tidal pool, touch pond, and dolphin tank could be added to better serve the public.

This option might work better if the the Aquarium could be guaranteed funds on an independent basis, with little interference from University administrators. The past record of University sponsorship was not characterized by cooperation or reliable support, regardless of whether or not funds were in short supply. Under the best conditions, however, the faculty could be expected to contribute their time and knowledge in the areas of lectures and research to improve Aquarium programming and operations. It is not certain that this would amount to any more than might be expected by any other community service facility. Despite this, aquarists and aquatic scientists share much in common. Keeping an organism alive and content in a controlled environment is more than half the battle in many experimental marine biology problems. The similarity of their activities could conceivably foster a spirit of sharing, esprit d'corps, and solving common problems effectively.

The key difference between the status quo and this option would be one of expanded facilities and programming.

(2) Combined effort between the University and the Bishop Museum. [University-Bishop Museum]

As in option (1), the Aquarium facilities would have to be expanded to include more and bigger tanks, holding areas, and new display areas. In addition, space would have to be

made available for static displays, as in any other museum. A large central collection of Hawaiian and Pacific flora and fauna is also needed, particularly since large numbers of species are disappearing. By displaying such collections, the public could be educated as to their value, susceptibility to extinction, and the surrounding environment of life.

The advantage of such an alliance would be that a new outlook as a marine science center and museum of natural marine history could be developed for the educational-recreational enjoyment of the public. Substantial information on native aquatic ecology could be developed with the help of Museum staff expert in the area.

The chief advantage of this option lies in the expanded programming and additional expert staff. It would provide the public with a palatable, educational, and unique marine experience.

(3) Completely independent, but the recipient of State funds. [Independent]

If this option were selected, the Aquarium might revamp its program and activities in hopes of increasing revenues and strengthening their independence by soliciting contributions, offering memberships, and doing similar things. This would probably encourage them to be more responsive to public opinion and desires, because much of their support would have to come from them.

As with many other privately supported aquariums, this one would probably concentrate its efforts more on public displays than on research. Public education programs, hobby workshops, and general interest lectures could also

flourish in this atmosphere. Because it would function as an independent entity receiving supportive State funds, it could determine its own future, establish programs which it deemed desirable, and work toward generating more public support than it has in the past.

(4) Make the Aquarium part of the City Administration. [City]

One of the chief advantages of placing the Aquarium under the City is that of convenience. The present Aquarium is surrounded by City administered property. It is the one spot on a long stretch of beach that is not City-owned and operated. City maintenance facilities and crews are always nearby and would make the repair and maintenance of the Aquarium building a much easier job. Its off-campus location has always been somewhat of a problem for University crews, who often placed the facility low on the priority list.

One proposal under the City-Administration plan has been to relocate the Aquarium directly on to the zoo grounds, thereby combining the expertise of staff members from both and possibly increasing the accessibility of the Aquarium to the public. This plan would also pave the way for increasing the beach area for public use.

The chief distinction of this option is that it would undoubtedly emphasize the public-recreational aspect of the Aquarium, similar in impact to the zoo. This might mean more public support, greater public awareness, and changes in display and program orientation. In meeting the needs of a strictly public Aquarium, it would undoubtedly be more than adequate.

Marine Museum

Hawaii is currently lacking in museum-type exhibits relating to the sea. The Bishop Museum, which does store several marine-related collections, has removed most of these from public display. They do have some models of the Pacific current and a few other marine-oriented displays, but in relation to the importance of the sea that surrounds us, these displays are virtually insignificant. The Aquarium has a display of shells, corals, and crustaceans, but these are crowded into a small area and do not have the impact that they would otherwise have in a spacious, well-designed museum display.

It is interesting to note that three research facilities at the University--the Hawaii Institute of Geophysics (HIG), the Pacific Biomedical Research Center (PBRC), and the Hawaii Institute of Marine Biology (HIMB)--each conduct research directly related to the sea. However, very few people outside the University are familiar with their work. If the public were made to understand the importance of the research, or merely its relevance to their lives, good rapport between scientists and the community would be developed, as well as a deeper perception about the sea.

A museum-type display could be based on Hawaii's research and economic activities. Rather than static displays of dead animals, the Museum might concentrate on an explanation of the biota and physical oceanography important to Hawaii, the geology and biology of the formation of atolls and islands, the interplay of currents and tradewinds, methods of deep sea investigation, habitat groupings of coral reefs, pollution control methods and much more. Topics of local interest, such as the reef runway project, pollution of Kaneohe Bay, shark control, whale preservation, and the crown of thorns could also be explained in educational yet understandable terms.

Such a Museum would be an integral part of the Aquarium facility, perhaps occupying one wing of a building. It would also be tied to the University and scientific community for its basic stimulation, data, and research findings. Furtherance, it would be a fruitful source of educational information from elementary through University levels.

Facility Needs. The Museum displays would require exhibit halls, shops for the preparation of new exhibits, and work areas for the reconditioning of old exhibits. Space for

permanent exhibits on marine geology, engineering, etc. would also be needed. Sales areas for books and other Museum-oriented objects would also be appropriate. Equipment, unlike the normal Aquarium equipment, including bulletin boards, additional show cases, and lighting might also be considered.

Implementation Alternatives

(1) [University]

The ties between such a facility and the University would be strengthened since the University would be an important source for research data. However, the University alone does not usually serve any kind of Museum function. Its staff is oriented toward higher research and instruction at advanced levels. Therefore, Museum activities, or even Aquarium operations in general do not appear to be a normal function of the University. It could still be done under this alternative. However, experts in Museum and Aquarium operations from outside the University would have to be hired to maintain effective Museum-Aquarium exhibits.

(2) [University-Bishop Museum]

This option would probably be the best for a Museum-oriented display. The resources and data would be readily available from the University faculty and staff; and at the same time, the Museum experience and expertise would be handy for display work and Museum design. Maintenance and operations could be satisfactorily handled with a combination of in-put from both sides and dynamic leadership. On the other hand, the Aquarium segment would still require Aquarium expertise for efficient management and operations. A duplication of

efforts would probably not be encountered with good coordination and administrative guidance. The controlled efforts of both factions would be very effective in the operation of an Aquarium-Museum display.

(3) [Independent]

As with most of the other alternatives, this option would require the hiring of additional personnel with a good background in Museum operations. Since this option provides for an independent operation, resource gathering and data collection may be difficult to coordinate among University personnel with absolutely no ties to the facility. However, establishing a Museum-Aquarium display of interest to the public would undoubtedly be within the range of their capabilities. Being independent, one of their main concerns would be to satisfy the public and cater to their needs. If they felt that a Museum operation would be popular, they would undoubtedly work to develop an outstanding one. If they felt the public would not appreciate it, however, they would most probably eliminate the Museum exhibit.

(4) [City]

Under the City, a Museum operation could flourish if appropriate funding and staffing were made available. Although a City-run Aquarium connotes "zoo" and "recreation only" to many people, several municipally suppported museums and aquariums have managed to build scientific, educational, and museum-renowned reputations under city administrations. One of the most influential factors would have to be the dynamic leadership capabilities of the director. One

contention has been that City placement would result in a probable "political" appointee as director, potentially unqualified to handle the job. Yet, the chances of hiring an ineffective director is just as high in the other alternative implementation plans.

If the facilities were moved to the zoo grounds, plans for a Museum addition might be hampered by lack of space, but no matter which alternative was taken, expansion would have to be seriously considered.

Teaching Facility

An Aquarium is a natural place to learn about the marine environment. The nearby ocean and reef life, the living flora and fauna, and the general ocean-like surroundings constitute an inspiring and inviting atmosphere for the study of the sea world. Even more, it is attractive and stimulating to students of all ages and at all levels of study.

Senate Resolution 151 requests a recommendation as to the feasibility of changing the Waikiki Aquarium into a Marine Education Center. After a review of the subject and interviews with numerous individuals in the field, it was ascertained that the Aquarium could well be described as a marine education center right now. It houses large collections of shells, corals, and other invertebrates, and it has programs of various capabilities available for students from grade school to university age. The question then arises, to what degree should an educational program be developed rather than should it be developed at all. It does exist, but it can be improved to emphasize this aspect to a greater degree. In that sense then, this question is answered in this section, offering the alternative of developing the Aquarium into a teaching facility or more developed educational center.

The University's Waikiki Aquarium Advisory Committee, appointed by the Dean of Marine Programs to offer advice on the future of the Aquarium, prepared a report on their findings. Essentially, they recommend that the Aquarium remain in the University system because of its strong educational function. (See Appendix O.)

In the past, Aquarium staff members have conducted school lectures and prepared educational materials, but these efforts have been curtailed ever since the cutback in funds and staffing occurred. The University has also held many classes in the Aquarium, most of which were related to marine biology. However, these classes have been moved back to Manoa or other University facilities. Various University memorandums on the subject agree on the reasons for the moves:

(1) Deterioration of the reef nearby the Aquarium;

(2) Space limitations and general overcrowding of the Aquarium building;

(3) The use of the sea water system in Edmonson Hall at the Manoa campus; and

(4) The development of the Coconut Island laboratory with its richer Kaneohe Bay reefs; at least as a base for field trips and for small, highly specialized graduate courses.

When compared to other institutions of similar function, such as John G. Shedd Aquarium and Vancouver Public Aquarium, it is clear that the Waikiki Aquarium has not reached its full potential as a teaching facility. Several ideas on the subject have been expressed in various documents on the future of the Aquarium, the key points of which follow:[2]

The teaching program should be designed to accommodate the following type of instruction:

I. Formal credit or non-credit courses:

A. Regular University courses in the biological sciences that demand a laboratory-class room with a reliable supply of pure sea water and a direct access to the sea for specimens. These might include courses in Marine Ecology, Algal and Invertebrate Embryology, Physiological Ecology, or other courses which demand frequent access to the reef flora or fauna.

B. College of Education courses designed to help fulfill the Department of Education's requirement for continuing education of its teachers. These would be in the various oceanographic sciences, especially marine biology, for intermediate and high school science teachers, and would be offered late afternoons, evenings, and summers. They would consist of seminars on inshore fauna, animal preservation, Aquarium management, and other topics of interest.

C. Division of Continuing Education courses for students who have interests in the marine sciences but who are not enrolled full time in degree programs.

D. Regular University courses which are taught on campus, but which need facilities for field trips to the reef areas.

II. Informal Adult Education:

A. Adult science clubs oriented toward the marine sciences; these clubs, such as the Malacological Society, various diving clubs, aquarist clubs, etc., need space for their meetings, and would profit from the stimulation of the facility. It might also be noted that the clubs would provide specimens and much valuable volunteer labor.

Facility Needs. Several "wet" and "dry" laboratories, lecture rooms, and audio-visual equipment would be needed. In this way, classes and clubs could meet at the Aquarium with all of their needed material, equipment, and live samples nearby. Showers and dressing rooms would also make ocean studies by classes possible. To coordinate all of these activities, an educational specialist, with an education

background and some familiarity with Aquarium activities would be essential. While some familiarity with Aquarium operations and marine biology would be helpful, this specialist would not have to have a strong technical background in the rather, education would have to be the specialist's strong point.

Implementation Alternatives

(1) [University]

The University could develop an educational program which would probably be as good as that prepared under any other option. Since the University is in the business of education, a reputable program is possible. However, if the funds and the staff are lacking or considerably less than necessary, then very little can be expected. This has been the case in the past with the result that no educational program to speak of is yet evident at the Aquarium. If one were to judge from past experience, therefore, this option would not appear to be very promising. Again it must be stated that the potential is there, but the production questionable.

(2) [University-Bishop Museum]

The University-Bishop Museum option is potentially another good source of educational achievement. With two learned institutions backing the project, staff experts from both, and the proper equipment and training, chances are good for the development of a top educational program. Once more, the strong support of the administration, in terms of staff and funding, is essential. The Museum ties could also provide classes with a new outlook on marine life, different from that of an Aquarium alone.

(3) [Independent]

Because of the lack of professional-educational ties, this option may find the development of a marine education center a little more difficult than some of the others. Everything would depend heavily on the administrative leadership and what is determined to be the desires of the public. Other public-oriented facilities have established model educational programs, however, most of these have done so with the aid of educational specialists competent in planning similar kinds of programs. Usually their activities are geared toward the K-12 age groups, with college students used as teacher aids or instructors, and others merely using the facilities for research.

(4) [City]

The City option might entail some problems in establishing a functional education program. This is not a regular responsibility of the City administration, therefore, they could not be as familiar with the job as options 1 and 2. This does not mean that they have no educational experience, for they do work with recreational groups, drivers' education, safety programs, and various other learning systems.

Given an educational specialist and the proper backing, the City could probably produce as valuable a marine education center as the other alternatives might. Judging from the zoo program, however, an extensive program involving seminars, field trips, experiments, and research is not probable. Like option 3, the program would probably be geared toward K-12 audiences, rather than higher level students.

Science Research Center

The Waikiki Aquarium was the home of one of the first off-campus research facilities in the University system. Before the Kewalo and Coconut Island facilities were built, much marine research was conducted at the Waikiki quarters. Since that time, however, most of the researchers have vacated their quarters in Waikiki, and those who haven't, seldom use them. The status of marine research and the outlook for Hawaii and the sea has already been reviewed in previous chapters.

A research function would be essential to a University-Museum operation and could prosper in a strictly University operation, but it would probably be inconsequential to a City or independent system. The classification of life forms, including their distribution, biogeography, and ecology, is fundamental to all biological sciences and critical for Museum displays. One explanation of the importance of this area follows:[3]

> It must be emphasized that the Indo-Pacific biota, especially that associated with coral reefs, is the richest marine biota in the world, and, incredibly, is probably the least known. The larger, spectacular species--crabs, echinoderms, shells, fish--are well known, but the smaller, less conspicuous forms usually have never been thoroughly studied, even here in Hawaii. Moreover, there is no single reference, or set of references, that the scientifically trained non-specialist may use for identification of the species found in the tropical Pacific. Thus, a reference museum is even more vitally needed by the marine biological sciences of the tropical Pacific.
>
> This museum function is definitely not a function of a university. The research interests of a university vary from generation to generation, and new groups of investigators may have no interest in the old and important collections of their predecessors. An example of changing interests is the collection of fish at Stanford University. It was started by David Starr Jordan and Edwin C. Starks when the University was young and had been augmented in the half century

> until it became second in America only to the great Smithsonian collections. However, the present zoologists at Stanford work in the field of molecular biology and have manifested no interest in the maintenance of the collections. This last year the California Academy of Science took over the collections to insure their preservation.
>
> On the other hand, a museum has as one of its chief functions the preservation of definite reference specimens so that all biologists may obtain precise identification of the species they study.

More than a research-museum, the science research center is viewed as a valuable research facility covering aquarium-related research problems such as fish disease, methods of feeding, animal behavior, and any other type of relevant research.

Facility Needs. For this type of operation laboratory space and access to specimens would be required. Vaults for the storage of specimens, offices for curators and visiting investigators, and running seawater could also be used.

Implementation Alternatives

(1) [University]

> The Universtiy would function well in the research area. It has already found the Waikiki facilities useful for marine research, and it could always expand its activities there. Problems could stem from the lack of definitive responsibilities to the Aquarium and the nonrelevance of the research conducted on the grounds. The idea is not merely to provide a research laboratory, but to provide a place for research directly relevant to Aquarium activities. In the past, the University has been very weak in meeting this goal.

(2) [University of Hawaii-Bishop Museum]

This option appears to be one of the best for accomplishing the goals of a science research center. It would include University researchers familiar with marine research and Museum personnel with expertise in classifications and other research functions. The Museum has expressed an interest in establishing such a facility in the past, but lack of funds and space has been a problem. Their personnel would be appropriate and very desirable in this function.

(3) [Independent]

This alternative would probably not develop a formidable research function unless it received private grants, government grants, or special contributions for particular research projects. Chicago's Shedd Aquarium has managed to support a research program, but again the research was relevant to Aquarium operations. It is not likely that research would be as important under this option as it would be under option 1 or 2.

(4) [City]

Very little research would be expected under this option, simply because of the recreational orientation of the proposed city operations. It is unlikely that the equipment, facilities, or staff could be made available to develop a top-knotch research facility. The ties to the University and the Museum would not be as strong as under their own administration, therefore, the program would face more obstacles and be more difficult to develop.

The preceding sections of this chapter have taken a functional approach toward the role of the Waikiki Aquarium and its potential under the various jurisdictions. At this point, the converse will be explained; i.e. under the various jurisdictions, what can be expected of the Aquarium.

(1) [University]

The University has the potential for building an academically sound Aquarium. One that could function as a teaching facility and science research center while at the same time providing a measure of sheer enjoyment for the general public. The faculty in-put, research findings, and mere association with the University could conceivably provide the necessary impetus for development.

Judging from past experience, however, it is obvious that University associations and University administration are not enough. The Aquarium has been under University management for decades, and it cannot yet be called a renowned teaching facility or science research center. Other scientific research centers have used its physical facilities, but they were in no way tied to Aquarium management or personnel.

Very few ties with University faculty and students even exist. As the surveys have shown, tourists, school children, and local residents and their families comprise the bulk of the Aquarium visitors. The leadership problem of the past, and the currently vacant staff and managerial positions have contributed to the unfulfilled potential. Yet no assurances have been made about changes in the near future. Therefore, while the Aquarium, under University management, does have the potential to develop much further, without drastic changes in Aquarium-University relations, the proper

guidance, and dynamic leadership, the outlook is not good. (See Figure 17.)

(2) [University of Hawaii-Bishop Museum]

The prospects for success as a science research center, marine museum, and teaching facility are fairly good under this option. Given the use of expert personnel from the museum and University faculty, possibly with part-time appointments to the Aquarium, a valuable program can be developed. The Museum expertise in collection, display, and categorization are already badly needed. The University faculty in-put in the form of research and teaching could also be used. In addition, if the research, teaching, and museum elements were developed, the appeal to the public would naturally follow.

A proposal, such as this, has previously been submitted to the Board of Regents for consideration, however, no action toward approval was taken. (See Figure 18.)

(3) [Independent]

An independently operated facility would depend in large part on public awareness, interest, and stimulation in determining its program output. Research and scientific achievement would probably not be very strong under this option unless private grants and supportive funds could be obtained.

On the other hand, a strong teaching program, using college students and public school teachers, could be developed for the K-12 grade levels. School groups are always attracted to this kind of facility, so in seeking to

Figure 17

POSSIBLE ORGANIZATION PLAN UNDER
UNIVERSITY ADMINISTRATION

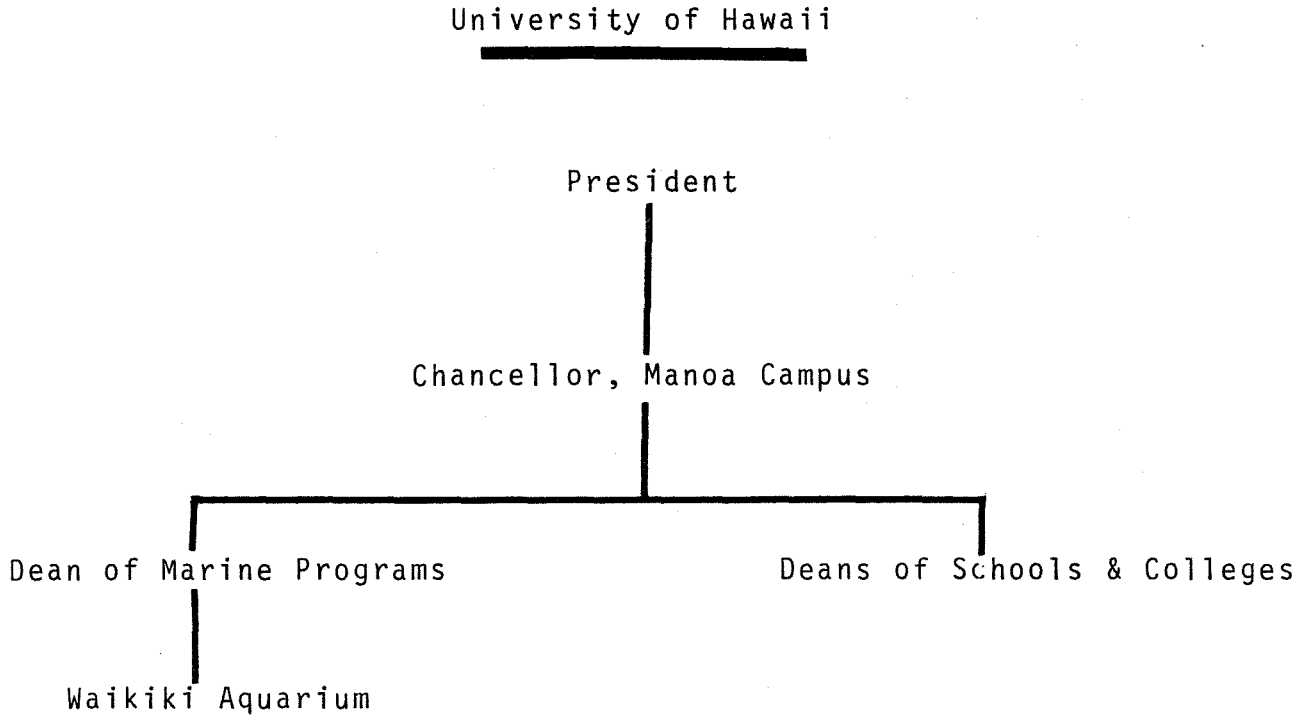
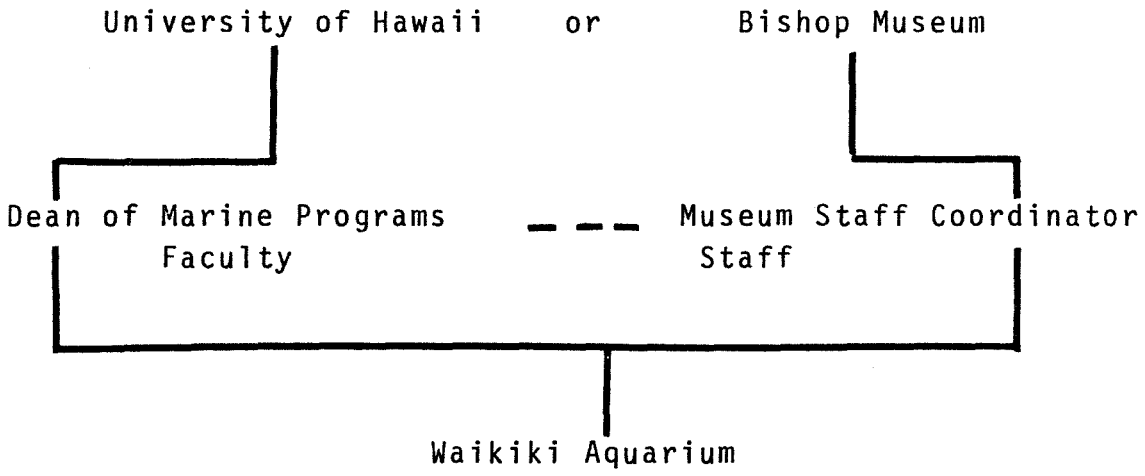


Figure 18

POSSIBLE ORGANIZATION PLAN UNDER
UNIVERSITY OF HAWAII-BISHOP MUSEUM ADMINISTRATION



meet the needs of this group, it is likely that education would be stressed.

