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LOCAL COASTAL PROGRAM
BACKGROUND REPORT

AQUACULTURE

June, 1979

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BACKGROUND REPORT

AQUACULTURE

June, 1979

This report is one of a series of background reports which will serve as the basis for the County's Local Coastal Program. The purpose of these reports is to provide the public with a statement of progress on the LCP and a focus for discussion of important coastal planning issues.

The San Mateo County Department of Environmental Management gratefully acknowledges the input and technical assistance of the University of California Sea Grant Marine Advisory Program in the development of this report. Without such assistance the publication of this report would not have been possible.

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I. PURPOSE

A. INTRODUCTION

Aquaculture, defined as the culture of plants or animals in an aquatic medium, is well established in California and is viewed as a future major producer of fisheries protein. The same characteristics that made California a world leader in agriculture could be viewed as highly favorable for aquatic husbandry. The mild climate, the availability of water ranging in temperature from cold to that of geothermal springs, and the 1,100 miles of coastal waters all contribute to California's potential as a major producer of aquaculture products.

B. DEFINITIONS

The following definitions are given to facilitate a better understanding of this report.

Aquaculture--is the culture of plants or animals in aquatic media. The term is also used to describe specific types of culture such as fresh water aquaculture, or saltwater (marine) aquaculture.

Mariculture--is another term used to describe saltwater or marine aquaculture. The terms aquaculture and mariculture will be used interchangeably in this report, and refer to existing and/or proposed commercial enterprises in one of the various stages of development.

Hatchery--facility used to spawn adult animals and rear the resultant eggs through successive larval stages to a form suitable for stocking in a grow-out system.

Grow-out Systems--systems used to grow the animals to a commercial size.

Extensive Culture--culture systems that incorporate a low density population of animals relative to the water volume, and where the

nutritional and environmental requirements of the animals are provided through the natural productivity of the water system.

Intensive Culture--culture systems where a high density of animals require supplementary food and environmental manipulation.

Maximum Sustainable Yield--the level of continuous harvest a fishery can sustain without suffering adverse impacts to the resource.

Mollusk--a group of animals including oysters, clams, mussels, and abalone.

Anadromous--an organism that lives in the sea and returns to fresh water in order to spawn.

Smoltification--the physiological process by which anadromous fish adjust to life in saltwater. Once changed, these young fish are called smolts.

Imprint--the process in which young salmon pick up a given stimulus from a specific site and use this stimulus to return to that site during spawning season.

The purpose of this background paper is to:

1. Present basic data on the significance and status of commercial marine aquaculture.
2. Provide interested individuals, decision makers, and others with a brief overview of the aquaculture industry as an emerging but important coastal dependent activity.
3. Propose policies to maintain and enhance aquaculture within the realm of coastal planning.

The information provided here will be incorporated into Commercial Fishing and Recreational Boating Element of the LCP and is designed to

stimulate public discussion of the important issues concerning the nature of aquaculture and its relation to other coastal activities.

C. COASTAL ACT POLICIES

Until very recently in California, planning policy with respect to aquaculture was non-existent. Therefore, it is relatively easy and useful to trace the emergence of aquaculture as a coastal planning issue in the State. During the development of the Coastal Plan (1975) aquaculture was documented as a marine use. In the chapter on the marine environment (page 26), the findings relative to aquaculture in coastal waters state that:

Aquaculture (water agriculture) involves the cultivation and harvest of aquatic organisms. Currently it produces most of the mollusks marketed on the West Coast. In the future, aquaculture techniques may be improved and applied to other species, reducing costs and increasing availability of fish and shellfish as sources of protein, etc.

Several sections of the Coastal Act (1976) apply to aquaculture. Aquaculture/mariculture is specifically mentioned only twice in the entire Act. The most important policy areas addressed are Sections 30230 and 30231 as noted in the March 23, 1978, State Commission review of San Mateo County's Work Program and Section 30255 previously identified by County staff as having implications for aquaculture development.

Section 30230. Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.

Section 30231. The biological productivity and the quality of coastal

waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of groundwater supplies and substantial interference with surface waterflow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that project riparian habitats; and minimizing alteration of natural streams.

Section 30233.

(a) The diking, filling or dredging of open coastal waters, wetlands, estuaries, and lakes shall be permitted in accordance with other applicable provisions of this division, where there is no feasible less environmentally damaging alternative, and where feasible mitigation measures have been provided to minimize adverse environmental effects, and shall be limited to the following:

(8) Nature study, aquaculture, or similar resource-dependent activities.

Section 30255. Coastal-dependent developments shall have priority over other developments on or near the shoreline. Except as provided elsewhere in this division, coastal-dependent developments shall not be sited in a wetland.

Coastal dependency is the most important policy which will guide the future development of aquaculture. The test of coastal dependency is stated in Section 30101 of the Coastal Act. Coastal-dependent development or use is defined as that "which requires a site on, or adjacent to, the sea to be able to function at all."

D. RECENT LEGISLATION

The California Aquaculture Development Act was recently passed into law by the State Legislature. This Act amends Section 30411 of the Coastal

Act. Of major significance to the LCP effort is Section 30411(c) which reads:

(c) The Legislature finds and declares that saltwater or brackish water aquaculture is a coastal-dependent use which should be encouraged to augment food supplies and to further the policies set forth in Chapter 4 (commencing with Section 825) (see SB 52) of Division 1. The Department of Fish and Game may identify coastal sites it deems appropriate for aquaculture facilities. Such sites shall be identified in conjunction with the appropriate local coastal program prepared pursuant to this division. The commission, and where appropriate, local governments shall, consistent with the coastal planning requirements of this division, provide for as many coastal sites identified by the Department of Fish and Game for uses as are consistent with the policies of Chapter 3 (commencing with Section 30200) of this division.

The Act further specifies that "the operative provisions of this Act shall be implemented by the DFG and the Resources Agency as funds are available within the department or the agency, or may hereafter become available through legislative appropriation for the purposes of this Act."

II. BACKGROUND INFORMATION

This section provides information basic to the discussion of issues and formulation of policies related to aquaculture.

