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Proceedings From the
Second North Carolina

Marine
Recreational
Fishing
Forum

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The Latest in Fisheries Management
and Research that Affects
the Recreational Fishing Industry

February 6, 1993

Proceedings from the Second North Carolina Marine Recreational Fishing Forum

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This forum was convened Feb. 6, 1993, to provide the latest information on fisheries management issues and research that affects the recreational fishing industry.

Moderated by Jim Murray, director of Marine Advisory Service
for the North Carolina Sea Grant College
Edited by Jeannie Faris

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Jim Murray is director of the Marine Advisory Service for the North Carolina Sea Grant College.

This year, the forum planning committee focused the discussions on a saltwater recreational fishing license, based on the evaluations of last year's meeting. We at Sea Grant do not have a position on the license, but we have planned this forum to give all sides an opportunity to voice their opinions because the General Assembly will be looking at the issue over the next year or two. This information will be published, and the Legislature can use it in decision-making.

Overview of the Fishery

Mike Street is chief of research for the N.C. Division of Marine Fisheries. His career with the division has spanned 23 years, involving him in every aspect of the fisheries. He is also chairman of the Management and Science Committee of the Atlantic States Marine Fisheries Commission.

I will briefly hit a few of DMF's 1992 highlights and talk about plans for 1993 that will be of interest to marine recreational fishermen.

The DMF operates the N.C. Saltwater Fishing Tournament, which is a program that awards certificates to anglers who bring in large fish of a variety of species to coastal weigh stations. We are also increasing emphasis on catch-and-release and giving release certificates in this program. The state record program keeps track of the largest fish of each species taken by anglers. In 1992, records were set for three species: tautog, African pompano and pinfish. A lot of people don't think much of a pinfish, but a 2-pound pinfish is pretty good-sized. It is also one of the most caught fish in North Carolina, although few people pursue it.

The tournament had between 4,000 and 5,000 entries in 1992. We are still processing them. Among the highlights was a 260 percent increase in white marlin entries. Virtually all of them were releases. The total entries for blue marlin, sailfish and red drum also increased sharply in 1992, and virtually all were releases.

As most people know, tournament fishing in North Carolina is big and growing. A total of 43 saltwater tournaments were held along the coast in 1992 — 21 targeted king mackerel, 10 targeted billfish and the others pursued a variety of other species.

The first North Carolina-South Carolina Shoot-Out was held in September on the northern coast, and

North Carolina won it. The governors of both states participated, which we hope will set a good precedent. North Carolina's governor landed two wahoo; South Carolina's governor didn't get any, but he claims he was on foreign territory. We'll see what happens next year.

The Governor's Cup Billfishing Conservation Series had a very successful year in 1992. Sponsored by Texaco, it included seven tournaments held May through August along the coast. The largest blue marlin was 691 pounds. Of the 71 billfish brought to the boats during the series, 60 were released, which we think is excellent.

The artificial reef program is one of DMF's major programs to serve recreational fishermen. In 1992 we sank the 320-foot *Indra* on the Howard Chapin Reef off Bogue Banks. We put more than 3,000 sections of concrete pipe on eight sites along the coast. This is an excellent, long-lasting structure.

DMF estimates that 146,000 anglers made 56,300 trips to the artificial reefs. Fishermen caught about 1 million black sea bass, king mackerel and other targeted species. These figures don't count the other bottom fish that they didn't target, such as porgies and grunts.

The division has a public fishing access program that is perhaps one of its better kept secrets. We pass money to local governments to develop public fishing access. The program emphasizes construction of small, local fishing piers in the estuarine waters rather than boat ramps or ocean piers. The Wildlife Resources Commission has a very large, well funded public boating access program with ramps, so DMF is taking a different approach.

In coastal waters, DMF encourages local governments to build piers and provides 75 percent of the funding. Two new piers were built in 1992 — one at the Harkers Island Causeway and the other at the Carteret County Sportfishing Club on Town Creek in Beaufort. Two others are in Wilmington and the Neuse River at Spring Garden Landing.

The division's gear research on reducing bycatch is another program of interest to recreational fishermen. DMF demonstrated to the satisfaction of our commission that fish excluder devices (FEDs) work in the shrimp fishery. Late in the year, these devices were required by proclamation of the fisheries director in all shrimp trawls used in North Carolina. Ours is the only state to require that. The division began work to reduce bycatch in the offshore flynet fishery and demonstrated the potential for turtle excluder devices in the winter trawl fishery for flounder.

A number of rules were enacted that are certain to be of interest to recreational fishermen. The sale of

red drum over 27 inches is prohibited. All sale of tarpon is prohibited. FEDs are required in the shrimp trawl fishery to reduce bycatch. Use of gill nets in a number of popular sportfishing areas is prohibited. The 10-inch minimum size limit for weakfish has been implemented, and DMF requires a larger mesh size in the tailbags of ocean flynet trawls to protect undersized weakfish and other species.

The division's recreational statistics program, which is perhaps the best on the Atlantic coast, conducted 13,000 intercept interviews. Anglers were interviewed at the end of their trips or called as part of the survey. About 12,000 phone calls were made.

In 1993, DMF will continue working with the fishing tournament and the Sportfishing Advisory Committee. The committee can really help inform the public about the tournament and increase participation. It can also let the division know more about what the public wants in the tournament. The division will work to increase conservation among anglers by encouraging catch-and-release; to this end, king mackerel has been added to the list of species eligible for certificates for release, effective this year.

There will probably be about 50 tournaments along the coast in 1993, compared to 43 last year. The division will step up its work with the tournament sponsors to encourage the release of small fish. The Governor's Cup Billfishing Conservation Series will continue and the North Carolina-South Carolina Shoot-Out is planned this year in South Carolina.

The DMF has more work planned for the artificial reef program, including completion of the *Artificial Reef Guide*. This publication will show the location of all reefs and provide history and information on the artificial reefs. It will be printed on waterproof paper.

The division will also conduct a sidescan sonar survey of all ocean reefs this summer to accurately map the location of materials on every reef. DMF intends to test three new types of high-profile prefabricated units beginning this year. Some prefab units have been used on one or two reefs, and new ones will be tested. The real advantage to these prefab units is that they're always available, unlike concrete pipes or ships. So prefab units, if they're priced reasonably, can be put out continually on the reefs. Very little of the space available on each reef site is being used, so more material can be added to increase the fish populations available to anglers.

In the access program, DMF is negotiating with Swansboro and Oriental for additional sites and has made preliminary contacts with local governments interested in other projects. Gear research is continuing on flynets; work will be added on bycatch reduction in pound nets and long haul seines.

Conflicts were a focus of the recent Marine Fisheries Commission workshop and business meeting in Atlantic Beach. A lot of people stated their views on the conflicts, airing problems and perceptions of problems. Perhaps this year, the division can reduce those conflicts through new rule-making authority or the authority that already exists.

The division will continue efforts to reduce shrimp trawl bycatch by maintaining the FED requirement and working with the fishing industry on further improvements. The division will continue evaluating the use of gill nets in different areas and use the director's proclamation authority to make adjustments as needed.

Enforcement — either too much or too little — is something else people have strong feelings about. But DMF has an initiative in the Legislature to increase the enforcement staff. If this is positively received, the state can make some progress here.

Gary Harrison: I am from Wilmington, N.C. What is the status of inshore shrimping? I believe North Carolina is the only state that still allows it.

Mike Street: No. A number of other states also allow inside shrimping. That is a policy issue that should be addressed by Bill Hogarth, director of the Division of Marine Fisheries.

Bill Hogarth: Some revisions to the amendment were made yesterday (Feb. 5, 1993) for the Marine Fisheries Commission to address, such as the headrope restrictions inside. The division also offered more closures. There is one public hearing scheduled, but the commission asked for further evaluation of inside trawling as a total package. That will happen over the next year.

The fish excluder devices (FEDs) are working. There is some concern that they haven't had a chance to work — they've been in less than a year — and should be further evaluated before more restrictions are added. But it is an issue that DMF will address. Some of the commercial trawlers themselves want to see weekend closures, and they want to see some of the bays and rivers closed. But there are no definite data right now. States have closed inside waters, and some of them, such as South Carolina, have re-opened areas that had been closed, so it's difficult to measure the difference.

In my opinion, when you drag a 2,000-pound trawl door across the bottom day in and day out, there's not much left as far as grass beds, crabs and shrimp because they won't survive that practice. The division needs to address that practice and get back to the commission immediately.

Lib Heverley: I'm from Emerald Isle. As a pier owner, I am concerned with the stop nets on Bogue Banks. If something isn't done to regulate these nets, the economy of Bogue Banks will be ruined. It will continue to get worse until something is done. What regulations or rules will the Division of Marine Fisheries offer to relieve this situation?

Bill Hogarth: Last year, the Marine Fisheries Commission gave me the authority to regulate gill nets through the proclamation process. The Division of Marine Fisheries had problems because gill nets were suddenly showing up in areas that had been closed; for example, gill nets were being used as swipe nets and seines. The definition of gill nets and seines will be debated in public hearing to help DMF manage them; then, the authority to regulate seines will go into the proclamation authority.

Now, the commission is going to public hearing with a provision that I have proclamation authority with certain restrictions to look at all commercial gear set in the ocean along the entire coast, from South Carolina to Virginia. I asked for proclamation authority on the ocean conflicts because they need to be looked at, and it's very difficult for the MFC to put conflict resolution into a rule. So the division will be meeting with the various localities to consider restricting commercial gear within a half-mile of piers and other distances from rock jetties and inlets.

Also, George Clark, one of the commissioners, has asked that a 17-mile area around Masonboro be free of nets, gill nets and stop nets, though they are already forbidden there. That proposal will go to public hearing. In sum, I think the issue of netting along the coast and in inlets is being addressed very thoroughly right now.

Lib Heverley: Allowing stop nets a half-mile from the pier isn't going to help one bit.

Bill Hogarth: The Division of Marine Fisheries has the authority to do more if this provision passes. The division has looked at stop nets and the passage of fish through them and will revisit the entire issue again with the authority to correct it.

Jim Murray: Red Munden will talk about how the Division of Marine Fisheries is funded, where the money comes from and where it goes. The planning committee thought that this presentation could provide background information for a license discussion later. If there is a license someday, the public will want to know how the proceeds will be used and how the budget is set up.

How the N.C. Division of Marine Fisheries is Funded

Red Munden is director of operations for the Division of Marine Fisheries, where he has worked for 23 years. He works a lot with the Marine Fisheries Commission, is in charge of enforcement and works with most of the division biologists.

The marine fisheries rules — found in the little blue books available at marinas or through the DMF — are passed by the MFC. One of these rules outlines the scope and purpose of the DMF. It says, "The Division of Marine Fisheries is charged with the stewardship of the marine and estuarine resources of the state of North Carolina and is responsible for the management of all marine resources." Well, it takes money to manage these resources.

Each year, the division receives about \$6 million in appropriations from the General Assembly and \$675,000 from the sale of commercial fishing licenses. The license receipts money is used for law enforcement. The division also gets about \$1.3 million a year through federal aid receipts, or F/A, the majority of which is Wallop-Breaux money. DMF's total funding is about \$8 million.