Another strong point under this option would be the recreational aspect of the facility. Shark pools, dolphin tanks, and other popular attractions would probably be added in an attempt to attract more visitors, and consequently supportive funding, to the project. A wide selection of flora and fauna, as well as notable displays, would undoubtedly receive primary emphasis under an independent operation. Since independence implies support chiefly from private sources, entry fee revenues, etc., pleasing the public becomes an important concern. (See Figure 19.)

(4) [City]

A City administration can be expected to operate in a capacity similar to that of the zoo. Popular public attractions, strong display and collection orientation, and a formidable educational program could develop under city jurisdiction.

The physical location of the Aquarium facilities makes city administration attractive. Proximity to the zoo permits easy access for maintenance services, equipment use, and a sharing of supplies and services.

However, developing the areas of scientific research and Museum orientation would probably receive a much lower priority. Generally, such a facility would place its strongest emphasis on the public-recreational activities. (See Figure 20.)

Figure 19

POSSIBLE ORGANIZATION PLAN UNDER
INDEPENDENT ADMINISTRATION

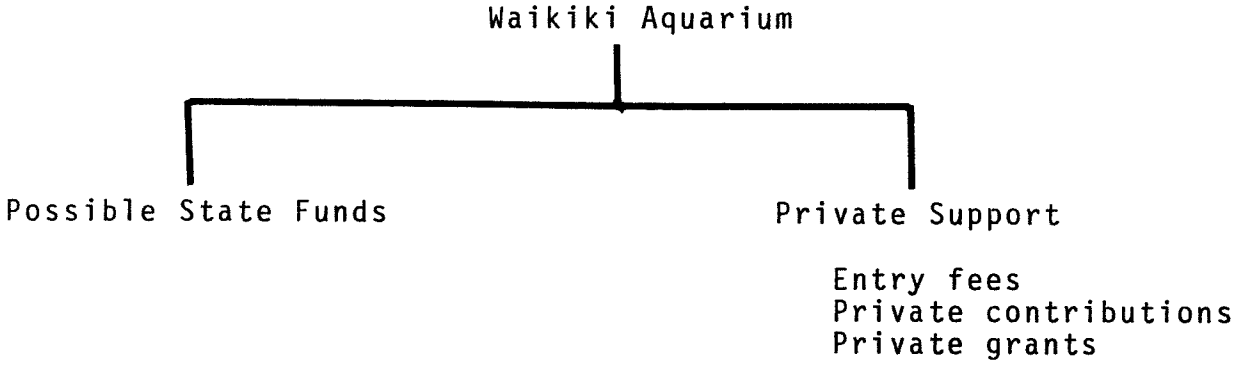
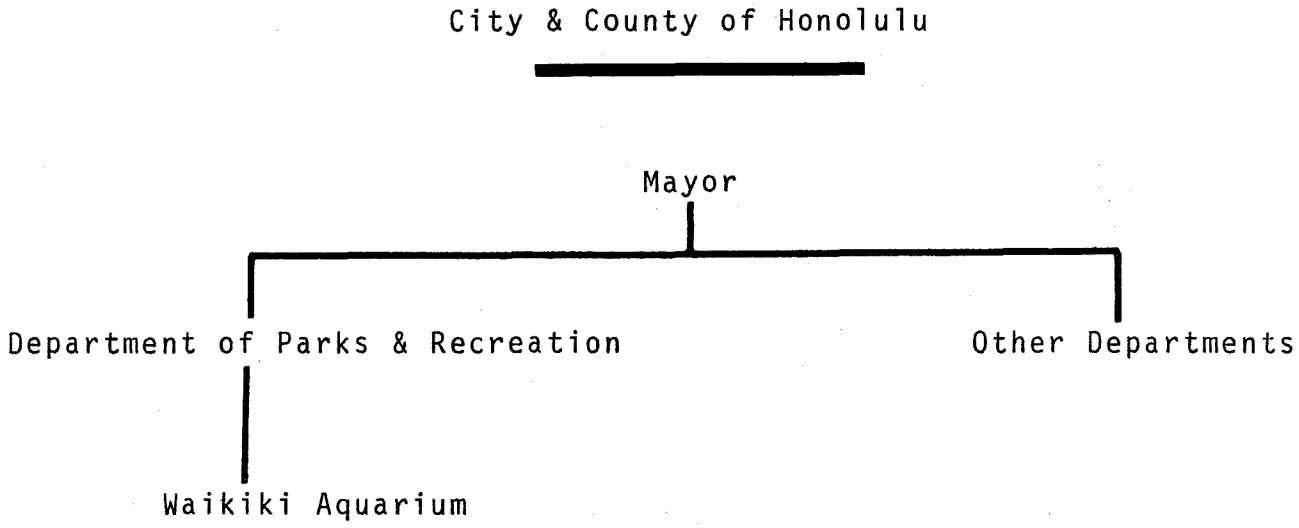


Figure 20

POSSIBLE ORGANIZATION PLAN UNDER
CITY ADMINISTRATION



In summary it may be said that there are many alternatives open for the future development of the Waikiki Aquarium. It can become a recreationally-oriented facility under the City, a science-research facility under the University, a Museum-Aquarium operation, an independently administered operation, or a combination of several of these. What the Legislature determines to be the objectives and goals of the State in this area should be the key to the selection of one of the many viable alternatives now open to the Aquarium. Given the overall policy objectives, the appropriate alternative for development should be fairly clear from the study. Again, it should be mentioned, however, that Hawaii's unique and exciting marine environment places the Waikiki Aquarium in a special light. The location of the facility itself, its access to fascinating marine fauna, and its easy accessibility to residents and visitors alike provide the raw materials from which a great Aquarium can be built. The potential for worldwide renown exists, but the proper guidance, leadership, and support are necessary for any future success.

FOOTNOTES

CHAPTER II

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2. L. G. Weeks, "The Gas, Oil, and Sulfur Potentials of the Sea," Ocean Industry, June, 1968, p. 43.

3. From a speech by John Bardach in Hawaii, Department of Planning and Economic Development, Proceedings, Kauai Aquaculture Conference, June 25, 1972 (Lihue, Kauai: 1972).

4. U.S., Commission on Marine Science, Engineering and Resources, Panel Reports, Vol. 2: Industry and Technology, Keys to Oceanic Development (Washington: U.S. Government Printing Office, 1969), p. V-5.

5. John Kinard, "Intermediaries Between the Museum and the Community," Ekistics, 35 (210) (May, 1973), 261-263.

CHAPTER III

1. Emanuel Ledecky-Janecek, "New Labeling System at John G. Shedd Aquarium," in Drum & Croaker, no. 1, pp. 21-

2. Ibid.

3. Donald W. Wilkie, "Educational Program and Policies at the Wayland Vaughan Aquarium-Museum," in Drum & Croaker, no. 9.

4. Dave Powell, "New Tidepool Display at Sea World, San Diego," in Drum & Croaker, no. 6, pp. 78-

5. Dave Powell, "Colors Beneath the Sea," in Drum & Croaker, no. 2, p. 16.

CHAPTER IV

1. Waikiki: Aquarium, Directory of the Public Aquaria of the World, 1972-73, prepared by Margaret G. Fraga, Charles Deluca and Spencer Tinker (4th ed.; Honolulu: 1972).

CHAPTER V

1. Hawaii Rev. Stat., sec. 304-31 (1967).

2. Hawaii, University, Academic Development Plan Committee, An Academic Development Plan for the University of Hawaii (Honolulu: 1964), pp. 79-80.

3. See Appendix B for the complete text of this memorandum.

4. Ibid., p. 79.

CHAPTER VI

1. Letter from Herbert Green, President of the Salt Water Aquarium Society of Hawaii to Dr. John Craven, March 11, 1973.

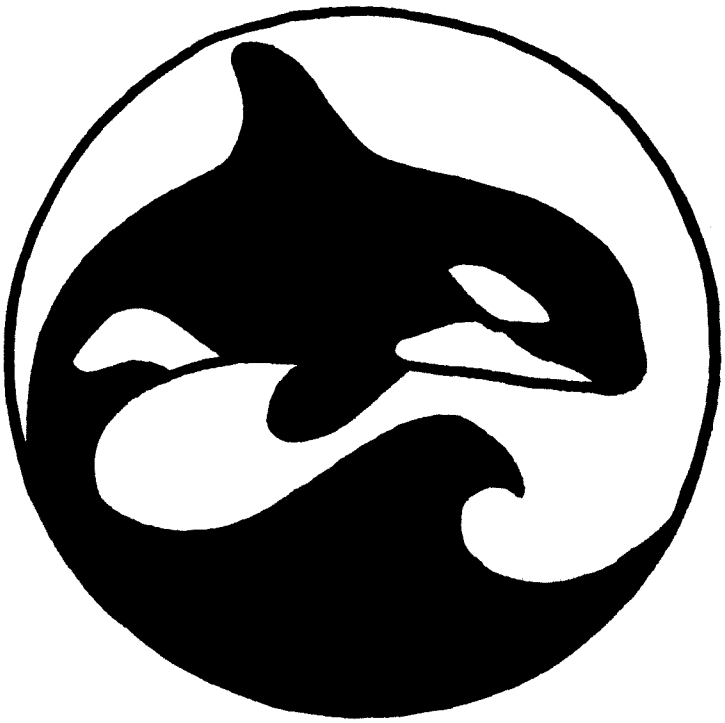
CHAPTER VIII

1. An attempt was made in estimating the actual costs of each alternative. However, after discussing the matter with several experts in the field, it was indicated that reliable cost figures would be difficult to determine without a definitive idea as to what was planned in the way of capital improvements and staffing.

2. See University of Hawaii and Bernice P. Bishop Museum, "Plans for Revitalization and Expansion of the Waikiki Aquarium;" and Andy Berger, "Memo to Joe Branham, Art Reed on "Plans for the Waikiki Aquarium," September 29, 1969.

3. University of Hawaii and Bernice P. Bishop Museum.

VANCOUVER AQUARIUM



WHALES

A PROGRAM FOR GRADE 10 SCIENCE CLASSES OR GRADE 11 AND 12 BIOLOGY CLASSES

MONDAY THROUGH THURSDAY 1:00 TO 2:30 P.M.
BY APPOINTMENT

VANCOUVER AQUARIUM

"WHALES"

1972 - 1973

The Aquarium is offering this program to grade 10 science classes

and grade 11 & 12 biology classes

MONDAY thru THURSDAY

from 1:00 - 2:30 p.m.

BY APPOINTMENT ONLY

This program will take place from November 20th through June 1st. Up to 40 students can be accommodated at each session.

THEME:

Through the centuries man has been intrigued and mystified by whales. This program, for a limited number of science classes, is specifically designed to give the students an understanding of these highly specialized marine mammals. The class will hear an illustrated lecture centering on the killer whale, but also covering the various whales of the world -- the baleen whales, sperm whales, beluga whales, narwhals and dolphins. Topics discussed will be the evolution of whales, their adaptations to the aquatic environment, the whaling industry, the biology of whales, and the part the killer whales played in Indian legends. The windows of the lecture room look directly into the killer whale pool, giving a unique situation--- whales in the classroom!

RESERVATIONS:

Teachers are requested to book directly with the tour arranger for the "whale program". For information and for booking, please telephone on any weekday afternoon, or write:

Mrs. G. DYER, 929-3033
2158 Chapman Way,
North Vancouver, B. C.

Please do not telephone the Aquarium for bookings.

Teachers are urged to book early since there are only a limited number of openings, and bookings will be on a first-come-first-serve basis. As this is an experimental program this year, it is offered to only 3 classes from each school.

Classes may participate in this program BY APPOINTMENT ONLY!

CANCELLATIONS:

Please notify the tour arranger immediately, if you must cancel your visit. If it is a "last minute" cancellation, please telephone the Education Supervisor at 685-3364.

VISIT:

Upon its arrival the class will be guided to the underwater lecture room by volunteer "docents". There the students will hear an illustrated talk dealing with the part played by the killer whale in Indian legends; the evolution of whales; adaptations of whales to the aquatic environment; the biology of whales (centering on the killer whale); the whaling industry. Following the lecture the students will observe the whales in the pool, and there will be a question period. To end the program the students will watch a short film on killer whales in the wild, accompanied by killer whale sounds.

The students should bring their science/biology note books and writing utensils. This program will be conducted along the lines of a university lecture.

The classes must arrive at the Aquarium entrance promptly at 1:00 p.m.!

TEACHERS:

All teachers are expected to participate in the program, along with their classes. Since there is generally little known about whales, this will be a learning experience for the teacher too! Through participation, the teacher can make post-visit discussions and projects more meaningful.

PREPARATION:

Careful pre-visit preparation by the teacher will make the students' visit to the Aquarium a much more meaningful educational experience.

As the program will be conducted like a university lecture, if the students have not had previous experience with note-taking, it is suggested that the teacher go over this procedure with the class before the visit.

a. The students should realize that it isn't necessary to copy-down every word - only the important points.

b. Their notes should have headings, and should concisely cover the major points of interest.

c. The writing of notes should not be the major activity--listening and thinking about the facts put forth is important!

The notes taken will be valuable in recalling salient facts for post-visit discussions and projects.

Because most students at the high school level have not had a great deal of vertebrate biology, the teacher is strongly urged to give a brief lecture on the following subjects, in class, before the visit.

a. The characteristics which set the mammals apart from all other animal groups.

b. The way in which mammals get oxygen from their environment, and the means by which the oxygen is moved through an animal's body and utilized.

c. The adaptations, which a semi-aquatic mammal (e.g. river otter, seal) has evolved for aquatic life.

d. Basically what evolution is. How is it possible for animal species to change over a period of time.

These subjects are expanded upon in the following "Teachers' Guide to the Whale Program". Through experience we have found that students who have background knowledge are more interested and gain more from their "Aquarium" experience. Therefore, we cannot stress too strongly the need for pre-visit preparation.

AFTER THE VISIT:

In order to reinforce the material the students learn at the Aquarium, it is recommended that there be a follow-up discussion back at the school. Suggestions for post-visit discussions and projects are included in the "Teachers' Guide to the Whale Program".

DOCENTS:

The Whale Program will be implemented by volunteer "docents", each of whom contributes one afternoon a week to the Aquarium's school program. These experienced volunteers are given a course in marine biology each fall by the Aquarium staff, and they receive additional training about whales prior to working with the whale program.

VANCOUVER AQUARIUM

"TEACHERS' GUIDE TO THE WHALE PROGRAM"

I. BACKGROUND INFORMATION FOR THE AQUARIUM VISIT

It cannot be stressed too strongly that pre-visit preparation is essential to this program. As the hour-and-a-half will be spent specifically on whales, it is suggested that the teacher prepare the class on a few basic concepts prior to the Aquarium visit. Suggested topics can be found in the "Pre-visit Preparation" section.

Introduction

The following pages are designed to give a brief introduction to one of nature's most interesting creatures, the whale. Although there are many technical and popular writings about whales, there is still great mystery surrounding them. Whales carry on practically their entire lives beyond the reach of man, so that most of our knowledge has been pieced together from the study of the bodies of slaughtered whales, whalers' observations, and recently, from the study of some of the smaller whales, dolphins and porpoises in captivity. The literature on whales still abounds in partial truths, misinterpretations and technicalities which confuse even the specialists.

Whales are Mammals

Mammals are warm blooded animals, that is, they differ from "cold blooded" animals such as fishes, amphibians and reptiles, in their ability to regulate their own body temperature. Therefore, in spite of wide variations in the surrounding medium, the body temperature of the typical mammal is maintained within the relatively narrow limits that are best suited to the needs of the animal. Mammals also bear their young alive, and possess mammary glands that permit the female to nourish the new-born young with milk. Mammals usually possess hair, although it is confined to the early stages of development in most whales.

Whales are Aquatic Mammals

Modification for an aquatic life by a mammal involves numerous anatomical and physiological alterations. The degree of specialization is a corollary to the amount of connection retained with the land.

Examples of semi-aquatic species are elephants, tapirs, hippos, moose, mink, river otters, muskrats, and beavers. The pinnipeds (seals, sea lions, and walruses), the sea otter, the sirens or sea cows (manatees, and dugongs), and the cetaceans (whales, dolphins, and porpoises) are the most highly specialized aquatic mammals.

Special problems which aquatic mammals had to adapt to are:

- breathing air while in the water,
- holding the breath for extended periods while diving,
- bearing air-breathing young without drowning them,
- maintaining high body temperatures in a cold and wet environment,
- moving rapidly through water with a body originally adapted to life on land,
- finding enough food to maintain a very high metabolic rate while using a sensory system developed for life on land,
- retaining enough fresh water in the body while living in an ocean with no available fresh water, or having some mechanism for getting rid of salt.

Types of Whales

Whales are known technically as cetaceans; this order includes whales, dolphins, porpoises, and the extinct Archaeocetes. The term 'whale' usually refers to the larger cetaceans, although dolphins and porpoises can also correctly be called whales.

The cetaceans are divided into three suborders: the Archaeoceti (extinct), the Odontoceti (toothed whales), and the Mysticeti (baleen whales).

1. Archaeoceti (extinct)
   - will be covered under 'Evolution of Whales'.
2. Odontoceti (toothed whales)
   - Includes sperm and beaked whales, dolphins (killer whales), porpoises, narwhals and belugas.
   - The jaws are equipped with teeth which are used for grasping and tearing prey, not for chewing.
   - Most feed mainly on fish and squid, although some members also feed on mammals and birds.
   - Possess a single blowhole.
   - The sperm whale has been made famous through the novel Moby Dick.

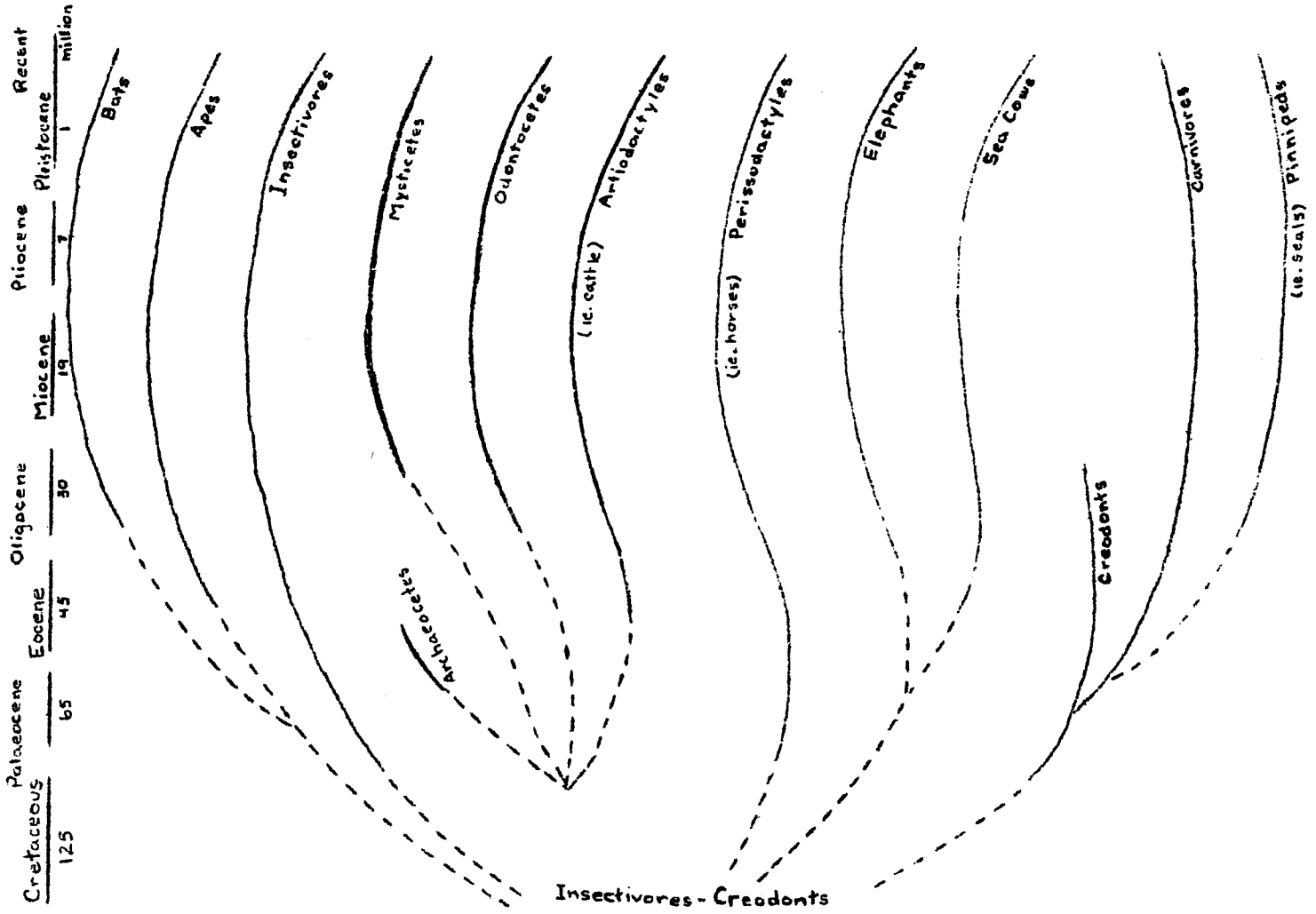
3. Mysticeti (baleen whales)

- These whales are generally larger than the toothed whales and include right whales, humpback whales, gray whales, and the rorquals (fin and blue whales).
- They possess a double blowhole.
- Also called whalebone whales, these animals are characterized by a highly specialized mechanism for gathering small animals (plankton) which float in large numbers in the upper layers of the oceans. In the place of teeth, they have an array of whalebone or baleen plates. Although these mammals have tooth buds in the upper and lower jaw in the foetal stage, these disappear and baleen plates develop in their place in the upper jaws. They grow in a series of up to 200 or 300 flat plates set crossways along the edge of the jaw and hanging from it. The plates are tough but flexible and have a fibre-like structure. On the inside of the mouth the edges of the plates are frayed out into long bristles, those of adjacent plates overlapping to form a strainer or filter which separates the food from the water.

