

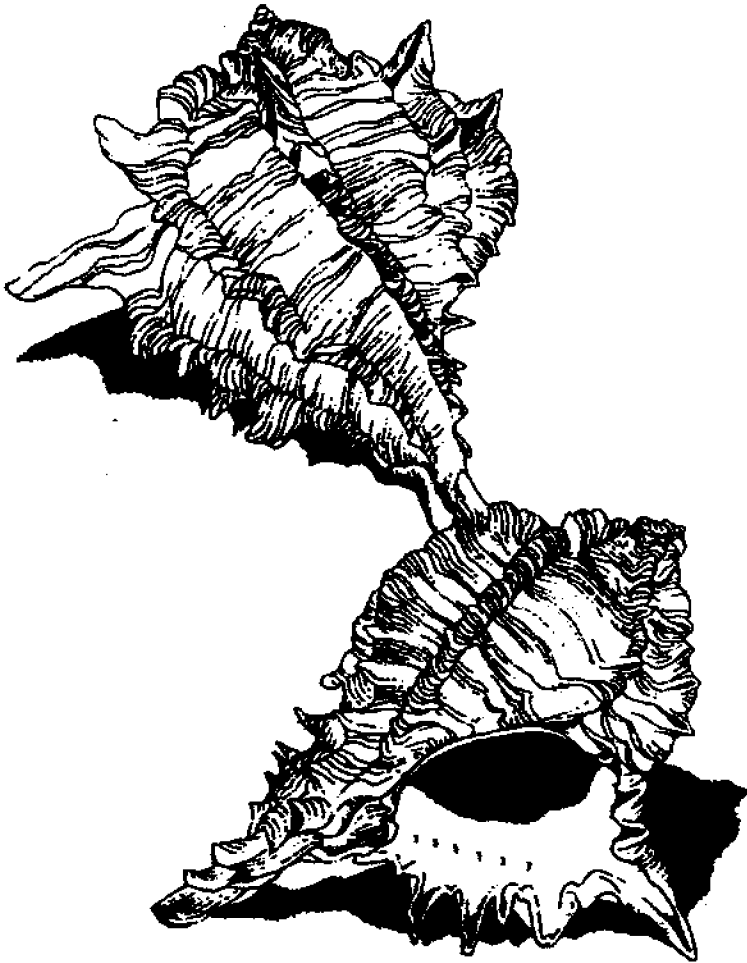
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Working Paper
89-3

***A Policy and Management Assessment
of Southeast and Mid-Atlantic
Artificial Reef Programs***

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A Policy and Management Assessment of Southeast and Mid-Atlantic Artificial Reef Programs

BY

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\$3.00

November 1989
UNC Sea Grant Publication UNC-SG-WP-89-3

This project was conducted under the Federal Aid in Sport Fish Restoration Act (Dingell-Johnson Act) through the Wallop-Breaux Amendment, and funded, in part, by the U.S. Department of the Interior, U.S. Fish and Wildlife Service, under Project No. F-25. This work was also partially sponsored by the Office of Sea Grant, NOAA, U.S. Department of Commerce, under Grant No. NA86AA-D-SG046, Project No. A/EA-10, and the state of North Carolina through the University of North Carolina. The U.S. Government is authorized to produce and distribute reprints for governmental purposes notwithstanding any copyright that may appear hereon.

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Acknowledgements

I would like to thank the N.C. Division of Marine Fisheries for their funding and support of the project. In particular, Fentress "Red" Munden, Mike Street and Liz Noble facilitated the funding process and provided ideas on approaching the project. Stephen Phillips of the Sport Fishing Institute and Joe McGurrin of the Atlantic States Marine Fisheries Commission provided thoughts on the report format and helped to focus it to meet the needs of the commission's Artificial Reef Committee. I acknowledge the helpful comments on the first draft by Dave Adams, Art Cooper, Mike Meier, Mark Reef, Bud Griswold, Liz Noble, Joe McGurrin, Dick Stone and Stephen Phillips. Nancy Davis provided excellent editing support. I also would like to thank the artificial reef managers from New Jersey to Texas. They patiently sat through lengthy interviews and provided the ideas included in this report.

Executive Summary

For a variety of reasons, public interest in artificial reefs has grown throughout the late 1970s and 1980s. The increased demand for artificial reefs and the corresponding increase in reef-building activity by local and state governments and private interests led to a re-examination of artificial reef development. This concluded with the National Artificial Reef Plan of 1985. The plan suggested that states should play a major role in the development of guidelines for artificial reefs.

Most coastal states have not established clear development plans that consider social, economic, environmental and biological factors associated with their artificial reef programs. Of the 12 coastal states from Texas to New Jersey analyzed in this study, nine do not have an approved artificial reef management plan. Using insights from artificial reef managers, states can develop more effective policies, plans and programs.

Specifically, the objectives of this report are to: 1) describe the general status of state artificial reef programs in reference to the issues of administration, budget, siting, promotion and education, evaluation, and future trends and major concerns; 2) typify and describe generic management problems associated with current programs; 3) provide recommendations to develop effective state policies.

Using a form of the Delphi technique, state artificial reef managers in the 12 states were interviewed. Answering a pre-determined set of open-ended questions, each described the situation in his/her state related to the issues identified in objective 1. After completing this phase, identical questions related to the same issues were repeated, but this time the managers were asked to assume they could set up the program exactly as they saw fit without interference or constraints from their agency or public. This, in effect, reflected their idealized version of how the program should work.

This report is structured according to those major issues. For each section, general patterns are described, problems identified and analyzed, and recommendations made. The report addresses overall issues and not individual state management regimes. The latter are included in Appendix II. Twenty-nine recommendations are made for state agencies to consider as they develop or improve artificial reef policies and management plans. The recommendations are presented at the conclusion of each of the five sections of Chapter II and concern administration, budget, siting/construction, promotion and education and evaluation of artificial reef management systems.

Chapter I

Introduction

Artificial reefs and fish aggregating devices (FADs) are tools that fishery managers can use to improve or enhance fishing and diving benefits. Because of increased commercial and recreational demands on fishery stocks and the loss of estuarine habitat and water quality, more fishermen are competing for the same fish. Properly constructed artificial reefs can enhance bottom habitats and fishing for benthic and pelagic species, provide quality fishing grounds closer to access areas, benefit the economies of shore communities, and increase the total fish biomass in an area (Stone, 1985).

Public interest in artificial reefs has grown throughout the late 1970s and 1980s. Explanations for this include: 1) a perceived reduction in catch per unit of effort because of increased competition for the resource, 2) a growth in saltwater recreational fishing that has outpaced U.S. population growth (Chandler, 1984), 3) increased affluence and the ability to buy offshore boats, 4) increased participation of sportfishing groups in the political process, and 5) the high visibility for reefs often generated by state agencies in their reef-building programs. North Carolina, for example, has established 42 ocean and 24 estuarine artificial reef sites (Noble, 1988). In 1985, the growing popularity of artificial reef development led to applications for 30 additional estuarine reef sites, necessitating a moratorium on permits by the director of the N.C. Division of Marine Fisheries until a publicly discussed general permit was adopted. The moratorium was believed necessary by the division and the N.C. Marine Fisheries Commission because of a lack of research on the effectiveness of estuarine reefs, concerns over interference with traditional commercial trawling activities, and fear that state artificial reef resources would be spread too thin.

In response to similar situations, Congress passed the National Fishing Enhancement Act of 1984 (P.L. 98-623, Title II). The act directed the secretary of commerce to develop and publish a long-term national artificial reef plan "to promote and facilitate responsible and effective artificial reef use based on the best scientific information available." The act went on to state: "Planning and management are needed to ensure that maximum anticipated benefits are derived from artificial reefs. Improperly planned, constructed, or managed reefs can be ineffective, interfere with other activities or damage natural habitats and benefits may not be realized." The plan, developed in 1985, stated that it is imperative for state agencies to play a major role in the development of national and site-specific guidelines for artificial reefs. It recommended development of artificial reef policies and management plans by the states.

Section 205 of the National Fishing Enhancement Act required the Secretary of the Army to deny a permit "to a person unless that person demonstrates to the secretary the financial ability to assume liability for all damages that may arise with respect to an artificial reef and for which such permittee may be liable" (P.L. 98-623, Title II). The risks can be substantial and include; 1) injuries to personnel handling the reef materials; 2) damage to vessels transporting the reef materials; 3) improper location causing damage to fishing gear; 4) damage to vessels in transit over the reef; 5) injury to recreational divers; 6) movement of the reef to an unauthorized location; or 7) environmental hazards caused by incomplete cleaning of hulls or holds (Stone, 1985).

The plan recommended that the secretary of commerce and chief of the U.S. Army Corps of Engineers (Corps) provide explicit permit standards and conditions to minimize the risk that can be associated with improper artificial reef development. The effect of this recommendation was for the Corps to require permit applicants to provide proof of liability insurance. Since many reef builders are fishing clubs with limited assets, the provision has necessitated that, in most cases, the states hold the permits.

Of the 417 research papers reviewed by Bohnsack and Sutherland (Bohnsack and Sutherland, 1985), only 15 dealt with sociology and economics. None expressly analyzed artificial reef policy. They state:

"Unfortunately, a naive and usually unstated attitude exists among some managers: they know artificial reefs work; they do not need to know how they work. Too much emphasis is often given to amateur input especially in deciding where and where not to build reefs. Some programs appear to continually build reefs without having a well-defined objective or end point."

Bohnsack and Sutherland went on to recommend that reef builders develop comprehensive plans for artificial reef development and deployment.

Because of these trends, most states either have or plan to develop a statewide artificial reef management plan. As of this writing, along the Gulf and East coasts, only New Jersey, Louisiana and

North Carolina have administratively approved statewide artificial reef management plans. All but one state (Alabama) in the Gulf, Southeast and Mid-Atlantic regions are considering plans.

Objectives

The goal of this study is to describe and analyze state artificial reef management systems. Artificial reef development may be hindered by a lack of state management policies. Most coastal states have not developed clear plans that identify purposes of their reef program or that consider social, economic, environmental and biological factors. Using insights from artificial reef managers, it is suggested that states can develop more effective policies. The need for coastal states to develop artificial reef management plans was addressed in the National Artificial Reef Plan. The plan also indicated research was needed "to compile and evaluate the 'state-of-the-art' information on artificial reef development and management" (Stone, 1985).

Specifically the objectives of this paper are to: 1) describe the current status of artificial reef programs in relation to administration, budget, siting, promotion and education, evaluation, future trends and major concerns; 2) typify and describe generic management problems associated with current programs; 3) provide recommendations for the development of effective artificial reef programs at the state level.

This study analyzes policy issues, points out generic problems and suggests recommendations or ideas to improve state artificial reef management systems. There is no one way to develop state policy. Each state has developed a management system based on historical, social, economic and political factors. However, as some states develop or review policies and plans, these states may be able to adapt their programs to successful models which exist in other states. This report attempts to assist in that process.

Methodology

This study used a form of the Delphi technique. The Delphi technique is a process that maximizes idea generation by soliciting the opinions of experts (Delbecq *et al*, 1975). For this study, the experts were the state artificial reef managers. They must deal with the myriad of situations related to reef programs from construction activities and budgets to public relations with various interest groups.

Because of the predominance of reef building in the Gulf, Southeast and Mid-Atlantic regions, the geographic area chosen for this study was coastal states from Texas to New Jersey. During a four weeks from mid-February to mid-March 1988, structured open-ended interviews were conducted with each reef manager at his/her office. East Coast reef managers were chosen from the membership of the Artificial Reef Committee of the Atlantic States Marine Fisheries Commission. The director of marine fisheries in each state appointed an agency staff member with principal responsibility for artificial reefs to participate on the committee, and these individuals were chosen for the interview. Along the Gulf, reef managers were identified by the state directors of marine fisheries. Interviews lasted from one to four hours. In some cases, other staff in the artificial reef program participated.

After confirming a date for the interviews, letters identifying the topics to be covered were sent to each manager (see Appendix I). To expedite the interview, managers were asked to have available certain documentation such as organizational charts, statutes and budgets. The format of the interview was to describe their current state situation as it related to each issue.

After completing this phase, identical questions relating to the same issues were repeated. But this time, the managers were asked to assume they could set up the program exactly as they saw fit without interference or constraints from their agency or public. The second set of questions in effect, reflected their idealized version of how the program should to work. The managers were assured that their idealized version would be written generically (in this report) to provide them anonymity. For example, in the first set of questions managers were asked where the artificial reef program appeared in their agency's organizational chart. In the second set of questions they were asked how they would structure the artificial reef program within the agency's organization chart if it were up to them. The second set of questions helped to provide a framework for states now reviewing their artificial reef management programs.

The remainder of the report is structured by major issues. For each section, general patterns are described, problems identified and analyzed, and recommendations made. The report addresses overall issues and not individual state management regimes. To understand the context from which the ideas were generated, Appendix II includes a description of current state programs as of March 1988.

Chapter II

Artificial Reef Management Systems

Administration

Description

Of the 12 artificial reef managers interviewed, 10 reported their programs were administered as part of the state's marine resources or fisheries agency. One manager represented a private, nonprofit foundation, the Mississippi Gulf Fishing Banks Inc., and reported to its board of directors. Another was located at Louisiana State University, but this appointment was temporary until a state hiring freeze was lifted at the Louisiana Department of Wildlife and Fisheries. Of the 10 who were part of fisheries agencies, there were no clear organizational patterns. Four report to the head of the fisheries management section, three to the chief of fisheries, one to the head of recreational fisheries, one to the head of fisheries development and another to the assistant secretary of the department of natural resources. Only three managers worked solely on artificial reef programs, and one of these reported being routinely reassigned to help other divisions. None of the managers had control over all of their equipment needs. Most borrowed equipment or personnel from other divisions within the agency on a project-by-project basis. Most contracted with private companies for some or all of their equipment and services.