A. AQUACULTURE SYSTEMS

1. Extensive and Intensive Culture

Aquaculture technology can be applied in either extensive or intensive culture systems. Extensive culture incorporates a relatively low density population of aquatic animals maintained in large aquatic systems such

as bays or estuaries. In these systems, animals are provided adequate nutritional and environmental requirements through the natural productivity associated with the body of water. This form of production usually requires leasing State-owned submerged lands or alteration of topography to accommodate large water enclosures. In the United States, and especially in California, land values and restricted use of submerged lands limit this form of aquatic husbandry. The California oyster industry uses extensive culture techniques to grow oysters to a marketable size using approximately 4,000 acres of leased submerged land distributed over four bay systems. The advantage of using extensive methods of oyster cultivation is the compatibility of the two biological systems. Studies have shown that the impact of oyster culture on the water quality of these bays is negligible and it has been demonstrated that production activities and maintenance of the biological environment are compatible.

In intensive aquaculture systems, animals are maintained in ponds, raceways or tanks, and in high densities requiring supplementary feeding and environmental manipulation. Because of economic and social factors in California many marine aquaculture systems are evolving towards more intensive applications. A number of species and associated intensive culture systems are being examined for commercial application, however, most still fall under the category of research and development. At present, viable commercial intensive marine aquaculture in California is limited to the culture of mollusks. Oysters, clams and mussels are spawned and the eggs are maintained in controlled systems where they are reared through their successive larval stages. When the oyster larvae, for example, settle as individual mollusks, they are further cultured in trays using water supplemented with algae for food or given access to the rich waters of bays or estuaries. The young seed oysters are then used to seed commercial systems in the U.S. or are sold on the international market.

2. Impact on Coastal Utilization

When extensive culture techniques are practiced, the possibility of impacts on other coastal uses is greater than when intensive systems are

employed. For example, with extensive oyster culture, it is sometimes necessary to fence large areas to afford protection from predators. Fencing of such waters could impact or restrict free passage, recreational boating and fishing within the area.

In contrast, intensive culture systems have a minimal impact on coastal utilization. Production facilities are designed to accommodate intensive units in the smallest space possible to facilitate maximum environmental control. These activities can be housed in a building or incorporated in external tank systems. With the trend toward high density intensive closed or semiclosed systems requiring less acreage, fewer coastal use conflicts are anticipated.

A common misconception concerning marine aquaculture involves the nature of the metabolic waste products of the cultured animals and its impact on coastal waters. The effluent discharged from marine culture systems is the natural metabolic waste product of marine animals and a natural product of the marine environment. These discharges are comparable to the natural metabolic discharges of oyster reefs and fish populations, and when properly disposed under permit regulations have a negligible impact on either ocean or bay systems. Aquaculture is subject to the environmental quality standards and regulations imposed at the various levels of government. In fresh water aquaculture, the effluent from fish farming operations is being used as a source of supplementary fertilizer for agriculture products. Research is now being conducted on the use of saltwater for the irrigation of barley and tomatoes to expand production in arid lands, and the nutrients from saltwater aquaculture are viewed as having the same potential when applied to saltwater culture of agriculture products.

In contrast to many existing coastal uses, most aquaculture (exclusive of oyster culture) represents a relatively new coastal/ocean use. Because of this, it is difficult to fully document those conflicts which might exist between aquaculture and other marine activities in close proximity. One effort which attempts to illustrate potential conflicts is the U.N. Economic and Social Council report, Uses of the Sea:

Report of the Secretary General (E/5120). A summary matrix titled "Potential Interactions of Marine Activities in Close Proximity" is included in the Appendix of this background report.

B. PROFITABLE MARINE AQUACULTURE ENTERPRISES

Marine aquaculture in the form of oyster culture has been practiced in California since the early 1850's. Native oyster production could not meet the market demand and oysters were shipped from the Puget Sound and the eastern U.S. for replanting in San Francisco Bay. The industry expanded with production reaching almost three million pounds of meat a year at the turn of the century. As the San Francisco Bay area was developed, water quality declined. Oystermen had discontinued the practice of rearing oysters from seed by 1921, and had abandoned the Bay Area by 1939. The industry remained depressed until the introduction of the Pacific Oyster at which time it experienced rapid growth in other bay systems in the State. The current oyster aquaculture industry, located primarily in Humboldt, Tomales, Drake and Morro Bays, accounts for over 90% of all oysters produced in California waters. The industry produced over 4,700,000 pounds of oyster meat between 1972 and 1977. The wholesale value of the 1977 oyster harvest was \$1,734,138 (Table 1). This form of extensive aquaculture has been active in California for more than a century contributing significantly to the State's economy through its fisheries markets, tourist restaurant trade and to its rich seafood heritage.

In the mid-1960's, the oyster industry took on new dimensions with the development of molluscan hatcheries. Rapid progress in molluscan larval technology has been achieved in the past seven years and today an active hatchery, Pigeon Point Shellfish Hatchery, is located in San Mateo County. The development of this facility, as well as others, is a direct result of a strong market demand for good quality seed stock coupled with limited availability, both here and abroad. The hatcheries have undergone the transition from commercial research and development projects to viable commercial industries producing Pacific, Olympia, European, Eastern and Samino oysters and several species of clams. Seed

stock is sold to buyers in France, Spain, Holland, the Scandinavian countries and Asia as well as the United States.

Shellfish hatcheries are an example of intensive aquaculture. Adult mollusks are maintained and spawned in controlled environment systems and the larvae are reared in intensive tank culture requiring precise environmental control. Because of the extremely delicate nature of the larvae, subtle influences of environmental contaminants can result in a complete loss in the hatchery. In addition, because of the capital costs involved in establishing a hatchery, short-term occupation of the facilities is not feasible. As a result of this, hatcheries avoid discharges that could be detrimental to their water source, in this case the marine system. The Pigeon Point Shellfish Hatchery at Pescadero pumps water from the rocky shoreline and uses the water to transport cultured algae and to maintain adults, larvae and seed oysters in tank systems. The metabolic load discharged is comparable to that of a small oyster reef and is regulated through the permitting process.

The activities of hatcheries are viewed as one of the most valuable aspects of aquaculture. The production of seed stock for food production and natural fisheries enhancement identifies hatchery aquaculture as a very beneficial coastal activity.