  When a baleen whale finds a good shoal of plankton it plows through with its mouth wide open, engulfing the small animals by the thousands. The whale then shuts its mouth, and by raising its tongue, squirts the water out of its mouth through the filter bed of baleen. The bristly mat retains the plankton which the whale then swallows.
- In some of the larger baleen whales, the underside of the throat is shaped into many grooves running from the chin to about 1/3 of the way along the body. The grooves are about 3 inches deep, and it is thought that they open out to expand the mouth capacity, although this has not been proven.

Evolution of Whales

To appreciate fully the biology of whales, one must understand something of their beginnings. Their ancestors were terrestrial mammals, and although it is impossible to account for all the steps which were necessary for their re-entry into the oceans, the fossil records are numerous and permit at least a partial reconstruction of the evolutionary steps.



(Dotted lines indicate the absence of fossils) After Slijper

The study of fossils has shown that a group of small primitive mammals called Creodonts, appeared in the Cretaceous period which began 125,000,000 years ago. These animals, which probably lived on land and partly in trees, had characteristics strongly reminiscent of primitive carnivores and primitive insectivores. As yet, little is known about these small animals, but it is thought that the mammalian line can be so constructed that cetaceans can be traced back to this group of primitive Creodonts.

While it is thought that the primitive Creodont is an ancestor common to all mammals, including man, as the diagram shows, the cetaceans possess their closest ties with the Ungulates, and particularly, the even-toed Ungulates (Artiodactyls e.g. cattle, sheep and camels). Evidence supporting this relationship is found in protein comparisons which show that 11% of all cetacean and Artiodactyl proteins are identical, while only 2% of the proteins of either group agree with those of other mammals (Boyden & Gemeroy 1950).

Of the three sub-orders of whales that have ever existed, the Archaeocetes, the Mysticetes and the Odontocetes, only the Archaeocetes became extinct. According to fossil evidence, the first fully-fledged cetaceans date back to 45 million years ago, and the last Archaeocetes died out 25 million years ago. Some of the members of this group were snake shaped, while others had the torpedo shape so characteristic of modern whales.

As a group, the Archaeocetes reached the peak of their development 30 - 50 million years ago. Development of the group was climaxed in Basilosaurus, an animal with proportions usually ascribed to the mythical sea serpent, and due to its specialized vertebral column, must have moved in a serpentine manner. These were giants among primitive whales and reached as much as 70 feet in length. These animals were highly adapted to life in the sea and had already lost the hind limbs of their terrestrial ancestors.

It is generally assumed that the three great groups of cetaceans developed quite separately but that the Mysticetes (or whalebone whales) are closer to the Archaeocetes than are the Odontocetes (or toothed whales). Yet, while it seems that the whalebone whales are derived from primitive Archaeocete stock (they are not derived from the more specialized members of that group) there are clear indications that the distant forefathers of the Mysticetes were toothed animals. Yet the earliest known representatives of the Oligocene period had already lost all traces of teeth. However, even modern Mysticetes cannot be said to be entirely devoid of teeth since tooth buds are still found in the foetuses of these animals. The tooth buds in the upper jaw lie slightly sunken within a ridge from which the baleen later develops. When the beginnings of the baleen, a row of small cornified transverse ridges, first appear in the foetus the rudimentary teeth of both the upper and lower jaw disappear. This evidence suggests that the whalebone whales are descended from a line of ancestors which possessed teeth in both jaws.

When the first whalebone whales appeared in the oceans is unknown, but Mysticete history begins with certainty 30 - 40 million years ago with the Cetotheridae, primitive baleen whales of 9 to 33 feet in length. Because of certain characteristics of the skull, Cetotheres are considered to be the ancestors of modern Mysticetes.

While Mysticetes abandoned the use of teeth for straining devices of whalebone, the majority of whales retained their teeth and now form the sub-order Odontoceti (toothed whales), the largest group of whales existing today.

The oldest known representatives of Odontocetes appeared in the upper Eocene some 40 million years ago, and existed as contemporaries of the Archaeocete Basilosaurus.

The most marked feature of specialization in the Odontocetes is the extreme telescoping of the skull roof. The nostrils have moved far back over the top of the skull, forming a single vertically placed blowhole. No trace of this typical telescoping is seen in Archaeocetes, and although the Odontocetes presumably derive from a stock related to the Archaeocetes, the two groups must have diverged at an early stage.

The modern whale type must have developed rapidly. The skulls of contemporaries of Basilosaurus show an early stage in the telescoping process, and these primitive forms appear to have been ancestral to the Squalodonts. The Squalodonts, so called because of jagged teeth strongly resembling those of sharks, became the characteristic world-wide cetaceans of the early Miocene. They probably greatly resembled modern porpoises in habits and appearance, but were not destined to retain their importance, for even by middle Miocene times they had been largely replaced by the dolphin-like types which developed rapidly out of toothed whale stock and which were essentially modern in build. 25 - 30 million years ago both the sperm whale and the killer whale swam in the seas essentially as they are today.

Cetacean Characteristics and Adaptations to Aquatic Life

Not only have whales become completely adapted to aquatic life, but they have eliminated nearly all the design features which were necessary for life on land.

The retention of air breathing remains but with an improvement in the conservation of oxygen necessary to make long dives possible. Diving mammals, to a degree not possessed by their terrestrial relatives, are able to shut down those bodily activities which contribute little to the diving mission. These activities can go on later when more oxygen is available. It is also normal to incur an oxygen debt by borrowing from stockpiles present in the tissue fluids and muscles. After a long dive a whale will idle at the surface in order to free the body of the excess carbon dioxide and to pay back the oxygen debt. The greater the debt, the greater the number of breaths which must be taken.

When a whale surfaces to breathe, the act of exhaling is called "blowing". Whenever a whale has been submerged for a dive, the air in the lungs becomes saturated with moisture from the blood and the sudden expansion of the expelled air produces sufficient cooling to condense the moisture. This condensed moisture, expelled as a conspicuous cloud, is the reason why it was thought that whales spouted water. A frightened whale can hidethe telltale spout and elude detection by exhaling just before surfacing, and expose only the nostrils and not the buoyant head.

Inhalation is accomplished quickly, and the breathing act is generally both visible and audible. The nostrils form a single external opening in Odontocetes and a double opening in Mystecetes -- this opening is called the blowhole. It has migrated to the top of the head to facilitate breathing when the whale surfaces only slightly. The natural buoyancy of the animal exposes enough of the head to keep the blowhole clear of the waves. Strong muscles around the blowhole and the pressure of the water keep the nostril closed so that, regardless of depth, there can be no leakage.

The nostrils communicate directly with the lungs rather than share a portion of the throat, as is common in other air-breathing vertebrates. This allows the mouth and throat to be full of water with no danger of flooding the lungs , and it also makes it unnecessary to empty the mouth and throat prior to breathing. In addition, it is unlikely that a Mysticete could prevent flooding through the baleen, because there is no upper lip over this device.

Some ways in which whales have resolved the problem of diving are:

- They fill their lungs to capacity, the air renewal at each breath being 80 - 90 percent in the large whales, as compared with 10 - 20 percent in land mammals. The cetaceans are believed to dive with their lungs full.
- There is a high concentration of myoglobin in the muscles. Also, there is a high proportion of blood and amount of oxygen carried by it.
- The basal metabolic rate of whales is only one-fifteenth that of man in calories per kilogram of body weight, and the blood will hold enough oxygen to maintain this for about 65 minutes.
- The respiratory center is comparatively insensitive to the increase of carbon dioxide in the blood; it may depend rather on oxygen lack as a stimulus to breathing.
- As soon as the animal begins a dive, the heart beat slows down to 50 percent of normal in the bottlenose dolphin, and much less in some others.
- Blood vessels to non-essential areas such as the digestive tract, and small vessels on the surface become constricted; only vital organs such as the brain and spinal cord receive blood when the animal is submerged.
- Lack of damage caused by nitrogen bubbles may lie mostly in the simple fact that the marine mammal, unlike the diving man, is not breathing underwater, and therefore does not accumulate a large amount of nitrogen in its lungs to pass into the blood. Also the lungs are compressed, so that the walls are thickened and less apt to absorb air, and air driven into the thick-walled trachea and its branches is not readily absorbed. Even so, an animal returning from great depths may, under normal conditions, do so slowly.

The most essential features needed for successful invasion of the marine habitat were those necessary for efficient propulsion. The solution required a streamlined form with a tail for propulsion, with flippers and a dorsal fin for maneuvering and for balancing. As a consequence, all whales look basically alike, differing principally in colour, size and degree of streamlining. In the streamlined body to present a minimum

resistance to the water, there can be no discontinuities to accomodate the head, neck, trunk, and tail -- instead these features must grade imperceptibly one into the other. Projecting parts are kept to a minimum: nipples and sex organs are withdrawn into slits inside the body; there is no external ear or pinna, and the ear opening is reduced to a tiny hole or completely lacking. (Opposing this streamlining are a host of barnacles and other parasites which cover many of the larger whales.) The only exception is the end of the tail which is expanded into fleshy horizontal lobes, called flukes, which propel the animal when moved in an up-and-down motion. The up-and-down movement is of advantage to an animal which does frequent rapid diving and surfacing. There is no skeletal support in the tail flukes. Whales have long banks of muscles on either side of the backbone which connect to the tail flukes by means of tendons, making it unnecessary to disturb the streamlined form by bending the hind part of the trunk. The flexibility of the body, and possibly the way in which the epidermis is attached to the underlying blubber, helps to change the water flow along the body to cut down resistance. The power in the tail is capable of driving a 100-ton body through the water at 20 knots.

The hind limbs which were useful on land have been eliminated and all that persists are vestigial bones or cartilages which are buried deep below the body surface. Embryonic whales (1 inch) show tiny flaps for both fore and hind limbs possessed by remote ancestors. The forelimbs have undergone reduction and have been modified into flippers which assist in manoeuvering the whale. These flippers contain the same bones as the human arm and hand, and most have the same five fingers. They differ only in having many more bones in the two central digits, and in the shortening of the arm bones.

Whales are almost completely hairless except for a few bristles found on the head in some adult Mysticetes. Toothed whales have these hairs only in the embryonic stage and narwhals and belugas have none at any time. These represent not hair in the ordinary sense, but tactile vibrissae or whiskers. Certainly the elimination of hair has improved streamlining by reducing frictional drag.

Hair on whales would not provide an insulating effect as in terrestrial mammals as this depends upon air being trapped and warmed in a layer over the body. Whales combat the cold of ocean waters by insulating their bodies with a thick layer of blubber or fat. As heat is produced throughout the bulk of the animal and lost only through the surface, it is easier for the larger animals to keep warm. The fat layer may also serve the purpose of tiding the animal over periods when food is not available -- perhaps during migration -- but this is not known for certain.

Whales mature sexually between their third and seventh years, with the Odontocetes attaining sexual maturity later than the Mystecetes.

Although growth in most mammals stops at sexual maturity, this is not true of the whales, which continue to grow for years. Females generally produce an offspring every other year as the gestation period is approximately one year. At birth the calf is completely formed and active, and is nursed for about 9 months. Muscles in the breasts of the mother force the milk into the young whale's mouth in relatively large amounts.

The milk of cetaceans is low or lacking in sugar, is low in water (conserves water - only 40 - 50% as compared to 80 - 90% in most domestic animals), twice as high in protien as is milk of most terrestrial mammals, and very high in fat (40%). For cetaceans, which nurse under water, this rich concentrated milk cuts down necessary feeding time, puts fat on the young quickly to serve as insulation, and gives fuel necessary for metabolism.

Cetaceans have no possible access to fresh water, except for a few species who live in it all the time, or those which occassionally run up rivers. Water loss is minimized by the fact that whales live in a medium with a cool and constant temperature and that they inhale air saturated with water vapour. They swallow a minimum of sea water when feeding, and those which feed on fish and mammals have less of a problem than those which feed on invertebrates. Evidence from the structure of the kidneys shows that a large amount of urine is excreted, thereby getting rid of large amounts of salt, and that those feeding on invertebrates have more highly lobulated kidneys. Need for extra fresh water may come from high metabolism wherein water is liberated as a result of the oxidation of food, especially fats.

The intelligence of whales, especially the dolphins, is a prominent subject of conversation in our present age. Whalers have remarked that it is difficult to approach whales which have previously escaped, and that gray whales have been observed avoiding coastal areas where whaling has been carried on.. Animal trainers have found toothed whales to be easily trained, and much research has been done on these animals in captivity. However, just how intelligent whales are, in the "human" sense, is still under speculation.

Nevertheless, the whales seem to have well developed sense organs. The eyes are important and effective under water, and the killer whales are believed to search the sea's surface and the edges of ice floes for seals and birds. Whales appear to have acute hearing, and the toothed whales which travel in pods (groups) are capable of a great variety of vocalizations. Whales have a highly developed "echo location" system. They emit high frequency sounds which are used like man's sonar for finding obstacles and food. The sense of smell is not developed in whales, but some species, such as the killer whale, are thought to be able to taste.

The physical properties of water freed the animals from the need for structural and muscular development to support themselves against the pull of gravity. Free of this structural problem, whales were able to evolve into the largest mammals the world has ever known.

PRE-VISIT PREPARATION

As has previously been stated, it is strongly recommended that the teacher give pre-visit preparation to the students. A brief lecture on the following subjects would be of great value to your class.

1. The characteristics which set the mammals apart from all other animal groups.

   This is covered on page one of the "Teacher Preparation to the Whale Program".

2. The way in which mammals get oxygen from their environment, and the means by which the oxygen is moved through an animal's body and utilized.

   Important points to be covered:
   - how the oxygen is picked up through the lungs,
   - how the blood carries the oxygen,
   - how the oxygen is utilized by the body,
   - how the venous and arterial systems work,
   - how the carbon dioxide level affects respiration.

3. The adaptations which a semi-aquatic mammal (e.g. river otter, seal) has evolved for aquatic life.

   Important points to be covered:
   - how the breathing apparatus has changed,
   - how the body temperature is maintained,
   - how the young avoids drowning at birth,
   - how the animal has changed for movement in the water,
   - how the animal retains fresh water.

4. Basically what evolution is. How is it possible for an animal species to change over a period of time.

   Important points to be covered:
   - what a fossil is and how it is formed,
   - the importance of studying fossils,
   - the Darwinian and Lamarkian theories,
   - the nature of adaptation,
   - compare the bones of the human body with the bones of a marine mammal --- particularly the limb bones.

AFTER THE VISIT PROJECTS AND DISCUSSIONS

Post visit discussions and projects are recommended to reinforce the material learned during the Aquarium visit. The list following contains a few suggestions:

1. Compare the whale to a scuba diver. Why doesn't the whale get the "bends"?

2. Problems man is trying to solve which are perfected in the whale --- sonar, diving, streamlining of airplanes and submarines.

3. What are mans' limitations to living in the sea? What are some of the ways in which he has tried to conquer the sea? Submarines, underwater habitats, scuba equipment.

4. Has British Columbia had a whaling industry? What are examples of good and bad results of whaling?

5. What is a fossil? Why is the study of fossils so interesting to students of biology?

6. How have whales been depicted through history?

7. Which species of whale have become extinct? Which are on the endangered species list? What legislation has been passed or should be passed to preserve these magnificent animals?

BOOKS ON WHALES

The following books were used as reference material for the "Teacher Preparation". As the "Whales" program will continue to be a part of the Aquarium education program, school libraries may be interested in acquiring some of the following books for the use of the students and teachers.

1. Guide to the Whales, Porpoises and Dolphins of the North Eastern Pacific and Arctic Waters of Canada and Alaska by Pike $.35

   (Fisheries Research Board of Canada, Biological Station, Nanaimo)

   A small paperback fieldguide which briefly tells of each species found off the coast of British Columbia.

2. Toothed Whales in Eastern North Pacific and Arctic Waters and Baleen Whales in Eastern North Pacific and Arctic Waters $1.75

   (Pacific Search Books, 715 Harrison Street, Seattle, Washington)

   Both of these paperback publications contain a series of informative essays on whales. 31 and 44 pages.

3. Whale Primer by Walker $1.25

   (Cabrillo Historical Association, Box 6175, San Diego, California)

   A small paperback edition covering the various characteristics of whales, centering on the grey whale. 55 pages.

4. Marine Mammals of California $.50

   (Department of Fish and Game, 1416 9th Street, Sacramento, California)

   A paperback with a good introduction to marine mammals, containing a brief resume of the life and habits of each species. 87 pages.

5. The Blue Whale by Small

   (Columbia University Press)

   A very readable book on the life history of the blue whale.

6. The Whale published by Simon and Schuster $24.00

   A beautifully illustrated book dealing with most aspects of whales and whaling.

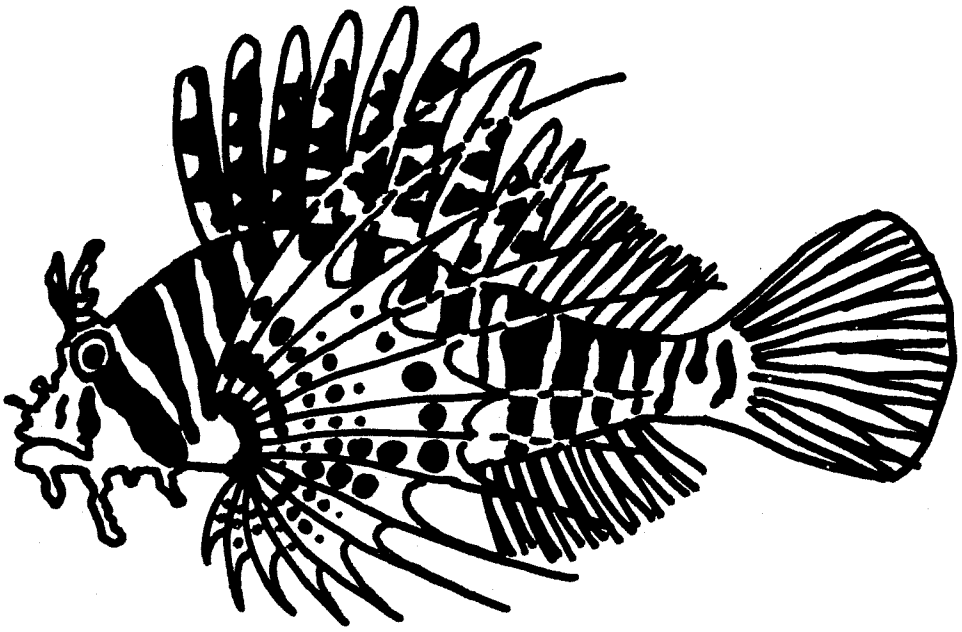
7. Whales by Slijper

   (out of print at present)

   The most complete book on the biology of whales.

Some of these books are available through the Aquarium.

SECRETS OF SURVIVAL



A PROGRAM FOR GRADE 6 CLASSES ... 1:00 TO 2:30 P.M. MONDAY THROUGH THURSDAY · BY APPOINTMENT.

VANCOUVER AQUARIUM

VANCOUVER AQUARIUM

"SECRETS OF SURVIVAL"

Recommended for grade 6 classes

MONDAY through THURSDAY

from 1:00 to 2:30 p.m.

BY APPOINTMENT ONLY

This program will take place from February 12 through April 19. Up to forty students can be accommodated in one visit, and there is no charge to students.

THEME:

Every species of fish living in the oceans, lakes and streams has predators---other fish, amphibians, reptiles, birds, mammals. "Secrets of Survival" deals with the ways in which various fishes avoid being eaten. Some are spiny and, thus, difficult to swallow; others have poison glands; a few give off an electric shock; many are armoured; a number are shaped and coloured so that they blend in with their surroundings and thus avoid detection. The students will observe living fishes in the Aquarium tanks, which illustrate several mechanisms of protecting, and they will also view slides and touch special demonstrations.

VISIT:

Upon their arrival the students will be met by volunteer "docents" and will be taken to view the killer whale show. Then after the show the group will assemble in the Rufe Gibbs Hall. Here they will hear a short introducory talk, with slides, after which the class will be divided into smaller groups. The smaller groups will view live specimens in tanks and see and touch special objects (such as skin, teeth, dried specimens) which illustrate some interesting defense mechanisms. Finally the group will again assemble in the Rufe Gibbs Hall to view slides of strange fishes that protect themselves in exceedingly bizarre ways.

TEACHERS:

All teachers are expected to remain in the Aquarium with their classes. Since most people are not familiar with the ways in which aquatic animals protect themselves, this will be a learning experience for the teacher too! Through participation, the teacher can make post-visit discussions and projects more meaningful.

PREPARATION:

Careful pre-visit preparation by the teacher is necessary in order that the class' visit to the Aquarium be a meaningful one. For information concerning student preparation, please refer to the pages entitled "Student Preparation for Aquarium Visit" and "Pre-Visit Activities for Students".

AFTER THE VISIT:

At the end of the class visit to the Aquarium, the teacher will be given copies of a drawing which has fish incorporated into the design. It is suggested that the teacher pass them out to the class back at the school and have the students figure out how many fish are in the picture. Also there are other possible activities described in the pages entitled "Post-Visit Activities for Students".

DOCENTS:

Docents are adult volunteers who are carefully trained by Aquarium staff and who contribute one morning or afternoon each week to the Aquarium's school program.

RESERVATIONS:

Schools should book directly with the "Secrets of Survival" tour arranger. For information on scheduling and booking, please telephone:

Mrs. B. O. Gjerdalen 987-4892
1750 Ridgeway
North Vancouver, B. C.

Please call on weekdays, between 9:00 and 11:30 a.m. or 6:00 and 10:00 p.m. It is not necessary to telephone the Aquarium.

CANCELLATIONS:

If you cancel your trip, please notify the tour arranger (Mrs. Gjerdalen). If it is a last-minute cancellation, notify the Education Department at 685-3364.

VANCOUVER AQUARIUM

"TEACHERS' GUIDE TO THE SECRETS-OF-

SURVIVAL PROGRAM"

I. Student Preparation for Aquarium Visit

- A. What is a Fish?
- B. Basic Fish Body
- C. Optical Illusions
- D. Animal Camouflage

II. Pre-visit Activities for Students

III. Post-visit Activities for Students

I. STUDENT PREPARATION FOR AQUARIUM VISIT

Teachers whose classes are participating in the "Secrets-of-Survival" program are strongly urged to prepare their students before the Aquarium visit. They should not only be aware of what a fish is and how it differs from other animals, but they should also know some of the basic principles of camcuflage and how animals employ these for their protection.

All of the information the teacher will need is in this set of sheets.