Only four of the 12 states have statutes that govern the reef programs, and these were generally broad. For instance, North Carolina law gives the Marine Fisheries Commission the power and duty to establish standards and adopt rules and regulations governing the location and utilization of artificial reefs in coastal waters (General Statute 143B-289.4 (2) (i)). Additionally, fisheries regulations give the fisheries director the power to close or restrict by proclamation coastal fishing waters, including artificial reefs. Conditions established for closing artificial reefs include 1) limits on the area to be restricted, 2) limits on the time to be restricted (maximum one year), 3) a requirement for the director to consider the economic effect of the closure, and 4) a requirement for the reef-closing proclamation to be approved by the Marine Fisheries Commission at its next official meeting (North Carolina Marine Fisheries Commission, 1988).

In Florida, statutes and rules establish the procedures for administering the artificial reef grant program with the counties.

The Louisiana Fishing Enhancement Act (Act 100-1986) signed into law on June 25, 1986, is the most comprehensive set of statutes pertaining to artificial reefs at the state level. The act provides for 1) establishment and administration of the artificial reef program, 2) creation of a Louisiana Artificial Reef Council, 3) establishment of a Louisiana Artificial Reef Development Fund, 4) development of a reef plan, 5) establishment of the state as the permittee for artificial reefs developed under the plan, and 6) relief from liability (Wilson, et al, 1987).

Three states (Louisiana, North Carolina and New Jersey) have approved artificial reef plans. Eight of the nine remaining managers expressed the desire to compile a plan, with Virginia and Maryland having already initiated the process. One manager believed his current management situation was satisfactory and a plan was unnecessary.

All reef managers have developed working relationships with other federal and state agencies with common interests, notably the U.S. Army Corps of Engineers, the U.S. Coast Guard and the U.S. Environmental Protection Agency. Informal relationships with other agencies and programs vary from state to state and are dependent on the motivation of the artificial reef manager to build a network of support. Numerous examples were mentioned. One reef manager obtains diver support from volunteer police and fire departments. Another obtains labor from inmates at the Department of Corrections. The U.S. Navy and Marine Corps provide explosives for sinking ships and barges. Materials have been obtained from departments of transportation, General Services Administration and the National Park Service, to mention a few. Sea Grant programs provide education support and assistance for liaison with fishing groups. These informal working relationships seem to work well and are usually developed by managers with primary responsibility for artificial reefs. They have more latitude within their agency to work these arrangements on their own.

Two opinions predominate regarding the liability question. One group is unconcerned about liability,

providing the conditions of the permit are followed. They believe that as long as they abide by the permit, their liability exposure is minimal. Another group is quite concerned by the liability question and has tried to obtain rulings from their state's attorney general's office. In most of these cases, the ruling has not been forthcoming or has been too vague to be of assistance to the managers. To date there still has not been a lawsuit regarding artificial reefs. The issue will most likely remain vague until this happens. One manager mentioned his agency had ruled that its personnel cannot dive on artificial reefs for liability reasons. The manager was able to successfully get around this ruling by purchasing a remotely operated vehicle-submarine with videotape capabilities.

Discussion

The organizational arrangement of the reef program within its parent agency, although varied, mattered little to the reef managers. They had learned to adapt to their system, and none suggested changes in the organization chart.

A problem repeated by several managers was a lack of control over equipment and personnel. Most programs still rely on materials of opportunity for construction. But it is difficult to schedule and plan the placement of these materials. Reef managers must often borrow equipment and personnel from other departments or subcontract for these services. In these cases, they are at the mercy of another division head who may control the barge or a state purchasing agent who controls subcontractual procedures. For economic efficiency reasons, each department does not need to be self-sufficient, but the managers believed the system could be improved.

Each state has a unique purchasing system. Some reef managers were frustrated over missed opportunities for materials because of too much bureaucracy in the purchasing department. Often, when materials become available, they must be acquired with expediency. Discussion with state purchasing agents regarding contingency plans for such situations may prove useful for situations in which quickness is necessary.

Most reef managers preferred to operate under the auspices of an artificial reef management plan. In contrast, only one manager preferred the adoption of statutes to guide his artificial reef program. This preference was in order to obtain statutory authority to develop a plan. Most reef managers were afraid of legislative interference and did not want their legislature to develop statutes. They desired a policy approved by their management council or commission to establish a decision-making framework to justify their positions in public.

Most managers preferred the general permit approach with the U.S. Army Corps of Engineers. A general permit allows for building a reef without applying for an individual permit, provided all conditions of the general permit are met. The general permit helps them to comprehensively plan their programs and saved administrative paperwork. Several managers said reef permitting and other requirements within the Corps and Coast Guard varied by district. Several managers in the Gulf wanted greater enforcement activities by the Corps in response to illegal reef building. They feared a public backlash to state-supported reef building activities, if illegal reefs caused problems.

Innovative programs involving local units of government and the private sector varied from state to state. Those programs most successful in developing local liaison were more likely to have managers who had sole or principal responsibilities for artificial reefs. Beyond this pattern, the reef managers who were aggressive and had established an assistance network of individual agencies within their state seemed to have well developed local programs.

At least three managers believed they were at a disadvantage within their agency because either their administration or legislators were not willing to spend state resources in the federal waters referred to as the Exclusive Economic Zone (EEZ). To them, this was paramount to building a state park in another state. In most coastal states however, reef building is precluded in territorial waters because of lack of suitable water depth, particularly for large, high profile reefs. This interjurisdictional problem derives from the perceived loss of management control over reefs by states that built them.

The South Atlantic Fishery Management Council has included a Special Management Zone (SMZ) Provision in the Fishery Management Plan for the snapper-grouper fishery of the South Atlantic. Any reef permit holder can ask the council to designate a reef as an SMZ with certain approved restrictions. Restrictions can be placed on gear, minimum sizes of fish, areas and/or seasons for artificial reef use.

Currently the SMZ classification is only available to the South Atlantic states (North Carolina, South Carolina, Georgia and Florida). Several reef managers in the Mid-Atlantic and Gulf favored this approach in their regions. It would allow the states management control over reefs they are building. This would help to eliminate the perceived ownership problem and would allow management options for

minimizing potential problems associated with incompatible gear types .

The liability issue in artificial reef development has been discussed often since the publication of the National Artificial Reef Plan, which recommended the U.S. Army Corps of Engineers develop specific permit standards and conditions. The Corps has developed a policy requiring the permit holder to prove adequate liability coverage. Because most private fishing associations cannot afford the insurance premiums, many states have assumed the role of the permittee. Although many state managers welcomed this as a way of gaining control of artificial reef activities, it has necessitated a closer inspection of each state's liability. The level of concern varied widely, but the general consensus was that clarification is needed from the state's attorney general's office. Most reef managers felt that even this would be vague and subject to interpretation until a case comes before a court.

Recommendations

1. Each state should obtain a general siting permit from the Corps. The general permit requires the state to develop a holistic approach to siting decisions. Once the site(s) are selected and approved, public pressure to "build a reef in my backyard" ceases. Further, it reduces the agency time and effort required to comply with the law.
2. Artificial reef managers should be given more managerial authority over personnel, equipment and budget. The mechanisms to achieve this will vary from state to state, but upper level agency managers with active reef programs should review their administrative structure to be sure program efficiency is not impaired by scheduling problems associated with labor or equipment. Interagency agreements should be investigated as a management device to formalize personnel or equipment sharing. Since some of these changes may require additional expenditures, states should explore ways to increase allocations to the reef program through Wallop-Breaux or other federal aid, saltwater sportfishing licenses or other programs.
3. Each state should develop an artificial reef policy and management plan. This recommendation was made in the 1985 National Artificial Reef Plan and has only been partially realized. Nine of the 12 states in this report do not have a plan, and eight of these nine states would like to develop one. A lack of time or agency interest were the reasons most cited for not having a plan. Agency administrators should encourage reef managers to produce a plan and to provide extra staff or hire consultants to assist the manager in writing it. To take advantage of the experiences of other states more advanced in the planning process, a peer review system should be fostered.
4. In the Gulf and Mid-Atlantic regions, the states should work with the fishery management councils to develop SMZ provisions in appropriate fishery management plans. The provisions could be modeled after the South Atlantic Council's, and would reduce states' concerns about a lack of management authority over "their" reefs in federal waters.

Other Ideas

During the course of the interviews, reef managers expressed some other specific ideas. Although they do not apply to all situations, they are presented here as considerations.

1. The National Marine Fisheries Service should periodically train district personnel of the Corps, EPA and Coast Guard in the purpose of the national reef plan and agency responsibilities necessary to carry it out. Some disparity was reported in the interpretation and implementation of agency responsibilities by individuals or district offices. Annual or biennial training sessions would provide consistency among regions and districts for policies and programs and help to coordinate agency activities. Procedural manuals could be developed, with state input as necessary, to supplement the meetings.
2. Reef managers should explore regional funding opportunities for shared ownership of equipment that often requires high capital expenditures. Some equipment such as underwater video cameras, submarines or side-scan sonars would be useful but not cost effective for each state to purchase. But, if joint proposals to purchase and use this equipment could be developed, it would cost agencies and the public less or provide more benefits per dollar spent. Saltonstall-Kennedy Funds could be used and the regional or national headquarters of NMFS or a state agency could serve as the owner of the equipment and schedule its use.
3. The Gulf states, through the recreational fisheries committee of the Gulf States Marine Fisheries Commission, should appoint an artificial reef advisory committee composed of reef managers. The purpose of the committee would be to improve communication and coordination among reef managers

- and advise the commission on reef issues needing their attention. A similar committee exists in the Atlantic states, and managers felt it was helpful.
4. States should develop policies on tax breaks for donations of equipment, materials and services. Several states have used tax incentives to encourage donations of materials, but with the exception of the Louisiana Artificial Reef Initiative, the incentive programs have not been clearly established and presented to the public. Clear policies that outline and encourage tax benefits will enhance private participation in reef development and will help managers negotiate with the private sector. Also, the reef programs should work through their fisheries agency with the state's department of transportation to specify reef building options in contracts for bridge and highway construction projects.
 5. Discussions should be held with the federal General Services Administration to allow more flexibility in the use of government surplus property. For example, confiscated vessel hulls can be used for reefs, and the sale of electronics or engines could be used to recoup the costs of placement. The present system requires the proceeds of any sales to revert to the GSA and prohibits managers from building reefs using this option.
 6. Each state should review their artificial reef program with their state's attorney general's office in order to clarify their program's liability exposure. Some states have sought help from their attorney general's office, but the resultant clarification has remained vague, in part because the questions were vague. What is needed is an in-depth review of artificial reef program operational procedures with the attorney general's office. From a liability standpoint, the review would either help to improve operational procedures or reduce uncertainty about exposure on the part of artificial reef managers.
 7. Regional and national artificial reef management and analysis will be assisted by composite data about numbers, types and locations of reefs. Artificial reef managers should input reef building activity data into the National Marine Fisheries Service's artificial reef data profiles system maintained on computer at NMFS headquarters in Washington, D.C., and the Sportfishing Institute. The data is designed to keep current the *Profile of Atlantic Artificial Reef Development* published by the Atlantic States Marine Fisheries Commission (McGurrin, 1988).

Budget

Description

Typifying a state artificial reef budget is difficult. Comparisons of budgets between states are meaningless because costs sustained by other divisions within the agency were not reported or considered. For example, buoys are a major budgetary component in some states. In Maryland, all artificial reefs are marked with buoys, but buoying expenses are paid by the Waterway Improvement Division and are not reported as an artificial reef expense.

The average reported annual budget for reef programs was \$139,000, with a range of \$0 to more than \$400,000. Most monies are generated from either Wallop-Breaux funds or state appropriations. Wallop-Breaux funds refer to the 1984 Wallop-Breaux Amendment to the Federal Aid in Sport Fish Restoration Act. The program is designed to increase sportfishing and boating opportunities through the investment of anglers' and boaters' tax dollars. The amendment measures that most affect artificial reefs are 1) an increase in available sportfish restoration program funds and 2) a requirement for more equitable expenditures between freshwater and saltwater projects (Moyer and Christian, no date). In recent years, most budget increases have been because of Wallop-Breaux allocations. Other sources of funding have been mitigation (Virginia, New Jersey), one time appropriations for specific projects (most states), unfunded motor boat fuel taxes (Virginia), or a saltwater fishing license (Maryland).

Typically the artificial reef program is shown as a line item in a state's marine fisheries budget. The budget figures are developed by the reef manager based on past appropriations plus adjustments for new projects and inflation. Budget negotiations are likely to occur at the division level. Once the budget leaves the division, it is rarely changed.

Staffing size and patterns were difficult to distinguish, but the average staff size was small; 1.1 full-time equivalents with a range of 0 to 4.

Most programs either own or have access to vessels. Other equipment runs the gamut from forklifts, dump trucks and front-end loaders to remote submersibles equipped with VCRs. Six programs maintain a buoy system, and three of these contract out the work. Most managers prefer contracting for construction over the alternative of owning and maintaining barges and other reef building materials.

Few states have cost-sharing arrangements with local government. In New Jersey, counties pay for

materials and construction costs. In Alabama, the private sector (usually fishing clubs) provides the funds for material acquisition and placement. In these two cases, the state holds the permits and manages the activities.

Discussion

Eleven of 12 reef managers believed their program needed more money. Eight managers reported needing more personnel, and three believed they needed more money for either purchasing a barge or paying to subcontract one. They thought increased funding should come from state appropriations for specific projects, private fund raising efforts, mitigation rulings, county allocations or additional Wallop-Breaux grants. These kinds of funding are subject to great fluctuations. An artificial reef management plan, recommended in the previous section, would provide additional leverage when requesting budgetary expansion. Losses or additions of special projects or reallocations within the agency's budget can shift available funds. As a result, personnel and equipment can be spread too thin in years of budget increases or underutilized in years of decreases. Some states are either using or plan to use pre-fabricated reefs to provide a base of activities to keep personnel and equipment fully employed between materials-of-opportunity projects.

Some managers complained about delays necessitated by the state procurement procedures required to purchase, clean or transport materials of opportunity. Quick turnaround with contractors is often necessary to take advantage of material availability. In some cases the timing of the state's fiscal cycle hinders reef building activities. In at least one state, the fiscal year ends on June 30 in the middle of the reef building season, and funds cannot be carried over into the next year. This causes unnecessary guesswork and timing of construction activities in order to spend the monies.