C. AQUACULTURE: RESEARCH AND DEVELOPMENT

With increased interest in aquaculture and the recognition of its future potential, many commercial organizations in California are investing in the research and development (R&D) of species previously not cultivated through aquaculture. These R&D species include among others, abalone of the genus Haliotis, and salmon of the genus Oncorhynchus produced through salmon ranching.

The California abalone fishery was first harvested intensively by Chinese divers in the early 1850's and accounted for landings in excess of 4 million pounds per year by 1879. Records kept by the California Department of Fish and Game since 1916 show a southward shift of com-

mercial populations and a decline in total landings beginning in 1969. Current landings amount to approximately one million pounds a year.

Prior to 1945 the abalone fishery was concentrated on the red abalone because of its large size, color and quality. Due to market demand and declining abundance of reds, pink abalone were added to the fishery in 1945 and small numbers of greens in 1950. With declining abundance in the late 1960's, the more inaccessible white and less desirable black abalones were added to the fishery. Despite these adjustments, declining populations of abalone in California and the world, coupled with accelerating market demands, have precipitated R&D abalone aquaculture. Since 1971, several companies have developed commercial hatchery and grow-out techniques and are predicted to make the transition from R&D aquaculture to viable commercial entities, in the near future. The aquaculture industry working primarily with red, pink and green abalone has technologies available for spawning, feeding, and larval settlement. Once the larvae settle on a substrate, they soon adopt the characteristic shell of the adult. Various methods are employed to grow the animal to market size including intensive tank culture and off-shore container culture where habitats are provided to the abalone, along with a diet of kelp. In demand are 1/2 to 1 inch abalone for fisheries enhancement programs, 4 inch abalone for the Asian market and larger abalone for the U.S. market.

Salmon ranching, only recently introduced to California, has been successfully employed in the Soviet Union, Japan, and with growing success in Alaska, Canada and Oregon. The concept uses the same basic principles as traditional salmon hatcheries which rely on the homing instinct of anadromous fish during spawning years. Traditional public hatcheries spawn and rear the young of salmon that are captured miles upstream from the river's mouth. The young fish are raised to juveniles then released at the hatchery site. The fish move downstream, undergo smoltification and move into the sea. Coho and Chinook salmon released under these conditions remain at sea from 30 to 50 months then return to the hatchery site where they were released. Return figures vary between 0.5 and 1.0 percent depending on losses incurred during the trip down-

stream, those due to natural mortality, disease, predation, and the harvest, and those incurred during the return trip in spawning season.

Salmon ranching employs the same basic techniques as traditional hatcheries, with few exceptions such as fish vaccination against kidney disease and a separation of the hatchery and release site. Fish are spawned and reared in intensive systems at a fresh water site, some of which employ heated water to accelerate growth and cut this portion of the cycle from 18 months to 7 months. When the fish are ready to undergo smoltification they are vaccinated and then transported by tank downriver to a holding facility at the release site. The fish are held for several weeks at the release site where they are "imprinted" before they are released to sea. Coho and Chinook stay at sea from 30 to 50 months before returning to the release site. With the initial trip down river and the return river trip removed, and increased health precautions, returns range from 1.0 to 6.0 percent. This represents a significant increase over the traditional hatchery-release system and has provided an economic incentive to commercial aquaculture. Special legislation in California has allowed an R&D salmon ranching facility to operate in Santa Cruz County (Silver King Oceanic Farms, Davenport), and new legislation is being considered to expand R&D opportunities to other operators (see Appendix B).

Both commercial R&D abalone culture and salmon ranching offer means of increasing available seafood and enhancing the existing fisheries. The California Department of Fish and Game is looking to commercial abalone hatcheries to provide small abalone for seeding programs on the central California Coast. Young salmon are utilized by both commercial and sportfishermen from the time they are released until they return to the release site as adults. This form of aquaculture whether it is operated through private ownership or through State cooperatives, has a positive impact on available salmon.

These two forms of marine R&D aquaculture were chosen as examples from a number of species being investigated. They were discussed because they are approaching commercial viability and show promise in contributing as

a food source. Other species such as bay scallops, lobsters, seaweed and additional finfish all have similar promise as a result of R&D efforts.

D. IMPETUS FOR AQUACULTURE DEVELOPMENT IN THE U.S.

1. Historical Response to a Depleted Fishery

Aquaculture practices began in the eastern United States as a direct result of depletion of the natural oyster fishery. In the early 1800's before the development of the cattle industry, the annual consumption of oyster meat on Long Island was 7 million bushels per year. By the 1850's the oyster fishery in Long Island Sound was depleted to the extent that oyster seedlings were transported from Chesapeake Bay and planted in the Sound for cultivation. As other centers of population developed throughout the country, the sequence of supplementation of the natural fishery through aquaculture was repeated. Oyster aquaculture spread along the Atlantic Coast, throughout the Gulf of Mexico into the Pacific Northwest. Today 40% of the oysters consumed in the U.S. are produced through aquaculture representing 22 million pounds of oyster meat valued at 21.2 million dollars in the wholesale market.

2. Enhancement of a Natural Resource

Aquaculture's role in supplementation and enhancement of a natural fishery was dramatically repeated in the U.S. salmon industry. Between 1880 and 1930 human activities including construction of dams, logging practices and fishing pressure resulted in a 90% reduction in the harvest of chinook, coho, pink, chum and sockeye salmon. The industry from the Puget Sound through California remains depressed in relation to historical runs, however, aquaculture has been instrumental in maintaining the commercial fishery, and in the case of chinook and coho has reversed the trend of declining abundance and harvest. The majority of salmon on the West Coast use the Columbia River for spawning and early life stages. Records show that 50% of all salmon returning to the Columbia to spawn were hatchery produced. It is estimated that 30% of

all Pacific salmon in the U.S. catch were hatchery produced in the State and Federal aquaculture facilities.

E. AQUACULTURE AND ITS RELATION TO WORLD FISHERIES

Because of its potential as an economic stimulus and as a major contributor to available protein, aquaculture has gained national attention. This interest has accelerated because of the international realization that there are limitations to the world's natural fisheries. Our traditional fisheries once thought to be unlimited are now estimated to be capable of producing an annual maximum level of harvest of 100 to 120 million metric tons (MMT).^{*} Excessive fishing beyond these limits are predicted to have adverse effects on the fisheries abilities to recover and to remain a viable resource.