A. WHAT IS A FISH?

The animal kingdom is divided into two main categories: Ninety-five per cent of the creatures on earth are what we call "invertebrates". These are animals, such as worms, snails, starfishes, insects, crabs, sea anemones, etc., and they all have in common the fact that they have no backbone or "vertebral column". They come in various shapes and sizes and live in the sea, on land, and in the air.

The other five per cent of the animals are termed "vertebrates", and these include amphibians, reptiles, birds, mammals, and the aquatic group we call "fish".

All of the vertebrates are quite closely related to each other biologically, and the backbone they possess consists of a series of bones lined up to form a supporting rod. The latter is part of the animal's skeleton, and the children can feel their own "backbone" and even each of the individual bones in it. This backbone is called a "vertebral column", and each bone in it is a "vertebra" (plural = vertebrae).

"Fish" are animals that possess a backbone, but they differ from amphibians, reptiles, birds, and mammals in that they

1. live in water
2. swim with fins
and 3. breathe with gills.

They possess no hair, as do mammals, and no feathers, as do birds. Instead their skin is usually covered with scales, which are structured in a way peculiar to fish. However, in no way do fish scales resemble the scales seen in reptiles or on the legs of birds.

Like the amphibians, reptiles, birds, and mammals, fish have internal organs such as the stomach, liver, heart, kidneys, arteries, veins, muscles, brain, etc., but unlike the other four groups, they are adapted to spend their entire lives in water.

Instead of legs fishes have fins, and they use these for swimming and maneuvering. In most forms, the fins are very thin and filamentous, like those of goldfish, but they are in fact made somewhat rigid by supporting "rays" in them. (These are the lines seen in fins.)

Fishes generally breathe by means of gills, which are situated just behind the head on each side of the body. The gills are comprised of a series of filaments which are filled with blood vessels, and these filaments are located in passages which lead from the fish's pharynx to the outside. Thus, water enters the fish's mouth, goes to the pharynx, flows over the gill filaments, and exits out the openings into the water outside. The gill filaments are thin-walled and oxygen and carbon dioxide are exchanged as the blood flows past the filaments.

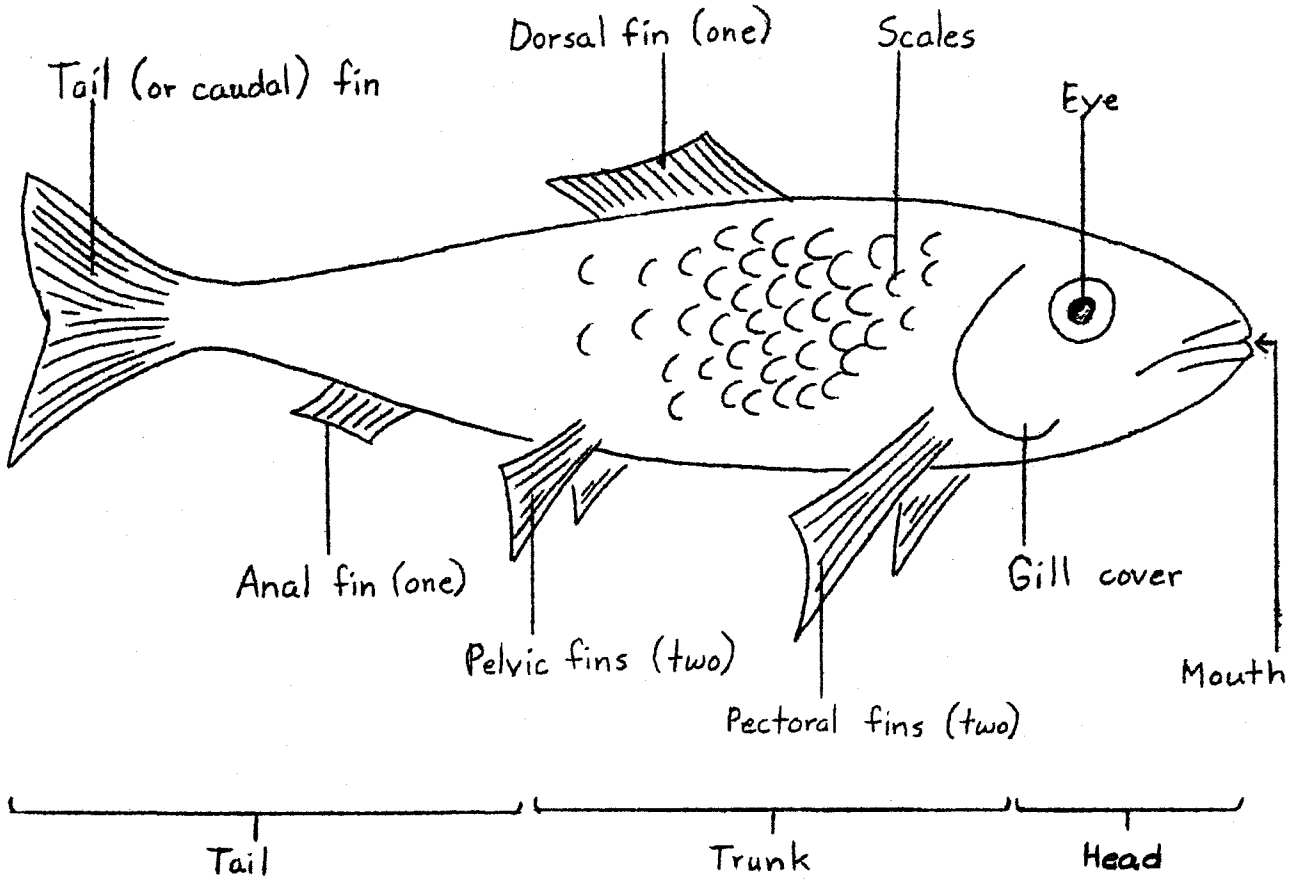
Amphibians, reptiles, birds and mammals all possess lungs with which they breathe air, and this is the way we ourselves breathe. In this case, the oxygen we need is picked up as air enters our lungs, and as we let our breath out, carbon dioxide is expelled. However, as you've probably heard, there are several kinds of fish that also have lungs (the lungfishes), and large numbers of other kinds possess a swim bladder.

Many of the ancient fishes evidently possessed true, functioning lungs, with which they breathed air during periods of drought or whenever they were in waters low in oxygen. In addition to these lungs, however, they also possessed gills. The modern-day descendents of the ancient forms, in fact, still possess the old original lung, but it now no longer functions in breathing and instead is now used as a "swim bladder". The swim bladder functions to make a fish heavy or light in water: When it is full of air, the fish rises; when gas is removed, the fish sinks. The lungfishes still possess the ancient functional lung, although many modern fish have neither lung nor swim bladder, and have lost all traces of the ancestral structure. In any case, our lungs are related to fish lungs and fish swim bladders.

B. BASIC FISH BODY

The following is a diagram of a typical fish which is fairly primitive and adapted to living in open waters. The strangely shaped

fishes that the students will observe and study were originally evolved from this basic body type. As the original fishes assumed different modes of life, their bodies changed. Some became very elongated, others more flattened, some with knobby protuberances all over the body, and many with other shapes and sizes. But no matter how bizarre a modern fish looks, it originally evolved from the simple form shown in the diagram.



Points to emphasize:

1. The body is spindle-shaped, very streamlined, and compressed from side to side.

2. The gills are covered with a flat plate, called a "gill cover" or "operculum".

3. Along the midline of the back is a single "dorsal fin". (The fate of this fin will be seen during the visit, for it assumes some interesting functions.)

4. On the ventral side are two sets of paired fins: the pectoral fins (anterior) and the pelvic fins (posterior). These fins are biologically related to our own arms and legs.

5. The anal fin is a single fin in the ventral midline.

6. The tail fin fans out from the end of the fish.

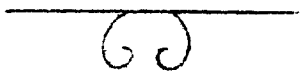
The students should know this diagram well before they arrive at the Aquarium. It represents a type of fish related to trout, salmon, or herring.

C. OPTICAL ILLUSIONS

During the Aquarium visit the students will be observing a few methods employed by fishes to camouflage themselves from their enemies. In order that they better understand what they see, it is recommended that the teacher explain to the class how optical illusions work. This need only be a short summary, but it should be clear and concise.

When we experience an "optical illusion", we feel as if our eyes have been tricked.. We know what something should be but we don't see it that way. The lake in the middle of a hot, dry desert is only a mirage. The tiny "twig" on a stump is actually a preying mantis. You see only grass and leaves on the ground; yet right in front of you is a lizard or a bird.

When we see something, evidently our eyes organize our impressions for us, and it is clear that certain forms attract our eyes more than other forms do. For example, look at the following diagram:

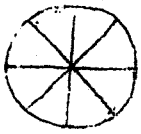


To our senses, this is composed of a straight line and a curved one, which touch each other.

However, the diagram could just as easily be broken apart this way:

But we must force our eyes to see these alternative parts, for our eyes are normally drawn along the straight line and the curved line.

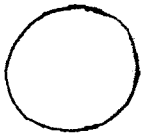
Here is another pattern:

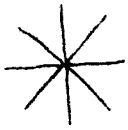


Our eyes do not easily see that it might be composed of these two componants:

and

Instead we immediately think of it as having <u>these</u> parts:





Animals take advantage of the eye's tendency to see only certain shapes or patterns and not others. By "camouflaging" themselves, they appear to blend in with their surroundings and they avoid being seen by enemies.

D. ANIMAL CAMOUFLAGE

Many animals (including several kinds of fish) are structured and coloured in such a way that they look like something other than what they are. The preying mantis looks like a stick. Certain moths have large "eyes" painted on their wings so that they can suddenly spread the wings and frighten a predator. Moreover, we've all heard of the fawn that lies quietly and blends-in with the grass and leaves on which it rests. A lot of animals are, thus, "camouflaged" so that they can fool a would-be predator and avoid being eaten.

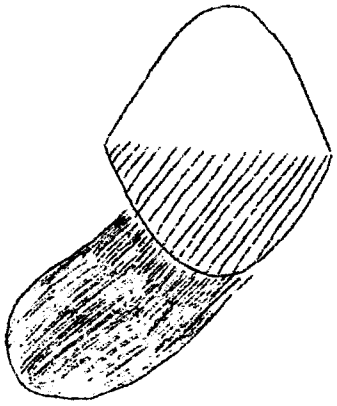
There are several ways in which colour patterns and body shapes are employed to protect different creatures, and all of these depend on the animal behaving in a certain way so that the camouflage works. Although most studies have dealt with insects and other land animals, it happens that fish use many of the same methods. It is recommended that the instructor review these methods with the class before coming to the Aquarium.

1. <u>Concealment of contours:</u> Any predator looking for a tasty morsel in the form of a fish will tend to look for an animal that is "fish-shaped". Consequently, many fishes (or other animals) are camouflaged in such a way that the outline of the body is not obvious. Thus, the fish-like contours are "erased". There are three versions of this method that the students will observe.

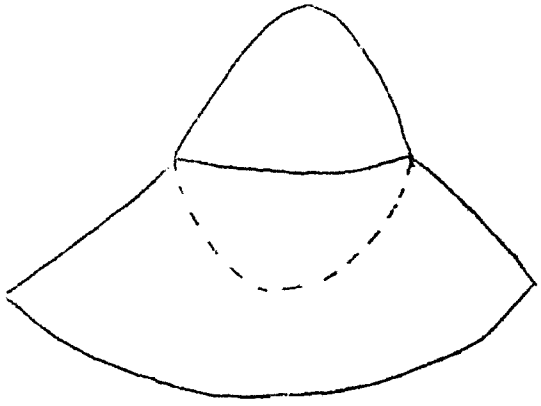
a) Disruptive colouration: If you take a light grey toy block, paint large dark spots on it and then place it in a fish pond, you will tend to see only the dark spots as you look into the water. The spots will be obvious and unless you look closely and critically, you won't see the outline of the block. Some fish are coloured in much the same way, with dark or bright spots or lines, against a light or dull background.

b) Countershading: Many fish in the Aquarium are white on the underside and dark on top. These are often creatures that swim in open water. When an enemy sits on the bottom of the sea and looks up at such a fish, the white underside blends in with the light surface of the water where sunlight enters. If the predator is above the said fish, the latter's dark topside blends in with the bottom. This phenomenon is termed "countershading".

c) Hiding shadows: This is a method employed by bottom-dwelling fish, as well as many lizards and moths. A dead giveaway when an animal is sitting on the bottom or ground is the fact that the creature casts a shadow and the enemy sees the outline of the animal against this shadow. Thus, many creatures are able to become quite flat and, moreover, they have lateral extensions of the body that tend to eliminate shadows. Here is how it works:



This object casts a shadow



If you put flaps on it, it no longer casts a shadow.

2. Camouflage through masking: This mechanism is not used by any fish in the Aquarium, but it is used by a number of other creatures and is really interesting anyhow. "Masking" occurs when an animal cements bits of plants and/or other animals onto its back. Thus, it is hidden from direct view of enemies. An example is the "masking crab" (or "decorator crab"), which glues small barnacles,

seaweeds, hydroids, etc. on its back. There is also a snail, called a "carrier snail", which cements a lot of tiny shells to its own shell, and a hermit crab, with its shell covered with sponges, and another with sea anemones on its shell.

3. Camouflage through resemblance: This method of camouflage is employed by creatures which look like something else. For example, the praying mantis looks like a stick and some other insects look like leaves. In either case, the enemy mistakes the animal for that object, and doesn't bother it. There are several interesting fishes in this category.

   In addition, there are some creatures (including a few fish) that are able to divert an enemy's attention to a relatively unimportant part of the body, so that if an enemy does harm it, it is not mortally wounded. One such example is the lizard with its long tail that can be cast off. Should an enemy catch the lizard, the latter can shed its tail, which then proceeds to "wiggle". Meanwhile the predator's attention turns to the moving tail, while the lizard escapes.

   In some of the fish, there is a large black spot near the tail, which looks like an eye. Many predators tend to attack the region where the eyes are (i.e. - the head), and thus a predator, seeing such a fish, attacks the tail end instead.

4. Concealing colours: Many creatures have colours that match the colours of their surroundings. Thus, even though the shape of the animal is quite distinctive, the colouration is so like the background that it is almost impossible to see it. The well-known chameleon falls into this category, and, in this case, the lizard can change its colours to match its surroundings. Several fishes can change their colours also.

II. PRE-VISIT ACTIVITIES FOR STUDENTS

It is recommended that students do some work on their own, in addition to any preparatory discussion that the teacher might carry on with the class. Any or all of the following activities would be appropriate.

1. Before the teacher's preparatory discussion, have the students look up the following words and write the meaning of each. Have them put the definitions in their own words; so that the meanings are clear to them.

a) camouflage	k) illusion
b) vertebrate	l) electric eel
c) invertebrate	m) gar
d) fish	n) venom
e) to conceal	o) pectoral
f) gills	p) pelvic
g) fins	q) armour
h) to breathe	r) predator
i) water	s) colouration
j) to survive	t) behaviour

2. There are many animals that have interesting ways of protecting themselves from enemies. Have the students look up the following animals in nature books or encyclopedias and write down how each avoids being eaten or harmed by other creatures.

porcupine	snapping turtle
chameleon	horned lizard (also erroneously called "horned toad")
rattlesnake	
armadillo	octopus
pond turtle	lobster
skunk	owl
snail	lion
opossum	boa constrictor
wasp	black widow spider
	praying mantis

The World Book Encyclopedia is a good source of much of this information. The students can look under "Animal".

The teacher may wish to have a class discussion about these animals, letting the students tell what they learned and what creatures they thought were most interesting. (At the Aquarium they will see fishes that have similar ways of avoiding enemies.)

III. POST-VISIT ACTIVITIES FOR STUDENTS

1. Have the students take the illustration given the class at the end of the visit and try to figure out how many fish are in the picture. The fish are hidden in a way similar to that used by many real fish when hiding from enemies. That is, the lines of their bodies blend in with the lines of their surroundings. (For the teacher's information, there are 32 fish in the picture.)

2. There are many military applications of the principles of camouflage. Have each student write an essay on military camouflage, comparing what men do to hide themselves with what fish do. Men and fish often employ similar techniques, and the students can select a few fishes and tell what human applications are similar. Example: A certain World War I tramp steamer (ship) was painted with large splotchy areas against a light background to break-up the ships outline. This was so enemies couldn't determine the size and direction-of-travel from a distance. The same mechanism is used by clownfishes.

   A lot of information on military camouflage can be found in the Encyclopaedia Britannica, under "Camouflage". Although there is a small amount of information in the World Book Encyclopedia, under "Camouflage", it may be worth a trip to the public library just to look at the Encyclopaedia Britannica.

3. Have the class as a whole do a project on the physical ways fish protect themselves and some of the equivalent methods used by man to help his own life. This can include research in books, drawings, murals, collecting magazine or newspaper clippings, or just a group discussion. Here are a few examples:

   a) The medieval armour (coat-of-arms) was used to protect a soldier in much the same way the heavy scales of the alligator gar, cowfish, and trunkfish protect these animals.

   b) The doctor's hypodermic needle punctures the skin and injects the medicine. In a similar way, the venomous spines of the stonefish inject the toxin into a diver's foot.

   c) The "poison-arrows" used by certain primitive tribes are dipped in poison and used to kill or stun. The stingray (a bottom-dwelling fish related to sharks) has a poisonous spine on the tail. Both have the toxin on the surface of the point.

   d) The electric eel uses its electricity to stun prey, to shock predators, and to detect food. Water is a good conductor of current, and the animal can produce up to 600 volts (but the amperage is low). We use electric heart stimulators or shock therapy. How else do we use shocks?

e) The spine of the surgeonfish works like a sharp knife.

4. Have the class solve a problem in a discussion period, with everyone presenting ideas and the teacher writing the suggestions on the blackboard. Here is the problem:

Suppose your great-grandmother was being held captive by pirates right in the middle of Stanley Park. She has been bound to her rocking chair and is being heavily guarded by three men on foot, five on horses, and a German shepherd. The pirates on foot are guarding her by standing close by her, while the horsemen are prowling through the park.

Your job is to free her singlehandedly. This will be difficult, for you will have to work in daylight as well as by night, and you must cover a lot of territory, consisting of both forested and grassy areas. You must somehow sneak past all of the pirates, untie your great-grandmother, and carry her away.

Fortunately you have learned about camouflage at the Aquarium. Try to figure out how you can sneak past all of the guards and rescue the lady without getting caught.

1. What would you take with you?
2. How would you camouflage yourself as you moved through forested areas? Grassy areas?
3. How would you move in both areas?
4. How would you react if you saw a pirate approaching and you knew that, if you tried to run, you would be captured?
5. How would you dress and move at night, as compared to doing these things in daylight? What would you bring, etc.?

APPENDIX B

MEMORANDUMS REQUESTING THE USE OF AQUARIUM SPACE

March 2, 1972

TO: Dr. John P. Craven, Dean, Marine Programs, University of Hawaii

FROM: Spencer Tinker, Director, Waikiki Aquarium, 2777 Kalakaua Avenue, Honolulu, Hawaii 96815 Phone 9239741

SUBJECT: Request For Designation of Aquarium "Laboratory" For Aquarium Use.

This letter is a request that your office issue or arrange to have issued a letter authorizing the Waikiki Aquarium to occupy and to use the "laboratory" section of the Aquarium building, which is currently occupied by the Pacific Biomedical Research Center, at such time as they move to their new building at Kewalo Basin in April, 1972.

This request is based upon the following reasoning:

1. The "laboratory" space was built with money authorized "For Construction of Aquarium and Equipment . . . $400,000" by Act 401, Session Laws, 1949 Territorial Legislature, and its use for other than Aquarium purposes is regarded as illegal.

2. Letters from the Office of the Attorney General support the above position.

3. The Academic Development Plan, January, 1964, p.79, approved in principle by the Regents, provided for the return of this "laboratory" for Aquarium use upon the completion of the Kewalo Laboratory. This time has now arrived.

4. The diversion of a portion of the Aquarium building fund to build a "laboratory" for other than Aquarium use and contrary to the advice of the Office of the Attorney General represents an administrative act by University officials of very, very questionable standards and an act which will not stand the scrutiny of any investigative authority including the Regents, the Legislative Auditor, or a court.

   It is very important that the misuse of the Aquarium building be corrected, that the image of the University as it relates to this problem be cleansed, and that the action to set this problem aright be taken within the University administration.

   The Aquarium has waited patiently for this administrative indescretion to be corrected. It can now be corrected without any inconvenience to any University program.

The Waikiki Aquarium has great need for additional space for the following:

1. It needs space to enlarge and to better present its exhibits. It proposes to move the little auditorium to the "laboratory" area and to develop additional exhibits within the present auditorium room. The new location for the auditorium would allow evening meetings without the necessity of opening the Aquarium building and would be easier to supervise.

Dr. Craven: March 2, 1972

2. The walk-in freezer at the Aquarium is rotted and decayed on its bottom, is leaking water over the floor, and should be rebuilt in a nearby room in a size large enough to hold the frozen fish food which we are currently storing in rented freezer space in Honolulu. Additional space is required for this project.

3. The Aquarium graphics should be collected and housed in a single room for more efficient use.

4. The hobby clubs of the Aquarium, particularly the Hawaiian Malacological Scoiety and the AudubonSociety, are doing excellent work in their respective biological areas. Space is needed for their publications, back issues, mailing activities, etc.

5. TheCurator has a special skill in preparing fish model in fiberglass. This work, which is now scattered over the shop, his office, the library, and elsewhere should be gathered into a single room for more efficient use and to imcrease the productivity in this area.

6. The Aquarium has a desire to improve its small library. Currently this room is used as a storeroom for a wide variety of supplies for want of other suitable storage area.

7. The Aquarium needs laboratory space. It currently has neither a laboratory nor laboratory space. The irony of this is apparent when you read the various letter of 1951-52 from University administrators to the Regents and to the Legislature telling how very necessary a laboratory was for the operation of an Aquarium. Yet the Aquarium never occupied it.

The undersigned thinks that it would be very fitting for your office or some other appropriate office to immediately issue a letter to the undersigned stating that the entire Aquarium building is henceforth reserved for Aquarium use. This letter is urgently and respectively requested.

Spencer Tinker

Spencer Tinker

APPENDIX C

June 15, 1968

TO: Mr. Richard L. Balch, Vice President, University of Hawaii

FROM: Spencer Tinker, Director, Waikiki Aquarium

SUBJECT: Reallocation of Space in Aquarium Laboratory Wing

This letter is a request that your office take the necessary steps to have the Waikiki Aquarium permanently assigned the use of the three rooms on the makai end of the second floor of the laboratory wing of the Aquarium building effective July 1, 1968.

The Waikiki Aquarium desires the use of these rooms for its laboratory and educational activities.