Recommendations

1. Reef managers should keep their agency administrators closely informed about all aspects of their program. Budget requests stand or fall at the department or agency level. To achieve support for budget needs, constituent feedback and budgetary limitations must be communicated on a routine basis. Some programs routinely reported results and needs to their superiors. Others rarely did.
2. Each state should maintain a base budget for its artificial reef program. With a fixed operating budget that remains constant over several years, reef managers will be better able to forecast and plan activities. Beyond the base budget, the state should provide a pool of funds to be held in an trust fund for special projects which can't be forecast. The account could be augmented through the annual budgetary process or other means such as user fees or fines for fishery violations.
3. If possible, reef managers should be granted short-term, no-cost extensions of their budget. This is particularly important for states whose fiscal year ends in the middle of the construction season.
4. To take full advantage of material availability, states should develop and implement quick processing procedures with their purchasing department. This is especially important in circumstances requiring expediency.

Siting/Construction

Description

Six reef managers said recreational fisheries enhancement was the primary purpose of their artificial reef program. The major objective of three others was to enhance commercial and recreational fisheries. One manager viewed the program as primarily a grants program to the counties; another said the main objective was to build oyster reefs. Two program managers believed commercial fisheries enhancement would receive more attention in the future.

Each program used some form of deductive planning to decide on individual reef sites, notably exclusion mapping. Areas under consideration for reef sites were chosen based on proximity to access points, obstructions or available materials. Specific sites were chosen in these areas after physical and biological attributes were reviewed and conflicts with other uses were determined to be minimal. The managers most often cited interference with navigation, productive natural areas and commercial fishing as reasons to avoid an area. They were sensitive to the needs of their commercial fishing constituency and made formal and informal attempts to gain approval of sites from them prior to reef construction.

Three managers were opposed to fish aggregating devices (FADs), and two were in favor of them.

The remainder were either building or planning to build FADs or planned to but had reservations about them. In one Gulf state, the reef manager did not believe FADs would work because of high currents. Only one state actively supported a FAD program. In other states, FADS were either being built privately or experimentally by the state.

Materials of opportunity provide the cornerstone of most reef programs, and many kinds of materials are being used. Scrap vessels and bridge and highway rubble are the building blocks of most reef programs. In the Gulf, Louisiana has already used and Mississippi has plans to use obsolete oil rigs. Alabama plans to receive help from gas companies building platforms over a newly tapped gas field.

Other materials include quarry rock, railroad cars and oyster shell. Tires, the former mainstay of reef programs, have lost their popularity because of problems associated with their physical movement. Several states have moratoriums on the use of tires, however New Jersey and Virginia are placing tires in concrete units (TICs). Five states are testing or building prefabricated reefs.

Georgia is using a concrete slab with PVC pipe protruding from it like porcupine needles. South Carolina is experimenting with three designs. These include steel cubes with and without mesh, concrete culvert pipe with holes and fiberglass reinforced plastic materials. Virginia is building "igloo" reefs that are concrete, half-domes with holes and TICs. Maryland is using fiberglass re-enforced plastic (FRP) materials and New Jersey is using TICs. Florida's program rules prohibit the state reef program from using state funds for material acquisition. Materials are procured by the counties, which sometimes use state grant funds.

Four reef programs have benefited from funds generated through mitigation efforts. The reef managers have not actively pursued mitigation programs because their agencies have policies recommending kind-for-kind trades, and artificial reefs cannot compensate for loss of wetlands.

Only five of the 12 states use some type of advisory committee for programmatic or siting input. Several managers cited a fear of relinquishing control of the program as the main reason for not having one.

Discussion

The majority of reef managers view their constituency as sport fishermen. Some said the reefs were for all fishermen, but the main user group was still recreational fishermen and, to a lesser extent, sport divers.

Pressure for artificial reef construction by state agencies has come largely from sportfishing groups. Special appropriations to strip and sink a liberty ship or barge have been made because of activism by the sportfishing community. Wallop-Breaux funds, which have increasingly been used in the past few years for reef programs, are generated from excise taxes on sportfishing equipment and are earmarked for sport fishing enhancement.

A few reef managers said they would like to build reefs for commercial fishermen. To accomplish this, they will need more support from commercial fishing interests to press for appropriations. Federal funds other than Wallop-Breaux will have to be used. Saltonstall-Kennedy funds may be one alternative. These funds are allocated by the National Marine Fisheries Service for purposes of fisheries development. Existing management tools being used to protect sportfishing activities could be extended to commercial fisheries. Special Management Zone (SMZ) restrictions could, for example, be used to exclude sportfishing gear (hook and line) on some reefs. Reefs built for commercial fishing purposes could be constructed with funds generated by commercial fishermen.

Building FADs poses a dilemma for artificial reef managers and is often met with ambivalence. The managers are housed in agencies with responsibilities for managing and conserving fishery stocks. Since FADs serve to attract rather than produce fish, there are concerns that FAD building might exacerbate problems related to the management goals of maintaining sustained yields at or near present levels of fishing, especially for stressed fish stocks. The concern was particularly true in states outside the South Atlantic that did not have the SMZ management tool available to them. Since the goal of reef programs in most states is to enhance the recreational fishery, a few managers believed FADs would make more fish available to fishermen at a relatively low cost. One program builds inexpensive "throwaway" FADs for \$4/unit. The objectives of conservation and enhancement either already have or soon will conflict in many states. Fisheries agencies will have to carefully review their FAD policies to minimize uncertainty by the reef managers and to present consistent policies to the public.

The concern extends beyond FADs. Many managers were concerned about the conservation vs. aggregation question in general. One troublesome problem is related to the inability of artificial reefs to assist fishery production at all stages of the life cycle. Several managers were worried they were not

doing enough to enhance nursery or estuarine habitat and that too much emphasis was being placed on improving habitat used by fish only during adulthood. These managers believed research should determine how some reefs attract or produce different species of fish. Such information could lead to better reef building and to achieving more holistic fishery management objectives. Managers also were sensitive about overfishing of demersal stocks on artificial substrate reefs. The average red snapper caught on Alabama artificial reefs was 0.8 pounds, and the manager believed he lacked options to correct the situation.

There was an apparent trend of increasing preference for prefabricated reefs over materials of opportunity. During the past several years, many states have increased their reef building activities, budget and staff. Since 1986, the Wallop-Breaux funds have fueled even greater expansion. Effective utilization of budget and staff requires a steady source of reef materials. Materials of opportunity are available only sporadically and present a feast or famine situation to reef managers. With increased funding, several programs have begun to build reef structures, which has allowed long-range planning to target reef acreage and better utilize personnel levels. As will be shown in the evaluation section, better funding has enabled better evaluation of designs. This assists reef managers to better justify and defend their programs.

Reef managers as a group were ambivalent about how to obtain public input for the reef program. Only a minority used an advisory committee, and in at least three cases, the committees rarely met. Reef managers recognize the value of public input and of having a public group legitimize their decisions. But there was trepidation that they would lose control of their program to a committee. On the other hand, several managers expressed concern about how their decisions would be accepted by the public.

In the future as reef budgets grow and programs become more complex, managerial decision-making will also become more complex. More people are demanding specific types of reef programs or sites. Although the structure will vary from state to state, reef managers eventually will have to develop advisory committees. If they are carefully conceived and managed, advisory boards can provide valuable input and take pressure and uncertainty from the manager without losing managerial control. For example, a few managers perceived the public wanted offshore sites, but managers also believed these reefs served only a small user group. Even so, they felt compelled to accommodate the vocal minority of offshore fishermen who advocated offshore reefs. By appointing a balanced artificial reef advisory committee, the managers would have a sounding board to test these ideas. If offshore reefs were not considered a priority, they would have an appointed group of fishermen representatives to help them defend their positions.

Recommendations

1. Reef managers should formalize public participation in artificial reef programs. To adhere to state management objectives and to avoid "the squeaky door gets the grease" influences, advisory boards or committees should be established to help reef managers develop new ideas and make trade-offs and choices for reef building activities. In some cases, the reef manager could use existing boards, such as the recreational fisheries advisory committees that exist in some states. This group, or a subcommittee of it, could act as an artificial reef advisory committee. If a new committee is appointed, care should be taken to make certain there is membership balance among clientele groups. It should be clearly pointed out to new members that their role is advisory and final decisions are made by the state. Most cooperative extension or Sea Grant programs have specialists available to assist government agencies develop advisory boards. They should be consulted if there is doubt about how to begin.
2. More research is needed on the ecological affects of artificial reef programs. Managers now appear to be uncertain about the ecological impact of reef construction. Are they conflicting with state fishery management objectives? Are there limiting factors elsewhere in the ecosystem that will hinder attempts to build healthy stocks of target reef species? If nursery areas or estuarine habitat are important to production in a species' life cycle, should a percentage of the reef budget be spent enhancing these areas? If so, how does the reef manager arrive at the appropriate percentage? Unless we can answer these questions, reef managers will continue to face uncertainties. Specifically related to siting, three areas of research were suggested: 1) What is the productivity of estuarine reefs and can they be built to complement offshore reefs?, 2) Can nursery areas be improved to complement reef productivity?, and 3) Can we design reefs to selectively target non-stressed species (species being harvested at below maximum sustainable yield)?
3. State agencies should encourage the Fishery Management Councils to implement SMZs management

measures to manage fish and fishermen. Reef managers believed they needed to site more reefs inshore near user groups. Although these reefs receive the most use, managers feared inshore reefs might lead to overfishing and conflict between user groups. This could happen without management systems designed to minimize potential problems. Time, area or use zoning could be developed to avoid conflicts, and sanctuaries and/or closures could be implemented to allow for rebuilding of overfished stocks.

4. Each state fisheries management agency should develop a FAD policy. As noted, the reef managers felt much ambivalence about FAD construction. Often, FAD building by the artificial reef program was driven by pressure from sportfishing groups, and the manager worried that by attempting to accommodate his constituency he was creating long-term problems for the stocks. A FAD policy developed at the top level of the agency would reduce or eliminate the present dilemma.

Promotion and Education

Description

Ten of the 12 reef managers believed it was their agency's responsibility to develop educational and informational programs to inform the public about its artificial reef program. Two of these believed the responsibility should be shared with their Sea Grant program. Two other managers said the primary responsibility for reef education was with the state's Sea Grant program. Most recognized the high profile nature of their reef program and believed it provided good public relations for their agency.

The types of educational activities varied and are shown below as follows:

<u>Educational activity</u>	<u># of states that use it</u>
slide programs	8
pamphlets	7
speaking engagements	7
Loran handouts	4
films or videos	4
displays	3
guides	2
bumper sticker	1

Discussion

Most reef managers are proud of their programs and recognize their responsibility to keep the public informed about its status. Accordingly, they have become proficient at public relations. But public relations is not their primary responsibility, and often they received little assistance from their agency's public relations or education office.

The needs for the production of educational materials are many. Increased communications efforts by the reef program offers the fisheries agency an ideal public relations asset. Fishery managers are often in the business of developing and enforcing regulations, some of which are unpopular. Artificial reef programs are usually quite popular and offer an ideal opportunity for showing the public that something beneficial is being done for them. The reef program can give the agency a platform from which to deliver other conservation messages. In fact, because of the concern about the production vs. aggregation question, the managers believed it was important to stress conservation in all their education efforts. They thought it important for their educational materials to include information about conservation, fishing ethics, fishery regulations and non-traditional recreational species. As one manager said, "We need to make the public understand that building artificial reefs is not the panacea for all fishery ills."

The materials which were available to the public were often out-of-date. Reef building and management have improved and increased in recent years. In many cases, the information available does not reflect these changes. Many brochures, films and displays do not have recent information on reef building activities, technologies or locations.

Numerous ideas or needs were expressed during the interviews. Video production was considered a priority because, unlike some aspects of fisheries management, artificial reef programs lend themselves to mass appeal. Other ideas include: 1) signs and maps, locating reefs with LORAN-C readings, at popular marinas and boat launches, 2) improved and updated maps and pamphlets, 3) slide-tape

programs (so the reef manager need not to be there to present it), 4) artificial reef newsletters, and 5) statewide conferences to inform fishermen about the limitations and potential of artificial reefs.

Not every Sea Grant program conducts artificial reef education programs. Through joint planning with Sea Grant, artificial reef managers could stimulate or contract with Sea Grant to develop artificial reef related educational programs. Outdoor writers have been cultivated by most reef managers. They are routinely sent news releases and asked to accompany reef personnel to view reef building activities as well as fish over reef sites. These activities should be supported and encouraged by their agency.

Recommendations

1. Reef managers should update and expand their array of artificial reef information materials. The choice of educational materials will vary from state to state. Because public funds are spent on artificial reef programs, the public must be kept informed about the results and benefits of these expenditures. It is important for information to reach as many of the marine fisheries constituents as possible. Assistance for some of these projects should be obtained from Sea Grant programs.
2. Reef managers should develop strategies to increase the budget for educational and promotional activities. Compared to reef construction budgets, only negligible amounts of money are allocated to the education function. These activities, although recognized as important, are often viewed as one of many additional responsibilities of reef managers and are not given high priority. Programs should consider devoting a portion of their budget to education. This may be difficult to establish within existing budgets, but as programs grow, implementation of this recommendation would be feasible using new funds. If educational expansion cannot be financed out of the reef budget, other alternatives should be explored. With few exceptions, there was not much interaction and support given to reef programs by their agency's education or public affairs office. But high profile, popular programs, such as artificial reefs, offer fisheries agencies an excellent opportunity to enhance their image with their constituency. They also offer a mechanism for introducing a variety of conservation and management themes. As much as 10 percent of a state's Wallop-Breaux funds can be used for educational purposes. Before funding educational projects, the U.S. Fish and Wildlife Service requires the state to have an approved aquatic resources education program. Not all states have a plan, making it impossible to use the W-B funds for education. Reef managers should encourage their agencies to develop approved aquatic resources education plans to introduce artificial reef information and education.
3. Reef managers should coordinate their educational programs with other agencies and with the media. Some states, notably Florida and Virginia, have developed excellent working relationships with their state's Sea Grant program. Sea Grant's Marine Advisory Service is designed to conduct public education and information programs related to improving and conserving marine resources.