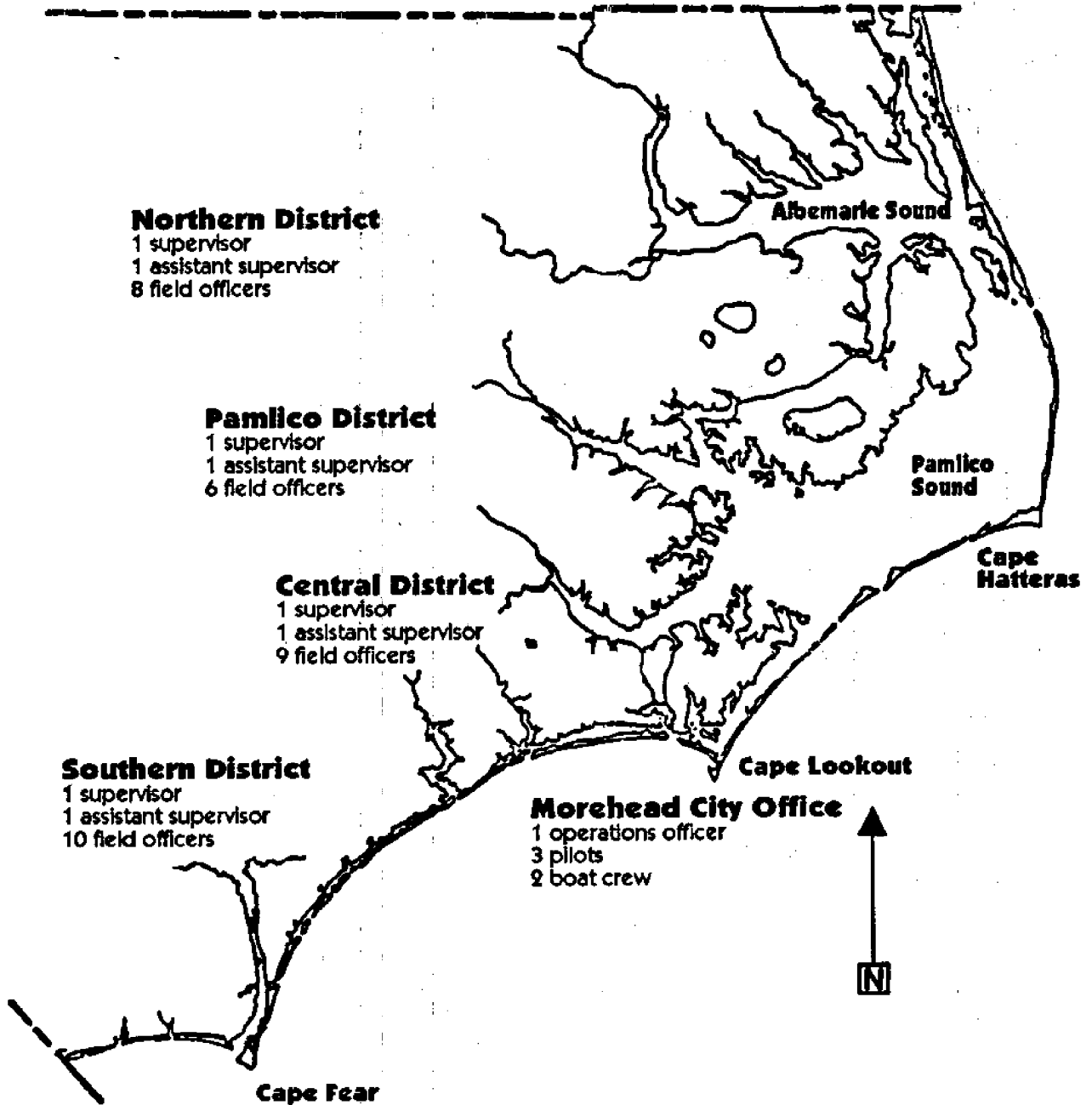
The division operates through four sections: administration, research, operations and development. Administration is under Director Bill Hogarth and includes his staff, the marine fisheries office buildings, mechanics and maintenance staff. Mike Street has already talked some about the research section. Operations is the section that I'm responsible for, with law enforcement officers, biological and support staffs, such as our communications center operators. The development section, headed by Mike Marshall, is responsible for building artificial reefs and the shellfish lease program.

DMF has 177 permanent employees. Some of these positions are funded by federal aid receipts and some by the General Assembly. The division is divided into four districts, each with a district manager. The northern district, based in Elizabeth City, is responsible for the state's northern coastal area and the Outer Banks from Ocracoke to the Virginia line. The Pamlico district is responsible for the western Pamlico Sound, and it operates out of the Department of Environment, Health and Natural Resources regional field office in Washington, N.C. The main office is in Morehead City, where Hogarth and his staff, the operations and development sections operate primarily. The central district is responsible for law enforcement and fisheries management for Carteret County, Craven County and a portion of Onslow County. The southern district takes over

**Division of Marine Fisheries
Law Enforcement Districts**

Effective July 1993

Coastal North Carolina



Statistics

- 47 law enforcement officers
- 2.2 million acres estuarine waters
- 0.5 million acres ocean waters (out to 3 miles)
- 4,000 miles of coastline
- 21 coastal counties actively patrolled



below Swansboro and runs to the South Carolina line.

So what does this mean? DMF covers 21 coastal counties with its law enforcement efforts and fisheries management activities. Its jurisdiction goes up to the inland waters and into areas such as Fayetteville, where fish dealers are checked. The division's area of responsibility reaches beyond Edenton toward Halifax. The jurisdiction of DMF applies to all species of marine fish no matter where they're found. A fish market in Asheville, if it is handling undersized flounder, comes under that jurisdiction. Economically, DMF cannot afford to dispatch someone to Asheville to look for undersized flounder, but that is still within its area of responsibility. So the division tries to detect the undersized product before it gets away from the coastal area, before it's loaded on a truck and driven away from the fish house.

DMF law enforcement officers are responsible for patrolling 4,000 miles of coastline, from the Virginia line near Corolla, down the Outer Banks and back up the inside, around all the little tributaries in the Albemarle, Croatan, Currituck and Pamlico sounds and south. The biological staff works in the estuaries in the same areas. DMF is responsible for the state's 2.2 million acres of estuarine waters and a half-million acres of the ocean waters from the beach to 3 miles outside, which is our outermost jurisdiction.

Our biologists work in the estuaries, pulling shrimp trawls to collect biological samples that are separated by species and length. This information is used to indicate the productivity of an estuary, which over time can be used by the MFC to justify special protection for an area, known as a primary nursery area. Primary nursery areas cannot be disturbed with bottom-disturbing gear such as trawl nets, seines or dredges. DMF uses this biological information as a background for making comments about coastal development. When a developer wants to build a high-rise condominium, bridge or marina, DMF can say an area is valuable or not so valuable to the fish. The information is also used to decide when to open or close a shrimp season. Or it's used to determine when finfish are large enough to survive activities that would normally cause mortality, such as trawling.

The division has a 44-foot research vessel that operates primarily in the Pamlico Sound, though it works offshore as well. It has a full-time captain and a full-time crew member. DMF uses the vessel to monitor the resources, to survey species in Pamlico Sound and the nearshore ocean.

If a commercial vessel has a particular type of gear or method of fishing that DMF doesn't have, the division will sometimes charter the boat and pay to

remove the fish from nets, tag and release them. The division goes out to people who are fishing stationary gear such as pound nets and offers to pay market price for all the flounder of a certain size. Then, the fish are tagged and put back overboard. From this, DMF gets information to manage the species, such as how large the fish were when they were tagged, where they were recaptured, how many days or months later and how much they had grown. We also collect biological information from fish that are landed in the mackerel tournaments.

The artificial reef construction money comes from state appropriations. The federal money is used to identify and buoy the reefs and put out the reef guides. A policy decision was made several years ago that only state money would be used to build the reefs. DMF does receive a lot of money from sportfishing clubs and the people who organize the tournaments. Oftentimes, they share the profits from those tournaments with the provision that the division use it to purchase a vessel, clean a vessel or move it to the reef site. This is a combined effort between local fishing clubs and the division, and it helps in building artificial reefs.

DMF also has four oyster rehabilitation vessels, which are essentially small self-propelled barges. Oyster shells are loaded up, taken to planting sites and sprayed off with a high-pressure water hose. This method cleans the shell material of any dirt or foreign material. Once they're on the bottom, baby oysters attach to the shells; this keeps them from settling into the sediments and dying. The division uses all available shell material to rebuild or rehabilitate the state's public oyster beds. These small vessels range from 32 to 65 feet in length. In addition, two 115-foot vessels are used to plant shells in Pamlico Sound, build artificial reefs and put out buoys in the winter months. All these shellfish vessels come under Mike Marshall's jurisdiction in the development section. For the most part, state appropriations pay to operate these vessels. Occasionally, DMF can use federal funds to maintain them, but most of these funds come from the \$6 million appropriated by the state.

The law enforcement unit has two seaplanes, a land-based aircraft and a 38-foot patrol boat. These are high-priced items and they cost a lot of money to operate. The division purchased this equipment new, and it's very effective. It allows DMF to efficiently carry out its law enforcement mission. But again, all of this equipment is funded by appropriations. Law enforcement is entirely funded by state money; it doesn't get federal aid receipts. The use of Wallop-Breaux funds for law enforcement is specifically prohibited.

DMF has 47 law enforcement officers, and most

of them have a boat. Some have two boats; often one of them is a johnboat. The operations section alone maintains 65 boats, which are used by law enforcement officers and the biological staff. And it takes a pile of money to keep 65 boats in operation.

Every year, the division has an exhibit at the N.C. State Fair to take our message to the public. As many as 20,000 people will come through the exhibit in a day, and some of them will say that they had no idea DMF was involved in this kind of work, so it's worth the effort.

Most division activities are funded by state appropriations. The Wallop-Breaux funding comes from a tax on recreational fishing gear and equipment. Every time I buy a lure, a portion of that payment goes into the Wallop-Breaux fund. It's not like a big pot of federal money that North Carolina is trying to grab; it's money that the recreational fishermen of this state and others have contributed to.

Right now, the division is spending about \$600,000 a year in funding available through Wallop-Breaux. The problem is that this money requires a 25 percent match. In order to get this \$600,000, DMF has to come up with a 25 percent match. The division normally does this by saying that a state-funded employee will work on this project. All things being equal, DMF uses the salary of one state employee to hire three other federally funded employees, which is great if the objective is to build up the number of employees. But also keep in mind that the division needs operating money. So the Wallop-Breaux money is used to create positions for people to do the work and to pay operating expenses for research projects such as identifying and buoying the artificial reefs or building fishing access. Wallop-Breaux money that isn't spent can be carried forward to the next year, but it reverts after two years. So it's critical to have good projects and obligate the money.

Just briefly, I will run down some of the things that DMF does with Wallop-Breaux money. Already mentioned are artificial reef identification and coordination, but not construction. The division conducts a marine recreational fishing survey and creel work and monitors striped bass stocks with these funds. It does finfish life history studies to determine how fast they grow, where they migrate and where they are found. DMF is also working on bycatch and ways to improve commercial fishing gear so that it harvests desirable species without killing everything else. And the division assesses the status of important recreational fish species with these funds.

What can we do? It's important for the General Assembly to realize that without appropriated, state-funded positions, DMF cannot match about \$200,000

a year of available Wallop-Breaux money. The money is what we, as recreational fishermen, have contributed to the Wallop-Breaux fund. And the money is there, but we just don't have the 25 percent match.

Every person who can work on the federal aid projects in DMF is already doing so. Improving the match is the only way to tap those additional funds and do more projects that directly benefit recreational fishermen.

THE LEGISLATIVE PROCESS AS IT RELATES TO FISHERIES ISSUES

Sherri Evans-Stanton is the counsel for the Joint Legislative Study Commission on Seafood and Aquaculture. This commission is playing an increasingly important role in fisheries issues. Evans-Stanton heads the research on marine issues. She has been with the General Assembly for four and a half years.

Let me start by giving a quick overview of the legislative process; then I'll get to the study commission. Basically, bills can be introduced by individual members of the Legislature or they can be recommended by a study committee. Oftentimes what happens when a controversial issue is broached, such as the license to sell, it is introduced as a bill and then sent to the joint legislative study commission for further study.

The Joint Legislative Study Commission on Seafood and Aquaculture has been a permanent commission since 1989. It started as a temporary commission that would expire at the end of each legislative session. But the co-chairs thought that fisheries issues are so important that they need regular study.

The commission has 15 members. Sen. Marc Basnight of Dare County and Rep. David Redwine of Brunswick County are the co-chairs. The Senate appointees are senators Richard Conder, Beverly Perdue and Robert Shaw. Appointments by the House of Representatives are representatives Howard Chapin, Robert Grady and Ronald Smith. The governor's appointees are Cash Caroon, James Carson Jr., John Coslow and Mike Holloman. And the commissioner of agriculture's appointments are Tom Caroon, Rep. Vernon James and Rep. Pete Thompson.

The general statutes set forth a very broad list of seafood and aquaculture issues that the commission may study, as well as other issues relating to fisheries. Some of these include increasing the state's production and marketing, creating a central permit-

ting office and evaluating actions of boards, commissions and departments such as the Division of Marine Fisheries, Wildlife Resources Commission, the Marine Fisheries Commission and the Department of Agriculture.

The commission studied the license to sell. It also recommended shifting the authority to grant shellfish leases from the MFC to the secretary of the Department of Environment, Health and Natural Resources.