In the late 1940's, the world harvest of fisheries products was approximately 20 MMT. The harvest was expanded to 69.7 MMT by 1975 and are predicted to reach 94 MMT in the next 20 years. With expanding world population, the demand for fisheries products will exceed availability. In the early 1950's, the U.S. with a fisheries landing of 2.8 MMT was ranked second to Japan with a harvest of 4.8 MMT. Since 1955 U.S. landings have remained the same and our fishing efforts are ranked sixth internationally. To meet the expanding market demand, the U.S. imports two-thirds of its fisheries products, representing an import expansion from 700 million pounds in 1946 to 4.7 billion pounds in 1976. Demand for fisheries products in the U.S. continues to expand, concurrent with increasing competition for the limited resource.

The majority of our traditional fisheries including cod, haddock, many flatfish, redfish, shrimp and lobster are estimated to be at or near their limits of natural production. Some species including the abalone, dungeness crab, American lobster, anchovy and sardine have disappeared as an existing fishery or have exhibited a marked decline in traditional fisheries grounds. These identified limits in production and marked

^{*}MMT = 2,204.6 pounds.

declines in our traditional fisheries have accelerated interest in aquaculture as a tool to supplement the existing supplies of fisheries products, and in some cases enhance the fishery through hatchery and reseeding programs. Aquaculture produces approximately 10% of the world's fisheries products and in 1975 the U.S. was ranked fifth in aquaculture production (Tables 2, 3).

The international fishing community has set goals for fisheries harvest that are predicted to meet natural production limits of our traditional fisheries within 25 to 30 years. The two major fishing nations, Japan and the Soviet Union, have identified aquaculture as the primary means of supplementing the natural harvest and have accelerated aquaculture development to match natural harvest 17 to 40% in 25 years. The U.S. has recognized these international objectives, and although the mechanisms to implement these programs have not been established in the U.S., they are being pursued. U.S. aquaculture has been identified as being in the national interest and given priority status through congressional intent. The contributions that aquaculture have made are significant and its future role warrants consideration in coastal planning processes.

1. Aquaculture Projections in the U.S.

In 1974, the National Marine Fisheries Service gathered available data to project the estimated fisheries supplies that could be achieved by U.S. aquaculture. The data presented represent projections gathered from public and private sources and were incorporated in the National Fisheries Plan. Total production from 21 selected species groups represents a current U.S. aquaculture contribution of 172 million pounds. It is estimated that, with proper support, production of 1.2 billion pounds annually can be achieved by the year 2000 (Table 2).

III. ISSUES

A. SITING AQUACULTURE FACILITIES

Aquaculture developments have the potential to be damaging to the environment. If not properly sited and designed, sensitive habitats may be harmed by tank overflow, development-related erosion, and removal of streambank vegetation.

However, if properly sited and designed, saltwater or brackish water aquaculture is a coastal-dependent use that may be compatible with a variety of existing coastal land uses. The absence of aquaculture as a permissible use in local zoning ordinances is because of the limited experience of local governments in dealing with such developments. It appears that coastal dependent aquaculture developments can be located in the Light Industrial and Resource Management Districts of the Land Use Plan if they are sited and designed to prevent adverse impacts upon sensitive habitats.

B. DEVELOPMENT IMPACTS

Because aquaculture facilities can cover large areas of land and require intake and outfall lines for seawater, their operation could be incompatible with recreational use of the adjacent beach.

To minimize impacts on coastal visual resources, facility structures could be well screened and depressed below grade when feasible.

The above-ground channels or pipes associated with coastal dependent aquaculture may interfere with lateral beach access for the public. Intake and outfall lines for ocean water can be placed underground unless the particular activity, such as salmon culture, prohibits it.

If channels and pipes must be above ground, adequate provisions for lateral beach access might be required.

Because of the potential hazards involved when an aquaculture facility

is located adjacent to high-use recreational areas, barriers could be erected to discourage encroachment by curiosity seekers, etc.

C. THE PERMIT PROCESS

Numerous agencies at the local, State and federal level regulate use of the ocean and coastal land. Lack of central control has led to a very complicated permit process which does not encourage potential aquaculturists. Because the State has not yet developed a policy for aquacultural developments, conflicts can develop among the permitting agencies, themselves. SB 52 provides for planning policies for aquaculture and gives the Department of Fish and Game authority to identify coastal sites deemed appropriate for aquaculture facilities in conjunction with the local coastal program. The County could assist the State in selecting suitable areas for aquaculture.

IV. POLICIES FOR AQUACULTURE

The County will:

1.1 Definition of Aquaculture

Define aquaculture as the culture and husbandry of aquatic organisms, including, but not limited to, fish, shellfish, mollusks, crustacians, kelp and other algae.

1.2 Appropriate Location for Aquaculture

Permit aquaculture in the Light Industrial and Resource Management District zones.

1.3 Permit Conditions for Shoreline Facilities

Require that aquaculture facilities to be sited on or near the shoreline be coastal-dependent developments or uses.

1.4 Definition of Coastal-Dependent Development or Use

As stated in Section 30101 of the Coastal Act, define coastal-dependent development or use to mean:

Any development or use which requires a site on, or adjacent to, the sea to be able to function at all.

1.5 Sensitive Habitats

- a. Require that development be sited and designed to prevent adverse impacts on areas designated as sensitive habitats.
- b. Require that natural vegetation buffer areas be maintained to protect riparian habitats.

DEVELOPMENT STANDARDS

1.6 Coastal Visual Resources

Require that facilities be compatible with natural surroundings. Shoreline facility structures should be well screened and depressed below grade where feasible.

1.7 Intake and Outfall Lines

Require that intake and outfall lines be placed underground unless not feasible for a certain activity such as salmon culture.

1.8 Coastal Access

Require that aquaculture facilities adjacent to high use recreational areas erect barriers designed to discourage encroachment.

ROLE OF THE COUNTY

1.9 Permit Policy

Work with the State to identify coastal sites appropriate for aquaculture facilities.