Evaluation

Description

Evaluation of artificial reef programs by state agencies is largely nonexistent. Instead, the emphasis is on reef building. Only three of the 12 programs conduct routine biological and physical monitoring activities. Three other programs conduct periodic maintenance checks to determine if materials are remaining on site, to examine reefs for sedimentation and scouring, and to assess reef community development and fish abundance. Reef managers in the six other states without evaluation projects all said they would prefer to be conducting more evaluation activities to help them better understand the dynamics and impacts of their projects. Two of the three states (New Jersey and Virginia) with extensive evaluation programs spend nearly 50 percent of their budget on evaluation activities.

Of the six states evaluating reefs, four have been developed as one-time special projects (i.e., master's thesis). A few managers use statistics from the NMFS recreational fishing survey to assist them in making judgments about reef effectiveness. Three states have conducted at least one economic impact assessment study of sportfishing studies associated with artificial reefs. Two of these are more than 10 years old. The South Carolina program initiated an economic impact study of scuba divers using artificial reefs in the summer of 1988. Several managers believed these studies were only useful when justifying new funding initiatives to units of government or local chambers of commerce.

Three of the 12 programs either conducted or sponsored basic research. This work included population studies, diet studies of important reef species and engineering studies related to the effectiveness of

materials and designs. Ten of the 12 reef managers have worked with universities on research projects. The relationship is opportunistic rather than systematic. There were few instances of more formal interaction between university research programs and reef managers through research priority development, membership on advisory boards, proposal reviews or idea exchange. Relationships with university faculty and administrators are developed on an individual basis. Three of the 12 reef managers publish their work, and a few others report their activities through in-house reports or news releases to the media.

Five states carry out certification programs to ensure that contractors are fulfilling the terms of their contracts. Their policies require personnel from the artificial reef team to be present during all reef building activities. Virginia uses side-scan sonar and Hastings Radist computer print-out techniques to map and catalog reef sites.

The areas of research managers mentioned needed were: tagging studies of key reef species to determine recruitment patterns (especially in the Gulf); biological and catch-per-unit of effort monitoring over time at selected in-shore and offshore reefs; succession studies comparing artificial and natural reefs using several different artificial reef materials; and fish trap studies to monitor fishing pressures and to examine food habits.

Discussion

Reef managers believe artificial reef evaluation programs are important. Managers need objective information to justify their management decisions and reduce uncertainty about reef effectiveness. The managers also recognize the importance of data in responding to questions from the public, their agency supervisors or the legislature. At this time, well-developed evaluation programs have not been established. The reasons for this include the limited time, staff and budgets of most programs (and the perceived priorities of the public). The sportfishing public typically demands construction over evaluation activities, and reef managers respond to this situation.

Because of these realities, other arrangements should be explored. Enlisting university or volunteer support for research and evaluation programs has not reached its potential. Communication among agencies, universities and dive clubs or sportfishing organizations could be improved. Through this dialogue, some organizations, dive clubs or sportfishing associations could be enlisted to collect data. Faculty or graduate students could be encouraged and possibly supported to work on special projects.

For some projects, reef managers should develop grant proposals to funding sources other than Wallop-Breaux. Saltonstall-Kennedy funding, administered by NMFS, has been largely untapped by reef programs. The purpose of this program is to provide funding for fishery research and development projects. The South Carolina program received a grant for fish censusing from the National Oceanic and Atmospheric Administration's National Undersea Research Program. Other opportunities such as this should be explored.

Often work is conducted when time and resources permit. This type of timing often lacks experimental protocol. There was a general consensus that more work should be done to evaluate artificial reef production over time. At the regional level (Gulf, South Atlantic, Mid-Atlantic), many of the informational needs are generic. With limited resources, care should be taken to avoid duplication of effort. Each state should work to communicate and coordinate their research and evaluation efforts to maximize effectiveness. The Artificial Reef committee of the Atlantic States Marine Fisheries Commission provides a vehicle to communicate and coordinate research efforts. A list of research needs is being compiled, and it is important for reef managers to communicate with others outside their program. This communication is absent in the Gulf States. Another overlooked communications tool is publishing the research results. Publication of findings and distribution of routine status reports will ensure information is shared among managers and appropriate reef scientists.

Less than half the states routinely monitor reef building activities to make certain the procedures specified in the permit for materials and sites were followed. Those programs that do either build reefs with state vessels or have state personnel present during all reef building activities. Several managers were aware of illegal reef building activities, or purposeful dumping off the approved site to hide the correct LORAN-C numbers from the public. Such reefs could cause interference with shipping and trawling activities. Negative publicity associated with illegal dumping could prove detrimental to the acceptability of legal, state-supported reef programs.

Recommendations

1. Reef productivity and engineering studies should be conducted systematically. To evaluate trends in reef performance, monitoring studies must be undertaken on a multi-year basis. The studies will require an extended commitment of budget and staff time to achieve the desired results. Reef managers should devote a percentage of their annual budget to evaluation activities. Within each region, these activities should be coordinated between states to avoid duplication of effort. The research most often mentioned--fish trap surveys, tagging, succession and food habit studies--will provide information that can be extrapolated across state lines.
2. Studies should be undertaken to evaluate the requirements and preferences of the user communities. Reef managers attempt to satisfy their constituencies, but decisions are usually intuitive or based on input from a vocal minority. These studies should assess the interrelationships and concerns about reef programs from their diverse publics including sport fishermen, commercial fishermen, sport divers and environmental groups.
3. Reef managers should develop procedures for communicating the results of evaluation studies. The Artificial Reef Committee of the Atlantic States Marine Fisheries Commission has been instrumental in improving communications among East Coast reef managers. As mentioned in Section 3.3, the Gulf States should develop a similar committee. The reef committee should continue to expand communications beyond the reef management community to include other agencies (Corps of Engineers, Coast Guard, EPA), private interest groups industry and universities. Reef managers should develop a publications system and encourage the production and distribution of reports on their evaluation activities. As Bohnsack and Sutherland (1985) pointed out, "Valuable information has been collected that is unavailable and useless because it was either not published or appeared only in technical reports that were difficult to obtain." The Sport Fishing Institute's Artificial Reef Development Center or the Atlantic States Marine Fisheries Commission could act as a clearing house for publishing this information.
4. Reef managers should actively make known their evaluation activities and needs to universities. Presently, communication with university researchers is based on individual communications with researchers who are known by the managers to be interested in reefs. At the state level, more formal communications with universities should be developed. Key members of the university research community, including Sea Grant directors, could be appointed to artificial reef advisory committees. Conversely, reef managers should communicate their research needs through memoranda or participation on university advisory committees. The universities should ask reef managers to review all research proposals related to artificial reefs. This serves the dual functions of improving communications and promoting input to the research process. Assistance can be obtained from Sea Grant's Marine Advisory Service to communicate the results of evaluations to the public through workshops and meetings.
5. Reef managers should propose evaluation projects with less traditional sources of funding. Recently, Wallop-Breaux funds have been the financial mainstay of new evaluation initiatives. Other sources of funds have been largely untapped. Funding from programs such as Saltonstall-Kennedy, the National Undersea Research Program or private foundations have often not been sought. But funding from such sources would reduce pressure on stressed budgets. These funds must be viewed as supplemental and not replacement.
6. Volunteers should be trained and encouraged to assist the reef program with monitoring activities. Scuba diving clubs could be used to report the movement, deterioration or scouring of reef structures and materials. Sportfishermen or charter captains could be used for collecting catch-per-unit of effort data and reporting buoy maintenance needs. Florida Sea Grant has trained volunteers to assist communities developing artificial reefs. Their success could be used as a model. Volunteerism has the additional benefit of involving constituents who become political advocates of the reef program.
7. The states should adopt policies to certify that construction permits were followed. One recommended practice is to have state personnel present during all construction activities. In states where this is not feasible because of staff limitations, other procedures, such as periodic spot checks using scuba or side-scan sonar, should be initiated to monitor reef-building activities. Penalties in the form of fines, permit revocation or removal of eligibility from state contracts should be imposed on violators.

Chapter III

Assessment of Artificial Reef Programs and Recommendations for Improvement

Future Outlook and Major Concerns

The managers were asked to assess future trends for their artificial reef programs. The responses centered around the general thrust of their activities. Four managers believed there would be a major expansion of their program. This response came from managers whose state agencies had long-term goals to implement salt water fishing licenses. Three others thought a gradual increase was likely, three indicated it would remain about the same, and two thought there would be a decrease. One manager also suggested there would be a trend toward greater emphasis on in-shore reef building.

Six managers said their major concern was the production versus aggregation question. As discussed earlier, they were worried their reef-building activities were in danger of running counter to other fishery objectives. Two managers mentioned illegal reef building as a major concern. They feared a flood of adverse publicity if an illegal reef caused a serious problem. One manager's major concern was a lack of a consistent budget from which to plan. His program used materials of opportunity, and, because the price of scrap steel fluctuates widely, it was difficult for him to plan activities ahead and to keep staff fully employed. Another manager was concerned that too much attention was being given to offshore reefs at the expense of inshore reefs, which were used by more people. Another concern was that popular reef programs were inviting political interference that could drive the program away from its fisheries management base. Lastly, one manager believed a major problem was going to be the expense and headaches associated with maintaining buoys on all reef sites.

Summary

The use of artificial reefs as a fisheries development tool will likely increase. To effectively respond to this demand, fisheries managers will have to develop artificial reef policies that provide for management efficiency, appropriate operating funds, rational siting decisions, extensive public information and adequate evaluation.

The hypothesis of this paper is that artificial reef programs may be hindered by a lack of state management policies and plans and that insights from artificial reef managers could be used to develop more effective policies. Although artificial reef managers are managing as well as they can under their current management systems, all 12 managers interviewed believed their system could be improved. Eight of the nine managers without state management policies and plans supported the development of a plan in order to improve their program. Additionally, they offered numerous other recommendations to improve their current programs. Twenty-nine recommendations are offered as considerations for artificial reef management improvement.

Although this report presents ideas for improving artificial reef management from the point of view of artificial reef managers, it is not a complete view of the artificial reef arena. Other important players are notably absent. These include the reef users who pay for, support and benefit from reef programs and the public decision-makers, including agency heads and elected officials, who make allocation decisions. Further work must be done to understand user motivations, needs and concerns in order for agencies to obtain a complete picture of all the actors. Understanding the entire complex will help agencies develop the best possible management plans to meet the demands for artificial reef development in the 1990s and beyond.

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Appendix I

Questions Addressed During Interviews With State Reef Program Managers

I. Administration

- Organization chart - How is the reef program structured within the agency?
- Relationships with other divisions - research, development, biological
- Authority to make decisions - statutory and real
- Policy guidelines - are they available?
- Liaison with other agencies (federal, county and local government units)
- Liability policies

II. Budget

- What levels?
- What sources of funds? (state appropriation, Wallop-Breaux, counties, private funds)
- Who determines and how?
- Staffing, subcontract procedures
- Equipment available (staging areas, barges)
- Maintenance (buoys, replacement, etc.)
- Cost-sharing arrangements
- Allocation of the budget within the reef program

III. Siting

- Purpose(s) of the reef program
- Availability of a management plan
- Parameters influencing decisions
- Influence of local interest groups including political influence
- FAD use and policy
- Type of materials used
- Mitigation policies in effect
- High tech reefs
- Target-specific species

IV. Promotion and Education

- Whose responsibility? - fisheries agency, Sea Grant, private interest groups
- Educational materials available
- Active speakers bureau approach
- On-site education, posters, etc.

V. Evaluation

- Monitoring activities - data collected (by species)
- CPUE data dept
- Economic impact
- Percentage of budget
- Basic research conducted - productivity, etc.
- Certification program to make sure reefs meet permit guidelines
- Enhancement plans and priorities for future reef development
- Are the results being published or made available to other researchers?
- Are cooperative efforts being sought with universities?
- What is the scientific background of the artificial reef personnel?

VI. Future Outlook

- Trends (budget, new technologies, other user groups)

VII. Concerns

- Production vs. aggregation
- Environmental - loss of other habitat
- Share of budget

Appendix II

Description of Current State Programs

The interview process with each reef manager involved first asking them to describe their current situation in relation to major problem functions identified in the report (administration, budget, siting, education and promotion, evaluation, future outlook and major concerns). Although the purpose of this project was not to describe state reef programs, the current management systems provide a context from which to understand the analysis and recommendations included in the text. For this reason, a state-by-state description of programs is provided in the appendix. It is not an all-inclusive treatment of the programs, but is related to fundamental management and policy issues which must be addressed as state agencies develop artificial reef management plans and policies. The interviews were conducted between February 10 and March 17, 1988.

Alabama — CONTACT: Hugh Swingle, Director, Alabama Division of Marine Resources

Administration

The division is one of five in the state's Department of Conservation and Natural Resources. Swingle reports directly to the Commissioner of Conservation. There is no artificial reef manager or coordinator. Swingle handles this function as one of his many activities. In this capacity he has no problem getting work done in other Marine Resources departments since he is administrative head of them.

The only statute related to reefs was 1971 legislation, which set up a commission to handle vessel preparation and deployment operations related to the Liberty ship program. Five Liberty ships were sunk, and the commission no longer functions. As manager of the reef program, Swingle has broad authority to run program operations as needed.

There are no policy guidelines. As director, he feels the best approach is to respond to the fishing community the best he can and to minimize conflicts with the historical users of the resource. There are no formal relationships with county governments, and the reef program has an excellent relationship with the Mobile, Alabama, district of the Corps of Engineers.

There has not been a problem with liability. In Alabama you cannot solely sue the state, but you can sue individual state employees in combination with the state. Two years ago the state passed a law providing each employee \$1 million worth of liability coverage. The Coast Guard has waived the requirement to buoy the reefs and the state does not maintain any buoys.