The commission focused on these issues in 1992 and held six public hearings in Sunset Beach, Oriental, Beaufort, Sneads Ferry, Atlantic Beach and Raleigh, as well as six meetings across the state. Anybody who isn't familiar with this commission should come to the meetings, raise issues with the members or send something to me. It serves as an excellent forum for discussing fisheries issues. A number of people have been before the commission, including commercial and recreational fishermen, aquaculture farmers, members of the Southeastern Waterman's Association, the Cape Fear Atlantic Coast Conservation Association, the N.C. Fisheries Association and its auxiliary and agencies such as DEHNR, MFC and the Department of Agriculture.

The commission held its final meeting in December 1992 for the proposals of this legislative session; it made seven recommendations.

The first is a license to sell saltwater fish taken from coastal waters. This was — and still is — a highly controversial topic. Some of the arguments used to support a license to sell saltwater fish are the same as those that I've heard recently for recreational licenses. For example, I've heard that people support these licenses because there is inadequate data right now. There is no good data base to help the DMF make resource decisions. Lack of accurate information also affects national quotas for North Carolina's commercial and recreational fishermen. Most people who came to the hearings said they'd support a license to sell as long as the fee was minimal and the proceeds were used to develop new programs rather than pump up the general fund. On the other hand, people have said it is overregulation, that the license would be too cumbersome to get and would discourage people from fishing in North Carolina.

The second legislative proposal would continue funding the shellfish enhancement program. This research started last year with Pete Peterson, a professor of marine science biology and ecology at the Institute of Marine Sciences at the University of North Carolina. He presented a project for shellfish enhancement research that would help revitalize the seafood industry and increase production of oysters, bay scallops and clams.

The third proposal would transfer authority to

grant shellfish leases from the MFC to the secretary of DEHNR. The reason for that is the commission meets only quarterly. Getting a permit usually takes a minimum of 180 days because your application was incomplete the first time or you needed something else. So the idea is, if you delegate authority to DEHNR, the secretary can designate a division director to make decisions about the leases. This would cut down on the time it takes.

The fourth proposal would authorize the governor to appoint a spouse of a commercial fisherman to serve on the MFC in the slot of a commercial fisherman. This was included because members of the N.C. Fisheries Association Auxiliary would come to the hearings when their spouses couldn't because they were out on a boat. And it became clear to the commission that these people could talk about the problems the commercial fishing industry was having with water pollution, overregulation, disease and lack of the resource.

The study commission also recommended that the state develop aquaculture programs at the colleges and community colleges. It became clear that a number of people coming before the commission had been trained either outside the state or on the job. So a program within the state could encourage more people to get involved in aquaculture and make investments.

Along those lines, another legislative proposal would reduce the water column fee from \$500 an acre to \$100 an acre for the first three years. This would also encourage people to get involved in the industry. The feeling here is that \$500 an acre is quite an investment and it takes time to get started.

The commission also recommended that the Department of Agriculture, rather than the Wildlife Resources Commission, regulate the production and sale of commercially raised freshwater fish and freshwater crustacean species. This would be a continuation of the 1987 Aquaculture Development Act that made the Department of Agriculture the lead agency.

In addition, the commission set forth a number of issues it wanted to continue to study. These include regulation of imported fish, including size, labeling and compliance with safety inspections; the effectiveness of the state's seafood marketing program; proclamation authority by the director of DMF; recreational saltwater licenses; and issues raised by the Albemarle-Pamlico Estuarine Study (APES).

A number of environmental proposals were in the APES study that the commission didn't have time to fully consider, and members thought that the proposals needed to be stronger to improve water quality.

In addition, co-chairs Basnight and Redwine

appointed a committee to review and recommend changes to the existing advisory committees. The members are senators Basnight and Perdue, representatives Redwine and Smith, Bill Hogarth, John Coslow and Melvin Shepard. This committee will look at strengthening the committees and perhaps dividing them to give oyster and clam harvesters a voice or providing a shellfish advisory group. This committee hopes to work during the session. The study commission most likely will not meet during the session, but will pick up again afterward.

Let me make a couple of comments about recreational licenses. Currently, 12 states have recreational licenses: Alabama, Alaska, California, Florida, Georgia, Louisiana, Maryland, Oregon, South Carolina, Texas, Virginia and Washington. These licenses vary from state to state but are available in many cases on a short-term basis from one to 10 days, or in some states, to residents for a year. Some states exempt children under 16 and senior citizens from obtaining the license. And nonresidents usually pay substantially more than residents.

In our case, the DMF has estimated that it would cost about \$5 to process a license, and it would be nice for the license to cost \$12 to cover supporting programs that are underfunded.

Let me say in closing that I have heard Basnight, Redwine and others on the commission tell people at the hearings that the Joint Legislative Study Commission on Seafood and Aquaculture is a forum for their issues. That is why it was made permanent, to hear from people. The commission holds hearings every year across the state, and the turnout at some has been disappointing.

Lucia Peck: I am from Raleigh. How much do you think the license would cost to administer? As you said, the recreational license might cost \$5 to administer, and I want to know if anyone has looked at how much a license to sell could bring into the state in additional fees and funding for managing the fishery.

Sherri Evans-Stanton: Another bill recommended in the packet was an appropriation for first-year start-up costs. It's about \$50,000. That was worked out by the DMF with the fiscal staff. When they were coming up with the figures, they consulted other states such as Florida to get some ideas on costs. The license fee in the bill is \$35 for residents and \$150 for nonresidents. There have been numerous estimates of how many licenses would be sold in the state. That's one of the problems. We don't really know.

Lib Heverley: Most of the businesses on the coast depend on day visitors, and many of them are from out-of-state. Would they have to buy a \$100 license to fish one day?

And has anybody considered what this would do to the economy of the coastal area? Has there been an impact study?

Sherri Evans-Stanton: Not yet.

Lib Heverley: Will there be?

Sherri Evans-Stanton: I don't know. We're talking about two different things. The proposal I'm talking about, which is already in the packet, is a license to sell saltwater fish, not a license to fish. I mentioned that the commission wants to look at recreational licenses, but first there would be a lot of study and hearings.

Lib Heverley: So you would expect an impact statement before the recreational fishing license went into effect?

Sherri Evans-Stanton: That would probably be included in what DMF provides the commission. A notice of commission meetings is sent to everyone on the mailing list, it's published in the General Assembly calendars and all the associations get one. Usually there are monthly meetings after the legislative session.

Recreational Saltwater Fishing License for North Carolina: Pros and Cons

Moderator **Mike Orbach** is a member of the N.C. Marine Fisheries Commission, one of three scientific appointments. He is a professor of marine affairs and policy at Duke University.

I especially appreciate forums like this because the MFC has to do two things with conservation and management. It has to conserve the resource and involve people in deciding how to distribute the benefits and run the policy in programs that accomplish all our purposes. And that is what we're here about today.

I grew up in Newport Beach, a little southern California town that looked a lot like Atlantic Beach does today. Anybody who has been to southern California recently would probably guess that it doesn't look the same anymore. The little town of 12,000 that I grew up in is now about 200,000 in the

middle of a group of cities with a population of 18 million.

Now, we probably won't see that in North Carolina, but we will see significantly heavier use of all our natural resources. And that makes it important — from the perspective of the MFC and the other state and federal policy-makers — for everyone who uses the resource to enjoy its benefits and contribute to its management and conservation. That includes commercial fishermen, recreational fishermen and coastal residents.

Someone asked whether we are going to do impact assessments and studies of other areas or potentials before taking action on the saltwater sportfishing license. The answer is clearly yes. In fact, there have already been some studies in other states. But to get the actual experience, this panel brings people from other states to talk about recreational fishing licenses.

Some speakers have had more experience with the issue than others, and they are all a little different from one another. It's all for consideration in how we might do things here.

The License Experience in Other States

Florida

Virginia Vall is chief of the Office of Fisheries Management and Assistance Services in the Florida Department of Environmental Protection.

One of my responsibilities is explaining the saltwater recreational fishing license: who needs one, why they need one, where they can get one and how we are spending the revenues generated from license sales. Sometimes this is easier said than done.

In the spring of 1989, the Florida Legislature passed a law requiring specified saltwater anglers to hold a recreational fishing license as of Jan. 1, 1990. The licenses went on sale in December 1989 to give people time to comply with the new law.

As expected, the issue was very controversial, with proponents and opponents equally committed to their viewpoint. Actually, the controversy was more than 10 years old before it was resolved, if you consider the license to be a resolution. The controversy was focused, primarily, on whether everyone who uses a common property resource should pay a fee to ensure its perpetuity. Proponents saw this as only fair, especially considering the needs of fishery management in the state. Opponents saw saltwater fishing as something they never had to pay for before, and they didn't want to start. Besides, requiring a

license would hurt tourism and impact local economies. Regardless of the debate, we now have a saltwater fishing license.

The statute that creates the license is very clear about who would and would not have to buy one. It sets the cost of the short-term and annual licenses for both residents and nonresidents. It provides for the licensing of charter vessels and pay-to-fish piers. Anyone fishing from a licensed vessel or licensed pier that charges admission to fish does not need a license. In many cases, this is an out-of-state tourist who does not have to buy a nonresident license. The statute also sets out the cost of the license, what administrative fees may be charged in addition to the cost of the license and the penalties for fishing without a license.

In Florida, saltwater licenses are sold by the county tax collectors, who receive \$1.50 per license for administrative costs. Other enterprises, such as bait and tackle shops or sporting goods stores, also sell the licenses as subagents to the county tax collector. They receive 50 cents in addition to the \$1.50 collected from the tax agent. Resident anglers may choose a 10-day license (\$10), a one-year license (\$12) or a five-year license (\$60). Nonresident anglers have a choice of a three-day license (\$5), a seven-day license (\$15) or a one-year license (\$30). Lifetime resident saltwater fishing licenses are available from the Department of Environmental Protection.

Anyone who plans to catch, attempt to catch or possess marine fish for noncommercial purposes is required to have a saltwater license. However, there are several exceptions. The following people do not need a recreational saltwater fishing license: Florida residents fishing from land or a structure affixed to land, anyone under 16 years old and Florida residents 65 years and older, anyone fishing from a pier or vessel that has a valid recreational pier or vessel saltwater fishing license, anyone holding a valid commercial saltwater products license in their name or one person on a commercially licensed vessel, any Florida resident in the armed services and not stationed in Florida while home on leave for 30 days or less, anyone accepted by the Florida Department of Health and Rehabilitative Services for developmental services and anyone who has been assigned by a court to a program authorized by Health and Rehabilitative Services to train in aquatic resources.

To date, the sale of saltwater fishing licenses generates about \$12 million a year, which is deposited in a special trust fund called the Marine Resources Conservation Trust Fund. The allocation of these revenues (Figure 1) is specifically defined by statute. Not more than 2 1/2 percent of the total

revenues generated goes to the Marine Fisheries Commission for its mandated duties; not less than 5 percent is transferred to the Save Our State Environmental Education Trust Fund for aquatic resource education. Not more than 2 1/2 percent of the revenues can be used for the administration of the saltwater license program. Law enforcement receives not more than 30 percent. Marine research receives not less than 30 percent. Not less than 30 percent is allocated to marine enhancement activities, which include artificial reefs, fisheries statistical data collection and stock enhancement research.

The marine research grants program supplements the efforts of the Florida Marine Research Institute, a bureau in the Division of Marine Resources, to gather data on topical issues. Each year, specific research needs are identified and prioritized; research institutions in the state are notified that proposals for the specified projects will be accepted and competitively evaluated to determine the awarding of funds. The annual budget for the grants program averages about \$1.5 million.

Stock enhancement research includes projects

conducted at the institute's stock enhancement facility or hatchery. The emphasis at the hatchery goes beyond the production of fish (red drum) to include the monitoring of hatchery-reared juveniles after their release to determine survival rates, dispersal patterns and impact on both the wild stock and environment. We want to be sure that the release of hatchery fish into an estuarine system will not cause undesirable environmental impacts or, if survival rates were low, be an expensive exercise in futility.

Implementation of the license program was quickly accomplished. The license was designed, developed, printed and distributed to county tax collectors within five to six months. There was a concerted effort to inform the tax collectors of the license requirements and their role. Public awareness was already high because of the controversial nature of the license, but there was confusion about when a license was needed and where to buy a license. The Office of Fisheries Management and Assistance Services was created, in part, to provide the public with information on license regulations and other fisheries related issues.