V. REFERENCES

Conte, F. S. and Manus, A. T. 1979. Aquaculture and Coastal Zone Planning: An Information Package. Davis, CA: University of California Sea Grant Marine Advisory Program (in preparation).

Department of Planning and Economic Development. 1977. Permits and Environmental Requirements for Aquaculture in Hawaii. Honolulu, Hawaii: State Center for Science Policy and Technology Assessment.

_____. 1978. Aquaculture Development for Hawaii. Honolulu, Hawaii: State Center for Science Policy and Technology Assessment.

Glude, J. B. (ed.). 1977. NOAA Aquaculture Plan. Washington, D.C.: U.S. Department of Commerce/NOAA/NMFS/OSG.

National Academy of Sciences. 1978. Aquaculture in the United States Considerations and Opportunities. Washington, D.C.: NAS.

VI. APPENDIX

OUTLINE OF CONTENTS

Appendix A - SB 52

Appendix B - AB 1458 (not enacted)

Table 1 - State Aquaculture Oyster Production

Table 2 - World Aquaculture Production in 1975

Table 3 - Production in the Major Aquaculture Countries in 1975

Table 4 - Projected Marine Animal Aquaculture Production

Table 5 - Potential Interactions of Marine Activities in Close Proximity

Senate Bill No. 52

CHAPTER 187

An act to amend Section 8345 of the Fish and Game Code, to amend Section 30411 of, and to add Chapter 4 (commencing with Section 825) to Division 1 of, the Public Resources Code, relating to aquaculture, making an appropriation therefor, and declaring the urgency thereof, to take effect immediately.

[Approved by Governor June 29, 1979. Filed with Secretary of State June 29, 1979.]

LEGISLATIVE COUNSEL'S DIGEST

SB 52, Keene. Aquaculture.

(1) Under existing law, it is unlawful for any person to sell or purchase any rock scallops or scallops.

This bill would allow such scallops, cultivated pursuant to specified provisions, to be sold or purchased under such regulations as the Fish and Game Commission may prescribe.

(2) Under existing law, every person engaged in the business of cultivating marine life, with specified exceptions, is required to procure a license for such purpose, and existing law permits the leasing, in accordance with specified procedures, of state water bottoms for the cultivation of marine life.

This bill would enact the California Aquaculture Development Act to require the Director of Fish and Game to appoint an aquaculture advisory committee which includes specified representatives, require the advisory committee to conduct an investigation, as specified, relating to aquaculture development, require the director to select and the Department of Fish and Game to contract on behalf of the advisory committee with a qualified nongovernmental institution to conduct a study addressing specified matters, require the advisory committee to report to the Governor and Legislature on or before June 30, 1980, and specify related duties of the advisory committee.

The bill would make legislative findings and declarations in connection with the practice of aquaculture, and would provide for related matters.

The bill would also authorize the department to identify, in conjunction with the appropriate local coastal program, coastal sites it deems appropriate for aquaculture facilities, and if such sites are identified, would require the department to take specified action. It would also require the California Coastal Commission and local governments to provide for as many coastal sites identified by the department for such uses as are consistent with the coastal resources planning and management policies specified in the California Coastal Act of 1976.

The bill would specify that the operative provisions of the bill shall be implemented by the Department of Fish and Game and the Resources Agency as funds are available within the department or the agency, or may hereafter become available through legislative appropriation, for the purposes of the bill.

(3) The bill would reappropriate to the department for the same purpose the unencumbered balance of a \$50,000 appropriation to the department from the California Environmental Protection Program Fund which was made in the Budget Act of 1978.

(4) The bill would go into immediate effect as an urgency statute.
Appropriation: yes.

The people of the State of California do enact as follows:

SECTION 1. Section 8345 of the Fish and Game Code is amended to read:

8345. It is unlawful for any person to sell or purchase any rock scallops (*Hinnites multirugosus*) or scallops (*Pecten circularis*), except that such scallops cultivated pursuant to Article 4 (commencing with Section 6480) of Chapter 5 of Part 1 of Division 6 may be sold or purchased under such regulations as the commission may prescribe.

SEC. 2. Chapter 4 (commencing with Section 825) is added to Division 1 of the Public Resources Code, to read:

CHAPTER 4. AQUACULTURE DEVELOPMENT

825. This chapter shall be known and may be cited as the California Aquaculture Development Act.

826. The Legislature finds and declares that it is in the interest of the people of the state that the practice of aquaculture be encouraged in order to augment food supplies, expand employment, promote economic activity, increase native fish stocks, enhance commercial and recreational fishing, and protect and better use the land and water resources of the state.

827. The purpose of this chapter is to establish a policy and program toward improving the science and practice of aquaculture as a means of expanding aquaculture industry and related economic activity in the state.

828. As used in this chapter, "aquaculture" means the culture and husbandry of aquatic organisms, including, but not limited to, fish, shellfish, mollusks, crustaceans, kelp, and algae. Aquaculture shall not mean the culture and husbandry of commercially utilized inland crops, including, but not limited to, rice, watercress, and bean sprouts.

829. As used in this chapter, "director" means the Director of the Department of Fish and Game.

830. As used in this chapter, "department" means the

Department of Fish and Game.

831. As used in this chapter, "advisory committee" means the aquaculture advisory committee appointed pursuant to Section 834.

832. The advisory committee shall investigate the status of aquaculture research and practice and shall identify those current and prospective actions most likely to contribute to significant and economic aquaculture development compatible with the environmental policies of the state. The director shall select, and the department shall contract on behalf of the advisory committee with, a qualified nongovernmental institution to conduct a study. The advisory committee may disapprove the design of the study or the qualifications of the nongovernmental institution. The study shall address, but not be limited to, the following areas:

(a) Development for adoption by the Legislature of a state policy on aquaculture for California. The policy shall include a finding that describes the relationship between the practice of aquaculture and the agricultural industry.

(b) Development and recommendation of criteria for determining the suitability of species for use in aquaculture.

(c) Development and recommendation of criteria for the identification of those geographic areas, both coastal and inland, suitable for aquaculture.

(d) Recommendation of criteria for allocation of those areas determined to be suitable for aquaculture.

(e) The impact of aquaculture on existing fisheries, including, but not limited to, the release and capture of domestically reared anadromous fish in state waters.