Budget

At the time of the interview, there was no artificial reef budget per se. (Vernon Minton, Assistant Chief, indicated in a telephone conversation on December 6, 1988 that the state had recently used \$30,000 of Wallop-Breaux monies to develop railroad box car reefs at two sites located within their general permit.) In recent years, the state requires private interest groups to raise money to handle costs, and allows them use of the state permitted site. The state assumes liability but groups developing artificial reefs are responsible for transporting materials to the site. Over 20 years, an estimated \$150,000 of state monies have been spent on artificial reefs. Direct state appropriations have been the only source of funding. Swingle determines the budget. The last time state money was allocated for artificial reefs was in 1982 when \$57,000 was spent for towing a dismantled bridge to an artificial reef site. The state has no subcontractual procedures and no equipment.

Siting

The purpose of the reef program is to place materials for fishing improvement for both sport and commercial fishermen. Because of the high price of snapper and grouper, many sport fishermen sell their catch. The reef sites are located 10 to 50 miles offshore. Sites are chosen according to two criteria: to not interfere with existing uses and to try to make sites accessible to smaller boats.

A 320-square-mile blanket permit has been approved by the Corps of Engineers. Shrimpers supported the permit because it is in an area of hard bottom where trawling is prohibitive. The state has placed no

FADs, but during 1987 two sportfishing groups placed FADs near existing structures. Almost every type of material available is used. Mitigation policies for the oyster shell program have been discussed, but none have been mentioned specifically for reefs.

Promotion and Education

It is not a primary responsibility of the Division of Marine Resources to conduct education projects. Sea Grant has produced excellent brochures on reefs and a commercial company produced good quality charts. The agency provides fishermen with a one-page flyer with Loran and compass readings to their reefs. Periodically Swingle and Tony Lowery, of Alabama Sea Grant, speak to sportfishing groups about artificial reefs.

Evaluation

Alabama does not conduct any monitoring activities. A consortium of universities, Sea Lab Consortium, has done some research and periodically dives on the reefs. A Ph.D. dissertation was written and published several years ago. The division funded part of the dissertation project, which monitored and evaluated reefs over a five-year period. No catch per unit of effort data has been collected. In 1969 an economic evaluation of a sunken Russian freighter was conducted in order to convince the Maritime Administration to introduce the legislation which helped to launch the Liberty ship program. It is believed economic impact studies are not necessary unless you are trying to sell the legislature on reef development. The state feels basic research is the function of the universities. They have no monitoring program, per se. The state warns reef builders that if they are caught dumping at unpermitted sites they will be reported to the Coast Guard. The state maintains enforcement is the responsibility of the Coast Guard because the reefs are in the EEZ.

Future Outlook

In the future, the state program will be reduced because gas companies are building many structures off the Alabama coast which act as defacto reefs.

Concerns

The large blanket reef concept was developed because of the number of private reefs being built off the Alabama coast without a permit. It is an attempt at compromise with the shrimp fishery by directing sports fishermen to areas not used by shrimpers. One concern is related to sport fishermen giving inaccurate Loran numbers to the state when deploying materials within the area of general permit. This is done on purpose to disguise the reef's location.

Swingle thinks reefs primarily aggregate fish and mentioned the Gulf Council is developing management programs for stressed areas for snapper stocks along the Alabama coast. The stressed area delineation ranges offshore to 25 miles. The average snapper caught is only 0.8 pounds. If the snapper inshore fishery is already overfished, he feels reef programs may simply aggregate them, thus hindering management efforts.

Delaware — CONTACT: Charles Lesser, Manager, Fisheries Division of Fish and Wildlife

Administration and Budget

The Division of Fish and Wildlife is one of five in the Department of Natural Resources and Environmental Control. Lesser reports to the director of the Division of Fish and Wildlife. Delaware has no policy or statutes on artificial reefs and has never built a state reef. Two reefs are presently being built. The state is only passively involved with them.

The U.S. Army Corps of Engineers is filling 200 acres of marsh and river in the Delaware River. The Corps agreed to build an artificial reef as mitigation. Since similar habitat could not be created, there was no other mitigation option. The plan calls for a reef, and the Corps plans to subcontract the work. There have been legal and procurement problems with the program, and it has been delayed for two years. John Forren, Philadelphia District of the Corps of Engineers, is the principal contact for this project. The state is taking a wait-and-see approach to reefs until this situation is resolved. After the

Corps evaluates the reef for four years, the Division of Fish and Wildlife will proceed with an artificial reef program.

Siting

If the Corps' reef is successful, the state will develop a five-year management plan for reefs and may contract the work. The state is concerned about ocean reefs and is not authorized to spend money in areas outside its jurisdiction, i.e., beyond three miles. The Delaware situation was unique because they had little historic involvement with artificial reefs and no reef program at the state level. The interview became a general discussion about the history and attitudes toward reefs in Delaware.

Historically, there has not been a reef fishery in Delaware Bay, and there has been little pressure from sportfishing groups to develop one. In fact, some of the groups may be opposed to it for aggregation reasons. Also, from a management standpoint, the natural reefs in Adams Bay have generated conflicts between sport and commercial fishermen when fish tend to congregate. Gill netting is the only type of commercial fishing allowed in Delaware, and when the gill netters fish next to the sport fisherman, conflict results. There have been arguments and boat ramblings between the groups.

Aside from the mitigation reef mentioned above, an experimental coal ash reef has been built in the ocean by researchers at the University of Delaware and Delmarva Power and Light. Because it was outside of state waters, there was no participation by the Division of Fish and Wildlife. One of the major problems Lesser foresees in Delaware Bay is reef materials may scour and be buried and subsequently lost after only a few years because of strong currents. Sea trout, summer flounder and bluefish are the mainstay of their fishery. They have a sport fishery advisory council which maintains artificial reefs will only cause conflicts and aggregation problems.

Florida — CONTACT: Virginia Vail, PH.D., Marine Resources Adviser, Division of Marine Resources

Administration

Vail is staff to the Assistant Director of the Division of Marine Resources in the Florida Department of Natural Resources. Aside from artificial reefs, she also has responsibilities for the Federal Aid in Sport Fish Restoration (Wallop-Breaux) program. There is no artificial reef program at the state level in Florida per se. Dr. Vail has little direct responsibility for siting, permitting or constructing reefs.

The Florida Department of Environmental Regulation (DER) and the U.S. Army Corps of Engineers have regulatory authority over artificial reef dredge-and-fill projects. The Florida Department of Natural Resources, Division of State Lands, as staff to the Governor and Cabinet, have a proprietary or stewardship interest in how state-owned submerged lands are used.

Although all three agencies use the same permit application, the reviews and issuance/denials of permits are independently carried out. As part of the DNR in-house review process, Vail comments on artificial reef applications for State Lands staff. At this time she does not review applications for DER or the Corps. Her primary charge is to administer a grants-in-aid program to local governments to build reefs.

Vail has no staff and relies on other agencies for field support. If such assistance is needed, she requests it from other departmental divisions and government agencies. The grants program is governed by a specific statute and rule. In effect the statute is the Florida policy. Other policies that guide her are agency policies on such procedures as purchasing and contracting.

Because the program dispenses money to the counties, communication about grants applications with county governments is inherent. However, Vail's office generally knows only about reef projects in which DNR resources are involved. At the state level, the office coordinates with the Department of Transportation, which has been disposing of old bridges on reef sites. DOT has been very supportive of using suitable construction material on reefs. Depending on the project and district, DOT may deal directly with DNR or a local government or the DOT contractor may work with a local organization or government after the project is under way. At this time DNR has not decided whether to be an active participant or coordinator in the bridges to reefs program. The permits for reef sites may be in the name of a local government, fishing club or private citizen but rarely the state. Since there have been no major problems with liability, there has been no incentive to examine the issue. The state is usually indirectly involved in reef construction, rarely holds the permit to the reef site, has a standard "hold harmless" clause in all reef contracts, and has sovereign immunity.

Budget

The budget, appropriated entirely as a grants-in-aid program, usually ranges between \$400,000 and \$500,000 per year. One hundred thousand dollars comes from the state's general revenue and more than \$300,000 comes from Wallop-Breaux funds. Local government contributions vary annually. If the Wallop-Breaux allotment totals more than \$300,000, the counties are asked to assume the required match. The counties can match with cash or in-kind services. The budget must be appropriated by the Florida legislature annually.

With the exception of Vail, the reef program has no staff. The state has no equipment or buoys but manages about 18 to 20 contracts with counties per year. Nor does it have an appropriated operations budget. Recently there has been enough money to fund each county applicant provided the completed application was submitted by deadline. Application requirements and selection criteria are defined by rule. Unless the executive director approves otherwise, a \$30,000 cap is placed on projects. In practice each county usually receives \$20,000. This represents a trade-off between spreading the money around and giving each county enough with which to do something.

Artificial reef projects are funded on the basis of a competitive evaluation and ranking of local government applications and the annual budget. The most complete applications are funded, the lesser complete may be funded only if money is in the budget. For the last couple of years the state has been able to fund nearly every applicant. In a few cases, applicants may be funded only if they can provide the required matching funds. These applications are in the "lesser complete" ranking as the available state match goes to the more complete project applications.

Siting/Construction

Management and siting plans are the responsibilities of the county. Occasionally the legislature mandates funds for a specific county reef project. The rule interpreting the statute determines that money cannot be spent for materials. Therefore, the state buys no FADs or high tech reefs.

By law (Chapter 16R-9, FAC), tires, appliances, automobiles, etc. are prohibited in reefs built with state funds.

The DNR Division of Beaches and Shores has been approached about the use of artificial reefs to compensate for habitat destruction during shoreline stabilization projects. Such compensation is generally discouraged as not being an equitable replacement.

Promotion and Education

Vail believes education is everyone's responsibility and relies on Sea Grant to help get the word out. She maintains the state benefits from their activities and support. Among items used by her was a list of Sea Grant publications. She speaks to various groups about artificial reefs.

Evaluation

The state conducts no monitoring activities. The state leaves it to the universities to conduct basic research. And Vail's office is not always aware of on-going studies. It is the county's responsibility to certify completion and police their reefs. She does not publish reports, but routinely sends updates to personnel within the DNR.

Future Outlook

The program probably will maintain its status quo with local governments retaining the key role in reef development. Vail hopes the state will require development of a comprehensive artificial reef plan because of extensive reef development activities in the state.

Concerns

One concern is that "nobody is minding the store." The state-wide reef program is only a funding program with little involvement in reefs not built with state funds. No one is monitoring all reef development for the "big picture."

Georgia — CONTACT (Offshore Program): Henry Ansley, Outer Continental Shelf Program leader, Coastal Resources Division; **CONTACT (Inshore Program):** John Pafford, Recreational Fisheries Program leader, Coastal Resources Division

Administration

There are four programs within the Coastal Fisheries Section of the Georgia Department of Natural Resources' Coastal Resources Division. Two of them have responsibilities for artificial reefs. The Recreational Fisheries Program administers inshore reefs while the Outer Continental Shelf (OCS) Program has responsibilities for offshore reefs.

The inshore reef program is relatively new and is supported by Wallop/Breaux funds. The offshore program has existed since the early 1970s and has been funded through various federal and state sources. Currently the offshore program relies primarily on Wallop/Breaux funds and limited state support and match.

The Coastal Resources Division is small and works closely with other state and federal agencies, including educational institutions. For example, the division's reef program has utilized Navy explosive ordnance services, while the Coast Guard has provided towing and assistance to acquire buoy system materials. Staging areas and dock space have been provided by the Georgia Port Authority and various university system colleges; the University of Georgia's R/V GEORGIA BULLDOG has provided vessel support and towing for several state and club reef development operations. Offshore reef material has been obtained through various channels, including concrete rubble from the Navy and Department of Transportation and vessels from Government Services Administration, the National Park Service, United States Coast Guard, and Georgia State Division of Game and Fish. Sportfishing clubs have donated various materials and support to the state programs, often utilizing funds earned through club tournaments and other functions.

Inshore, the program's artificial reef sites are permitted individually through the state and the Army Corps of Engineers. Pilings marking the sites are permitted through and controlled by the US Coast Guard. Other than permit stipulations and some overall fisheries regulations, no specific statutes apply to these inshore reefs.

Contracted reef development and maintenance activities are covered by standard state contractual and liability provisions. Volunteers are required to sign releases before participating in any state operations. Finally, as a state agency, Georgia's Department of Natural Resources can exercise sovereign immunity, meaning the state declares itself immune from being sued.

Budget

All of Georgia's reef development and maintenance funds come from the Wallop-Breaux program. With the exception of \$5,000 earmarked by the state for annual offshore buoy maintenance, the required 25 percent match is made up of in-kind services and salaries. Amounts for development and maintenance vary annually depending on program needs and the division's Wallop-Breaux allotment. For example, in FY88 approximately \$93,000 (Wallop-Breaux) and \$18,600 (matching funds) were spent on artificial reef development and maintenance, respectively. The state projects spending \$81,000 on development and \$21,000 on maintenance in FY89. For both years, however, a proportion of the development funds (approximately \$27,000 in FY88 and \$39,000 in FY89) have not been used for actual construction. Instead they have been earmarked for related educational activities. Each program leader helps develop budgets for the Wallop-Breaux funds, which are split between the OCS (roughly 30 percent) and the Recreational Fisheries Programs (70 percent).

The state's inshore artificial reef program has similarly utilized materials of opportunity, specifically bridge rubble, at two sites. Currently the program is based on a specially fabricated unit consisting of a concrete base and PVC pipes. All units are constructed and deployed at the designated sites by inshore program staff. One or more pilings with signs are used to mark the inshore reefs.

Siting

The purpose of the offshore artificial reef program is to create more accessible recreational fishing opportunities closer to shore. Initially, siting criteria were poorly defined, with reef locations largely being dictated by angler recommendations, avoidance of conflicts with commercial fishermen, navigational concerns, and water depths. Reef locations designated by the regional permit have given

the state established siting guidelines.

All of the program's offshore reef sites are now included in the state's Corps of Engineers Regional Permit RP0036. While still requiring reporting to the COE and other agencies, the permit allows the department to approve construction at its offshore reefs under the specified guidelines. Typically, any group wishing to place materials on one of these state reefs would apply directly to DNR, which issues the approval and stipulations. These stipulations normally require the applicant to adhere to permit conditions and coordinate all placement operations with Coastal Resources Division's offshore reef program.