One of these rooms is currently assigned to Dr. Maxwell Doty of the Botany Department. It is used primarily as a staging area for sorties into the sea and for the storage of miscellany, most of which is not in use. There appears to be no continuing research currently in progress within this room. Since most of the gear used in their oceanic sorties is brought to the beach in a truck at the time of each visit and since bathhouse facilities abound in Waikiki and elsewhere, it is felt that the withdrawal of the botanical activities from this room will not really seriously affect anyone adversely.

Two rooms are currently assigned to Dr. Sidney Hsiao of the Department of Zoology who will be on sabattical leave next year and after one year retire. In view of the current schedule and activities in these rooms, it is believed that the office and laboratory room assigned to Dr. Hsiao in Edmondson Hall will be sufficient for his use during his absence and his following final year. Very little use has been made of these rooms in many, many months.

The Waikiki Aquarium has need for additional space.

- It needs freezer space built into the building to replace the space now being rented in town.
- The Aquarium needs a room to centralize its educational activities. It needs room for club work, for its label making, and for an artist who is currently working in the auditorium.
- It would be advantageous for security reasons to have a person residing in the building. The Aquarium has no night watchman and currently depends upon students for this work. A firmer arrangement is desired.
- The Aquarium needs laboratory space. It has none although both the Regents and the Legislature thought it would have. It also needs space for visiting biologists, collectors, and others who are not connected with other University departments.

It is a well known fact that the laboratory wing of the Aquarium building was built with money appropriated for the construction of the Aquarium and that its use for other than Aquarium purposes is not in keeping with the Act which provided for the Aquarium; neither is it in keeping with the various letters

from the Attorney General which have interpreted the use to which the laboratory wing could be put. In general, these letters have stated or implied the following:

- that the money was appropriated for the construction of an Aquarium;
- that any laboratory constructed would be incidental to the Aquarium and for Aquarium use; and
- that use for other than Aquarium purposes was not in conformity with the intent of the act.

The Aquarium recognizes that the University is crowded and has more space problems than it has solutions. However it must also be recognized that the present use of the building will not pass the scrutiny of either the Attorney General or the Legislative Auditor. The Aquarium thinks that the University should comply with the intent of the law and honor the advice of the Attorney General by slowly returning the building to Aquarium use. The Aquarium has been very, very patient in this regard, but a point has now been reached when this transfer can begin without an interruption in any existing programs by allotting the Aquarium the three rooms listed above. This transfer will then be completed by the move of the Pacific Biomedical Research Center to the new building at Kewalo Basin in the months ahead.

Approval of the proposal set forth in first paragraph is requested.

/s/ SPENCER TINKER
Spencer Tinker

Copy To-
Vice President For Business Affairs
Director, Facilities Management

APPENDIX D

CORRESPONDENCE AMONG GOVERNMENT OFFICIALS RELATING TO THE BUILDING OF THE NEW AQUARIUM

TERRITORY OF HAWAII
DEPARTMENT OF PUBLIC WORKS
HONOLULU

1.7012

MAR 29 MAR 29 1950

Honorable Walter D. Ackerman, Jr.
Attorney General of Hawaii
Iolani Palace
Honolulu, T. H.

Subject: Waikiki Aquarium

Dear Mr. Ackerman:

Loan Fund, Act 401, S. L. Hawaii 1949, appropriated $400,000.00 for the construction of an aquarium at Waikiki.

The University of Hawaii now maintains the existing Biological Laboratory and Aquarium and has expressed its willingness to release all property and improvements surrounding the Aquarium to the Parks Board providing that they will be provided with a Biological Laboratory where classes of study may be conducted. The Parks Board is willing to accept the University's offer of the property providing that it was the intent of Act 401 to provide a Biological Laboratory together with the Aquarium proper.

If, by your interpretation, a new Biological Laboratory cannot be constructed from the Aquarium funds, it may be possible for the Parks Board to rehabilitate the existing Biological Laboratory at less cost than new construction and thereby satisfy the desires of the University.

Kindly advise if it was the intent of the Act to include a Biological Laboratory as a part of the appropriation for the Aquarium.

Very truly yours,

R. M. BELT
Superintendent of Public Works

JM/h

C O P Y
WDA:lnc
1079:38

May 3, 1950

Honorable R. M. Belt
Superintendent of Public Works
Territorial Office Building
Honolulu, Hawaii

Dear Sir:

In reply to your letter of March 29, 1950, I wish to advise you that in my opinion funds appropriated by Act 401, S.L. 1949, for an aquarium, can be used for the construction of a marine biological laboratory only if such a laboratory is a necessary or common adjunct of the aquarium to be constructed, and then only to the extent that it is incidental thereto.

For your information, a laboratory of such an incidental nature would not satisfy the needs or desires of the University of Hawaii.

Very truly yours,

WALTER D. ACKERMAN, JR.
Attorney General

C
O
P
Y

June 9, 1950

Memo To: President Sinclair

Re: Biological Laboratories Attached to Marine Aquarium.

In response to the letter of May 3, 1950, written by the Attorney General, Walter D. Ackerman, to Mr. R. M. Belt, Superintendent of Public Works, may I reply to the following quotation "... funds appropriated by Act 401, S.L. 1949, for an aquarium, can be used for the construction of a marine biological laboratory only if such a laboratory is a necessary or common adjunct of the aquarium to be constructed and then only to the extent that it is incidental thereto."

During my recent visit to all the principal aquaria in the United States, including Marineland Studios, Florida, Shedd Aquarium, Chicago, and the Steinhart Aquarium, San Francisco, I was impressed by the fact that those of a size comparable to that proposed for Hawaii maintained a research laboratory as a necessary adjunct to their operation. Such problems as fish diseases, parasitism, aeration, rearing of rare fish, feeding experiments, etc., are handled in these laboratories. All administrators considered the laboratory to be an integral part of the business of operating a modern aquarium. Portions of such laboratories often are used to provide facilities for students studying marine life. In this way the laboratory and the aquarium supplement each other in an educational program.

In view of the above remarks, it is evident that the inclusion of laboratory facilities is essential for efficient operation of a modern aquarium, and therefore that a marine laboratory is a necessary adjunct of the proposed aquarium to be built by funds appropriated under Act 401, S.L. 1949.

Very truly yours,

S/ Robert W. Hiatt, Chairman
Dept. of Zoology & Entomology

File
U.H. file

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June 13, 1950

Mr. R. M. Belt
Superintendent of Public Works
Territory of Hawaii
Territorial Office Building
Honolulu, T. H.

Dear Mr. Belt:

As a result of our conference last week with the Attorney General, and in consideration of his letter to you of May 3rd, particularly that paragraph in which he states that "funds appropriated by Act 401, S. L. 1949, for an aquarium, can be used for the construction of a marine biological laboratory only if such a laboratory is a necessary or common adjunct of the aquarium to be constructed and then only to the extent that it is incidental thereto," may I say that I have taken this up with Dr. R. W. Hiatt, Chairman, Department of Entomology and Zoology, and with Dr. A. L. Tester, also of that department. Dr. Hiatt has just made a six months' investigation of marine biological problems in laboratories on the mainland. His letter is a clear indication to us that the Marine Biological Laboratory is a necessary adjunct to the Aquarium. I attach a copy of his letter.

Trusting that this matter has now been cleared up, I am,

Sincerely yours,

Gregg M. Sinclair
President

GMS:em
att.
cc Mr. Walter D. Ackerman, Jr., Attorney General
Mr. J. E. Lyons, Superintendent, Board of Public Parks and Recreation

UNIVERSITY OF HAWAII
P. O. Box 18, Honolulu 10
Territory of Hawaii

OFFICE OF THE PRESIDENT

June 15, 1950

Mr. R. M. Belt, Superintendent
Department of Public Works
Territory of Hawaii
Territorial Office Building
Honolulu, T. H.

Dear Mr. Belt:

On Tuesday, June 13th, I presented to the Board of Regents the whole matter of the Aquarium and the Marine Biological Laboratory such as we had outlined it in the discussion in my office and in the Attorney General's Office and in Mr. Serrao's Office. The following is part of the minutes:

> "The Board endorsed in principle the proposal of the Executive Officer that marine laboratory facilities be included, as a necessary adjunct, in the plans for an aquarium and that the University agree to having the aquarium built on the present site of the Breakers, provided that the Attorney General will take legal responsibility for the transfer of sites and the Land Commissioner will make arrangements with the City and County for this site being turned over to the Territory for this purpose."

Sincerely yours,

Gregg M. Sinclair
President

GMS:em

cc Mr. Walter D. Ackerman, Jr., Attorney General

C O P Y

UNIVERSITY OF HAWAII
Letterhead

June 28, 1950.

Mr. Walter D. Ackerman, Jr.
Attorney General
Territory of Hawaii
Honolulu, T. H.

Dear Mr. Ackerman:

I had a letter from Mr. R. M. Belt, Superintendent of Public Works, in which he states that there seems to be no obstacle to the building of an Aquarium and Marine Laboratory on the site of the Breakers, and he suggests that the University agree to the erection of the Aquarium and Marine Laboratory on this site.

The Regents of the University of Hawaii have agreed in principle to the plans proposed for the new Aquarium and Marine Laboratory at Waikiki, with the understanding that you, as Attorney General, will take responsibility for the legality of the transfer of the site. Our understanding of the procedure is that the Land Commissioner will transfer title of the Breakers area to the University, and the Aquarium and Marine Laboratory will then be erected on that site as a University building. If later the Legislature should consider the transfer of authority of the Aquarium, the Regents will not oppose this transfer, provided the University will retain control of the Marine Laboratory.

Sincerely yours,

/s/ Gregg M. Sinclair
Gregg M. Sinclair
President.

GMS:em

cc Mr. R. M. Belt, Superintendent
Department of Public Works

Mr. J. E. Lyons, Superintendent
Board of Public Parks and Recreation

F.H:dh
2103:42

June 30, 1950

Gregg M. Sinclair, President
University of Hawaii
Honolulu 14, Hawaii

Dear President Sinclair:

Receipt of your letter of June 28, 1950, concerning the proposed site for the new aquarium and marine laboratory, is hereby acknowledged. We have this date forwarded your communication to the Commissioner of Public Lands with a request that he prepare the necessary executive order effecting a transfer of the land involved.

Very truly yours,

FRANK W. HUSTACE, JR.
Deputy Attorney General

C
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P
Y

Hustace

See me
WLH Jr

UNIVERSITY OF HAWAII

HONOLULU 14, HAWAII

OFFICE OF THE PRESIDENT

July 3, 1950

Dr. Katsumi Kometani
2104 S. King Street
Honolulu, T. H.

Dear Dr. Kometani:

I attach herewith a copy of a letter I have sent to the Attorney General, with a copy to Mr. Belt and Mr. Lyons, relating to the site of the Aquarium. As you know, the University is attempting to work with the Parks Board on this matter, in accordance with our mutual understanding of last October or November. I also attach a copy of a letter I have received from Frank W. Hustace, Jr., Deputy Attorney General, dated June 30th. This is for your files.

I am a little disturbed, however, by the news item in the July 1st Star-Bulletin, relating to the Finance Members' opposition to the plan for the use of the Breakers' site for the Aquarium. I am sure the Regents had assumed that all such matters had been cleared. Naturally, we have no desire in the least to enter into a controversy with the Finance Committee of the Board of Supervisors. Although the Regents have not expressed themselves on this point, I feel confident that the Regents would prefer to build a new aquarium on the present site, with immediate access to the sea, than to have an aquarium built across Kalakaua Avenue.

I wonder if you would not write me a letter on this as to the attitude of the Parks Board, so that I may present it to the Board of Regents at its next meeting. I can assure you that it has been a pleasure to work with you and the members of the Parks Board, and to bring into being this great project for the benefit of the Community and the City and County.

Sincerely yours,

Gregg M. Sinclair
President

GMS:em
att.

C O P Y

1.8567

November 14, 1950

MEMORANDUM TO GOVERNOR STAINBACK
SUBJECT: WAIKIKI AQUARIUM

Selection of a site for the Waikiki Aquarium has been under discussion since September, 1949. Under present statute, operation of the Aquarium is vested in the University of Hawaii but both the University Regents and the Board of Public Parks and Recreation have agreed that this would more properly be a function of the Board of Parks and Recreation and plan to propose legislation to that effect at the next session of the Legislature.

For that reason, the university has consulted the Parks Board in every phase of the discussion. Both the Parks Board and the University are agreed that the present "BREAKERS" site is the one most suited for this construction, and the Parks Board requested the Board of Supervisors, which has jurisdiction over the property, to make it available for this purpose.

The Board of Supervisors referred the matter to the City Planning Commission, which came back with the recommendation against the Breakers site and in favor of the McInerny site on the Koko Head side of the Natatorium. The McInerny site is now privately owned.

From the standpoint of land area, shore frontage and building requirements, either site would be satisfactory. The Breakers site has the very favorable advantage of being now publicly owned.

At a meeting with the Board of Supervisors representation of the Honolulu Chamber of Commerce and the Waikiki Improvement Association gave support to those organizations to the Breakers site.

On October 27, 1950, the Board of Regents, concerned about the long delay, took the following action:

> "It was duly moved, seconded, and voted to authorize the Chairman, the Vice Chairman, and the Executive Officer of the Board to call upon the Governor and ask for his recommendations to whether the University should wait until City and County agencies can reach a decision and make available a site for the new aquarium, or whether the University should proceed with the construction of a new aquarium on the present site."

The meeting in your office this morning was the result of that action, and in accordance with your recommendation, I am referring the matter to you for action of the Attorney General in getting this issue resolved.

Respectfully yours,

/s/R.M. Belt
R.M. Belt
Superintendent of Public Works

Note: Language changes and grammatical editing has been done without affecting any changes in meaning.

C O P Y

WDA:lcn
374:14;38

December 7, 1950

Honorable Oren E. Long
Acting Governor of Hawaii
Honolulu, Hawaii

Sir:

Returned herewith is the memorandum of the Superintendent of Public Works relating to the site of the new aquarium.

I have inquired into the facts of the case and the law relating thereto. I wish to advise you as follows:

(1.) If the aquarium is to be built upon the present aquarium site, the University, with the Governor's approval, is free to proceed with construction. The approval of no other territorial agency is required. I might mention, however, that the project might fall under the federal ban on building for recreational purposes.

(2.) If the aquarium is to be built upon the Breakers site, a change in the Master Plan is necessary. This would require action by the Planning Commission. I understand it is opposed to any such change. Further I understand the Board of Supervisors has gone on record as being opposed to the use of the Breakers site for this purpose. This would indicate that it would not overrule the Planning Commission.

Respectfully,

Walter D. Ackerman Jr.
Attorney General

Encl.

APPENDIX E

ADDRESS REPLY TO
"THE ATTORNEY GENERAL OF HAWAII"
AND REFER TO
INITIALS AND NUMBER

WYHY:PH

1138:12:38:42

TERRITORY OF HAWAII

DEPARTMENT OF THE ATTORNEY GENERAL

HONOLULU

September 24, 1953

Mrs. Alice Spalding Bowen
2956 Makalei Place
Honolulu, Hawaii

Re: Appropriation of $400,000 by Act 401, Session Laws of Hawaii 1949, for Aquarium and Equipment

Dear Mrs. Bowen:

I wish to inform you that I am of the opinion that the construction of the new aquarium with a marine biological laboratory incorporated therein is a proper expenditure of the above-mentioned appropriation. My decision is based upon the following legal points and sequence of events:

1. Sections 1965 and 1966, Revised Laws of Hawaii 1945, vests the Board of Regents of the University of Hawaii with sole authority for the direction, establishment and maintenance of an aquarium and marine biological laboratory.

2. In 1950, Mr. Belt, former Superintendent of Public Works, requested an opinion from the then Attorney General Walter D. Ackerman, Jr. as to the intent of the legislature when it appropriated $400,000 for the construction of an aquarium and equipment. (Act 401, Session Laws 1949). Mr. Ackerman rendered an opinion stating that funds from this appropriation could be used for the construction of a marine biological laboratory if such a laboratory is a necessary or common adjunct thereto and then only to the extent that it is incidental thereto. (May 3, 1950, 1079:38). By this opinion, it was proper for the University of Hawaii to use a certain amount of the $400,000 for a marine biological laboratory.

The next question is, how much of the $400,000 should be spent on such a laboratory and who shall determine the amount? The body with the proper authority to make such a determination is the Board of Regents of the University of

Hawaii. (Sections 1965 and 1966, supra). The board also has the power to determine the necessity, size and scope of the marine biological laboratory as a necessary adjunct of the aquarium. A report from Professor Hiatt, Chairman of the Department of Zoology and Entomology, to President Sinclair stated that a marine biological laboratory is an integral and necessary part in the operation of a successful modern aquarium.

3. Although the Board of Regents of the University of Hawaii is vested with the sole direction and responsibility in the establishment and maintenance of the aquarium and marine biological laboratory, such aquarium is not a branch of the University of Hawaii. However, the University has the right to use the facilities of the aquarium and laboratory for its educational and research purposes. This laboratory and its facilities are also available to any person or public groups interested in the study of fish and marine life. The University of Hawaii cannot exclude the public from the uses thereof.

4. The plans for the new aquarium were approved many months ago and the building is near completion. It is, therefore, very impracticable and costly to make any structural changes at this late date. The best use and allocations of the rooms and facilities under the present plan rest within the sound discretion of the Board of Regents. If you question the wisdom of the Board, it is requested that you call the matter to its attention, personally.

In closing I beg to remind you that all prior negotiations in the planning of said aquarium were made prior to the present administration taking office.

Very truly yours,

Wadsworth Y. H. Yee

WADSWORTH Y. H. YEE
Deputy Attorney General

APPROVED:

Assistant Attorney General

cc: Mr. Ben Nutter - Sup't of Public Works
Dr. Gregg Sinclair - University of Hawaii

APPENDIX F

SURVEY OF AQUARIUM USERS, 1973

1. Where are you from? (County, State, or Country)

   _____

2. How did you find out about the aquarium?

   Travel brochure ____ Actively sought it yourself ____
   Hotel director ____ School ____
   Other, please explain _____

3. Would you visit the aquarium as often if the entrance fee were: (Please check either YES or NO at each price level)

	YES	NO		YES	NO
$.50	_____	_____	$1.00	_____	_____
$.75	_____	_____	2.00	_____	_____

4. Did you (or will you) also visit the zoo today?
   YES ____ NO ____

5. Would you visit the aquarium more often if it were located:

	More Often	Less Often	No Difference
In a rural area of Oahu	_____	_____	_____
On the zoo grounds	_____	_____	_____
Near Fisherman's Wharf	_____	_____	_____
Outside the Waikiki area	_____	_____	_____

   ☐ Location makes no difference

6. How did you get to the aquarium?

   City bus ____ Taxi ____ Rental car ____
   Tour bus ____ Walked ____ School bus ____
   Own Car ____
   Other, please explain _____

7. How would you characterize the Waikiki Aquarium?

   ____ Excellent, will heartily recommend it to all my friends.
   ____ Very good, would encourage others interested in marine life to visit it.
   ____ Good, but not as nice as the one back home.
   ____ Fair, but not any different than any others; nothing special.
   ____ Poor, will tell my friends to stay away.

8. How can the aquarium be improved to better suit you?

____ Add guided tours.
____ Improve displays (tanks, etc.)
____ Alter facilities, please explain _____
____ Display wider selection of marine life, from other regions, etc.
____ Increase staff services.
____ Other, please explain _____

9. Have you visited Sea Life Park? YES____ NO____

If yes, which did you prefer?
____ Sea Life Park
____ Waikiki Aquarium

Why? _____
_____
_____
_____

APPENDIX G

SURVEY OF AQUARIUM USE BY TEACHERS, 1973

Please return this questionnaire to the Legislative Reference Bureau in the enclosed preaddressed envelope within two weeks.

PURPOSE AND INSTRUCTIONS

Purpose

The purpose of this survey is to obtain basic general and educational information about aquariums.

Instructions

PLEASE COMPLETE ALL QUESTIONS AS DIRECTED, whether or not you feel that the question is particularly applicable to your situation. It is important that everyone contacted return a completed form.

When a question requests *"Check One"*, PLEASE CHECK THE ONE STATEMENT THAT COMES CLOSEST TO DESCRIBING YOUR CIRCUMSTANCES, even if it does not fit your situation precisely.

---

1. At which level do you teach? *(Check One)*

   [ ]Pre-school
   [ ]Elementary
   [ ]Secondary
   [ ]Other, please explain _____

2. How would you describe your teaching program? *(Check One)*

   [ ]Exclusively science
   [ ]Predominantly science
   [ ]Occasionally science
   [ ]No science

3. a. How many times have you taken students to the aquarium in the last year? *(Check One)*

   [ ]0 - "if 0, go on to question 4"
   [ ]1-2
   [ ]3-5
   [ ]6 and over

b. Was this aquarium trip

☐ A regular classroom activity?
☐ An extracurricular activity (clubs, hobby groups, etc.)?
☐ A special project?
☐ Other, please explain _____

4. If your class does not visit the aquarium, which of the following best describes your reasons?

☐ No transportation
☐ Not applicable to teaching program
☐ Inaccessible (too far from school, not on island, etc.)
☐ Dissatisfied with aquarium services
☐ Other, please explain _____

_____

5. How do your students use the aquarium? *(Check One)*

☐ Predominantly research
☐ Predominantly recreation
☐ Predominantly education
☐ Other, please explain _____

_____

6. Are you satisfied with the aquarium's educational program?

☐ Yes ☐ No

If "YES", go on to question 7.

a. What are the reasons for your dissatisfaction?

☐ Lack of cooperation from aquarium staff
☐ Educational materials not available
☐ Poor displays
☐ Uninteresting
☐ Poor physical facilities
☐ Other, please explain _____

_____

7. Which area of aquarium operations do you feel needs improvement most? *(Check One)*

☐ Educational program ☐ Facilities
☐ Displays ☐ Staff services
☐ Collections

8. Do current aquarium operations meet your needs as a teacher?

☐ Yes ☐ No

If "NO", please explain.

_____

_____

_____

9. Does your class visit the zoo on the same day that they visit the aquarium?

☐ Yes ☐ No

10. If the aquarium were not located in close proximity to the zoo, would your class visit the aquarium as often?

☐ Yes ☐ No

11. Would your class visit the aquarium more often if it were located:

	More Often	Less Often	No Difference
At the zoo	☐	☐	☐
In a rural area of Oahu	☐	☐	☐
At Ala Moana Park	☐	☐	☐

☐ Location makes no difference

APPENDIX H

SURVEY OF AQUARIUM USE BY UNIVERSITY PERSONNEL

Please return this questionnaire to the Legislative Reference Bureau in the enclosed preaddressed envelope within two weeks.