Figure 1

**Allocations Mandated in Legislation
Florida Saltwater Recreational Fishing License**

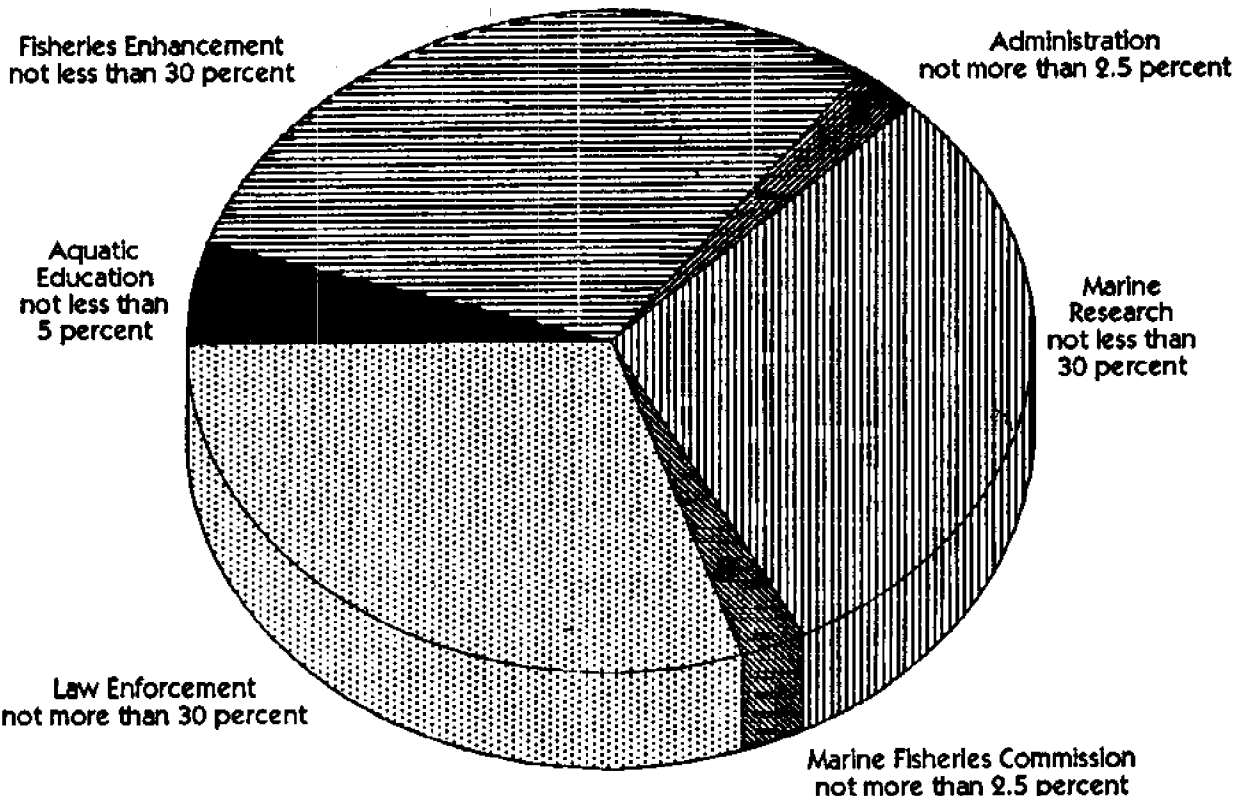


Figure 2

Marine Research Expenditures By Year

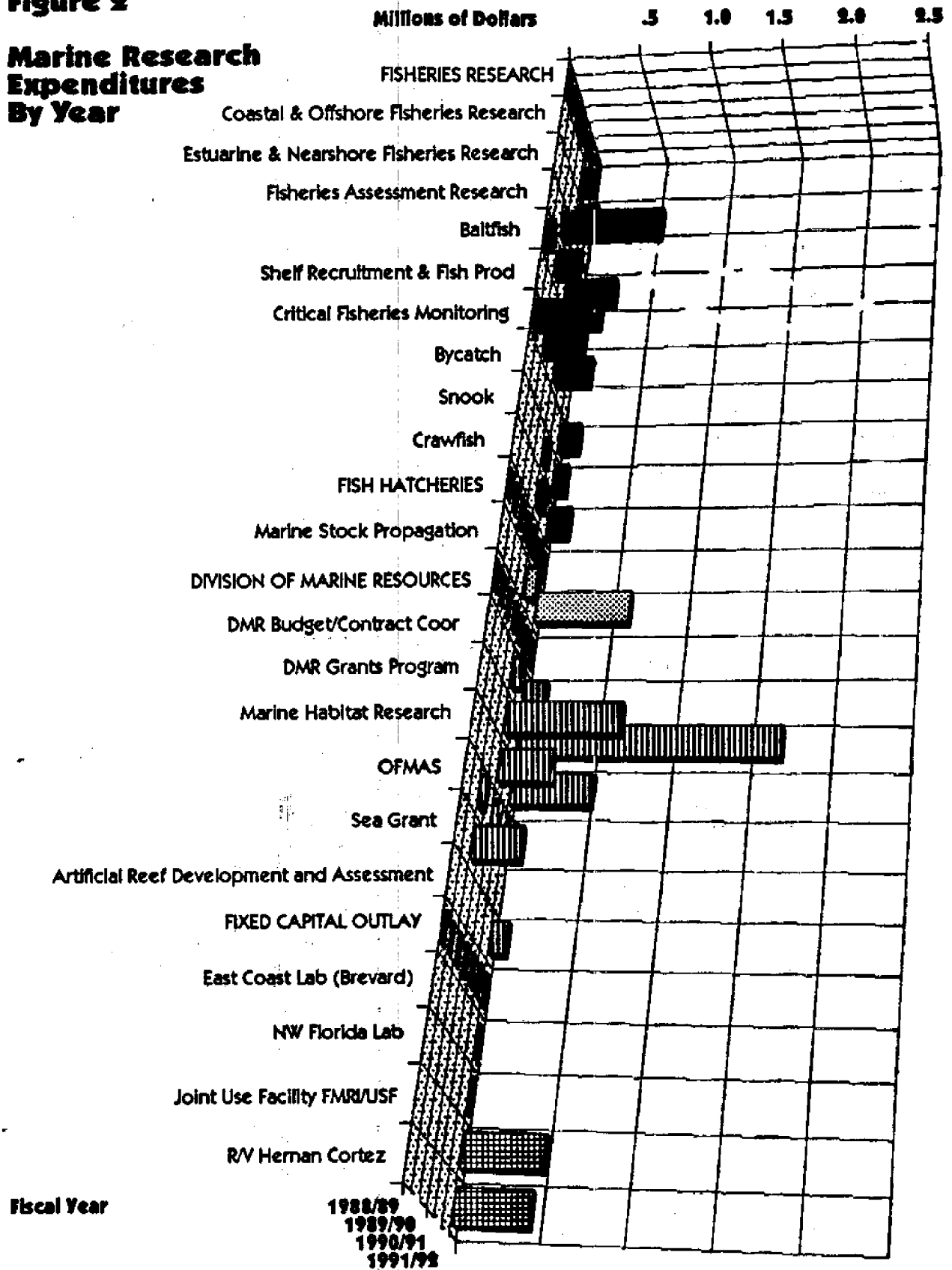
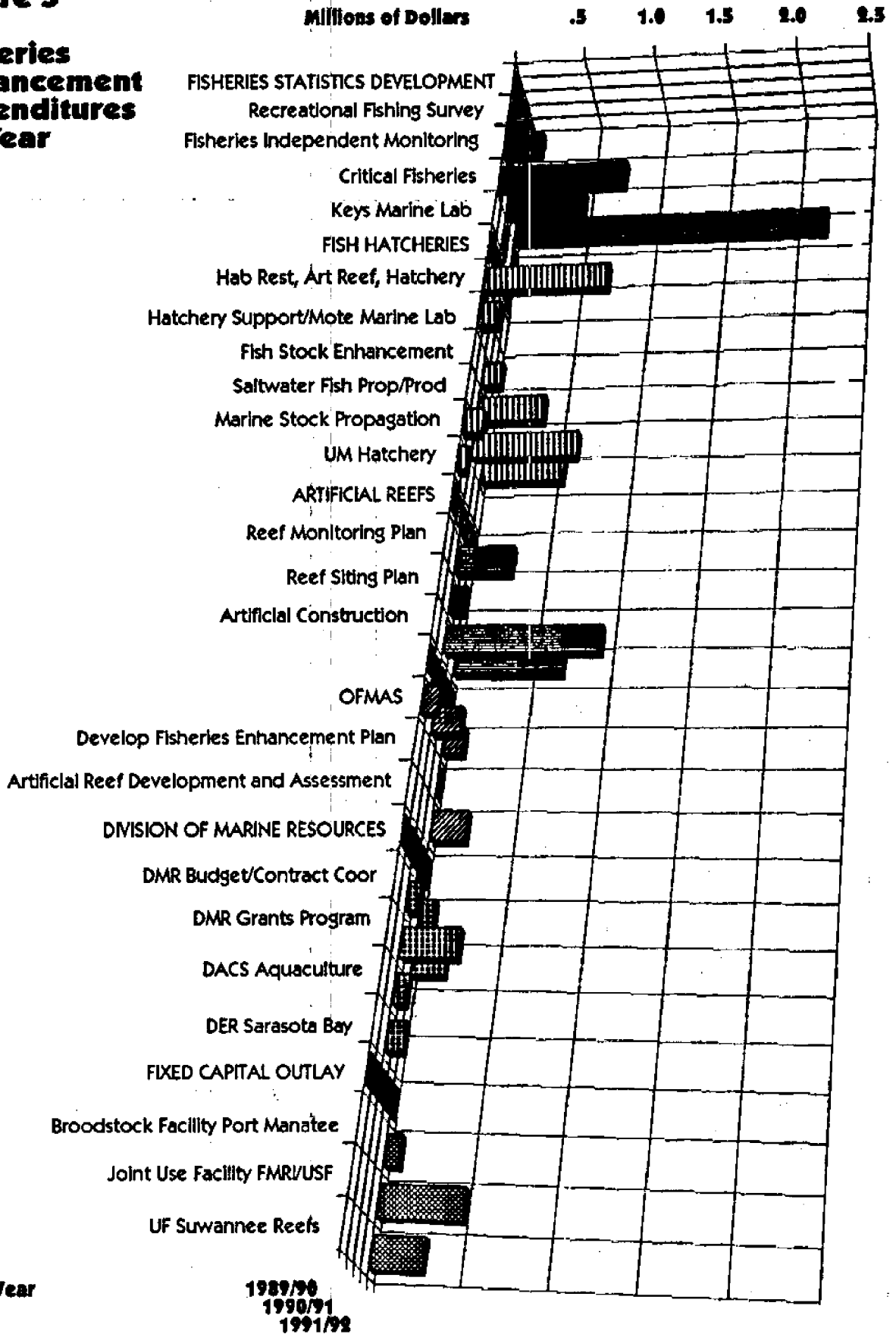


Figure 3

Fisheries Enhancement Expenditures By Year



The benefits of a marine saltwater license have been many. Research studies on tarpon, snook and spotted sea trout have been expanded through grants and our in-house capabilities at the Marine Research Institute. Enhancement projects have expanded with additional funds going to artificial reef development; the rearing, releasing and monitoring of juvenile red fish in tributaries of Tampa Bay and in Biscayne Bay; and juvenile fisheries monitoring and stock assessments. (Figures 2 and 3 illustrate the various marine resource activities funded through saltwater license revenues.) Law enforcement received 10 additional marine patrol officer positions, complete with cars, vessels and all the related equipment each officer would need. The Florida Marine Patrol has refocused its efforts on the resource and enforcement of resource protection regulations, especially fisheries regulations.

In hindsight, there are some suggestions I can offer for any state considering a saltwater recreational fishing license.

- When developing legislation to enact a saltwater fishing license, coordinate with your designated federal aid coordinator to ensure compliance with the requirements of the Federal Aid in Sportfish Restoration (Wallop-Breaux) Program. These requirements include state ascension to the Sportfish Restoration Act and guidelines for how license revenues may be used. The requirements can be confusing to those not familiar with them, but failure to consider them from the beginning can create major problems. We did not have statutory language stating our intention to assent to the language of the act when the license was first created. This language was added the following year to avoid loss of the federal funds.

- Be aware of public perception. What you think you are telling people is not necessarily what they are hearing; what you are going to do is not necessarily what they think you should be doing. In Florida, many anglers thought the license would result in more federal dollars and better fishing — immediately — in their area of the state. That wasn't necessarily the case, and we are busy explaining how the expenditure of \$34 million in license revenues on fishery projects has been to their benefit. All license revenues are going directly into fisheries research, enhancement and management, although the efforts are often very hard for the public to see.