All nine of the offshore program's reefs have also been designated as Special Management Zones (SMZ's) by the South Atlantic Fishery Management Council. Under these regulations, fish can only be taken with hand-held, hook-and-line gear or spearfishing equipment. In addition, no jewfish may be landed by any means from these offshore artificial reefs. All buoys are approved through the USCG.

Materials used thus far on Georgia's offshore artificial reef program have been materials of opportunity and several thousand tire units. Each reef is marked by one primary buoy, which is maintained by offshore program personnel and divers. The program's philosophy is that all publicly funded reefs should be buoyed to help users locate and use the reefs.

Presently the Department of Natural Resources proposes constructing several nearshore reefs more accessible to coastal anglers. Although many commercial fishermen remain wary, it is felt that improvements in materials, buoying and navigational electronics justify exploring the feasibility of nearshore reef construction. In addition to commercial concerns, several other criteria are being addressed. Both commercial and recreational groups are being asked to provide pre-hearing input. While political support exists for the offshore program and its proposed objectives, so far no appropriations have been passed by the state legislature.

Georgia's inshore artificial reef program also seeks to provide more accessible angling opportunities to anglers fishing either from structures or boats. Concrete rubble was placed adjacent to bridge catwalks and a pier to improve fishing habitat. The inshore program has also constructed three reefs with PVC/concrete units, which will be evaluated over the next several years. Situated on intertidal mud flats, the units eventually evolve into productive oyster mounds.

Promotion and Education

The Department of Natural Resources relies only minimally on Sea Grant for development of educational materials. The department has shared some printing costs on a series of inshore fishing maps developed by the Georgia Sea Grant Program. At present, the Coastal Resources Division distributes some of these maps, as well as brochures on the state's offshore artificial reefs and a non-boating fishing guide to inshore fishing. No guide has been developed for the inshore artificial reefs.

In addition to brochures, the division presents slide shows to coastal organizations and schools. Videos on the reefs and their opportunities are incorporated into displays at various events. Production of a new film and video on the Wallop-Breaux artificial reef program is under way, with release slated for the summer of 1989. Program personnel and the department's information and education staff routinely disseminate media information, distribute news releases and produce reef articles for the departmental periodical.

Evaluation

Currently follow up monitoring and evaluation of Georgia's offshore artificial reefs is sporadic, performed only in conjunction with other operations. Instead, available Wallop-Breaux funds are directed primarily towards mandatory reef maintenance and development efforts. During the earlier years of the program, however, several in-house studies were published on migration, standing stocks, fishing pressure and fishing success. Use and economic data on Georgia's artificial reefs is limited. Most information is extrapolated from the NMFS Marine Recreational Fisheries Survey and other studies, including economic studies in South Carolina and other states. Research by the state's universities and colleges has been restricted, largely because of a lack of resources or preemption by other priorities.

Inshore reef construction using the PVC/concrete units is scheduled to be completed during FY89. Monitoring and evaluation projects for these test units and estuarine sites will be designed and established shortly to determine their effectiveness.

Future Trends

As part of the department's five-year strategy, requests have been made to the legislature in recent years to allocate \$250,000 for a five-year nearshore reef construction program. Prior to these attempts, the offshore reef program requested various levels of state funding annually. The requests have not been successful in increasing state support beyond the \$5,000 and in-kind services match needed for Wallop-Breaux funding. Without greater state support, the level of offshore reef program activities will likely remain the same.

Future inshore reef activities will largely depend on the success of the reefs constructed to date. Development of other fabricated units will also be pursued utilizing Wallop-Breaux funds.

Concerns

Overall reef program concerns surround the increasing demands placed on its inshore and offshore fisheries by rapidly expanding coastal populations. Previously unknown conflicts between fishermen and divers have begun to develop over the offshore artificial reefs and wrecks. Since natural reef areas, or "live bottoms," are very sparse off Georgia, especially within 40 miles, the only evident solution to the problem is the construction of additional artificial reefs. Construction efforts inshore may similarly provide the needed solution.

For Georgia's offshore artificial reefs, it is felt that the production/aggregation question is not a problem and that reefs constitute an effective means of enhancing certain fishery stocks. Rather, the primary problem for the state's reef program is fiscal. Financial problems include the lack of establishment of long-term funding support; the lack of cost-effective, pre-fabricated reef units; undefined and insufficient tax incentives; monitoring programs; and state/federal regulations.

Louisiana — CONTACT: Rick Kasprzak, Artificial Reef Coordinator, Louisiana Artificial Reef Initiative, Louisiana State University, Center for Wetlands Research, Baton Rouge, LA 70803-7503

Administration

Kasprzak, Program Coordinator, reports to Chuck Wilson (CWR) co-chairman of the Louisiana Artificial Reef Initiative (LARI). LARI is administered by the Artificial Reef Council, which is composed of three people—the Secretary of the Louisiana Department of Wildlife and Fisheries, director of the Louisiana Geological Survey and the Dean for the Center for Wetland Resources. The reef program functions as a joint venture between LSU and Louisiana Department of Wildlife and Fisheries.

The goal of the program is to maintain existing and establish new fish habitat. Statutes set up the artificial reef council and delineate their powers. They are quite broad. The three members of the council are not involved with day-to-day activities, but they direct development plans and oversee financial matters. Policy guidelines are available.

They routinely work with other state and federal agencies. Once the program is self supporting management responsibilities will probably move to the Louisiana Department of Wildlife and Fisheries.

A milestone in the program's development was a statute allowing the state to assume liability for artificial reefs. This responsibility is outlined in the statutes. The Secretary of the Louisiana Department of Wildlife and Fisheries signs off as agent for the state, once the reef materials are transferred from the donor.

Budget

The 1988-89 budget for Louisiana's program is \$180,000. Of that, \$100,000 comes from Wallop/Breaux funds, \$30,000 is contributed by the state in match, and \$50,000 is generated from interest out of a trust fund. The program is funded by oil companies donating half their savings realized through participation in the program. Once sufficient funds are accumulated, the program will be run entirely from the interest generated from those funds. The budget is proposed by the reef coordinator and co-chairmen of LARI who obtain approval from the Artificial Reef Council. Budget is based on past expenditures plus anticipated new projects. They plan to increase the staff in the future. They subcontract for buoy maintenance and equipment. Buoy maintenance is budgeted at \$3,000 per year per reef site, depending on where it is. Most of the budget presently goes toward salaries and other operating costs.

Siting

Specific objectives are stated in the state plan. Their long-range goal is to have five or six reef sites composed of four to five rigs in each of the eight planning areas. Exclusion and inclusion mapping was used to determine their location and avoid areas such as navigational fairways, hazardous bottoms and shrimping areas, and to place the reefs in areas where bottom obstructions already existed.

At present, the Louisiana Artificial Reef Initiative uses no FADs or other type of reef materials. It is only an oil platform program. There are no mitigation policies in effect. The state is not building prefabricated reefs.

The program seems to have made a variety of groups happy. Offshore fishing is almost exclusively on the reefs, but the state was in danger of losing valuable reef habitat because of a Department of Interior regulation requiring oil companies to move these structures once they were obsolete. LSU and the Louisiana Geological Survey (LGS) took the lead and showed fishermen, oil industries and the legislature the benefits of this program. An important component in the success of the program was public involvement. LSU and LGS held numerous public meetings and invited many groups. There was some opposition by commercial shrimpers. If LARI organizers had it to do over again, the shrimpers would be more actively involved.

Promotion and Education

The information program will be developed by Wildlife and Fisheries with help from Sea Grant and LSU. They have worked well together in the past. For example, LARI wrote the artificial reef plan, LDWF paid for the printing and formulation of the plan with Wallop-Breaux funds, and Sea Grant published and distributed the plan. LARI has a slide presentation and personnel routinely speak to sport fishing, diving and other groups. Future plans call for the development of an inshore program. Phase I of that program calls for the mapping of all inshore obstructions and for distributing these maps to fishermen. Phase II will determine which of these structures are effective artificial reefs, and whether to enhance these by the addition of shell, concrete rubble or material obtained from the oil and gas industry.

Evaluation

Now there is no monitoring program. Plans call for beginning one in the summer of 1988. They are negotiating with the owner of a submersible to monitor work on one permitted reef site.

A graduate student is doing his master's degree work surveying rig fishermen. He is obtaining species-specific CPUE data from more than 50 fishermen. No one has collected economic impact information, but LARI would like for it to be done. In the future, LARI will be monitoring reefs to see how they hold up. Estimations are that the reefs will last 300 years.

Future Trends

LARI personnel view their reef program as long-term, and one which will increase in intensity as the removal rate of rigs increases. For the next five years or so, they will be doing most of their work offshore. But as a "kitty," is built they will be moving inshore in order for the reefs to be more accessible to fishermen. The offshore program will supply the funds to support the inshore program. LARI managers plan to use bridge rubble, piping, etc., in the inshore areas in the future. As yet, implementation of a FAD program has not been examined.

Concerns

Kasprak does not have a concern over the production versus aggregation question. The Louisiana shelf was a mud desert prior to the deployment of these defacto reefs, which provide over 4,000 acres of hard bottom habitat for commercial and recreational species.

Maryland — CONTACT: John Foster, Recreational Fisheries Coordinator, Fisheries Division, Department of Natural Resources

Administration

The coast of Maryland contains only 35 miles of oceanfront plus extensive Chesapeake Bay shoreline. This feature influences the Maryland artificial reef program. It is a component of the Recreational Fisheries Program, one of four line items in the budget of the fisheries division. Also, under the Recreational Fisheries Program are urban fishing, access and sportfishing projects. The program uses services from other DNR divisions but pays for these services out of its annual budget. For example, a vessel is chartered from the Maryland Geological Survey. Labor, however, was more difficult to obtain.

There is no specific statutory authority for reefs. Legislation that initiated a Chesapeake Bay sportfishing license determines how the money will be spent, and "enhancement of recreational fishing opportunities" is one of the specified expenditures and gives the program its authority. The state is working on a reef plan.

In Maryland, the State Wetlands Act requires the artificial reef program to obtain a permit from the Water Resources Administration, another DNR division. The department's policy is that reefs are to be permitted and owned by the state. The state works cooperatively with other groups, but the policy excludes private groups or other government agencies from holding permits. The program uses a sportfish advisory commission for policy and budget decisions.

The program believes liability issues are adequately covered in the National Artificial Reef Plan and that if the contractors abide by the requirements of the permit, the state has no liability. Because of liability concerns, the state does not permit any staff to SCUBA dive. This presented a problem to the reef program, but was solved by obtaining a submersible remotely operated vehicle.

Budget

The Maryland artificial reef budget ranges between \$150,000 and \$180,000 per year. Administration costs for the program are in addition to this figure. The total budget comes from the Chesapeake Bay sportfishing license, a \$5 per year fee charged to sportfishermen who fish in the Chesapeake's tidal waters. The money is required to be spent on Chesapeake Bay sportfishing enhancement, which prohibits the reef program from using these funds for reef development work in the ocean.

The state has developed cooperative projects with Ocean City, Md. to fund offshore work. The program develops the budget, and has had no problems obtaining requested budgets within state government because the money is earmarked and not legislatively appropriated. Sportfishermen keep a watch on the state to make certain their money is spent on artificial reefs and related projects benefitting sportfishing interests. The staff consists of the coordinator and two other professional biologists. The project contracts for all construction services and monitors all construction activities with reef staff. The program leases vessels and owns a remotely operated Phantom 300 submersible with video monitoring capability. Another DNR program, the Waterway Improvement Division, maintains all buoys.

Siting

The goal is to enhance sportfishing stocks through the development and improvement of habitat in Chesapeake Bay. Specifically the program's objectives are to design habitat to attract specific species, to enhance the stock and to distribute sportfishing effort. The management plan under development will divide the estuary into four zones based on species requirements. Reefs will be tailored to these zones. Zone 1, which is upstream, will target largemouth bass and freshwater species; Zone 2, striped bass; Zone 3, bluefish and weakfish using FADS; Zone 4, weakfish and drum using quarry rock as a primary material.

Siting decisions are made using exclusionary mapping techniques. In the bay many places are unsuitable for reef-building because of anoxic conditions, bottom type, oyster bars, clam and crab pot areas, existing good fishing or military uses. Foster coordinates with other sport fishing groups and has periodic press conferences for the media. Two trolling areas using McIntosh FADs were constructed. But based on preliminary findings by reef personnel, the FADs have not performed well.

The Maryland mitigation policy is mitigation-in-kind. The program has experimented with several types of prefabricated reefs on one reef site, including fiberglass reinforced plastics, a beach prism concrete unit and quarry rock. The reefs are presently being evaluated for aggregation and cost effectiveness. Prior to the project, Japanese scientists were invited to Maryland to discuss high tech reefs, and in particular, the FRPs. The FRPs are 6 feet x 25 feet and are located in the mouth of the Patuxent River. Beach prisms are triangular, 4 feet on a side and 25 feet long.

Promotion and Education

The state has not worked with Sea Grant for educational purposes. Instead it conducts educational programs on its own. A slide show and several publications, including tide tables and a Tidewater Sport Fishing Guide, are available.

Evaluation

Reefs are monitored on a case-by-case basis. Presently, the state does not have enough reefs to justify an ongoing monitoring system. As mentioned, Foster is evaluating three kinds of prefabricated reefs. CPUE data are collected in conjunction with NMFS sportfishing surveys by a researcher at the University of Maryland, who is analyzing the effects of the sportsfishing license and a striped bass moratorium. Basic research is not conducted by personnel of the artificial reef program because of a lack of staff, but the state has the budget to fund others to conduct it. Reef personnel are present during all reef operations. The results of their work are published in-house but are not circulated to the public.

Future Outlook

To avoid potential criticism about aggregation, the program is geared toward habitat enhancement. According to Foster, studies have shown that historically there were as many as 20 times more oysters than present in the Chesapeake Bay. The state maintains quarry rock and hard rubble provide a suitable substrate for the re-establishment of the oyster community which has been lost. By evaluating each structure, the state believes it can answer the habitat enhancement question.

Concerns

No major concerns were expressed.