PURPOSE AND INSTRUCTIONS

Purpose

The purpose of this survey is to obtain basic general and educational information about aquariums.

Instructions

PLEASE COMPLETE ALL QUESTIONS AS DIRECTED, whether or not you feel that the question is particularly applicable to your situation. It is important that everyone contacted return a completed form.

When a question requests *"Check One"*, PLEASE CHECK THE ONE STATEMENT THAT COMES CLOSEST TO DESCRIBING YOUR CIRCUMSTANCES, even if it does not fit your situation precisely.

---

1. What is your principal academic function? *(Check One)*

☐ Undergraduate teaching
☐ Graduate teaching
☐ Research only
☐ Combination graduate teaching and research
☐ Other, please explain

_____

_____

2. How would you describe your teaching program? *(Check One)*

☐ Exclusively or predominantly science
☐ Exclusively or predominantly engineering
☐ Exclusively or predominantly humanities
☐ No science

3. How would you describe your research program? *(Check One)*

☐ Exclusively or predominantly science
☐ Exclusively or predominantly engineering
☐ Exclusively or predominantly humanities
☐ No science

4. How many times have you used the aquarium in the last year? *(Check One)*

☐ 0 "if 0, go on to question 5"
☐ 1-2
☐ 3-5
☐ 6-10
☐ More than 10

5. For what purposes did you use the aquarium?

☐ Research
☐ Source of sea water, fish, or other supplies
☐ Teaching model
☐ Other, please explain

_____

_____

6. How many times have your students used the aquarium in the last year? *(Check One)*

☐ 0 "if 0, go on to question 7"
☐ 1-2
☐ 3-5
☐ 6-10
☐ More than 10

7. For what purposes did they use the aquarium?

☐ Research
☐ Source of sea water, fish, or other supplies
☐ Class work
☐ Special project
☐ Other, please explain

_____

_____

8. If you do not visit the aquarium, which of the following best describes your reasons? *(Check One)*

☐ No transportation
☐ Not applicable to teaching program
☐ Inaccessible (too far from school, etc.)
☐ Dissatisfied with aquarium services
☐ Other, please explain

_____

_____

9. Are you satisfied with the aquarium's program in the area of:

a. Research ☐ Yes ☐ No

If "No", please explain

_____

_____

_____

b. Education ☐ Yes ☐ No

If "No", please explain

_____

_____

_____

c. Supplementary services ☐ Yes ☐ No

If "No", please explain

_____

_____

_____

10. Which of the following best describes the reasons for your dissatisfaction with the aquarium? *(Check One)*

☐ Poor displays
☐ Poor physical facilities
☐ Lack of cooperation from aquarium staff
☐ Inappropriate educational materials
☐ Uninteresting
☐ Other, please explain

_____

_____

11. Which area of aquarium operations do you feel needs improvement most? *(Check One)*

☐ Educational program
☐ Display
☐ Collections
☐ Facilities
☐ Staff services

12. Do you agree with the following statement: "The Waikiki Aquarium is adequate and needs no further improvement."

☐ Yes ☐ No

APPENDIX I

BASIC PROGRAM SURVEY OF AQUARIUMS, 1973

Please return this questionnaire to the Legislative Reference Bureau in the enclosed preaddressed envelope within two weeks.

	Is the Name and Address of Your Institution or Organization Correct on the Address Label? 1 ☐ Yes 2 ☐ No If "No", what is the correct listing? Name of Institution or Organization Address *(No., Street, City, State)* Zip Code_____

Information Supplied By *(Name)*	Title	Date

PURPOSE AND INSTRUCTIONS

Purpose

The purpose of this survey is to obtain basic general and educational information about aquariums.

Instructions

PLEASE COMPLETE ALL QUESTIONS AS DIRECTED, whether or not you feel that the question is particularly applicable to your situation. It is important that every organization and institution contacted return a completed form.

When a question requests *"Check One"*, PLEASE CHECK THE ONE STATEMENT THAT COMES CLOSEST TO DESCRIBING YOUR CIRCUMSTANCES, even if it does not fit your situation precisely.

Answer each question within the framework established by the definitions given. Note that these definitions have been developed for the purpose of this questionnaire.

This report should include data on all of your operations.

SECTION A - GENERAL INFORMATION

1. Is your institution or organization operated by or directly affiliated with another institution, society, business, or organization?

1 ☐ Yes 2 ☐ No

If "YES", give the name of the affiliated institution, society, business, or organization:

_____

2. Which one of the following best describes the agency or organization under which you operate? *(Check One)*

1 ☐ Municipal or county government
2 ☐ State government
3 ☐ Federal government
4 ☐ College or university
5 ☐ Nonprofit organization or corporation administered in the public interest (Nonprofit--no part of net earnings may benefit any individual)
6 ☐ Company, business, or corporation organized for profit, including operation owned or run by individuals

3. Are your facilities open to the general public at stated hours without advance arrangements?

1 ☐ Yes 2 ☐ No 3 ☐ No Facilities

If "NO FACILITIES", go to Item 5.

a. Are your facilities open to the general public only by special appointment?

1 ☐ Yes 2 ☐ No

b. How many months per year are the facilities open to the general public? *(Check One)*

1 ☐ 10-12 Months
2 ☐ 7- 9 Months
3 ☐ 4-6 Months
4 ☐ Less Than 4 Months

c. How many hours per week (average) are the facilities open to the general public? *(Check One)*

1 ☐ 56 Hours or More
2 ☐ 41-55 Hours
3 ☐ 25-40 Hours
4 ☐ 9-24 Hours
5 ☐ 8 Hours or Less

d. Are your facilities open to the general public?

1 ☐ on Saturdays, all day
2 ☐ on Sundays, all day
3 ☐ on holidays, all day
4 ☐ on Saturdays, half day
5 ☐ on Sundays, half day
6 ☐ on holidays, half day

4. Does your institution or organization operate in a fixed location in its own (rented or owned) quarters?

1 ☐ Yes 2 ☐ No

If "NO", go to Item 5.

a. Are your facilities located on or near ocean waters?

1 ☐ Yes 2 ☐ No

b. How do you maintain your salt water supply?

1 ☐ Use artificial solution
2 ☐ Pipe to salt water source
3 ☐ Transport it
4 ☐ Other (Specify)

_____

SECTION B - INSTITUTIONAL RESOURCES

5. What kind of institutional facilities do you have?
(Check One or More)

☐ Oceanarium
☐ Building (or space within a building) significant chiefly for preservation or exhibition of collections
☐ Primarily display
☐ Zoological park (professionally designed compound where live animals are kept for display and study
☐ Nature/conservation center (facility for outdoor learning, including a natural site for field study, with facilities and services for an interpretive program)
☐ Primarily research
☐ Separate laboratory operation
☐ Other (Specify)

_____

☐ None

6. Does the institution or organization own and maintain collections? (*Collections*--objects or specimens maintained principally for the preservation or exhibition of significant material or for the support of research studies)

1 ☐ Yes 2 ☐ No

If "NO", go to Item 7.

Definitions for the Classification of your Collection(s)

Display--Materials are collected primarily for display purposes because of their aesthetic and attracting qualities.

Local --Materials are collected primarily with the intent of interpreting local marine conditions.
Science--Materials are collected primarily to demonstrate or interpret physical and biological phenomena and research findings, including their laws and applications.

a. What is the classification of your collection(s)?
(Check One)

1 ☐ Exclusively or predominantly Display
2 ☐ Exclusively or predominantly Local
3 ☐ Exclusively or predominantly Science
4 ☐ Nearly equal emphasis on Display and Local
5 ☐ Nearly equal emphasis on Display and Science
6 ☐ Nearly equal emphasis on Local and Science
7 ☐ Nearly equal emphasis on Display, Local, and Science

b. Have collections been used for research by scholars, aside from the institution or organization staff, during the past year?

1 ☐ Yes 2 ☐ No

7. Does the institution or organization maintain exhibitions? (*Exhibition:* an assemblage of objects of display, local, scientific, or technological nature, through which visitors move from unit to unit in a sequence designed to be meaningful instructionally or aesthetically. Accompanying labels or graphics are planned to interpret and explain.)

1 ☐ Yes 2 ☐ No

If "NO", go to Item 8.

a. What is the classification of the majority of your exhibitions? (See definition under Item 6 above.)
(Check One)

1 ☐ Exclusively or predominantly Display
2 ☐ Exclusively or predominantly Local
3 ☐ Exclusively or predominantly Science
4 ☐ Nearly equal emphasis on Display and Local
5 ☐ Nearly equal emphasis on Display and Science
6 ☐ Nearly equal emphasis on Local and Science
7 ☐ Nearly equal emphasis on Display, Local, and Science

b. Are most of the exhibitions designed and installed by persons specifically trained in exhibition display techniques?

1 ☐ Yes 2 ☐ No

c. Do you maintain exhibitions in mobile units such as trucks and trailers?

1 ☐ Yes 2 ☐ No

d. Have you originated any circulating exhibitions (for use by at least two other institutions) since January 1, 1972?

1 ☐ Yes 2 ☐ No

8. Does your institution or organization have a library? (*Library*--catalogued collection of publications and other materials, emphasizing the subject areas of the institution's collection(s))

1 ☐ Yes 2 ☐ No

If "NO", go to section c below.

a. Is the library open at regular hours for use by the general public?

1 ☐ Yes 2 ☐ No

b. Is the library open only by appointment to any interested person?

1 ☐ Yes 2 ☐ No

c. Other--please explain.

_____

_____

_____

_____

SECTION C - INSTITUTIONAL STATISTICS

STAFF--INFORMATION IN THIS SECTION WILL REMAIN CONFIDENTIAL AND WILL BE USED ONLY FOR STATISTICAL PURPOSES.

Definitions and Instructions:

Professional Staff--Paid employees doing work that requires education, training, and skill in the academic or scholarly aspects of the institution's program, as distinct from the merely mechanical and clerical aspects.

Such employees would usually have at least a bachelor's degree in a relevant subject, or post high school education and appropriate experience equivalent to a bachelor's degree.

Other Staff--Other paid employees not fitting definition of "Professional Staff".

Staff Positions by Full-Time Equivalents--To compute full-time equivalents (FTE) of part-time personnel, add the total hours worked per week by all part-time personnel, and divide by number of hours worked by a full-time staff person in a normal work week (e.g., 40 hours). Report these calculations as decimals, converting to nearest tenth of a position.

Example:

4 employees each worked 20 hrs. per week = 80 hrs.
2 employees each worked 10 hrs. per week = 20 hrs.
6 employees worked a total of = 100 hrs.

$$\frac{100 \text{ hours}}{40 \text{ hours}} = 2.5 \text{ FTE.}$$

ENTER A DASH (-) IN ANY ITEM THAT DOES NOT APPLY AND A ZERO (0) WHEN THE AMOUNT TO BE REPORTED IS ZERO. DO NOT LEAVE ITEMS BLANK.

9. The information given below is for what period?

1 ☐ Calendar Year 1972 2 ☐ Fiscal Year Ending _____ 1973

ITEM	PROFESSIONAL STAFF	ALL OTHER STAFF
a. How many full-time paid staff members were employed and paid by the institution at the end of the reporting year?		
b. How many part-time paid staff members were employed by the institution at the end of the reporting year?		
c. What are the full-time equivalents of your part-time staff members? (FTE of Item 9b)		
d. What is the total number of hours contributed by volunteers during the calendar or fiscal year listed above?		

Attendance

10. Are attendance figures applicable to your operations? (Attendance: actual count or careful estimate of the number of visits made to the institution, including those made for participation in special program activities.)

1 ☐ Yes 2 ☐ No

If "NO", go to operating expenditures.

a. What was the total attendance for the last calendar or fiscal year? Round to Nearest Hundred.

Number_____

b. Is the attendance figure counted or estimated? *(Check One)*

1 ☐ Counted 2 ☐ Estimated

c. Were attendance records kept for individuals participating in classes and other formal study groups during the calendar or fiscal year listed previously?

1 ☐ Yes 2 ☐ No

If "NO", go to operating expenditures.

d. What was the cumulative total attendance in study groups and classes operated by the museum?

Number_____

OPERATING EXPENDITURES--THIS INFORMATION WILL REMAIN CONFIDENTIAL AND WILL BE USED ONLY IN SUMMARY STATISTICAL TABULATIONS WITHOUT IDENTIFYING INDIVIDUAL INSTITUTIONS.

Definitions:

Operating Expenditures--Total annual fiscal operation, excluding acquisitions, major construction and other capital outlay, and special projects such as expeditions which are not recurring expenditures.

Contributions in Kind--Contributions for institutional operation made not in money, but through use of premises, provision of staff, provision of utilities, regular custodial or professional services, etc.

Round to Nearest Thousand.

Number_____

11. Does your operation have operating expenditures?

1 ☐ Yes 2 ☐ No

a. What were the total operating expenditures (for the year reported in Item 9) excluding contributions rendered in kind?

$_____

b. What was the estimated total value of contributions in kind, provided (during the year reported in Item 10), by outside agencies or organizations (State, city, school district, civic organizations, college, etc.) but not included in the operating expenditures?

$_____

Revenues

12. What were the sources and amounts of your income during your last full year of operation?

[ ]Municipal or county government	$_____
[ ]State government	$_____
[ ]Federal government	$_____
[ ]College or university	$_____
[ ]Endowment and contributions	$_____
[ ]Admission fees	$_____
[ ]Other (Specify)	$_____
_____	

13. Do you charge admission fees?

1 ☐ Yes 2 ☐ No

If "NO", go on to Item 14.

a. What are the rates for individuals?

Adults	_____
Children	_____
Others (Specify)	
_____	_____

b. What are the rates for groups? _____
schools? _____
Other special groups? (Please explain)
_____ _____

c. How are revenues from admission fees used?

[ ]General aquarium operations
[ ]Special aquarium use (i.e. exclusively for research, for displays, for equipment, etc.)
[ ]Deposited in a general fund (not earmarked for aquarium use)
[ ]Other (Please explain)

_____

_____

SECTION D - PROGRAM

14. What is the nature of your relationship with local elementary and secondary school districts? *(Check One)*

1 ☐ No significant working relationship
2 ☐ Schools represented on institution's board
3 ☐ Schools represented on advisory committee for educational program
4 ☐ Characterized by informal, personal contacts
5 ☐ Other (Specify)

_____

15. Does your institution have joint programs or special affiliations with colleges and universities?

1 ☐ Yes 2 ☐ No

If "YES", what kinds of programs or affiliations? *(Check One or More)*

☐ Research at graduate level
☐ Research at undergraduate level
☐ Work experience for credit at graduate level
☐ Work experience for credit at undergraduate level
☐ Work experience without credit
☐ Observation or participation in program by teacher trainees
☐ Inservice courses for classroom teachers
☐ Training program for professional museum workers
☐ Facilities or supplies loaned to colleges
☐ College credit courses taught in your facilities
☐ College credit courses taught by your professional staff (any location)
☐ Other (Specify)

_____

16. a. Does your institution have a formal, planned program specifically designed for training professional aquarium workers to educate the public, university associates, or students at any level (such as in giving lectures, conducting tours, etc.)? (See definitions for professional staff in section C.)

1 ☐ Yes 2 ☐ No

If "YES", how many individuals were trained during the reporting year?

Number _____

b. Do you have such a program for nonprofessional workers?

1 ☐ Yes 2 ☐ No

If "YES", how many individuals were trained during the reporting year?

Number _____

c. Do you have such a program for volunteers?

1 ☐ Yes 2 ☐ No

If "YES", how many individuals were trained during the reporting year?

Number _____

17. Towards which particular age groups are the majority of your regularly scheduled activities directed? *(Check One)*

1 ☐ Children (through 6th grade)
2 ☐ Youth (Junior-Senior High School)
3 ☐ Children and Youth
4 ☐ Adult
5 ☐ All Ages (no priority for a specific age group)

18. Did the institution's staff lead field excursions for the public to sites of marine or scientific interest during the reporting year?

If "Yes", for what kinds of groups were excursions led? *(Check One or More)*

☐ School Classes
☐ Community Groups
☐ Families
☐ Membership
☐ Other (Specify)
_____

19. What types of educational-cultural activities does the institution or organization regularly schedule under the direction of the staff, paid or volunteer? *(Check One or More)*

☐ Guided tours for school classes
☐ Presentations at schools
☐ Special lectures or demonstrations for school classes at the institution
☐ Organized school loan service of special materials and collections
☐ Guided tours and gallery talks for general groups
☐ Classes, clubs, and study groups for children
☐ Classes, clubs, and study groups for adults
☐ Lecture series for general audience
☐ Radio programs produced by the institution
☐ TV programs produced by the institution
☐ Film series
☐ Speaker's bureau
☐ Other
_____
☐ None

20. Did you have a publication program during the reporting year?

1 ☐ Yes 2 ☐ No

If "YES", were any of the following issued? *(Check One or More)*

- ☐ Formal annual report
- ☐ Membership newsletters, calendars, flyers, etc.
- ☐ Technical books, pamphlets or bulletins based on research findings
- ☐ Popular books, bulletins or pamphlets (excluding membership newsletters, calendars, flyers, etc.)
- ☐ Regular periodical(s) (magazines, journals, proceedings)
- ☐ Exhibition catalogues with extensive annotations (as opposed to lists)
- ☐ Catalogue of collection(s)
- ☐ Other (Specify)

_____

21. Did your organization or institution engage in formal research projects during the reporting year? (*Formal research projects*--Investigative projects which are carefully designed, executed and reported on to provide specific needed information for the museum staff, and whose outcome would be of interest to the aquarium field)

1 ☐ Yes 2 ☐ No

a. What types of research did you engage in? *(Check One or More)*

- ☐ Directly related to aquarium activities
- ☐ General marine research
- ☐ Other (Specify)

_____

b. Is research the <u>primary function</u> and activity of your organization or institution?

1 ☐ Yes 2 ☐ No

APPENDIX J

QUESTIONNAIRES SUBMITTED TO AQUARIUM MANAGEMENT

(1) In the past, what agencies have been responsible for determining the aquarium's policies?

(2) Is there adequate storage for valuable documents?

Adequate fire protection?

Adequate security measures?

(3) Are all records properly labeled and in chronological order? (wasted man hours in searching for things)

(4) Expenditure record:

What have the funds been used for in the last year?

(5) From time to time, do you share equipment and labor with other university departments?

Other government agencies?

Private Individuals?

Is there a charge for this service?

(6) Do you loan and sell collections or supplies to private concerns?

Under what circumstances?

(7) What is the value of your inventory of materials and supplies as of June 30, 1973?

(8) What are the aquarium's annual requirements for materials and supplies?

(9) Do you allow private concerns or individuals or other aquariums the use of your facilities or equipment?

On what basis?

(10) What was the attendance as of June 30, 1972? June 30, 1973?

Children	_____	_____
Adults	_____	_____

(11) How are fish collected?

By whom?

With what equipment?

At what cost?

How often?

(13) Do you exchange exhibits?

Explain all exchanges in the last year?

Personnel

Please list all personnel currently employed by the aquarium.

Name	Position	Appointment Status (civil service or non-civil service)

Please list:

(1) The positions which are currently vacant.

(2) Current budget for salaries?

How will these salaries be affected by newly negotiated contracts?

(3) Amount currently available for salaries.

(4) Pay rates for each classification.

How does this compare with similar positions in other states?

(5) How many students are employed? (Submit separate information of UH, NYC, and Hawaii school students)

At what cost?

In what capacity do they serve?

Are they adequate?

Capital Improvements

(1) What major repairs or additions have been made to the building since it was first built?

Roofing:

Waterlines:

Fixtures:

Tanks:

etc.

(2) How were these physical repairs accomplished? Cite contracts, means of employment, terms, etc.

(3) What work still needs to be done or is planned for the next three years?

How important is it?

Has money been appropriated for this?

Who will do the job?

* * * * * *

What do you view as the principal purpose of the Waikiki Aquarium?

What about secondary purposes?

Do you think that the civil service system can adequately test for aquarium experience and thus provide suitable personnel for aquarium job?

What is your stand on the admission fee policy?

Should it be eliminated?

Raised?

Other?

Please explain.

APPENDIX K

DEFINITION OF TERMS USED IN TABLE SHOWING USE OF STUDENT EMPLOYEES

STUDENT HELP

The attendance at the Waikiki Aquarium and in the area surrounding is slowly increasing; with this increase in visitors comes an increase in automobiles, rubbish, and increased need for supervision of people and in vehicles, and an increased need for maintenance services.

I. Laboratory and Technical
   1. Exhibit Preparation, Label, and Repair is the continuing work upon the exhibits and exhibit labels. These are continually being increased, changed, corrected, deleted, repaired, etc. This work involves composition, typesetting, proof making, and binding for printed labels and the use of the engravograph for engraved labels.
   2. Scientific Illustrating is the drawing of pictures for exhibit labels and for popular publications.

II. Clerical, Secretarial, and Fiscal
   1. The Cashier's booth must operate as long as the Aquarium is open including Saturday, Sunday, and holidays. Relief cashiers are also needed to allow the acting cashier (Steno I) to do stenographic and related work.
   2. A Sales Clerk will in time be needed for a sales operation if approval can be obtained for this activity.

III. General Service
   1. Janitorial Service is required for each day the Aquarium is open. The Civil Service Janitor works from Tuesday through Saturday. Student janitors are needed on Sunday, holidays, for evening meetings, during the vacation of the regular janitor, when he is sick, and during emergencies, etc.
   2. Yard Service is needed to augment the single groundskeeper. The Civil Service Groundskeeper works from 6 a.m. to 2:30 p.m. The area (102,210 sq. ft.) is too large for him and he is therefor supplied student help 5 hours daily in the late afternoon to pick up paper, water, weed, trim, sweep, etc. Saturdays, Sundays, and holidays require more yard work than weekdays; the groundskeeper must also be replaced during his vacation. During the summer months, the yard must be watered each night; here sprinklers are run in rotation since the feed line is too small and the pressure too low at this time of day to water the entire area at once.
   3. Parking Lot attendants are needed on Saturdays, Sundays, and holidays and also on certain week days to control the cars in order that the parking lot is reserved for the exclusive use of Aquarium visitors. In addition, schools and other organizations have to be guided and organized as they prepare to enter the building.
   4. A Doorman is needed at the Aquarium on Saturday, Sunday, and holidays, in the morning when the school children arrive, and each day when the weather is good.
   5. Hauling From Keehi involves four trips weekly. One or two students meet a fisherman late on weekdays and haul the specimens obtained by him back to the Aquarium.
   6. Collecting Specimens with the Aquarium boat will be done on Tuesday, Thursday, and Saturday if personnel are available. This item is for the students who will assist in the trap fishing and collecting.