- Listen to the public. Anglers are very much aware of the recreational license issues. It is their dollars being dedicated to their sport, and most have a very definite idea of what they expect to be done with their money. Where public understanding and expectations differ from those of the agency, it would be prudent to increase communication, identify the

reasons and resolve the differences. Resolution may be as easy as explaining the need for a certain activity, or modifying an approach based on input from the public. In the long run, everyone is working toward a common goal — fishery resource protection and enhancement.

- In developing a saltwater recreational license program, think in terms of explaining what you intend to do, what you need to do it, what you realistically can do and what the public can reasonably expect to be done. Once the program is underway, let the public know about license sales, revenues generated and what the revenues were actually used to accomplish. After a reasonable period of time, show results of studies initiated with license revenues — even if the results are preliminary.

Dick Stroud: I believe you indicated that anglers fishing from charter boats and commercial fishing piers are not required to buy additional licenses. Is there some kind of blanket fee assessed against the charter boat or the commercial fishing pier that would compensate for that?

Virginia Vail: In the case of charter boats, the fee is assessed by their size. A charter fishing boat carrying 10 or more passengers buys an \$800 license. A guide boat in the Florida Keys or some backwater area that carries only one or two passengers is about \$200. A commercial fishing pier buys a license for about \$500.

Lucia Peck: Florida's out-of-state fee is quite a bit higher than the in-state fee. Have there been any studies to determine the effects on out-of-staters who come to Florida to fish recreationally?

Virginia Vail: This was a major concern, that a license would chase away out-of-state fishermen. In fact, the charter boat license was a compromise to this, so that out-of-state fishermen would not have to buy a license to go out on a boat or a pier. Also, they can buy a short-term, as opposed to annual, license if they wish to fish from shore or private vessels.

South Carolina

Charles Moore is the program leader for finfish management with the S.C. Department of Wildlife and Marine Resources.

It feels strange to be in North Carolina talking about South Carolina's stamp system and not in South Carolina talking to our fisherman about why we need it and what it will do for us.

First, I want to talk briefly about what we learned from our licensing or stamp effort. If we learned anything over the past nine years, it has been that the great majority of recreational fisherman are conservation-minded and concerned about marine resources and protecting them for the future.

But licensing ocean fishing on the Atlantic coast is seen as a last resort. There are some people who really believe that this is a God-given right and no matter what, we should not charge anybody to do it. Luckily, most fisherman don't feel that way. I believe that once fishermen are convinced there are real problems in our fisheries — from overharvesting, pollution and loss of habitat — they want these fisheries protected. And they begin to see that the lack of information means they won't get their fair share. But they have to be convinced that the proposed system will provide information and revenue for that purpose.

In most states I'm familiar with, including South Carolina, fisheries managers and biologists talk among themselves more than they talk to the fisherman. As a result, there are very few fishermen on the docks who really understand the severity of the problems in marine fisheries up and down the coast.

There is also a basic mistrust of government. It is important that the legislation creating a license system spell out exactly what will happen to the money. Undoubtedly the comment made most frequently during our licensing effort was, "I support the license being proposed, but only with the stipulation that all the funds go to marine recreational fisheries and programs."

A good public information program that identifies the need for licensing is important. It is also very important to identify the key users — sportfishing clubs, conservation groups and community leaders — because without their support, it will be very difficult to get any kind of system through.

Three things helped us in South Carolina with our licensing efforts.

First, 21 active members of the coastal recreation community were placed on a blue ribbon committee in 1984. The committee studied the situation and led the educational program over the next few years.

Second, a group of fishermen organized into a politically active body called the Atlantic Coast Conservation Association of South Carolina.

And third, the stamp legislation created a Marine Recreational Fisheries Advisory Board of fishermen throughout the coastal area. I will say more about that later.

Our licensing efforts taught us five things: fishermen would rather go fishing than attend meetings, everything you do takes twice as long as you

planned, every one of Murphy's Laws is absolutely true, it is extremely important to keep it simple and those who are opposed will talk the most and the loudest.

I want to talk about a few key elements of South Carolina's system.

On July 1, 1992, a \$5.50 stamp was required for all residents and nonresidents fishing in South Carolina's marine waters. This stamp is required to collect oysters and clam or to fish from a private vessel. Special permits are required for charter boats and headboats, ranging from \$150 to \$300 based on the number of passengers they carry. The fishing piers pay a \$350 permit fee.

Like Florida's system, there are a number of exemptions. People under 16 or over 65 can receive a gratis stamp. Those fishing from shore, a bridge, dock or pier do not need a stamp.

The stamp must be affixed to an application form and signed across the face. So in reality it is a license, not a stamp in the sense that you would think of a duck stamp or a federal stamp. The application form identifies and describes the angler and tells whether he is an inshore or offshore angler, a shellfish collector or simply a stamp collector.

Reciprocity is another key element of the system, meaning that residents of any other state can fish in South Carolina waters if they have a stamp, license or permit under a comparable system. In other words, if another state recognizes licensed South Carolina residents on its waters, we will recognize its licensed anglers on our waters.

Another important aspect of our program allows stamps to be sold to collectors as commemorative items and for limited edition art prints. Other items, such as coffee mugs or T-shirts bearing the artwork, may also be sold. Funds from these sales go into a special dedicated account that is kept separate from the state's general funds and can be used only for recreational fisheries purposes. These funds can be carried forward year to year and can be used to match federal funds. The law stipulates only that no more than 25 percent of these funds can be used for administration and coastal law enforcement.

As I mentioned earlier, the act established a Marine Recreational Fisheries Advisory Board to help prioritize the use of these funds. This is a nine-member board of recreational fishermen. One is a South Carolina commissioner, two are appointed by the governor and one is appointed by each of the six coastal delegations. Although not required by law, the annual budget is based on the previous year's revenues so that all funds are in hand before they are committed to recreational fisheries programs. The board is just now beginning deliberations for the first

year's funding.

The act was drafted so that when it passed, it would become effective the following July to allow time to develop the administrative procedures and to notify fishermen that a stamp was required, where they could purchase it and so forth.

Two state programs greatly assisted in implementing the stamp in South Carolina.

Freshwater fishing and hunting licenses had been sold in South Carolina for a number of years, and 1,500 license agents were already in place. An application form similar to those used for the freshwater and hunting licenses was developed for the stamp. Forms were also developed for use by fishing piers and charter boats, which are required by law to keep harvest and effort information.

Another program that helped was the S.C. Duck Stamp Program, which had been in place since 1981. We basically adopted the same procedures for producing and distributing that stamp. There is a national art contest based on a single, preselected marine species that is held annually. We also receive a royalty on each collector print sold, and we can use that artwork on T-shirts, coffee mugs or whatever would be appropriate.

I want to briefly mention some of the history of our stamp system. In 1965, several legislators attempting to fund a new marine center in Charleston decided a saltwater fishing license would be a good mechanism. So they amended an unrelated bill so that most of the state's fishermen had no idea it was being considered until its second reading in the House. I can shorten the story by saying that those legislators and our Wildlife and Marine Resources Commission were not the least bit interested in discussing a license for the next 20 years. Needless to say, a great deal of opposition was expressed.

By the 1980s, things had begun to change. The South Atlantic Fishery Management Council was in full swing. Its plans and deliberations clearly showed that marine fisheries in many cases were being overfished and some were in serious trouble. It also pointed out there was little information available about recreational fisheries harvest, and the allocation process was going to leave the recreational fisherman short.

A number of national conservation organizations began to call for marine licensing. Beginning in 1983, a series of federal saltwater licensing bills under the Reagan administration were introduced in Congress. At the same time, the Uniform Recreational Fisheries Act of 1983 was launched and the regional director of the National Marine Fisheries Service was calling for a cooperative state/federal vessel permit.

In 1984, South Carolina's wildlife commission

responded to an in-house proposal to develop the seeds for a licensing system. The commission developed a policy stating that while marine licensing was a viable source of funds for marine recreational programs, it would not be considered unless requested by the public. Sportfishing clubs and other groups were made aware of this new policy and the fact that they would have to vocalize their support if the commissioner or anybody else was going to back such a system.

Also in 1984, we gathered coastal sportfishermen interested in marine fisheries into a group called South Carolina Anglers Inc. The charter created a nonprofit eleemosynary organization with the primary goal of protecting and conserving marine resources and speaking for the state's saltwater fishermen. Membership grew quickly over the next year and a half. In 1987, the group became affiliated with the Gulf Coast Conservation Association and changed its name to the Atlantic Coast Conservation Association of South Carolina.

The same year, the wildlife commission formed a 21-member blue ribbon committee to study the license issue. A year and a half later, an educational program was launched, including 120 talks, surveys and widespread media coverage. In November 1988, the committee made its final recommendations for a system that included a \$10 annual fee for residents and \$20 for nonresidents.

The license recommendations were accepted by the commission and sent to the Legislature, which formed a joint legislative committee that asked for the issue to be taken again to the public. Fears of a negative impact on tourism and subsistence fishermen — similar to the fears expressed in Florida — resulted in the development of a stamp system. As a result, compromises were made: the fee was reduced to \$5.50 and shore-based rod and reel fishermen were exempted.

Another one-year educational program and schedule of public meetings followed. It wasn't until January 1991 that the issue actually entered the South Carolina Legislature for the first time. It passed and became effective in 1992. We are now in the first year of our licensing system.

I want to sum up by saying that in any state the road to recreational licensing in marine waters is certainly going to be a very long one. There are a lot of detours along the way. There are no shortcuts. Don't run out of gas. Just keep going.

Dick Hunnicutt: I'm a sportfisherman from Gastonia, N.C., and I'm speaking for the guys who live in the major metropolitan areas about four hours from the coast. I have a place in Brunswick County

and I fish out of Little River Inlet quite often. I have a problem with the South Carolina fishing license. I fully support it; I think it is very reasonable and the money goes to a good purpose. But up our way, a typical fishing trip is a weekend trip and the actual fishing usually occurs on Saturday. If I invite someone to go fishing, we get to the beach about 10:30 p.m. Most of the time we fish marlin, tuna and wahoo on the edge of the shelf, which is about 70 to 80 miles off Little River. So we leave at 5 a.m. And these people have no place to buy a license before we go. Consequently, we come back in and I may have several people on the boat without a license. We either take a chance or we come back to Cape Fear at Ocean Isle and then go back to South Carolina.

In North Carolina, private boats are about 15 times more abundant than charter boats. I would like to see both North Carolina and South Carolina have a blanket fee for a private vessel. I don't mind paying \$100 or \$200, but it's just too awkward as a guest to get a license on a weekend fishing trip.

Charles Moore: A vessel permit was discussed, and it is a viable option. Right now South Carolina does not have one. If your boat is licensed by the Coast Guard, you can get a charter boat license that would cover you for \$150.

Harry Hattman: I am a sportfisherman. My understanding is that South Carolina does not require a license for anybody fishing from shore or shore structures. Is this a license primarily for boaters?

Charles Moore: That is correct.

Harry Hattman: They are the only people who buy the license?

Charles Moore: Or shellfish collectors.

Harry Hattman: Why would you exempt shore fishermen? I don't understand.

Charles Moore: A number of us don't understand. A compromise was made to benefit subsistence fishermen and for fear of the effect it would have on tourism.

Virginia

Claude Bain is director of the Virginia Saltwater Fishing Tournament.

My program is a part of the Virginia Marine Resources Commission (VMRC) and I am an agency employee. I am here because the chief of fisheries,

Jack Travelstead, was called to Richmond to a meeting of a special legislative subcommittee that is looking at a bill to repeal our saltwater fishing license. The license was passed last year in our Legislature by a one-vote margin. Virginia is one of the few states that has elections every year. The House of Delegates are elected to serve two-year terms, with half up for election every year. There were quite a few new delegates elected in 1992, and the bill to repeal the license was introduced with the hope that enough new delegates would be opposed to the licensing concept to kill it.

I have been involved in Virginia's licensing process since its inception in the early 1980s, back then as a citizen and in the last few years as a state employee. I will give a chronology of the licensing process in Virginia from the perspective that a good license is beneficial to recreational fishermen and to marine resources in general.

Licensing really began in Virginia in January 1984, when a state senator introduced Senate Bill 334 that would establish a marine recreational fishing license in Virginia. There was substantial opposition to the bill, and it was defeated in the Senate rather handily. It had come as an almost complete surprise to the recreational fishery. Until then, there had been no talk of a saltwater fishing license in Virginia. The press picked up on it a couple days before the Senate vote and people showed up en masse to oppose it.