Mississippi — CONTACT: Ron Lukens, Vice President of the Mississippi Gulf Fishing Banks, Inc. and recreational fisheries coordinator for the Gulf States Marine Fisheries Commission

Administration

Ron Lukens, Vice President of the Mississippi Gulf Fishing Banks, Inc., sometimes serves as spokesman for the group. Two counties (Harrison and Jackson) provide funds (\$27,500 and \$10,000 respectively) for the operation of the artificial reef program. The group, which began in the early 1960s, functions as a county board. It appoints a board of directors, elects officers and has bylaws like most non-profit foundations. The group is open to the public for a minimal membership fee. It has no salaried people except for a part-time secretary paid \$100 per month. Almost all of the work is volunteer through charter captains and other dedicated recreational fishermen and divers.

The sole purpose of the organization is to build reefs. Other agencies are relied on conduct research. The Mississippi Department of Marine Resources does not presently have an active artificial reef program, partly because the reefs are in the EEZ. The corporation has received research help from the Gulf Coast Research Laboratory. There has not been much research performed since 1978 when Lukens did his master's thesis.

There is no legislation which set up the corporation. The county supervisors voted on it, and it came into existence. They have no policy guidelines and have limited liaison with other agencies. The Mississippi Department of Marine Resources does not have an active artificial reef program.

The corporation is concerned about liability, but no one knows what their liability is, including county supervisors.

Budget

The corporation's budget is \$37,500 per year, but it anticipates an additional \$10,000 from Hancock County (a third coastal county). Also, the board of directors would like to see the group have a line item in county budgets. They received a \$10,000 grant from the Department of Marine Resources under the Wallop-Breaux program for a specific construction project in 1987 and will be submitting another project proposed in 1988. In addition, the corporation raises money through membership dues. The board of

directors determines the loosely structured budget. The corporation subcontracts all work and owns no equipment. Almost all of its money is spent on operations. Maintenance is conducted through a contract. Approximately 90 percent of the funds are budgeted for construction and 10 percent for maintenance.

Siting

The purpose of the reefs is to provide recreational fishing access and to create habitat. There are no oil rigs in Mississippi, so artificial reefs are critical to sportfishermen. With no active program, the state naturally has no reef management plan. Reef sites range from 12 to 50 miles offshore.

In 1972 the state held public hearings to gain input on locating reefs. Locations were based on the existence of obstructions, and five sites were chosen. Recently two other sites have been added. They were picked by the corporation in consultation with divers and fishermen. One site consisted of 860/ acres encircling three structures; a second site near an oil rig in Louisiana was chosen to take advantage of its eventual phaseout.

Most local interest is from sportfishermen in the corporation. Public hearings are not held since their meetings are open to everyone and advertised. County supervisors have almost no input into the program. In the past the shrimpers had concerns about potential interference with trawling but recently they have been resolved. The Gulf States Marine Fisheries Commission has issued a statement to the effect that reefs should not interfere with productive, trawlable bottom.

One FAD project, evaluating a low-cost FAD attached to a sunken ship hull, was developed. The corporation compared structures with and without FADs and believed the FADs worked, but a formal evaluation was not done. A dive club recently placed some PVC FADs near another reef. The club has no other information on the project. The corporation plans to explore the use of pre-fabricated reefs in the future. Mitigation programs have not been used. The types of materials used are materials of opportunity, primarily barges, bridge spans or other materials of long-term durability.

Promotion and education

The corporation has responsibility for education and has developed a relationship with Sea Grant for additional assistance. The corporation has a brochure available which describes the program, but is somewhat outdated after only one year. They have a canned slide/tape program which is loaned to groups, and Lukens and laboratory researchers give more detailed talks.

Evaluation

The only monitoring activities are conducted by the contractor. The materials are unofficially certified by the corporation in order to keep the Corps satisfied. Their policy is to abide by the conditions of the permit. They have no long-term evaluation plans nor do they monitor results being published.

The corporation works cooperatively with the University of Mississippi. One researcher has developed two proposals, one comparing low-profile structures at piers with and without artificial reefs and another plans to profile reef users through a survey.

Concerns

The club's major concern is achieving an effective buoy program. Some of the members are worried about habitat issues in general, and in particular about fishing them out.

New Jersey — CONTACT: Bill Figley, Artificial Reef Coordinator

Administration

Fifty percent of the reef coordinator's time is assigned to artificial reefs. But in reality he spends more time than that. He reports to the chief of the Bureau of Marine Fisheries, who reports to the Marine Fisheries Administration, a commission in the Division of Fish, Game and Wildlife of the Department of Environmental Protection. The reef program has its own small vessel (23 feet) and charters private vessels as needed. The goal of the coordinator is to have the reef program become self-sufficient. There

are no statutes, but an artificial reef plan is the official state policy. In compiling the plan, an interagency committee composed of all federal and state regulatory agencies and one private group, the American Littoral Society, was put together to provide input for the plan. The only routine coordination with other state agencies is with the Division of Coastal Resources for the one reef in state waters. Counties are heavily involved in building reefs, but have had little input in their management. Their interest is driven by solid waste management concerns. Regarding liability, the manager has a statement from the District Attorney General, which outlines the limits of liability accepted by the state and mandated by federal law.

Budget

The program began in 1984 with \$450,000 provided by the Oyster Creek Nuclear Power Plant. The money was given to the state as mitigation for fish kills. The money provided the base for the state to initiate an artificial reef program. Presently the coordinator uses about \$50,000 in Wallop-Breaux funds for managing and coordinating the program. It pays for the coordinator and technician's salaries. In 1988, they are receiving an additional \$50,000 for biological monitoring work. This program will last for three years. The coordinator puts together a budget, but the dollar amount is determined elsewhere in the department based on trade-offs with other projects. The staff consists of the reef coordinator and four or five other people who, combined, work approximately one-half man year on artificial reefs.

The program's equipment includes a 23-foot boat fully equipped with electronics. The costs of materials and transportation are borne by private or county interests. In the future, the program plans to charge hourly rates to cover the costs of state personnel, who must be present during deployment activities.

Siting

The purposes of the reefs are to (1) provide habitat, (2) provide new fishing grounds for sport fishermen, and (3) to provide structure for divers. There are 10 parameters which influence siting decision and these are specified in the plan. There are eight reef sites with at least one near each inlet in New Jersey. A goal of the program is to permit two or three more reefs over the next five years. Aside from the 10 siting parameters mentioned above, discussions were held with headboat and charter boat captains prior to selecting a site. Little opposition was received from commercial fishermen. Some sport fishermen have called for more reef sites.

At this time the state does not buoy reefs, but it may start buoying in 1988. Construction is paid for by private interest groups and counties (Cape May and Ocean). The state considers its role as one of monitoring, directing and coordinating the transportation and placement. The state has a blanket permit.

The program has built no FADs. The coordinator feels they are not necessary in New Jersey, because sport fishermen already catch enough fish, and it would set a bad precedent. Since the state does not have money to spend on materials, it uses materials of opportunity. The New Jersey program uses tires in concrete (TICs). They have changed the TIC design because some tire flaps were breaking off, and they want to avoid problems with commercial fishermen. Three thousand one hundred tire units were placed in 1987. The predominant species attracted to the reefs are tautogs, sea bass, cunner, ling, lobster, rock crab and porgy. Their mitigation policy is payment-in-kind.

Promotion and Education

It is the state's responsibility to conduct education and promotion. Materials available include: (1) a slide program, (2) 40-minute video and 16mm film made available to sportfishing clubs, (3) pamphlets, (4) display exhibit for sport shows and (5) news releases and fishing magazine articles. Figley speaks frequently to groups about the program. The state has a display at one of its fish hatcheries, and hopes to have one at a new aquarium in Camden.

Evaluation

The state receives \$50,000 per year for population dynamics studies to be spent over the next three years. It will augment this with Sea Grant mini-grants. The mini-grants are designed to answer very specific questions, i.e., the food habits of sea bass or colonization of artificial reefs. Sea Grant is providing \$2,500 for each the project. Researchers will obtain catch-per-unit of effort data and would

like to do an economic impact analysis in the next two years. They certify construction by being present during all activities. Additionally, personnel obtain reef profiles from a fathometer and dive on most reefs. They publish their work. Recently, for example, a study was published on their tire stability work.

Future Outlook

The coordinator believes floodgates will open if it is more cost effective to put tires and demolition debris on reefs rather than in landfills. If not the program will struggle along as is. The potential volume of such materials in New Jersey is enormous. For example, one project presently being put together will provide four times more volume for one reef site than presently exists for all existing reef sites in the entire state. (It consists of four hundred barge loads of concrete rubble). The state is concerned about the aggregation vs. production question and whether reefs increase production at all.

North Carolina — CONTACT: Steve Murphe, Artificial Reef Coordinator

Administration

The artificial reef coordinator reports to the Chief of Development who reports to the Director of Marine Fisheries through the Deputy Director for Administration. The development section includes shellfish rehabilitation and leasing, submerged lands, special projects and permits, as well as artificial reefs. A draft artificial reef management plan was developed by the research section, a separate section from the development section which contains the reef program. The N.C. Division of Marine Fisheries is decentralized, and four district managers provide input on siting decisions, review permits and assist the artificial reef program in making contacts with interested groups at the local level.

All labor comes from the development section, and personnel are traded back and forth between shellfish relay and artificial reefs as needed. For example, during a recent red tide episode, the artificial reef staff worked on relaying oysters. Law enforcement vessels are sometimes used to assist the reef program. Statutory authority is given to the Marine Fisheries Commission to establish standards and adopt rules and regulations governing the location and utilization of artificial reefs in coastal waters. Regulations have been adopted giving authority to the fisheries director to close or restrict by proclamation any coastal fishing waters including artificial reefs. Regulations set maximum distances which are measured from a mandated buoy for exercising this authority (1,000' in the ocean and 500' in coastal waters). The closure is limited to one year, subject to renewal by the commission and requires approval by the commission at its next official meeting. The director is also required to consider the economic effects of closures prior to proclamation. This regulation will come before the Marine Fisheries Commission for amendment in 1989.

The artificial reef policy guidelines are completed, and an implementation plan will soon be developed. Most federal liaison is through the permit process. A blanket permit approved by the COE was highly endorsed by the division. Because of the state's Coastal Zone Management agency's favorable reputation, the Corps has delegated permit authority for inshore waters to them. In some areas the counties hold permits, but there is no formal interaction with them. The state has determined it is responsible for liability. The major worry is employees getting hurt. Contractors must show proof of liability before they will be awarded contracts. The division has asked the Attorney General's office to determine if the state is adequately covered for liability associated with reefs. As of this writing, a determination has not been made.

Budget

Presently most of the funds are allocated from a special appropriation from the General Assembly for a program to sink over 200 boxcars. The division is uncertain of next year's budget. Wallop-Breaux funds are used for planning and purchasing buoys. There are no standard matching requirements with local municipalities, counties or private groups. Cost-share arrangements are individually developed. The chief of the development section develops the budget and submits it to the division director who reviews it for inclusion in the division budget. The program includes a staff of four which includes the artificial reef manager, 2 maintenance mechanics and a fisheries technician. Another biologist shares time between artificial reefs and shellfish management. The division uses no subcontract arrangements for labor. One position is funded by the state, and three are funded by Wallop-Breaux funds.

Reef personnel have access to equipment throughout the division, including two 115-foot LCUs, an 8,000-pound boom, four dump trucks, two bulldozers, two front-end loaders and a loading site in Morehead City. The maintenance budget is about \$58,000 a year. The budget is allocated past expenditures.

Siting

The state has a written siting policy which is incorporated into the draft artificial reef management plan that covers program goals and objectives and will soon have an implementation plan. North Carolina makes a concerted effort to obtain public input. Compared with other fisheries programs and issues, artificial reefs aren't very influenced by special interest groups or political processes. However, the need to compromise was discussed as necessary.

The state is beginning to develop a FAD policy. Questions to be answered about FADs include what designs to use, how much money to spend and whether the state should get into the FAD development business at all. It is believed FADs are a cost effective way to build reefs, but the public will need to be sold on the idea.

The state has a moratorium prohibiting the use of tires because of past problems with them moving off-site. Construction materials such as steel and concrete are encouraged. At present the state uses no pre-fabricated reefs nor has it used mitigation policies to enhance the program except for the oyster relay activity. The program has not attempted to target individual species.

Education

The division conducts some educational programs. They have videos, slides and handouts, and the staff presents talks to fishing clubs. The division believes reefs are high profile with the press, and the media usually gives them positive coverage. Division staff routinely accept speaking engagements. New products include handouts of reef locations and a video describing the program.

Evaluation

With the exception of buoy monitoring, the state conducts no monitoring activities other than occasional diver observations and has worked little with university or other researchers to develop more basic proposals.

Future Trends

In the short-run the program will be continued at its present high level, partly because department personnel see it as a program positively received by the public. They will be more selective in the type of reef materials they will allow and will try to meet the goals of the plan. Some of the sites are quite large (162 acres), and the priority will be to fill in these sites. More work will be conducted to match reef profiles to species of fish preferred by sportfishermen. The state will not actively pursue estuarine reefs because it needs more research, and, in their opinion; they are not as productive.

Concerns

The program feels the production vs. aggregation question needs to be addressed. A consistent budget is needed for planning purposes. The price of scrap fluctuates widely and may price them out of the market in some years. If they are going to keep personnel fully employed and be responsive to the public, they will need a backup source of funds to cover this contingency. Concern was expressed about offshore reefs providing "a rich man's sport", and adding to crowding of inshore areas.

South Carolina — CONTACT: Mel Bell, Chief, Recreational Resource Development Section

Administration

The recreational resource development section is one of three in the recreational fisheries program. Bell is responsible for the artificial reef and recreational shellfish programs. The recreational fisheries program is one of five divisions in the Office of Fisheries Management. There are well developed relationships with other divisions. If something is needed from another division, the division directors

are called directly. The chief has no formal statutory or regulatory authority to make decisions and has a *carte blanche* mandate to manage the reef program. He feels these procedures work well because he keeps his superiors informed. Policy guidelines are not written. The section believes a plan is needed, but the general feeling in the agency is, "It ain't broke, so don't fix it."