Cleaning large shells

Larger shells (such as the helmet, triton, strombus, etc.) can often be cleared of the animal by tying its foot and then suspending it. The shell's weight will eventually overcome the mollusk's ability to stay in it.

When the animal is dead, flushing the shell with a strong jet-stream of water is often successful. In many South Pacific Island areas, the shell is left for insects (such as the ant or certain flies) to clean.

Immersing the shell in formaldehyde or alcohol for about a week and a half will enable the collector to pull the snail with relative ease. A strength of 50 percent methyl or isopropyl alcohol, or 70 percent ethyl or grain alcohol, is safest. When formaldehyde is used, it should be no stronger than five per-cent. A substantial formalin bath may be made by mixing 1 part formaldehyde and 8 parts of water. A half to a full teaspoon of bicarbonate of soda is necessary to soften this mixture.

Final steps

Once the animal is removed, several approaches to cleaning the shell may be taken. A thorough soak and scrub in warm water and soapsuds is often sufficient. In the event the shell has stains or incrustations on its surface immersing it in warm water and laundry bleach for about 5 hours is beneficial. Following this, the shell should be dipped into muriatic acid for 10 seconds then flushed thoroughly with cold water. Care should be taken, however, when working with acid of any kind. It can be harmful to the shell, and it would be advisable to experiment with unwanted specimens before working with the shells that are to become a permanent part of a collection.

Some malacologists use a light oil rub as a finish for their shells. In several cases, a judicious coating of varnish or shellac is applied.

Value

The value of shells fluctuates from decade to decade, more in keeping with prevailing economic trends than in the availability of individual specimens. This is not wholly true, of course, with such shells as the Golden Cowrie and Glory-of-the-sea, *Conus gloria-maris*.

Because of its rarity, Glory-of-the-sea may command a price of up to $2000 and possibly more. What few are found are generally located in the southwest Pacific (Philippines, Solomons, etc.). There are only about 30 known specimens in private and museum collections around the world.

Golden Cowrie, by contrast, appears to be more valuable because of its demand than its rarity. Nevertheless, it remains one of the few shells with a high price tag of from $150 to $175 each. Another cowrie, a Caroline Island specimen, brought over $1300.

The Collection

Housing a collection does not have to be an expensive proposition. Cigar boxes are preferred by many hobbyists to store their shells, and records are kept on standard 3x5 cards. Perhaps the best data to keep as record are the location of the find, the date, and a bit of information concerning the habitat.

Scope

There are few branches of science that have been embraced by laymen on a scale displayed by conchology. Hundreds of thousands of people are actively involved in shell collecting as a hobby.

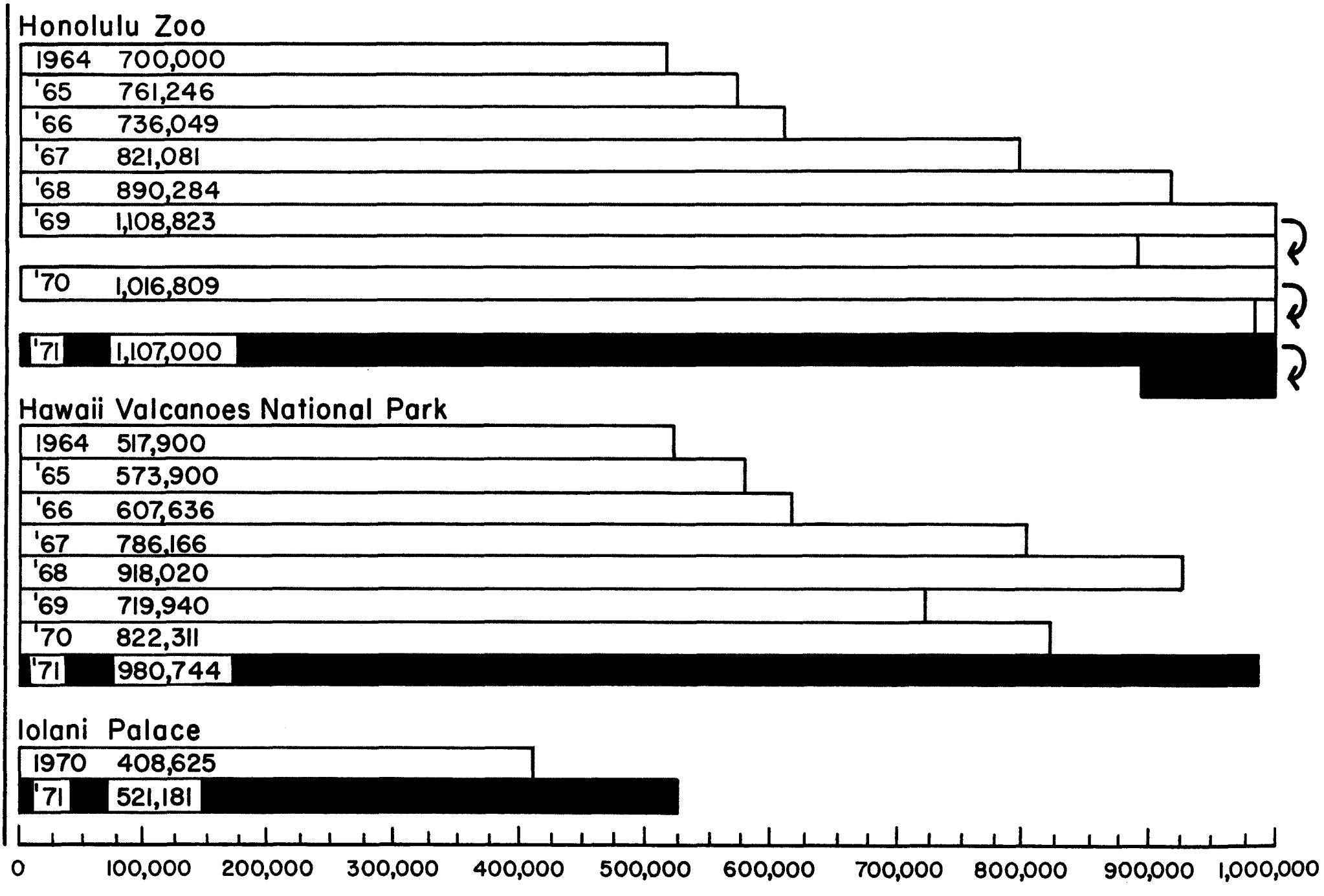
For anybody who might be interested in developing the few shells they possess into a more sophisticated collection, there are a number of up-to-date publications available. A list of these publications may be obtained on request from The U. S. National Museum, Division of Mollusks, Washington D. C. 20560.

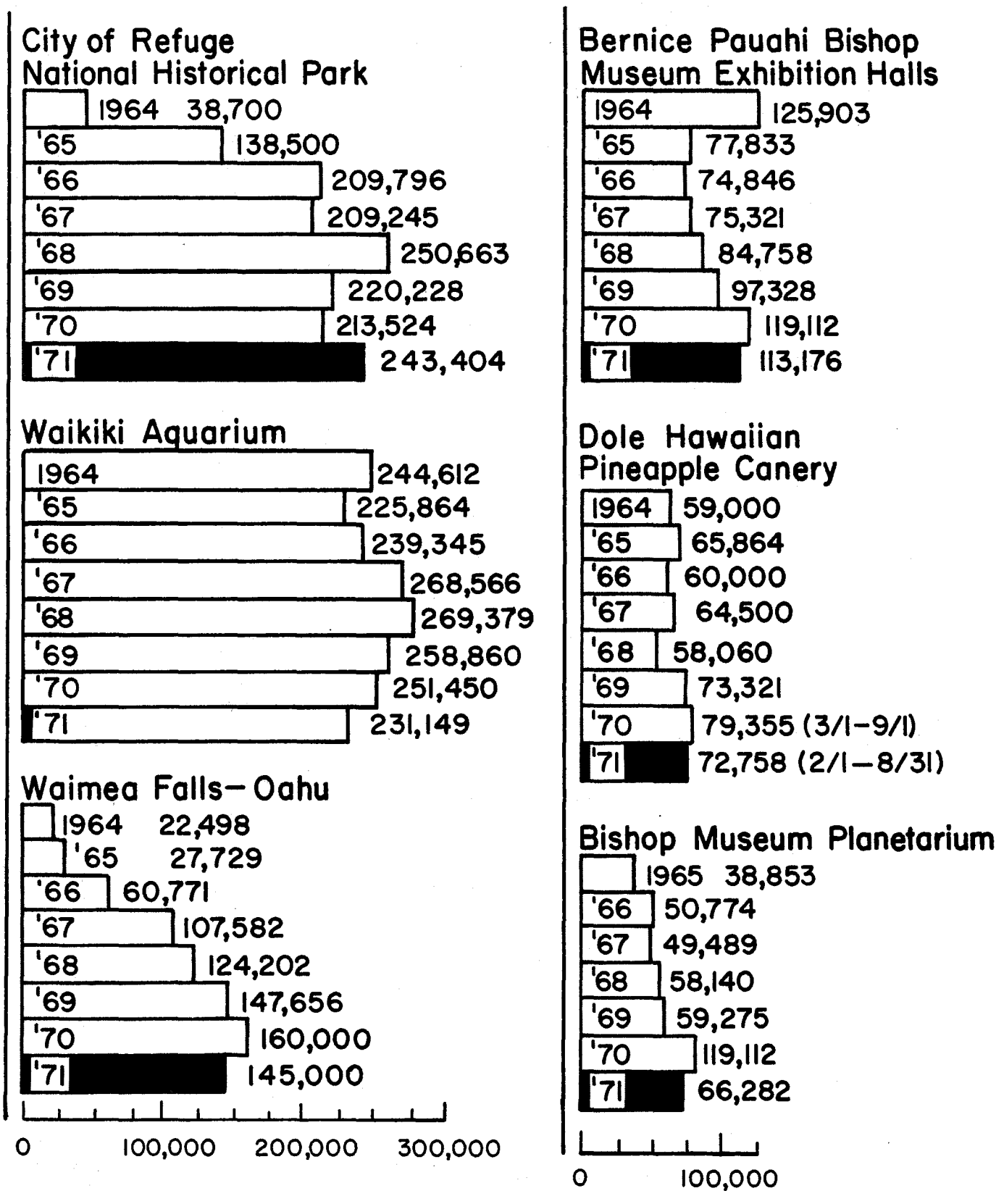
APPENDIX L

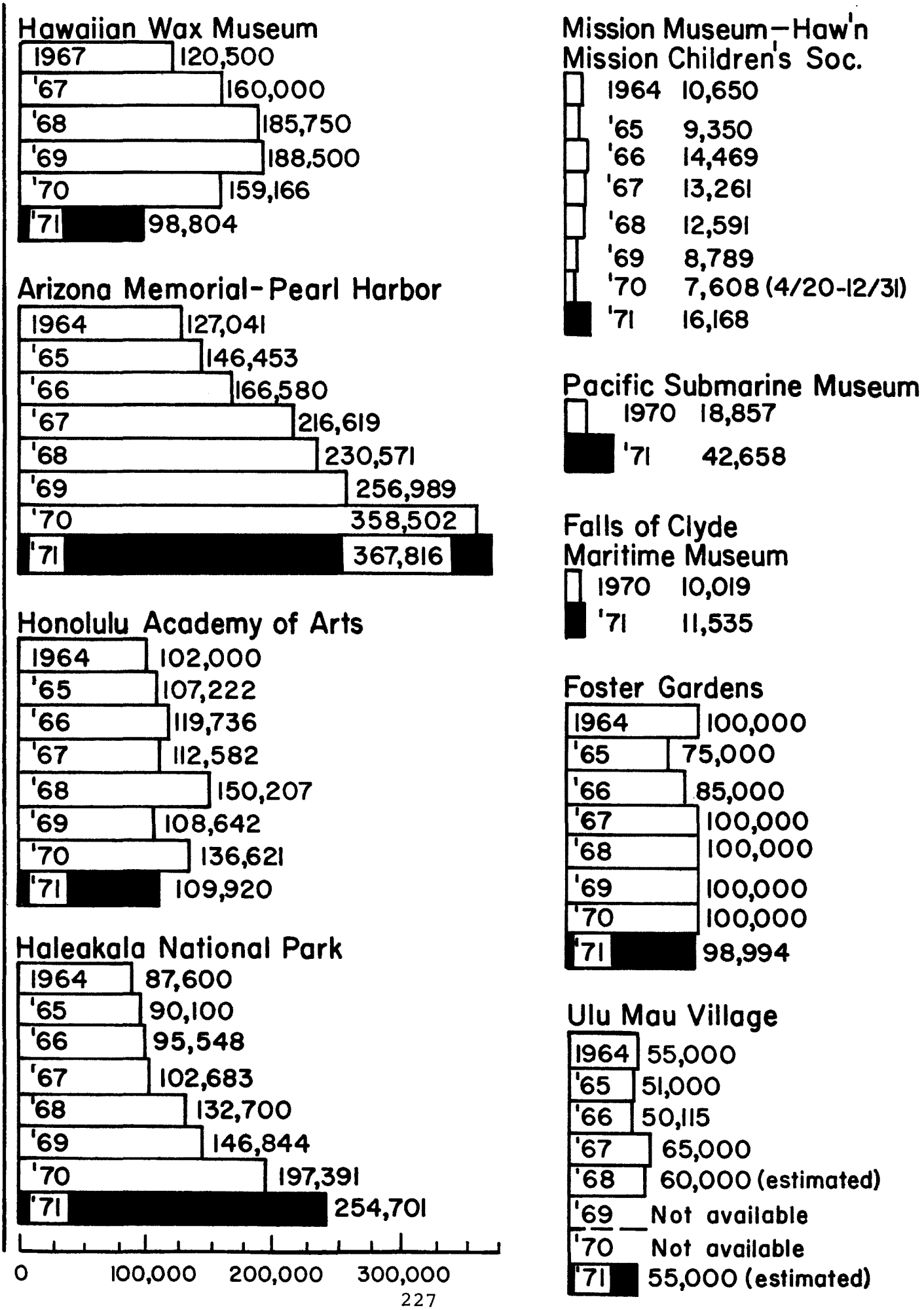
Attendance of Visitors at Hawaii's Parks and Museums

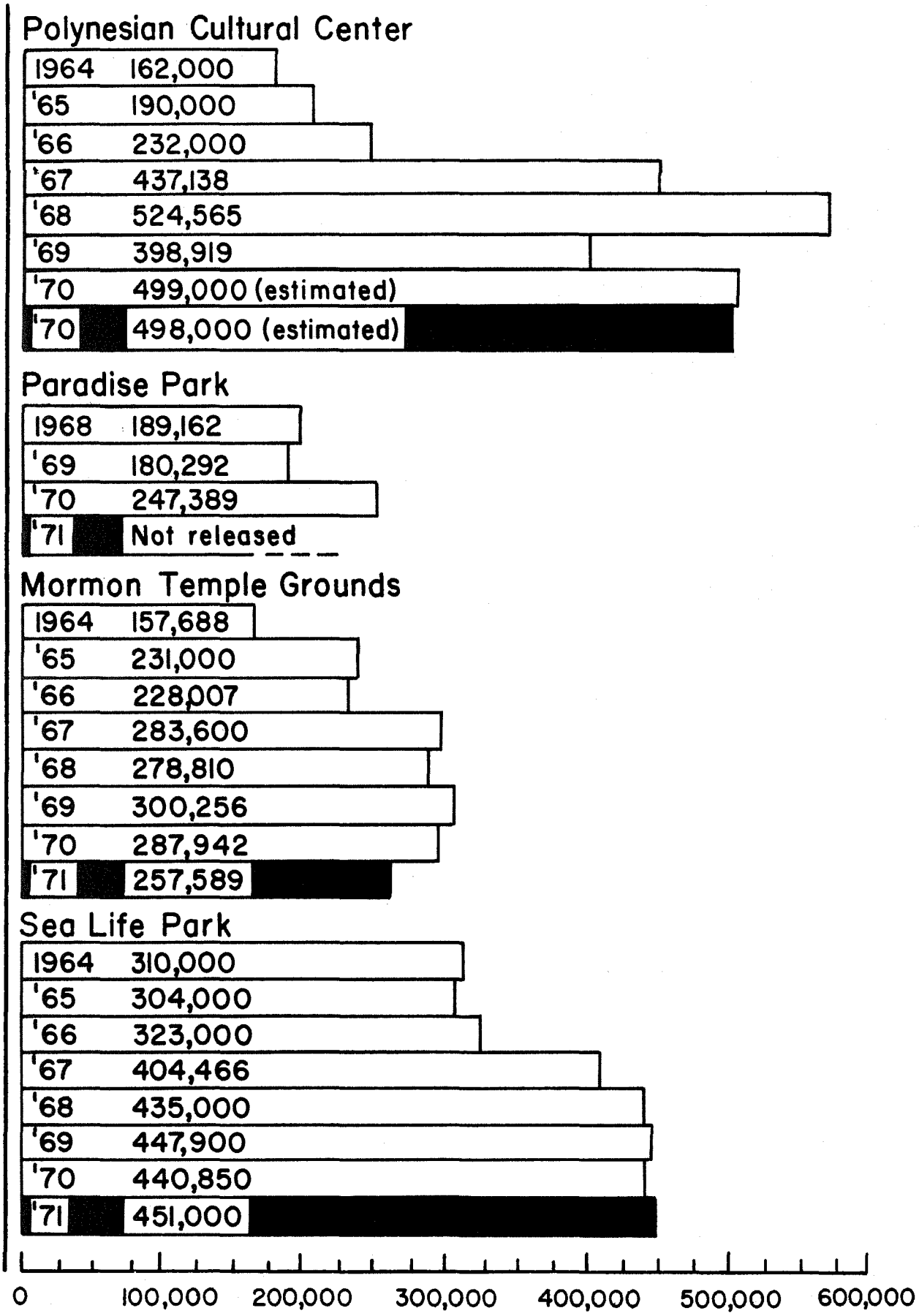
By Calendar Years

Prepared by THE WAIKIKI AQUARIUM · 2777 Kalakaua Avenue · Honolulu Hawaii 96815

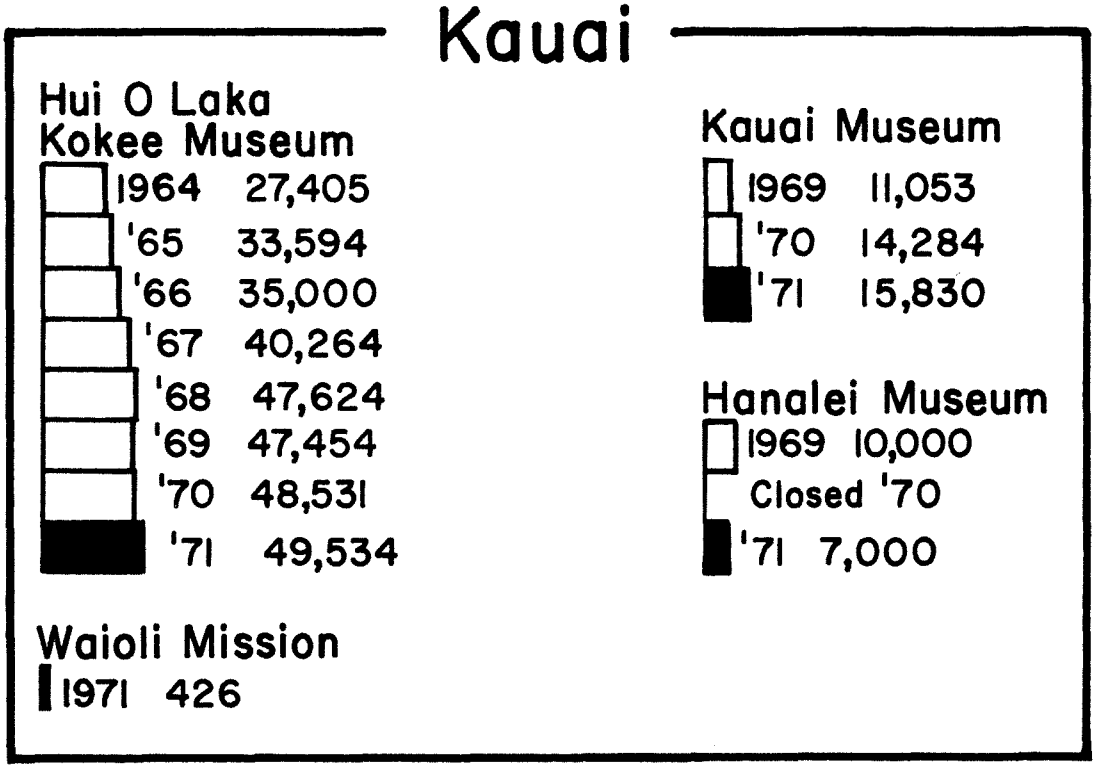

Honolulu Zoo
1964 700,000
'65 761,246
'66 736,049
'67 821,081
'68 890,284
'69 1,108,823
'70 1,016,809
'71 1,107,000
Hawaii Valcanoes National Park
1964 517,900
'65 573,900
'66 607,636
'67 786,166
'68 918,020
'69 719,940
'70 822,311
'71 980,744
Iolani Palace
1970 408,625
'71 521,181
0
100,000
200,000
300,000
400,000
500,000
600,000
700,000
800,000
900,000
1,000,000


City of Refuge
National Historical Park
1964 38,700
'65 138,500
'66 209,796
'67 209,245
'68 250,663
'69 220,228
'70 213,524
'71 243,404
Waikiki Aquarium
1964 244,612
'65 225,864
'66 239,345
'67 268,566
'68 269,379
'69 258,860
'70 251,450
'71 231,149
Waimea Falls—Oahu
1964 22,498
'65 27,729
'66 60,771
'67 107,582
'68 124,202
'69 147,656
'70 160,000
'71 145,000
0
100,000
200,000
300,000
Bernice Pauahi Bishop
Museum Exhibition Halls
1964 125,903
'65 77,833
'66 74,846
'67 75,321
'68 84,758
'69 97,328
'70 119,112
'71 113,176
Dole Hawaiian
Pineapple Canery
1964 59,000
'65 65,864
'66 60,000
'67 64,500
'68 58,060
'69 73,321
'70 79,355 (3/1–9/1)
'71 72,758 (2/1–8/31)
Bishop Museum Planetarium
1965 38,853
'66 50,774
'67 49,489
'68 58,140
'69 59,275
'70 119,112
'71 66,282
0
100,000
Hale Hoikeike Museum—Wailuku
1968 5,985
'69 5,741
'70 5,406
'71 3,621