Again, there were several reasons for the failure of the bill. A major problem was the lack of input between legislators and the public in putting this license together. There was also substantial public mistrust of government and how the money would be used.

And an unfortunate situation developed at this time, when the Chesapeake Bay programs were being implemented in Maryland, Virginia, Pennsylvania and Washington, D.C. The bill was introduced by the chairman of the Chesapeake Bay Commission, which was formed by these three states and the district to coordinate the bay cleanup efforts. Many statements by staff and others in government indicated that the money from the saltwater fishing license would be dumped into a generic Chesapeake Bay cleanup fund. The recreational angling public was very upset with the idea that the money might go toward upgrading municipal sewage treatment centers and other bay cleanup programs of that nature. People felt that the problems in the Chesapeake Bay were not of their own making. The industries and municipalities creating the problems should be addressing them, not the recreational angling public.

The actual bill that was drafted didn't say that. The use of this money was clearly spelled out — it

would go back into fisheries management. But again, the problem was that some statements indicated these funds would be dumped into the generic Chesapeake Bay cleanup fund.

Anglers also had a general mistrust in 1984 of the state's commitment to recreational fishing and fisheries management. We had gone through a very interesting situation in 1982, when several roller rig boats from Florida had come up and netted tremendous numbers of bluefish in the Chesapeake Bay. There were mixed signals about how the state was going to treat the boats. Finally, after about six weeks, the state banned encirclement gill netting in Chesapeake Bay and sent the roller rig boats packing to another area.

But fisheries management in 1982 was really a hodgepodge of legislative and commission-oriented activities. It wasn't until the 1984 legislative session, when the license bill was introduced, that the VMRC was vested with the full management authority it has today. So at the time this bill was introduced, the management system was running in a hodgepodge system between VMRC and the Legislature. The development of fisheries management in the Commonwealth of Virginia was in its infancy. That hurt the public's perception of the agency's commitment to recreational fishing.

One benefit of that bill, though, was the establishment of a joint committee, a Senate/House subcommittee, to study saltwater licensing for the remainder of the year and recommend whether to reintroduce it in 1985. This subcommittee was composed of members of the Senate, House and the recreational angling community. I was one of those four people, so I'm pretty familiar with the workings of that group.

Also at that time, the Legislature authorized the secretary of Commerce and Natural Resources to set up the Marine Users Advisory Committee, consisting of 30 citizen members who would recommend ideas about saltwater licensing to this joint subcommittee. Despite the creation of this large citizens' group, the public continued to question the state's commitment to conservation. One of the obvious problems was the responsibility for both conservation and economic development was lodged under one secretariat. This problem was subsequently addressed about four years ago when the Department of Commerce and Natural Resources was split into two cabinet-level secretariats: the Department of Economic Development and the Department of Natural Resources.

Both groups met during the year. The Marine Users Advisory Committee presented the joint subcommittee with some consensus items about the form and substance a license should take if it were ever introduced. This Marine Users Advisory Com-

mittee never actually recommended adoption of a saltwater license.

The joint subcommittee in November and December held public hearings at four locations to determine whether the public would favor saltwater licensing generally.

At the final meeting, this subcommittee presented a draft license that was basically a pretty good bill. It included dedicated funding, so that money raised by the license would not go into a general fund but into a segregated state account with an advisory board of recreational fishermen to advise the commission on spending.

The subcommittee decided then that the legislation to license saltwater fishing should not be introduced in 1985; rather, the subcommittee should continue to work on the license and educate the public for another year and re-evaluate it for the 1986 session. This did not sit particularly well with the legislators who wanted it done then or not at all, so the subcommittee was killed and nothing else was heard of the bill for quite a while.

There were two reasons why the effort to continue the study failed. Perhaps most importantly, the subcommittee had no concrete proposal for a license in hand when it went out to the public hearings. It was merely asking, "Do you want a license?" And the obvious answer from the public was, "No. We don't want a license."

Without a draft saltwater license bill, the public had no concrete proposal for forming a board that would advise on expenditures of license revenues; there was no indication where the funding would go or that the funding would be specifically dedicated to enhancing marine recreational fisheries. In short, there was nothing concrete to show the public, and that hurt efforts to gain support among those who were philosophically attuned to the idea that a license could raise money to manage these fisheries and help the beleaguered fisheries. They didn't have anything to show these people and they didn't really know what the bill would do. There was still a substantial amount of mistrust about the use of the money.

And it was very unfortunate that a couple of other things happened. This continued mistrust about the use of money in the Chesapeake Bay cleanup was fueled by the secretariat of Natural Resources, who stated that the Marine Users Advisory Committee endorsed the license concept. The committee never endorsed the license concept and the committee corrected the secretariat for making that representation to the Legislature.

The undercurrent that the license would create a problem with tourism was always present. And compromises in the 1985 draft legislation revolved

around the idea that coastal tourism could be seriously impacted by a saltwater fishing license.

After the process was over, the legislators involved said they would never again attempt to introduce a saltwater fishing license because there had been so much opposition and such a problem for them. It lay dormant until 1989, when a group of watermen and the Atlantic Coast Conservation Association of Virginia began working on proposals for a seafood harvesters license, mandatory reporting of commercial catch and a delayed entry scheme into commercial fisheries for Virginia.

These proposals were brought before legislators during the next couple of years. Nothing much happened until 1991, when a measure was introduced to institute mandatory reporting, a seafood harvesters license, delayed entry and to give VMRC limited entry authority in various fisheries. It was tabled for a year.

The sponsors of the bill added saltwater fishing license proposals and set up through joint House/Senate resolutions the Living Resources Roundtable to study a whole package of tools that VMRC might use to better manage the fishery resources.

The Living Resources Roundtable met monthly in 1991 to study these issues. The group consisted of 30 to 35 individuals, including scientists, VMRC agency personnel, legislators and citizen members from the recreational and commercial fisheries. They developed a full package including draft bills of all of these measures — the saltwater fishing license, the seafood harvesters license, delayed entry and limited entry. They went to public hearing in November and December with actual draft legislation. After the public hearings, the Living Resources Roundtable met twice again to make amendments to reflect the ideas and concerns raised by the public. They went back to a final public hearing in January with final draft legislation.

After the last hearing, the material was presented to the House Chesapeake Bay and Tributaries Committee, which introduced the legislation. All the measures passed last year. The commercial legislation passed almost unanimously. The recreational license, as I mentioned earlier, passed by one vote. And it passed in a very interesting manner. It was initially killed in the House, but it was brought up two days later with substantial amendments and it passed by one vote.

The process worked this time because the public was involved from its inception. People knew well in advance what the bills were proposing. They saw the proposals for the dedicated funds and the advisory boards. The timing was better. People were much more aware of the problems facing marine resources.

They had seen that VMRC — from 1984 to 1991 — had become much more responsive to the needs of the resource and a better steward of the resource.

Couple this with very real and necessary commercial regulation that would enable the VMRC to better regulate the commercial industry, and the recreational fishing public didn't feel it was being singled out as a source of funds to fix all the problems on the water.

This is a real concern in Virginia. We have had commercial gear licenses there for years. But all the commercial gear license money in Virginia goes to the Marine Products Board, which promotes the consumption of Virginia seafood. None of the commercial gear license money goes to management, enforcement or in any other way protects, preserves or enhances the resource.

I think the recreational fishermen are well aware of this in Virginia. And again, they don't want to be singled out to fix all the problems that they don't think, rightly or wrongly, they much contributed to. That doesn't mean there was not substantial opposition. There was. But there was also substantial support because of the process. Interestingly, the ACCA in Virginia opposed the license because of the structure that was presented.

The battle is still being fought in Virginia today. I am not saying that Virginia's license is ideal. It may not even be a good license in its current form. There certainly was substantial disagreement among members of the Living Resources Roundtable as to the form it should take. But they were able to put aside their differences and present a compromise bill to the Legislature. But when the bill was compromised even further in the House and the Senate in order to gain passage, many members of the Living Resources Roundtable became upset. They weren't excited about the prospect of the Legislature substantially altering the recommendations of the blue ribbon panel, which put this package together.

Let me give a quick overview of our licensing structure. The individual license is \$7.50 for both in-state and out-of-state fishermen. There is also a \$5 license for a 10-day continuous period. An individual recreational fisherman can license his boat: \$30 for a boat under 27 feet and \$60 for anything larger. So an angler who doesn't want to buy an individual license can buy a boat license that will cover everybody on his boat.

The charter boat license is mandatory. It costs \$150 for boats licensed to carry six people or fewer and \$4 for each additional person of license capacity. Fishing piers are charged \$450. Boat rental operations, livery operations that rent multiple little boats, pay \$7.50 for each boat on their premises up to a

\$500 maximum.

Exemptions are granted for people under 16 or over 65; landowners, their spouses and guests; and organized groups of veterans, disabled people and school groups with permission from the VMRC. There is also no license required in ocean waters, the most controversial exemption of all. This is a bay-only license.

The Living Resources Roundtable felt strongly that the license should apply to everybody fishing in salt water in Virginia. But the amendment was tacked on to exempt ocean fishing to get it passed after it failed the first time in the House. The amended legislation passed by only one vote.

Problems with this structure relate to getting better data on recreational fishing and anglers, which is primarily what the Living Resources Roundtable wanted out of the license. There are so many exemptions that I'm not sure this license will provide a good picture of the recreational fishery in Virginia. We still need substantial expenditures from the state to survey the recreational fishery.

Enforcement is a problem. Again, there is no dockside enforcement of the license. If a boatload of anglers, rods and fish comes in, the owner can say he was fishing in the ocean. He wasn't fishing in the bay and didn't need a license. Regardless of where the fish were caught, I am sure that the fisherman will make this argument when he comes into the dock.

The revenues will be substantially smaller than initially projected. The individual \$7.50 license was projected to raise \$5 million, but the exemptions have lowered that to \$2 million.

Obviously, the structure was adopted for expediency in getting a license passed. The lesson from this is that the process will be a long and tortuous road with some compromises to get the license passed.

The good thing, of course, is Virginia now has money for a wealth of projects. The state has a saltwater advisory board composed of recreational fishermen to advise VMRC on spending these funds, which can only be used to enhance species of fish of recreational importance. That is included in the legislation.

My final thoughts deal with implementing the license, which has also been a problem. VMRC had commercial dealers who sold commercial licenses. These included the main office in Newport News, the county or city offices and a few retail establishments. For example, a city the size of Virginia Beach had only two retail establishments selling commercial gear licenses.

Rather than attempting to sell the licenses at a bunch of retail businesses through VMRC, we contracted with the Department of Game and Inland

Fisheries to sell it through their licensing agents. Unfortunately, most of those were not located anywhere near salt water. And for whatever reason, Game and Inland Fisheries has been reluctant to add new retail establishments to sell the license. As a consequence, when the license went into effect in January, it was very difficult to find a place near salt water that sold it. And that is still a problem. It is going to take a while.

I think a lot of retail businesses around salt water didn't understand the process and didn't get involved in applying to sell these licenses in time. You need an adjustment period when it will be a little more difficult to find these licenses near salt water.

I would expect some public confusion about licensing as it goes along. The bottom line is there will be some transitional problems. I have seen it in Virginia. Even though our license just went into effect Jan. 1, I can see the problems.

We have a license in place in Virginia, I think. I will find out when I return tonight. Most of the people involved in the process, though they weren't totally happy with the structure, were happy to have the license in place. They believe that a failure of the license in the Legislature in 1991 would have been very similar to its death in 1984.

It would have been the end of the decade, perhaps longer, before the Legislature would be willing to bring it up again. And the need was pressing enough to get the license in place now. Amendments to improve its structure will be easier to obtain than passing a new license at a later time.

Audience Questions and Discussion

Mike Orbach: Claude just mentioned that a significant number of exemptions — for shore fishermen or others — will limit the data you get on who is actually using the resource. What has that kind of limitation meant in the way your state's management program has been implemented? In Florida particularly, do you have a sense of the differences in numbers that you're dealing with?

Virginia Vail: Not in numbers. We had hoped that the license would be a mechanism for determining the impact of recreational fishing on the different stocks. The license was implemented. We have a mechanism only for identifying one in 10 of the license purchasers. So we don't really know who is buying the license, and we have no mechanism for finding out where they go or how often they fish. What we have is a source of revenue and a general indication of how

many people fishing by boat are using the resource offshore. But we do not have a clear idea of exactly who is using the resource.

Mike Orbach: Does South Carolina have a sense of that?