(f) Compatibility with other land use policies, including recreation, scientific studies, and protection of estuarine and wetland areas.

(g) The use of waste waters in aquaculture.

(h) Existing constraints, both governmental and private, with emphasis on the constraints to small-business oriented and labor intensive aquaculture.

(i) Needed future governmental actions, including any incentives that might be appropriate and useful.

The advisory committee shall report the results of the study, together with the recommendations for administrative and legislative actions, to the Governor and Legislature on or before June 30, 1980.

833. The department shall be the lead agency for purposes of the California Environmental Quality Act (commencing with Section 21000 of the Public Resources Code) for any project involving the issuance of a permit required pursuant to Chapter 5 (commencing with Section 6400) of Part 1 of Division 6 of the Fish and Game Code.

834. The director shall appoint an aquaculture advisory committee to assist the department in carrying out the provisions of this chapter. The advisory committee shall include, but not be

limited to, the director; a representative of the Department of Food and Agriculture; representatives of a public institution of higher education, the commercial fishing industry, the recreational fishing industry, the freshwater fish farming industry, and the marine and brackish water aquaculture industry; a representative of the Assembly, to be selected by the Speaker of the Assembly; and a representative of the Senate, to be selected by the Senate Committee on Rules. Before selecting industry members of the advisory committee, the director shall consult with, and consider qualified delegates nominated by, organizations representing the aquaculture industry.

The advisory committee shall, in addition to its duties under Section 832, hold regular meetings, exchange information concerning activities of any state agency or institution involved in aquacultural activity, comment on the design of the study required pursuant to Section 832, and periodically review the progress of the study.

SEC. 3. Section 30411 of the Public Resources Code is amended to read:

30411. (a) The Department of Fish and Game and the Fish and Game Commission are the principal state agencies responsible for the establishment and control of wildlife and fishery management programs and neither the commission nor any regional commission shall establish or impose any controls with respect thereto that duplicate or exceed regulatory controls established by such agencies pursuant to specific statutory requirements or authorization.

(b) The Department of Fish and Game, in consultation with the commission and the Department of Boating and Waterways, may study degraded wetlands and identify those which can most feasibly be restored in conjunction with development of a boating facility as provided in subdivision (a) of Section 30233. Any such study shall include consideration of all of the following:

(1) Whether the wetland is so severely degraded and its natural processes so substantially impaired that it is not capable of recovering and maintaining a high level of biological productivity without major restoration activities.

(2) Whether a substantial portion of the degraded wetland, but in no event less than 75 percent, can be restored and maintained as a highly productive wetland in conjunction with a boating facilities project.

(3) Whether restoration of the wetland's natural values, including its biological productivity and wildlife habitat features, can most feasibly be achieved and maintained in conjunction with a boating facility or whether there are other feasible ways to achieve such values.

(c) The Legislature finds and declares that salt water or brackish water aquaculture is a coastal-dependent use which should be encouraged to augment food supplies and to further the policies set

forth in Chapter 4 (commencing with Section 825) of Division 1. The Department of Fish and Game may identify coastal sites it deems appropriate for aquaculture facilities. If the department identifies such sites, it shall do so by October 1, 1980, and shall by the same date transmit information identifying such sites to the commission and the relevant local government agency. The commission, and where appropriate, local governments shall, consistent with the coastal planning requirements of this division, provide for as many coastal sites identified by the Department of Fish and Game for such uses as are consistent with the policies of Chapter 3 (commencing with Section 30200) of this division.

SEC. 4. The operative provisions of this act shall be implemented by the Department of Fish and Game and the Resources Agency as funds are available within the department or the agency, or may hereafter become available through legislative appropriation, for the purposes of this act.

SEC. 5. The unencumbered balance of the money appropriated in category (c) of Item 171 of the Budget Act of 1978 is hereby reappropriated to the Department of Fish and Game for expenditure for the purpose specified therein. Such money shall be available for encumbrance until June 30, 1980.

SEC. 6. This act is an urgency statute necessary for the immediate preservation of the public peace, health, or safety within the meaning of Article IV of the Constitution and shall go into immediate effect. The facts constituting such necessity are:

In order that the aquaculture program contemplated by Item 171 of the Budget Act of 1978 for the 1978-79 fiscal year may be commenced during the 1978-79 fiscal year, it is necessary that this act go into immediate effect.

AMENDED IN ASSEMBLY MAY 9, 1979

CALIFORNIA LEGISLATURE—1979-80 REGULAR SESSION

ASSEMBLY BILL

No. 1458

Introduced by Assemblyman Bannai

March 29, 1979

REFERRED TO COMMITTEE ON WATER, PARKS, AND WILDLIFE

An act to repeal ~~and add~~, *add*, and *repeal* Article 6 (commencing with Section 6550) to Chapter 5 of Part 1 of Division 6 of the Fish and Game Code, relating to fish.

LEGISLATIVE COUNSEL'S DIGEST

AB 1458, as amended, Bannai (W., P., & W.). Domesticated anadromous fisheries: salmon.

Existing law does not permit the Fish and Game Commission to grant a permit to the holder of a domesticated fish breeder's license to release and capture domestically reared anadromous fish in state waters, except for specified waters, under specified conditions, and until January 1, 1981.

This bill would ~~make legislative findings and declarations until January 1, 1985, and~~ allow the commission to grant such a permit for the raising of chinook and silver or coho salmon only. ~~It would~~, require that a public hearing be held prior to permit issuance, place restrictions on such issuance, and provide that all fish released into the wild; are state property while in the wild. It would also require that a permit granted by the commission contain specified conditions. *The bill would make legislative findings and declarations in such connection.*

Vote: majority. Appropriation: no. Fiscal committee: yes.

State-mandated local program: no.

The people of the State of California do enact as follows:

1 SECTION 1. Article 6 (commencing with Section
2 6550) of Chapter 5 of Part 1 of Division 6 of the Fish and
3 Game Code is repealed.

4 SEC. 2. Article 6 (commencing with Section 6550) is
5 added to Chapter 5 of Part 1 of Division 6 of the Fish and
6 Game Code, to read:

7

8 Article 6. Domesticated Anadromous Fisheries

9

10 6550. The Legislature finds and declares that:

11 (a) It is the policy of the state to manage the wildlife
12 and fish resources of the state to provide optimum
13 economic, recreational, and biological benefits for
14 present and future generations of citizens.