The section has an excellent relationship with the Corps. The section, for example, borrows its sidescan sonar, and the Corps uses Bell as a diver for some of its work. The chief has developed a relationship with the Corps field enforcement staff, and they keep him posted about the availability of derelict vessels. Additionally, he has a good relationship with the Coast Guard. The Coast Guard inspects barges and vessels prior to being towed in order to protect the state from liability problems. The explosive ordnance unit of the Navy and the Marine Corps helps sink vessels. The reef manager is a member of the Naval Reserves, has a good working relationship with them, and believes interpersonal relationships are important in getting things done between agencies.

At the state level, the agency works with the Coastal Council to obtain permits. More recently the chief has been named to a committee of the Department of Health, which is interested in disposing of tires. They have done little at the local level, although the section has been able to obtain water resource management funds from three counties at a few thousand dollars each. The cities of Charleston and Beaufort have donated diver support through police departments and have loaned or made available patrol boats.

The Section has not received much help from private interests such as sportfishing clubs. In a few cases they have helped with procuring materials or labor or donated as much as \$1,500 for trolling alley development. But in most cases it is only the individual fisherman who helps.

The state has no official position on liability. The section tries to be careful of what they accept, and in the past has turned down barges because of lack of seaworthiness.

Budget

Aside from salaries, the state budget was \$46,500 in FY86; \$35,600 in FY87; and \$17,000 in FY88. In 1987 and 1988, however, the program obtained \$50,000 annually in Wallop/Breaux funds. These figures are split between materials and contractual services and do not include special projects. The section chief submits a budget which goes up the departmental chain and comes back usually reduced. Presently the staff consists of the chief and one vacant technician's position. The section prefers to contract all construction activities. Their equipment includes a large forklift and a 21-foot vessel, and access to four large research vessels (a 100-foot vessel with an 8-ton boom, a 72-foot shrimp boat, and two smaller shrimp boats). The program maintains 40 buoys, including five on natural wrecks on an in-house basis.

Siting

The purpose of the reef program is to provide recreational fishing enhancement. The program has balanced political pressure from sportfishing organizations against causing conflicts with shrimpers. The state has tried to site reefs near existing obstructions. The department is beginning to receive pressure from dive clubs for more reef building. Environmental groups have thus far remained interested.

The program has built several trolling alleys. These range from 500 to 2,000 yards long and were placed on permitted artificial reef sites for enhancement reasons. Their purpose is strictly for pelagic enhancement, primarily king mackerel. Since each FAD costs only \$3 or \$4, the state views them as throw-away reefs.

The department is opposed to mitigation. The program has initiated a research program to evaluate three types of pre-fabricated materials. These include steel cubes with and without mesh, concrete culvert pipe with holes and plastic reef materials. The plastic did not work well because of scouring. The cubes cost \$81 per cubic meter, and the concrete pipes cost \$168 per cubic meter. Evaluation of these materials is still underway.

Promotion and Education

The department develops almost all reef education materials. The staff has worked with Sea Grant on a diver's education conference and a recreational fishing brochure. The department has a slide show and is working on a video. Written information includes a xerox copy of Loran readings and an artificial reef guide and brochure scheduled for publication in 1988. Reef information also appears in the newsletter, "Saltwater Conservation." A display is used at fairs and boat shows.

Evaluation

Divers conduct routine inspections to monitor materials and species at reefs. Catch-per-unit of effort and economic impact data are kept as part of a special project. The percentage of the budget spent on evaluation is relatively small and is included in salary and boat time. The section is beginning to do more basic research, including engineering studies and fish censusing. The latter is through a grant funded by the National Undersea Research Program.

The state certifies the construction of reefs by having a state employee attend all reef building activities. The section chief recently published two papers on artificial reefs. The program would like to do more work with universities. In the past there have been a few projects, such as an FAD study, but they have not received much response from the universities. The section chief sent a memo on research ideas to personnel at the Wildlife and Marine Resources Laboratory.

Texas — CONTACT: Tom Heffernan, Director of Field Operations, Coastal Division, Texas Parks and Wildlife Division

Administration

The regional directors and maintenance personnel report to the director of Field Operations who was given responsibility for the artificial reef program. The present program is minimal and exists primarily to maintain one buoy. If the program needs support from other divisions, it is worked out at the director level. The state has statutory authority under Section 12.016 of the Texas Parks and Wildlife Laws to construct or contract for the construction of artificial reefs, accept reefs previously constructed by the Texas Coastal and Marine Council, maintain buoys and navigational aids, and acquire materials to develop future new reefs. In essence, the statute gives the state broad authority and freedom to manage the program as necessary.

The state is presently working on policy guidelines which will be added as an amendment to their six-year plan, which ends in 1991. They have no formal relationships with local units of government, and relationships with the federal government are through the permit system. The Coast Guard alerts the state about necessary buoy maintenance.

Liability is a major concern. The oil companies want to pass liability responsibilities to the state, which can be sued by citizens. At present there has been no determination from the Attorney General's office about the Division's exposure to liability. The division is trying to get some direction on this issue from the fisheries commission.

Budget

The annual budget, \$25,000 a year, maintains one buoy located off Freeport on an old Liberty ship. The Liberty ship sank accidentally while being towed to its intended location, necessitating the state to keep a navigational marker on it. Thirteen thousand dollars is budgeted for the subcontractor to make three trips to the reef per year for inspection. The remainder is for equipment. All money comes from state appropriations under the coastal fisheries operating budget. In the early 1970s, a now defunct agency called the Texas Coastal and Marine Council was set up to manage the Liberty ship program. The operating budget came from the selling of scrap steel. A sunset rule eliminated the agency, and their responsibilities were transferred to Parks and Wildlife.

Presently the director of Field Operations determines the budget. There is no staff or equipment.

Siting

Most of the effort has been directed toward estuarine reefs for oyster reef enhancement. It began in the 1930s and lasted until 1982. The objective of a recent six-year plan is to re-ignite the oyster reef enhancement program and enhance 500 acres of bottom over the next six years. The goal is to enhance oyster production and recreational fishing. The state used to have a management plan for the oyster reef program but no longer does.

There is not a lot of influence by local interest groups, most likely because of the high number of oil rigs located there. Most of the pressure comes from companies who want to get rid of junk. In the past some of the reefs have been constructed in conjunction with private associations, such as the Port Arkansas

Boatman's Association. The department believes FADs will not work in Texas because of strong wind and currents. Also, they are considered expensive and, with the incidence of oil rigs, they are not needed.

The state comments on the types of materials used. The oyster program is used for mitigation purposes for shellfish habitat destruction. The state has no pre-fabricated reefs and probably will not produce them because of conflicts with the shrimp fishery. Also, the state is reluctant to increase the pressure which already exists on the snapper stock. In the past, the state tried tire reefs, and it was a disaster. The tires moved, and they had a lot of complaints from fishermen. Junk cars presented similar problems.

Promotion and Education

When the Texas Coastal and Marine Council was in operation, a lot of promotional and educational work was conducted on behalf of the Liberty ship program. The state has one booklet summarizing its artificial reef construction program. Heffernan indicated a need for more education and involvement of the Sea Grant Marine Advisory Service. He would also like to involve oystermen in the development of an oyster management plan, which contains provisions to enhance oyster reefs.

Evaluation

The state conducts no monitoring programs of reefs or structures in Gulf waters. It conducts routine monitoring of the bays, including the oyster reef resource, on a monthly basis. The state is only beginning to address economic impact issues. The Texas Parks and Wildlife Division conduct some basic research at their pelagic research facility. However, it is only indirectly related to artificial reefs. The state has no certification program per se, but uses its environmental section and the EPA to check the various materials used. Monitoring results are published annually. The reef program has not coordinated much with universities, but Heffernan believes more should be done in the future. Division staff have participated in university advisory panels but would like to involve the extension program more in the future on the oyster shell program.

Future Outlook

The future depends on management priorities. The state believes the first item of business is an assessment study to see if the reefs are attracting fish or fishermen. It is doubtful any new major program will be developed. The division does not believe one more object in the ocean will make much difference, and the economic impact is likely to be quite low and replacement costs quite high. The Coastal Conservation Association has not listed artificial reefs as a priority. They recognize the state can only do so much, and other issues have had priority.

Concerns

Production versus aggregation was considered the crux of the problem in Texas. It was not viewed as a problem in the oyster reef program because it produces oysters. The oyster reef program has had some conflict with sailing clubs.

Virginia — CONTACT: Mike Meier, Manager, Artificial Reef Program, Virginia Marine Resources Commission

Administration

Meier reports to the Deputy Chief for Fisheries Management, one of four divisions in the Virginia Marine Resources Commission (VMRC). His primary source of vessel support is from the Division of Law Enforcement. For monitoring activities, he subcontracts outside the agency to the Virginia Institute of Marine Science (VIMS) or Old Dominion University (ODU). There are no statutes regarding the reef program as such and, as manager, he has wide latitude to make decisions. Policy guidelines and a management plan are not yet available, but work has begun on them. Plans call for having a draft ready by late 1989 for presentation to the VMRC for review and subsequent adoption. He feels a plan would help provide guidelines for decision-making.

Local liaison is considerable, with the commission having worked with the city of Norfolk in a cooperative tire program during which the city provided space and operational assistance for staging the

tires. The program currently utilizes a ship and adjacent property provided by NOAA's Atlantic Marine Center. Most work with other state agencies other than the university system is routine, such as obtaining equipment through state surplus and equipment repairs from the highway department. One unique feature is the program's use of inmate labor from the Department of Corrections. There are limitations related to the use of prison work crews, but it provides the program with affordable labor as well as a work-release opportunity for the prisoners.

There are no clear liability policies concerning artificial reef development and, as yet, the attorney general's office has not addressed it. The belief is that whatever problems arise can be handled under existing state law.

Budget

The program receives \$127,700 per year in unrefunded taxes on fuel from boats. Another \$100,000 in Wallop-Breaux funds is anticipated to be used, primarily for monitoring, side-scan sonar work, reef construction, and promotional activities. The budget is determined on a biennial basis in consultation with other managers in the Fisheries Management Division. The budget is then submitted to the legislature as part of the agency's overall budget. Rarely does the legislature get involved with the artificial reef budget. The staffing consists of the program manager and a field operations supervisor. Some work is subcontracted. The program owns very little equipment with the exception of a pickup truck, shop equipment and marine electronic gear. Program staff maintain buoys themselves to save money. The buoys are considered privately maintained aids to navigation, and the Coast Guard requires them to be painted yellow. They are not lighted.

The program has no formal cost-sharing arrangements but informally receives help from the Coast Guard, Corps of Engineers, NOAA and other private and public benefactors. For example, in 1988 the Army will save the program about \$30,000 in deployment costs by providing a barge and towing support. Of the \$127,000 in state money, about \$45,000 is allocated to salaries, \$27,000 to work crew expenses, \$24,000 in concrete and materials for construction of tire-in-concrete units, and the remainder goes for supplies and services.

Siting

The purpose of the reef program is sportfishing enhancement through the introduction of habitat providing structure/substrate in the marine environment. Siting decisions are made by the program manager. The parameters he uses include areas containing previous obstructions, nearness to access points, compatibility with other uses, bottom type, avoidance of anoxic conditions and water depth. The manager subcontracts with VIMS to do side-scan sonar on the bottom of chosen sites. Commercial fishing areas such as the edge of channels and oyster ground are avoided. A few FADs have been used for experimental purposes. FADs are not favored by the manager, but he feels constituents may eventually force the state to use them. From a management standpoint, FADs are considered high maintenance with the potential for many failures. Their preference is to use a combination of low-and high-profile reef structure. The high-profile reef is viewed primarily as an aggregation device. A variety of materials of opportunity, including tires which are currently fabricated into tire-in-concrete units (TICs) and various types of vessels (offshore), as well as specially designed concrete structures (Igloos) are being used.

The reef program was involved with one mitigation project. A coal handling facility in Newport News was required by federal agencies to provide \$100,000 to fund artificial reef research. The funds were to support a three year study conducted by Old Dominion University to study guidance for future artificial reef development. Generally, the program does not encourage mitigation efforts. The state's only pre-fabricated reefs are the "igloo" designs and TICs. They are satisfied with them. The igloos target tautogs, sea bass and summer flounder, but have also attracted spot and sea trout. In past years the artificial reef program has utilized an advisory committee, but presently it is not functioning. The Old Dominion study had a review committee consisting of sport fishermen. The VMRC has an overall sportfishing advisory committee with which the artificial reef program expects to work more closely in the future.

Promotion and Education

The reef program manager gives public slide presentations to sportfishing clubs, schools and other interested groups. The state has produced a poster that is placed at boat shows and sportfishing

meetings. They also have a Loran coordinate handout and have developed a reef and wreck chart in concert with V.I.M.S. The program manager routinely passes information to the state's outdoor writers as well as to radio and television stations. A brochure and bumper sticker are currently in the process of being prepared.

Evaluation

Side-scan sonar reconnaissance work is established for each site. Jon Lucy of VIMS Sea Grant is doing a reef utilization study. Researchers at ODU conducted an economic impact analysis of the Tower reef and found it was worth \$100,000 per year to the state's economy. Plans call for ongoing monitoring. The program conducts no basic research. Construction is certified by side-scan sonar and the Hastings-Raydist computer printout method. The program relies primarily on the universities to publish.

Future Outlook

From a longevity standpoint, Meier feels their program has a healthy future. The program has good support from the fishing public, and he expects a gradual increase in the budget, primarily because of Wallop-Breaux funding.

Concerns

The program manager feels the species management plans must be completed with appropriate input to the fisheries management councils so that reef managers can determine how to comply with management objectives. Meier feels the management issue will become more important in the future and that states will need companion legislation to take advantage of the Special Management Zone Plan. Liability is a big question mark, and reef managers need to be instrumental in the development of general guidelines. In the future, a mix of designed structures and materials of opportunity will be necessary in order for managers to efficiently utilize equipment and labor. He believes the igloo designs are one of the best choices currently available because they have been thoroughly tested and are designed to remain stable for 100 to 150 years.