Charles Moore: Our time frame is more like Virginia's. We have exempted a significant number of users, but we don't really know what portion that is of the recreational fishermen in South Carolina. And basically, as in Florida, it's now a matter of having revenue for additional surveys to look at even the shore-based fishermen.

Mike Orbach: There is also the issue of impacts and their assessment. Did you commission specific studies of potential impacts either in your state or in other states before putting the license in place? And since then, are there provisions for monitoring the impact of the license?

Virginia Vall: I am not sure that any specific economic assessment was commissioned. I am certain that the legislative committees looking into it investigated that possibility because it was one of the major opposing viewpoints, especially in the panhandle. The reason that charter boats are licensed in lieu of the fishermen that they carry is the charter boat association feared that this would be the case. To the best of my knowledge, since the license has been enacted there has not been a major impact on Florida's tourist fishery.

I would say right now the biggest impact will be the \$150 charge, effective July 1, 1993, for the angler from Georgia or Alabama who wants to fish in Florida. But a five-day or 10-day license fee has not really had that much impact.

Mike Orbach: Did South Carolina or Virginia have specific provisions for studies of economic impacts?

Charles Moore: No, there are no specific provisions either before or after. Our only indication would be that our phones haven't rung off the hook. There is no active effort right now to repeal the license. We have had very little impact from our stamp system. That would be the impact that I think we would see at this point.

Claude Bain: We did not have any specific impact studies during the study phase in 1991. The Living Resources Roundtable considered it and did as much work as possible to determine whether it would

have a major impact. The consensus conclusion was that the impact would be minor. But again, we don't have any way of assessing that since we haven't had a license in effect yet.

Mike Orbach: Let me just add for North Carolina that the Division of Marine Fisheries commissioned an impact study of licenses being put into place. And although one significant problem was there didn't appear to be many specific directed studies, the report concluded that a license would not cause significant impact.

David Bradley: I am a pier owner from Morehead City. It was mentioned that a recreational license fee is part of a total conservation package. And I think most recreational fishermen here and in other states would support that kind of thing. But when I have talked with people who come into my pierhouse, the perception is that the three states you represent are more restrictive in the use of destructive gear in inside waters. First of all, I wonder if that is true. And if it is, did the recreational license package come before, after or during part of that process? And how did it interact with the conservation effort?

Mike Orbach: By destructive gear, I presume you mean certain commercial gears such as trawls and gill nets?

David Bradley: Yes.

Charles Moore: In South Carolina, it is part of the process. Inside trawling has been illegal for quite some time. Gill nets were limited in inside waters in 1985, and about that time there was the conservation movement toward a stamp system.

Virginia Vall: Those gear types are allowed in Florida's nearshore waters. The license issue was separate from that, although it did coincide with heightened public awareness of offshore environmental issues, marine environmental issues. Whether one is a sign or an indication of another trend, I don't know.

Claude Bain: Again, Virginia is a little different. There is no shrimping industry per se, so this activity isn't going on. In 1988 or 1989, we banned all trawling within 3 miles of the coast. Ours is mostly otter trawling. But this is completely separate of the license issue. Gill netting is allowed.

Commercial regulations were part of a package that provided some fairly interesting things along with the saltwater fishing license. Right now, when

you buy a \$150 commercial seafood harvesters license in Virginia, you must wait two years prior to fishing. It is a legislative mandate. We have a delayed entry system now. You cannot commercially fish for two years after you buy your commercial seafood harvesters license.

The proceeds from the commercial seafood harvesters license go into a special dedicated fund for marine conservation. So these fees are, in fact, going back into the resource. The first expenditures of those funds are going to a mandatory reporting system for commercial fishing in Virginia, and that is in place right now. And that package authorized VMRC to limit entry in specific fisheries as it saw fit. We have now put a moratorium on all pound net fishing in Virginia. No permits are being issued. And we have a limited entry system in our black drum gill net fishery. Others may be forthcoming. There was certainly a package of programs presented with the license that are being put forward together as a management package.

Mike Orbach: Let me round that out for North Carolina. A bill may be introduced to create a license to sell commercially in North Carolina. There is no present proposal for a saltwater sportfishing license. Our Marine Fisheries Commission currently has authority to implement commercial gear licenses. A package has been developed and was considered at our Feb. 5 meeting. But it was tabled until May to see what happens with the license to sell.

Bob Lick: I am from Raleigh. No matter how well-meaning a regulation is, it has to be enforceable. Claude Bain was the only one who touched on the fact that this broad list of exemptions makes enforcement difficult. I am curious about South Carolina and Florida.

I am a surf fisherman — probably 85 percent of my fishing is from the surf. But if I was a South Carolina or Florida resident driving home with a boxload of fish and tackle and an enforcement officer stopped me, no matter where I caught those fish, I can say I caught them in the surf. I think these exemptions are creating a nightmare for your enforcement people.

Also, in five or 10 years, will this saltwater licensing create anything that a recreational fisherman can see, feel or kick, or will he just see a long list of studies and more employees on the payroll? Will there be anything meaningful we can all see, use and enjoy?

Virginia Vail: Those are two issues that I am very concerned with. Regarding the law enforcement

question, at times it is a nightmare. But our Florida Marine Patrol will be checking people on the beach, the surf fishermen and the shore fishermen. They won't be doing a road check of fishermen on their way home. They do in fact go to piers. They walk the beach and they ask people for their license.

One confusing point has been how far out a person must wade to no longer be a shore fisherman and require a license. Depending on the officer, it's water 3 to 5 feet deep. So that's an issue that has to be cleared up, probably by policy rather than statute.

The point about what we will have to show for all this money is well taken. The tangible product may be a report, but that report should give results. It should give new information on the species being investigated or statistical data to back up an evaluation of the activity's impact. You should have something tangible for your effort. It just may not be what you are expecting.

But by the same token, we as agency employees must have a better understanding of what the anglers expect to see or receive. So the bottom line is really working to improve communication, improve anglers' understanding of the situation so both sides are expecting reality rather than miracles.

Charles Moore: I am sure our law enforcement division would agree with your observation. But South Carolina is different because a stamp is required if you use a vessel at any point in your fishing trip. And they enforce along the water and the boat landings. Once they are removed from that, there is no way to enforce it.

As far as what we will see in five to 10 years that is tangible, I hope that it's more fish and less time between bites, that we can do some work with artificial reefs to help the habitat, that all this won't go strictly into research and that we have better facilities. But all this depends on fishermen in forums like this and the advisory groups that can watch where the fund is going.

Claude Bain: We have, as I mentioned, the Saltwater Recreational Advisory Board that advises the Virginia Marine Resources Commission in expenditures of money, so I can't speak for them. We have an underfunded reef program that I hope will benefit some from this project.

There are opportunities certainly. Much of our aging infrastructure, particularly bridges, can be torn down to provide access areas; or rather than tearing down bridges, we can tear out channels and take the old bridges and make them public access points.

One of the major needs right off the bat is an expanded recreational creel survey in Virginia. I think

that will be coming fairly quickly from licensing funds.

Dick Brame: I am with the ACCA. Are your states getting away from these exemptions on shore-based anglers? And I am interested in the total dollars and the dollars as a percent of your fishery budget. Did the state give you less money after you did this? Was there added money, and how much was it?

Claude Bain: We haven't had enough experience, and we don't exempt shore-based anglers. I don't know where we will go with our exemptions. We are projecting about \$2 million in license funds, and our total current budget is slightly over \$5 million a year from appropriated money. That doesn't count federal money and some other sources. So licensing is a sizable percentage.

There was concern during the study process among members of the Living Resources Roundtable that the Legislature would pull some sleight of hand and add money here and take it away there. It was made clear that this would not happen. But what happens in the Legislature is another ball game, and I don't know where that stands right now.

Virginia Vail: In Florida, the Legislature is prohibited by statute from substituting license revenues for general revenue. One year's Legislature cannot commit a subsequent year's Legislature to any funding actions. So it has been open. But Florida has been hurt by the recession and general revenue that has been appropriated to programs at level funding or continuation funding as in the past, only to get a 5 or 10 percent cut. So the bottom line was that we would get less general revenue than appropriated but still a pretty healthy chunk.

The research and enhancement funds are pretty much supplementary. The Marine Research Institute is still operating on a very healthy state budget allocation. There are discussions of bringing some exemptions into the required license category, but I don't know how far that will get.

Mike Orbach: And you said that the revenues were \$34 million?

Virginia Vail: We've brought in a little over \$34 million since December 1989. That's for two-and-a-half license years. My data is based on fiscal years, which begin July 1.

Mike Orbach: So we are talking about \$10 million a year, more or less?

Virginia Vail: About that. We've gotten about \$10 million for the research and enhancement categories total.

Charles Moore: South Carolina is far behind Florida in terms of revenues being brought in. At this point, our stamp has only been in effect for six months. So far, just over a half-million dollars have come in. What percentage that would be of the total division budget might not be nearly as significant as the amount it will represent for recreational fisheries activities and programs.

B.J. Copeland is director of the North Carolina Sea Grant College.

I am convinced that the complex problems of fisheries management will require a lot of togetherness. And togetherness can be based only on factual information. Forums of this kind get at the facts and the issues at stake. I am very proud of the fact that we at Sea Grant are able to help provide some of these activities. And I am convinced that we ought to do more of this as time goes on and we try to manage a changing resource.

We at Sea Grant have two objectives. I keep telling people that we don't make regulations, we don't enforce regulations, we don't have any fish to sell and we are not in the business of telling you what to do. We are in the business of uncovering new information and making it as relevant as possible. And we are also in the business of transferring that information to people who need it. We need to do that in a timely fashion. So we work hard at doing those two things and keeping ourselves out of the others. Now, most of you know how difficult that is because we see and we hear and we feel, but our business is to develop information as best we can.

It is my pleasure to introduce the speaker, Bill Hogarth, director of the Division of Marine Fisheries. He will talk about fisheries management policy of the new administration at the Department of Environment, Health and Natural Resources.

Bill Hogarth

This talk will be short since I don't know any of the policies. We could stop at that, but there are a few things I would like to say. Sherri Evans-Stanton has already said the Joint Legislative Study Commission on Seafood and Aquaculture would look at the proclamation authority of the director of Division of Marine Resources.

First, I think that the Division of Marine Fisheries and the resource are fortunate in the team that has been put together so far. Jonathan Howes, secretary

of the Department of Environment, Health and Natural Resources, is a planner. He has a lot of knowledge about marine fisheries and a lot of desire to make sure that the resource is viable and protected. He is a secretary you can work with and he will have a lot of input.

The deputy secretary is Steve Levitas, formerly an attorney with the Environmental Defense Fund. Levitas has made quite a reputation for himself working with the various interest groups, and he seems to be a consensus-builder. In my conversations with him, he has talked about how we can better manage the fishery and resolve some of the conflicts between the recreational and commercial industries. He has talked about a blue ribbon committee to look at management. He has talked about working more with the various user groups, even getting Sea Grant involved on some issues.

So I think that Howes and Levitas are very concerned about the resource and they realize the value of the resource. And that has always concerned me, that the public doesn't realize the value of this resource to the economy as a whole — not commercial and recreational fishermen, but restaurants, piers, fishing tackle sales and motels. It is an extremely valuable resource.

Although we don't have complete data, it's obvious that the dockside commercial fishing landings run \$75 million to \$80 million a year. If you use a multiplier of six to eight times that value for processing, you get a \$500 million value for the commercial fishing industry.

Recreational expenditures are at least equal to that or greater. The Big Rock Blue Marlin Tournament in Morehead City brings about \$3 million over 10 days to the area. Barry Martin at Pirates Cove says tournaments bring in about \$17 million a year to his area. So this is a big industry. And it should be managed as a business.

The DMF has a new assistant secretary, Joan Weld, who taught biology for awhile and worked for U.S. Sen. John Glenn of Ohio. Last week, she got quite an indoctrination. She spent two and a half days at staff meetings, a Marine Fisheries Commission workshop with various user groups and the commission meeting. She took a lot of notes, asked a lot of questions and will put a lot of demands on the division for certain things.

And we welcome that. I have only been at DMF for seven years, but others have been there 14 and 20 years. And sometimes you get into a rut and need a fresh look. Someone like Joan Weld can do that and get the division looking at different approaches.

Right now, the division is doing certain things to get in tune with what the new administration wants.

The administration has already asked me for a work plan. It seems the division has been working on a plan for years without reaching the point of making recommendations. The DMF will finish that plan and get it to the assistant secretary and the deputy secretary right away.