15 (b) The commercial and sportfishing salmon
16 industries are essential to the economic well-being of the
17 state, and the present low level of harvestable salmon
18 stocks has caused these industries to become
19 economically depressed.

20 (c) It is in the best interests of the state that salmon
21 stocks returning to state waters be increased with the
22 consequent benefit to commercial and sport fishing
23 salmon industries and the general public.

24 (d) The siting, construction, and operation of private
25 salmon hatcheries and release and recapture facilities
26 will enhance the salmon species while avoiding conflict
27 with the production and utilization of public fish and the
28 freedom of citizens to utilize public fish pursuant to the
29 law.

30 6551. This article applies only to chinook salmon
31 (*Oncorhynchus tshawytscha*) and silver or coho salmon
32 (*Oncorhynchus kisutch*).

33 6552. The holder of a domesticated fish breeder's
34 license may be granted a permit by the commission,
35 under such terms and conditions as the commission may
36 prescribe, to release and recapture domestically reared

1 anadromous fish in state waters.

2 6553. Prior to issuance of any permit by the
3 commission, a public hearing shall be held in the county
4 or counties affected. Notice of the hearing shall be
5 published at least once, and at least 10 days prior to the
6 hearing, in a newspaper of general circulation in each of
7 the counties in which the hearing is to be held, or if no
8 such newspaper is published in that county or counties
9 then in such a newspaper in an adjoining county. The
10 hearing shall be conducted by either (a) the commission,
11 (b) a member of the commission designated by it, or (c)
12 the director if requested to do so by the commission.

13 Such employees of the department as may be necessary
14 or are requested by any interested group of persons, shall
15 be present at the hearing.

16 6554. No permit shall be issued which may interfere
17 with the natural runs of anadromous fish, result in waste
18 or deterioration of fish, or when the proposed operation
19 is located on a stream or river below a state or federal fish
20 hatchery or egg-taking station.

21 6555. All fish released into the wild under authority of
22 this article, while they are in the wild, are the property
23 of the state and may be taken under the authority of a
24 sport or commercial fishing license.

25 6556. Any permit granted by the commission
26 pursuant to this article shall contain the following
27 conditions:

28 (a) Domestically reared anadromous fish released into
29 state waters shall be marked as the commission
30 determines practicable. Any such marking shall be
31 approved by the commission.

32 (b) If after a hearing, the commission finds that the
33 operation described in the permit and conducted
34 pursuant to this article is not in the best public interest,
35 the commission may alter the conditions of the permit to
36 mitigate such adverse effects, or may cause an orderly
37 termination of the operation under the permit.
38 Proceedings to cause such alteration or termination shall
39 be conducted in accordance with Chapter 5
40 (commencing with Section 11500) of Part 1 of Division 3

1 of Title 2 of the Government Code, and the commission
2 shall have all the powers granted therein. An orderly
3 termination shall not exceed a three-year period and shall
4 culminate in the revocation of the permit in its entirety.
5 During this period, the permittee may continue to
6 examine and take specified domesticated anadromous
7 fish according to the provisions of the permit, but may
8 not release additional fish.

9 (c) If the commission finds that the operation has
10 caused deterioration of the natural run of anadromous
11 fish in the waters covered by the permit, it may require
12 the permittee to return the fishery to the same condition
13 as it was prior to issuance of the permit. If the permittee
14 fails to take appropriate action, the commission may
15 direct the department to take such action, and the
16 permittee shall bear any cost incurred by the
17 department.

18 (d) Prior to release into state waters the fish shall be
19 examined by the department to determine that they are
20 not diseased or infected with any disease which, in the
21 opinion of the department, may be detrimental to the
22 state fishery resources.

23 (e) The permittee shall have the right to divert all fish
24 returning from public waters to an inspection area as
25 authorized by the commission, and shall be allowed to
26 examine all fish for the purpose of identifying
27 domestically reared fish that have returned.

28 (f) No unmarked fish may be transported from the
29 trapping facility other than to be returned to state waters.

30 (g) All fish not bearing marks required and approved
31 by the commission for the permittee will be returned
32 unharmed to public waters.

33 *SEC. 3. This article shall remain in effect only until*
34 *January 1, 1985, and as of such date is repealed, unless a*
35 *later enacted statute, which is chaptered before January*
36 *1, 1985, deletes or extends such date.*

Table 1. State aquaculture oyster production in lbs. packed weight* and gallons of shucked oysters.

	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>
Pounds	885,001	726,875	799,742	799,689	706,358	828,538
Gallons	102,907	84,520	92,993	92,987	82,134	96,341

*Packed weight is estimated to be 15.1% of live weight for C. gigas and 10.9% for C. virginica. Live weight includes the shell. Shucked gallons are calculated as 8.6 lbs/gal for C. gigas and 8.5 lbs/gal for C. virginica.

Table 2. World aquaculture production in 1975.

<u>Species Groups</u>	<u>Production in Metric Tons</u>
Finfish	4,000,000
Seaweeds	1,000,000
Oysters	600,000
Mussels	240,000
Scallops	63,000
Clams	38,000
Cockles & Other Mollusks	30,000
Shrimps & Prawns	15,000

Source: Glude, J.B. 1978. The contribution of fisheries and aquaculture to world and U.S. food supplies. In *Drugs and Food From the Sea*. University of Oklahoma Press. pp. 235-247.

Table 3. Production in the major aquaculture countries in 1975.

<u>Country</u>	<u>Production in Metric Tons</u>
China	2,500,000
Japan	945,000
India	494,000
USSR	210,000
USA	151,000
Indonesia	144,000
Taiwan	126,000
The Philippines	125,000
Korea	83,000
Thailand	83,000
Bangladesh	76,000

Source: Glude, J.B. 1978. The contribution of fisheries and aquaculture to world and U.S. food supplies. In *Drugs and Food From the Sea*. University of Oklahoma Press. pp. 235-247.

Table 4. Projected marine animal aquaculture production based on estimates from the 1974 National Fisheries Plan.