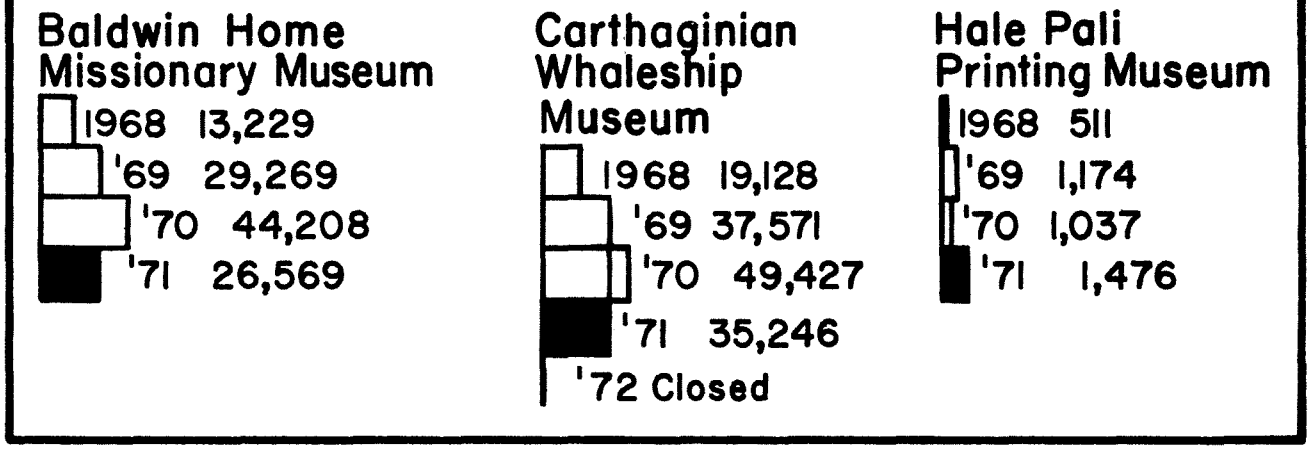

Hawaiian Wax Museum
1967 120,500
'67 160,000
'68 185,750
'69 188,500
'70 159,166
'71 98,804
Arizona Memorial-Pearl Harbor
1964 127,041
'65 146,453
'66 166,580
'67 216,619
'68 230,571
'69 256,989
'70 358,502
'71 367,816
Honolulu Academy of Arts
1964 102,000
'65 107,222
'66 119,736
'67 112,582
'68 150,207
'69 108,642
'70 136,621
'71 109,920
Haleakala National Park
1964 87,600
'65 90,100
'66 95,548
'67 102,683
'68 132,700
'69 146,844
'70 197,391
'71 254,701
0
100,000
200,000
300,000
Mission Museum-Haw'n Mission Children's Soc.
1964 10,650
'65 9,350
'66 14,469
'67 13,261
'68 12,591
'69 8,789
'70 7,608 (4/20-12/31)
'71 16,168
Pacific Submarine Museum
1970 18,857
'71 42,658
Falls of Clyde Maritime Museum
1970 10,019
'71 11,535
Foster Gardens
1964 100,000
'65 75,000
'66 85,000
'67 100,000
'68 100,000
'69 100,000
'70 100,000
'71 98,994
Ulu Mau Village
1964 55,000
'65 51,000
'66 50,115
'67 65,000
'68 60,000 (estimated)
'69 Not available
'70 Not available
'71 55,000 (estimated)

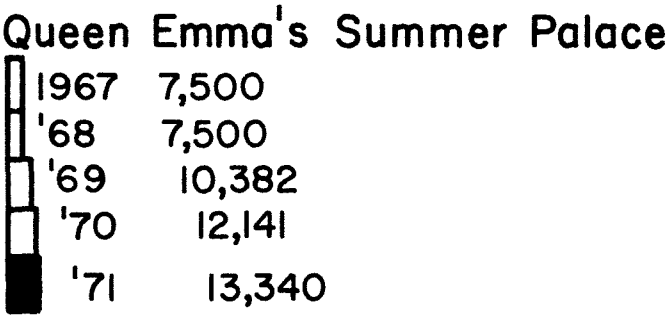

Polynesian Cultural Center
1964 162,000
'65 190,000
'66 232,000
'67 437,138
'68 524,565
'69 398,919
'70 499,000 (estimated)
'70 498,000 (estimated)
Paradise Park
1968 189,162
'69 180,292
'70 247,389
'71 Not released
Mormon Temple Grounds
1964 157,688
'65 231,000
'66 228,007
'67 283,600
'68 278,810
'69 300,256
'70 287,942
'71 257,589
Sea Life Park
1964 310,000
'65 304,000
'66 323,000
'67 404,466
'68 435,000
'69 447,900
'70 440,850
'71 451,000
0
100,000
200,000
300,000
400,000
500,000
600,000

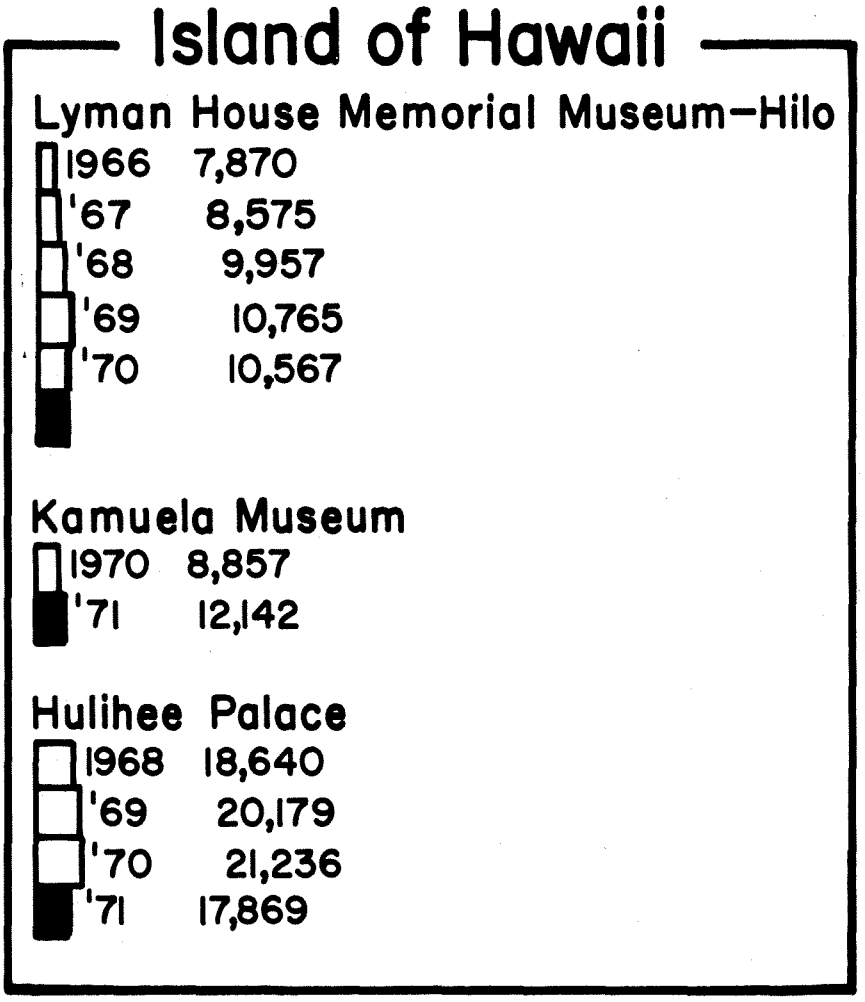
Kauai



Lahaina Restoration Foundation






Island of Hawaii
Lyman House Memorial Museum–Hilo
1966 7,870
'67 8,575
'68 9,957
'69 10,765
'70 10,567
Kamuela Museum
1970 8,857
'71 12,142
Hulihee Palace
1968 18,640
'69 20,179
'70 21,236
'71 17,869

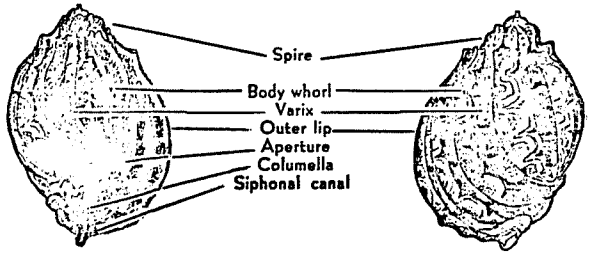
APPENDIX M

TYPES OF EDUCATIONAL MATERIALS PREPARED BY THE WAIKIKI AQUARIUM*

Pacific Marine Life

Shells

Parts of the mollusk shell



Composition

The mollusk shell is composed of calcium carbonate crystals, the end result of a process which begins with salt contained in the animal's blood in liquid form. This calcium is concentrated through osmosis by the mantle and deposited in layers to form the shell. There are, in many cases, several types of these layers, each one built by a different part of the mantle. The crystallization process results in either a calcite or an argonite layer. The finished product's cross section displays a structure of laminations which, of course, tend to give strength and rigidity to an otherwise brittle shell.

The interesting, often beautiful, color patterns which make the shell so attractive, are caused by pigment cells located throughout the mollusk-animal's body, particularly the mantle. Various pigments, obtained for the most part through the food consumed early in the animal's life, are concentrated by the cells and, in turn, these cells tint the newly forming shell. The individual designs depend upon the movements of "wandering" cells.

Collecting

Many collectors follow the tide charts in planning their shell hunts. Small specimens brought in by high tides are left lining the beaches when the tides recede. These shells seldom have live animals in them and, unfortunately, are not always in the best of condition. But they are often abundant.

Most mollusks are nocturnal so that excursions are especially productive at night. Snorkling with a strong light in the shallows is by far the best means of gathering good specimens. In areas where there are reefs, mollusks can be found clinging to or crawling over coral heads.

During daylight hours, the search for shells is more difficult. They may be found deep in the crevices and valleys of coral, or, in areas other than reefs, under stones and driftwood, and, often, among seaweed.

Commercial fishermen have on many occasions found beautiful specimens in their traps. This has led many collectors to set out traps of their own, baiting them with meat or fish.

Cleaning

The cleaning of shells is often considered the most laborious task facing the collector. There are no set rules applicable to all shells because the approach taken for one may be harmful to, or unsuccessful with, another.

Generally, the quickest way to clear a shell of its animal inhabitant is by boiling it in either salt or fresh water. To prevent cracking, it is wise to begin the process by placing the shell in cool water and slowly bringing it to a boil. After boiling it for about eight minutes, allow it to stand and cool. The animal's body can then be hooked and worked out of the shell by means of a bent pin.

Boiling cannot help clear the terebra. It is best in dealing with this mollusk to clean it when it is alive and extended enough to enable it to be penetrated with a sharp object and removed by means of a strong, steady pull.

A Waikiki Aquarium Publication

*Production has been severely hampered because of the lack of funds.

APPENDIX N

A Teacher's Guide to the Waikiki Aquarium

WAIKIKI AQUARIUM
Owned by the State of Hawaii
Administered by the University of Hawaii
HOURS

Tuesday through Saturday . . . 10 a.m.-5 p.m.
Sunday . . . . . 1 p.m.-5 p.m.
Monday and Holidays . . . . . Closed

General information

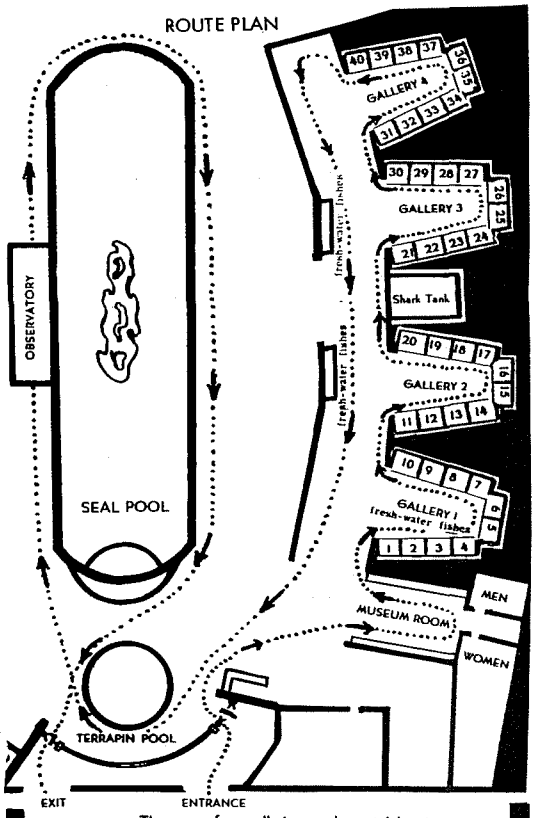
School groups may come to the Aquarium during the open hours without previous appointment. However, it is to the advantage of the group as well as the Aquarium to call several days prior to the planned excursion. If this is done, the Aquarium will be able to advise the tour leader whether or not there is liable to be a jam of groups at the time suggested. Most public schools require the teacher to phone prior to the excursion date. The Aquarium phone number is 923-9741.

Parking

Parking facilities fronting the Aquarium are very limited. The circular driveway cannot accommodate a bus. To avoid a tie up, which would necessitate our calling upon car owners to remove their vehicles so as to enable a bus to clear our driveway, it is necessary that the bus driver discharge his passengers at the bus stop on the street in front of the building. After the group has cleared the bus, the driver should then park farther on up Kalakaua or on the opposite side of the avenue.

Group leaders and teachers should immediately line the children up in single file before proceeding to the Aquarium entrance. The teacher should then announce their arrival to the cashier.

ROUTE PLAN



There are four galleries, each containing ten 300-gallon tanks. The gallery nearest the entrance contains Fresh-Water Fishes, most of which have been introduced and established on the island of Oahu. Hawaiian Reef-Fishes are displayed in the next three galleries.

The SEAL POOL is the home of both seals and large ocean-turtles. It has a capacity of 70,000 gallons. The pump supplying the pool delivers 400 gals. per minute or about 500,000 gallons a day.

A small MUSEUM ROOM contains exhibits of sea-shells, corals, crabs, starfishes, sea urchins and other marine animals.

Entering

There are turnstiles at the entrance and exit of the building--everyone entering and leaving the building must go through the turnstiles in single file, as it is almost impossible for children to pass through them while holding hands with each other. Each child, to enter, must push the horizontal bar on the turnstile. This device also counts the children. Teachers should precede the children through the children's turnstile in order to retain control of the group. If the teacher fails to do this, the children may become scattered about the building and it may be difficult to again assemble them. Parents accompanying the group are, by law, required to pay the 25¢ admission fee.

Please...

It is most important that the group leaders keep firm control over their spirited youngsters. Because of the narrow passageways, a continuously moving single file arrangement is by far the most appropriate. As much quiet as possible is especially important in the galleries.

Particularly interesting to most of the children who visit the Aquarium is the feeding of the seals. This is scheduled twice a day--11:45 in the morning and 2:30 in the afternoon.

Caution

While at the seal pool or the terrapin pool children are, under no circumstances, to put their hands anywhere near the animals.

The Shell and Coral Collections on display in the MUSEUM ROOM reflect Hawaii's unique location in the Pacific. Our islands mark the eastern boundary of the vast Indo-Pacific warm water faunal area. As such, Hawaiian waters and reefs are inhabited by species distributed in the areas to the south and west.

The SEAL POOL contains the HAWAIIAN MONK SEAL (one of only two mammals which originally populated these islands...the other being the bat. Other mammals either migrated or were introduced), the HARBOR SEAL (from the Pacific North-West), the GREEN SEA TURTLE, PACIFIC HAWKSBILL, ATLANTIC LOGGERHEAD, PACIFIC LOGGERHEAD.

The TERRAPIN POOL contains a wide cross-section of the Terrapin and Turtle families. Among the pool's inhabitants is the SNAKE-HEAD TURTLE, an odd looking creature which is able to extend its neck almost the the length of its body. The greenery among the rock-work at the pool's center includes FERN, COCONUT and ORCHID.

The landscaping features an assortment of tropical plants, bushes and trees; included are COCONUT and LAUHALA TREES, DATE PALMS and the exotic PHILODENDRON VINE.

APPENDIX O

MEMORANDUM FROM THE WAIKIKI AQUARIUM ADVISORY COMMITTEE TO JOHN P. CRAVEN

POLICY AND GUIDELINE STATEMENT - THE WAIKIKI AQUARIUM

The following statement was developed by the Waikiki Aquarium Advisory Committee in order to provide a framework for future legislation and action. The committee recognizes that the Waikiki Aquarium has the potential to become one of the finest marine education centers and aquatic displays in the world, and the committee has attempted to outline, in as succinct a manner as possible, the criteria, procedures, and recommendations for action to accomplish this goal.

I. Role of the Aquarium

To provide:

1. A unique marine experience not readily available from other sources, to the broadest possible spectrum of the community and visitor population. A visit to the aquarium should be an esthetic and fulfilling experience imparting information about the Hawaiian marine environment in a recreational manner. A visit to the aquarium should instill in Hawaiian residents a feeling for their integration with the life of the sea.

2. An interpretation of current concepts of marine conservation and living marine resource exploitation based upon an understanding and appreciation of the natural history of organisms, and of general ecological relationships in the Hawaiian marine environment. This is to be accomplished by innovative, imaginative displays, educational programs, and the broadest possible involvement of the public in aquarium activities.

3. Interpretation of complex concepts of current marine research into ideas that are meaningful to the general public. The aquarium should be

the public's window on marine research being conducted in the State of Hawaii.

4. A clearing house of information for the public's desires, queries, and aspirations concerning the marine environment, and a source of information on environmental concerns relating to the marine biota. This can be accomplished through displays and other interpretive material to provide information on current problems to be dispensed directly and through communication media. In a period of increasing environmental awareness, knowledge of the marine biota and how aquatic ecosystems operate is essential for enlightened public action.

5. Research facilites for thosepersons interested in the maintenance, propagation, and display of marine organisms. Such research should relate directly to the diseases, nutrition, propagation, and handling of aquarium species as well as to water quality, display techniques, interspecific interactions of organisms, and other facets of aquarium operation. Where possible research activities should be exhibited in order to convey a better understanding of the importance of research to the general public.

II. Administrative structure

In view of the dominant educational role of the aquarium, and in recognition of the existing emphasis upon marine activities in the areas of teaching, research, and public service at the University of Hawaii, the University is clearly the most appropriate agency in the State of Hawaii to administer the Waikiki Aquarium. Within the University, the Dean of Marine Programs should administer the aquarium as a separate entity through a director aided by an Advisory Committee,

both to be appointed by the Dean.

III. Board of Advisors, Director, and Staff

1. Role of Director

It is recognized that a successful aquarium director must have an unusual mixture of talents, some more important than others. In the context of an aquarium operation as a University of Hawaii function the requisite qualities of a director are listed below in their order of priority.

a. An aquarist with proven experience; a person with the respect of professional aquarists for his knowledge and skills, as well as by scientists, hobbyists, and other aquatic specialists. He should have a flair for combining scientific accuracy and artistic value in his exhibits.

b. An imaginative, innovative person who interacts well with all segments of the community, and with a strong enough academic background and/or sufficient experience so that his professional opinion on matters concerning marine biota will be respected by professional colleagues and the public at large.

c. A person with recognized administrative abilities adequate to manage an expanding organization.

d. A person with the ability to develop and nurture an aquarium educational program for entire state of Hawaii. Special emphasis should be placed on his ability to interact with, and to motivate younger people (elementary and high school age). Interested undergraduate and graduate university students should be encouraged to become directly involved in the docent and other volunteer

programs. The Director should be a person who can make effective use of the media to publicize the aquarium in a personally dynamic manner.

It is envisioned that a Director should not be chosen for his research record, nor should he be expected to conduct research, although he should be knowledgeable of research that relates to the organisms he will be displaying. He is also expected to encourage and support such research.

2. Board of Advisors

If the aquarium is going to serve the community, there should be a board of advisors or trustees consisting of influential and prestigious persons representative of the entire State of Hawaii who are sensitive to the needs of the community and the aquarium. This board should be as autocratic as allowable within the State and University structure, and should have as a major role the establishment of policy and the raising of funds from outside sources for special projects beyond those normally supported by state apporpriations.

3. Staff

The staff of the aquarium should be sufficient in number and composition to carry out the program decided upon by the Director and Board of Advisors. Serious consideration should be given to a staff position for an educational director who can give special emphasis to that program enlisting docents and other volunteers to make his program more effective.

IV. Operational procedures

Every effort should be made to make the aquarium operation financially self-supporting, consistent with its overall goals. These include solicitation of grants and contributions, consideration of concessions (e.g., gift and book shop) and a select admission fee with special consideration for local residents and school children, or a voluntary contribution program. The aquarium must serve the needs of the entire state, which may mean that at some future date branch aquaria be established on other locations throughout the state.

The exhibits should strive to represent natural aggregations of organisms and thereby convey ecological concepts, behavioral patterns and principles of conservation. The aquarium should emphasize (but not restricted to) Hawaiian aquatic organisms. Trained performing animals or extensive displays of animal skeletons, corals, shells, etc. are not considered appropriate to the aquarium's program. It is recognized that selective static displays of shells, corals, etc. used in an artistic manner to convey a message such as a plea for the conservation of a rare and endangered species are appropriate, particularly when they fill spaces in which live exhibits cannot be situated.

V. Recommendations

1. That $20,000 be appropriated for a director and provision made for continued support of the position.

2. A realistic appropriation for expanded operations be made, even though funds for its operation may be forthcoming from other sources at a later date.

3. That the appropriate mechanism and status be established to allow the aquarium to receive tax-free contributions, television rights, royalties on publications and slides, etc. for further support of aquarium programs.

4. Consideration be given to acquiring services of a consultant (if possible a successful aquarium director) to advise on the best means to realize the goals outlined for the Waikiki Aquarium. This should be done as soon as possible. Such a consultant should be charged with the development of a long range master plan for the evolution of an outstanding aquarium, for putting it on an independent financial base, and to aid in the choice of a director. For this purpose $15,000 should be acquired from other than legislative appropriation (if possible) in order to expedite this activity.

5. That the Aquarium be retained as a function of the University of Hawaii in recognition that both institutions serve the State's need for education and scientific interpretations. By continuing as part of the University, the Aquarium can become an important adjunct to the University of Hawaii marine programs, and additionally provide a mechanism for interaction between the University and all of the people of Hawaii on matters of the living marine environment.

6. That the admission fee be eliminated for elementary and high school students of the state of Hawaii. That the admission fee for others be determined by the Board of Regents of the University of Hawaii based upon recommendations of the President, and that receipts be placed in the aquarium revolving fund.

7. That the aquarium be renamed "Hawaiian Islands Aquarium" in order to reflect the broader scope of operations serving all of the people of Hawaii.