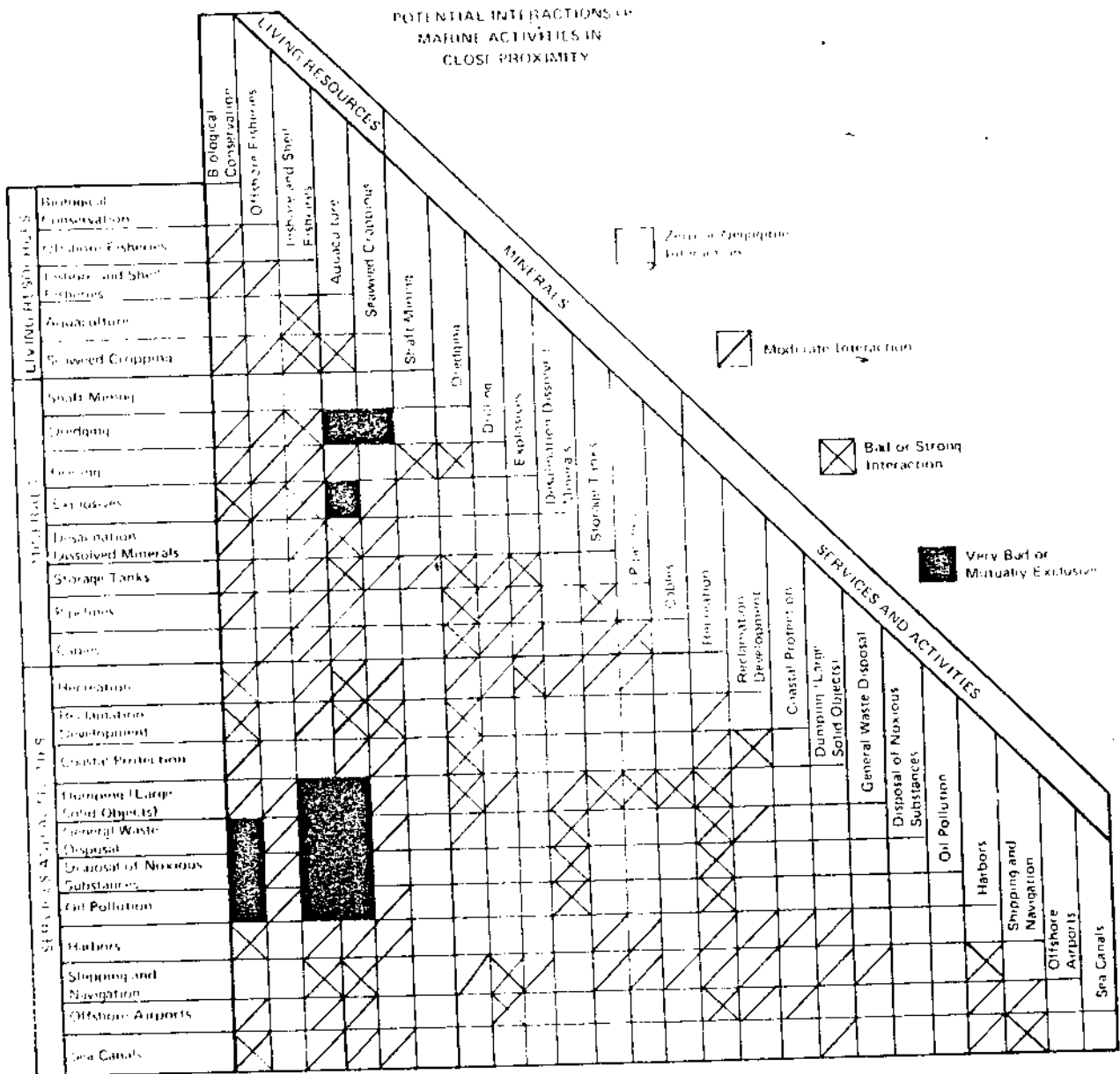
SPECIES GROUP	FISHERIES PRODUCTION Thousands of Pounds	CURRENT AQUACULTURE Thousands of Pounds	POTENTIAL AQUACULTURE PRODUCTION IN THOUSANDS OF POUNDS		
			1983	1988	1993
Pacific Salmon					
Public	213,000*	60,000	70,000	90,000	100,000
Private		1,000	14,000	60,000	120,000
Oysters	48,500*	20,000	40,000	80,000	200,000
Shrimp					
Penaeids	372,200*	500	7,000	23,000	43,000
(marine)					
Pandalids	70*	0	100	1,000	5,000
Lobster	29,000*	0	1,000	5,000	10,000
Clams (Hard and soft shell)	23,600**	2,600	5,000	10,000	25,000
Bay Scallops	1,800*	0	500	2,000	5,000
Abalone	700*	0	500	1,000	5,000
Mussels	800**	0	1,000	10,000	25,000
Pompano	1,400**	0	100	500	3,000

*1973

**1972

Source: Glude, J.B. 1978. The contribution of fisheries and aquaculture to world and U.S. food supplies. In Drugs and Food From the Sea. University of Oklahoma Press. pp. 235-247.

TABLE 5



United Nations, Economic and Social Council, Uses of the Sea: Report of the Secretary General E/5120 (New York: United Nations, 1972), p. 35.

ACKNOWLEDGEMENTS

PREPARED FOR

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San Mateo County Board of Supervisors

Fred Lyon, Chairman
Edward Bacciocco
John Ward
James Fitzgerald

San Mateo County Planning Commission

Lore Radisch, Chairman
Ernest Galeotti
Mem Levin
Conrad Pavellas
Wayne Thomas

Participating Planning Staff

David C. Hale, Planning Director
Mark Duino, Senior Planner
Lynn Koehnemann, Planner I

NATIONAL ARCHIVES DEPOSITORY
1980-1981 BUILDING
URI, DANIEL WEBSTER DAY CAMPUS
NARRAGANSETT, RI 02882

Typing

Frances Contreras

Technical Assistance

Fred S. Conte, Aquaculture Specialist, U.C. Cooperative Extension,
Sea Grant Marine Advisory Program
Andrew T. Manus, Area Marine Advisory/Coastal Resources Specialist,
U.C. Cooperative Extension, Sea Grant Marine Advisory Program