One thing to keep in mind — and this is awfully hard for the public to realize sometimes — is that the DMF and MFC must manage and enhance the resource for all users. That doesn't mean just recreational and commercial users. It means the consumers and the people who just enjoy watching. The resource belongs to the public. Use of the resource is a privilege, not a right. This is a public trust resource, which we shouldn't forget. We have to abide by certain laws and rules that the state may place on it.

To date, the new administration hasn't given us much policy direction. But it will be formulating some new policy for the DMF and MFC. It's obvious from my conversations that there will be better protection of the resource to ensure that it's available in the future and allocated to the user groups in a fair and equitable way.

There will also be more meetings of the user groups to build a consensus and more cooperation among the various commissions and users. There is a lot of concern about water quality and the fact that the MFC is pushing overfishing more than water quality. Control of our harvesting is under the MFC, but habitat and water quality are not.

I have encouraged the secretary to do two things, and I think he is very receptive. First, meet regularly with the division director and chairman of the three commissions — the Environmental Management Commission, the Coastal Resources Commission and the MFC — to make sure that they understand each other and their plans. Second, assign a member from each commission to another commission, so that a member of the MFC would be assigned to the EMC to carry forward the water quality or stormwater concerns. And I believe, again, that will be done.

This is a new administration and the secretary needs some time to formulate policies. He is in the process of putting people in place first, and then the policies will come. I think they'll be done fairly quickly.

Now I want to talk for a minute as an individual about managing the resource. This is Bill Hogarth talking, not policy from the administration. Number one, we have to identify the recreational angler and the commercial fisherman. There is no doubt about that. Once we identify them, we need to revamp the entire license structure to reflect the two user groups. And that doesn't mean that the recreational fishermen would not have an opportunity to use commercial

gear. They would use it on a limited basis to feed their families, but it's not a selling matter in my opinion. It has to be done.

Next, we have to look at the type of data we need to manage this fishery and make sure that we initiate programs to get these data, whether it's from a dealer or individual fisherman. Then we have to look very carefully at gear, the amount that is being set, the number of people allowed to set it, the type that's being set and where the gear is allowed.

If there is destructive gear in certain areas, then we need to recognize that and get it out. If it's in grass beds and doesn't belong there, we need to get it out. Right now, you can trawl over oyster rocks and oyster beds in North Carolina, and the state spends a lot of money planting oyster shells. So we need to look at the proper place for this gear and areas that we allow it.

In my opinion, there is no reason in the world why trawling can't be allowed in Pamlico Sound. But I have problems with trawling in some of the rivers and bays, particularly the size of trawlers we have allowed. But I think we have to look at the type of gear and where it is being allowed.

Another thing we have to address is the traditional uses that have been here for a number of years. Is it right to say that those traditional uses can be replaced by another use? And if so, under what circumstances are they replaced and should they be compensated?

Gear is the key. We can set all the size limits we want, but unless we control the gear that will prevent a certain size of fish from being caught, there will still be a lot of mortality.

The license to sell I will mention because I've heard a lot of comments that backing for the bill is not in good shape. We held 15 meetings across the state and found support for it running 2-to-1. People made some recommendations to look at it every two years to make sure it is operating as expected.

But we have to figure out some way to improve the data on catches that are being made. The license to sell is a very good way to do that. It has been endorsed by the N.C. Fisheries Association; the Southeastern Waterman's Association; the Atlantic Coast Conservation Association; the Raleigh Salt Water Sportfishing Club; and fishing clubs in Winston-Salem, Greensboro and Charlotte. So the license to sell has wide endorsement, but it appears to be in trouble, and I wonder if it's in trouble from a few people. I am really concerned that the program will lose favor because we need it badly. As I said, the MFC is looking ahead to resolve the conflicts. I think the commission will look favorably at what's going to public hearings.

Now, we are talking about zoning, though some people think that's not proper. It's a new technique in North Carolina, but we've used it commercially with crab pots and other things. So while it may be new in resolving recreational and commercial conflicts, it isn't new for our policies.

I'm also concerned that the commercial industry does a tremendous job in the political arena. The industry is very effective. I don't see the recreational fishermen involved in the whole process. That is something you continue to have to work on. You have good attendance here, but there are no legislators. If this was a commercial fishing meeting, they'd be here. I've seen them at most of the other commercial fishing meetings.

I don't say that to pit one group against another. I am saying that this is a two-way process. We have to hear from all users to resolve the problems. The DMF has worked with various user groups for five to seven years to improve the resources, and we were close to working things out. I'd like to see this completed.

In closing, we do have a valuable resource. Let's work together as groups to make strides to improve it. The stocks are not in good condition. They are stressed and overfished for various reasons, but I think that together we can correct it. If we keep fighting, commercial vs. recreational, we won't solve it in a manner that is fair and equitable.

Unidentified Speaker: To my understanding, there was a proposal to strengthen gray trout restrictions in our area. The Marine Fisheries Commission downgraded it or put a halt to it, and I was wondering why. That seemed like a first step in a comeback for the gray trout. Why wouldn't the commission support it?

Bill Hogarth: That was not the Marine Fisheries Commission. I doubt the commission even knew it was going on at the time. There had been some discussions about an interjurisdictional bill that would manage fish that are exchanged among states but stay primarily in state waters. This would be separate from the Magnuson Act, which covers fish outside 3 miles.

Congress held several hearings and considered a couple of options. One, a comprehensive interjurisdictional bill, would cover several species. And then, at the last minute, a congressman running for governor in Delaware proposed the Carper Bill, which would manage weakfish like striped bass. I had some concerns that several provisions of the bill hadn't been thought through. The bill would not have been effective until 1994 anyway. And there is time in this session to look at a comprehensive interjurisdictional bill.

I wrote a letter to U.S. Sen. Jesse Helms pointing out the problems in the bill. DMF would like to see it addressed further as an interjurisdictional bill for all species, not just weakfish managed like striped bass because we have problems with the striped bass bill. We are already going into Amendment 5 to the Atlantic coast striped bass plan.

Weakfish are in trouble. I am not going to deny that. We have tried five times to get a proclamation in place, and I think we have one now that is working somewhat. I am still concerned about the flynet fishery, and I am even more concerned after hearing the commercial fishermen talk about it last week. I think we have to go back and look further at that fishery.

But that is what came about. And there is still time to get a bill in place that will do a good job by the time that one would have taken effect.

Unidentified Speaker: Who is opposing the license to sell?

Bill Hogarth: In our meetings, it appeared that some commercial fishermen thought that they're already being regulated enough. There is a boat license and various other permits. The National Marine Fisheries Service now has permits that cost money. There is also a mammal exclusion exemption permit that fishermen must buy for \$35 or \$40 to fish gill nets in certain areas. Fishermen thought that a lot of licenses are being added that cost a lot of money. And that's when they said there should be an avenue for getting data without charging more. The dealers have the data. Fishermen sell to them. Make them provide the data.

As I said, the two major commercial fishing organizations in the state endorsed the license to sell. But there are individual concerns about a new license with additional costs that they believe are unnecessary because the data are available.

Unidentified Speaker: How will you define the difference between a commercial fisherman and a recreational fisherman?

Bill Hogarth: That is a tough issue. It will have to be worked at. All we have to go on is the marine fisheries statute that says a commercial fisherman gets 50 percent or more of his livelihood from the sale of food fish. There would also be a problem with that definition because of certain fisheries, but I think it's something we need to look at. A saltwater fishing license would perhaps start separating the two user groups.

Unidentified Speaker: I want to ask a question that you don't have to answer. Perhaps I should address it to the Marine Fisheries Commission. North Carolina has four commissions and directors that seem to be sainted height. But you are the only one who gets attacked. Dozens of groups are going after you all the time. I don't know what the MFC is doing, but I think it should defend you. The Wildlife Resources Commission protects its director totally; it takes responsibility and there must be a reason.

And Jerry Schill, executive director of the N.C. Fisheries Association, wants you to stand up and fight the federal and state governments illegally, get shot like a second lieutenant. I don't understand that. Do you want to comment?

Bill Hogarth: I will comment. It is the nature of the job. Number one is, we are regulating people who are trying to make a living out of the resource. Number two, for so many years, it was an open system. There was no concern about the status of the stock; it was in pretty good shape. Recreational fishermen didn't put much demand on the stocks because they didn't have the time or money to spend. And now it's come to the point that the stocks are in trouble. More people and gear are involved. Equipment and gear are more sophisticated.

A lot of people don't understand the difference between what the National Marine Fisheries Service does and what the N.C. Division of Marine Fisheries does. So it's easy to point to someone, and I happen to be the one. There will also be a focal point for the comments to be directed.

The Marine Fisheries Commission is concerned. In fact at the meeting last week, it set up a committee to look at the proclamation authority and see if it can legally get more involved without DMF losing that authority. The proclamation authority is unique in that I can do things within 48 hours that the commission takes six to nine months to do. And the state process, the Administrative Procedures Act, is the reason it's that way.

And I think it is a very good system. The commission has complete control over what I do. Any five members can go to the commission chairman to call a meeting and overturn anything I do. But some commissioners want to see if they can get more involved or help take some of the heat for the division director. I knew when I took this job that it was full of heat. Seven directors in 14 years tells you something. I think it is being looked at, but I think it is just the nature of the beast.

Panel Discussion on the Pros and Cons of a Recreational Saltwater Fishing License

Moderator **Mac Currin** is a marine policy analyst with the N.C. Office of Marine Affairs.

This segment features representatives of groups that supported or opposed the saltwater recreational license in the 1989 hearings.

Dick Brame is executive director of the Atlantic Coast Conservation Association (ACCA) of North Carolina.

I am going to take off on the discussion from last year's forum. The resource is in trouble — gray trout, croaker, I can go down the list. Fourteen of 22 species monitored by the Division of Marine Fisheries are classified as either stressed or overharvested.

And recreational fishermen are not properly represented in this process for a variety of reasons. One is that six of 15 members on the Marine Fisheries Commission make half or more of their income from the sale of food resources from the sea. They are industry representatives. It only takes one more vote for a tie. And that is 50 percent more representation than anglers have, which is four. It is 100 percent more than scientists have, which is three. It is 200 percent more than the at-large appointments. So there is a mechanical problem in how the MFC is made up.

Anglers have been excluded from this process. I am going to give a few examples and then lead up to licensing. About three years ago, the ACCA and DMF asked for a limit on the sale of scrap, or undersized fish. The DMF asked for a 1 1/4-ton limit on scrap per day. The commercial industry said it could only limit itself to 2 1/2 tons of undersized fish being sold each day. The limit was per fishing operation when it went to public hearing. But it was per fishing vessel after going to hearing and becoming law. A lot of these are multiple vessel operations, so you are talking 5,000 to 15,000 pounds per day — basically anytime, anywhere, anyplace.

Weakfish are in dire shape. The Atlantic States Marine Fisheries Commission recommended a 10-inch minimum in 1991, an 11-inch minimum in 1993 and a 12-inch minimum in 1994. It also suggested a one- to three-month closure during the critical winter season when the small fish are offshore in huge schools and easily targeted.

Our MFC managed to get through a 10-inch minimum size and no seasonal closures. We learned at the Feb. 4 meeting that the commercial response has been, "We are going to put conveyor belts in the back of the boats so we can just process the smaller

fish as they are dead, chuck them overboard and get the legal fish back to the dock."

There was no concern for the fish. There was no concern for moving to a gear that would not catch the smaller fish. It was to kill these small fish — again, anywhere, anytime, anyhow.

Croaker are in the same sort of trouble. I don't see any move to protect croaker. We asked last year for a nominal minimum size on croaker, 7 or 8 inches. The MFC wouldn't even take it to public hearing. The commission last year did move for a public hearing on tended gill nets. Outside the Albemarle Sound region, there are no restrictions on gill nets. I think it is a 2 1/2-inch minimum mesh. But the amount you can put out and where you can put it is largely unregulated. We just ask that if you put the net out, you tend it. That was voted down rather soundly — again, anytime, anywhere, anyhow.

At the Feb. 5 meeting, two very modest proposals on inshore trawling were brought before the MFC to go to public hearing. One would have eliminated trawling on Saturday and Sunday. The other would have limited the headrope size to 70 feet. That means the net opening would be about 50 feet wide. There are some people pulling three and four 90-foot nets in the Pamlico Sound. Now, they are required to use finfish excluders, and North Carolina is the only state that allows that. But this doesn't begin to address the problems of bottom destruction, oyster rock destruction, submerged aquatic vegetation and siltation. They would not take these two modest proposals to public hearing, much less consider them. There were vague assurances that they would look at it over the next year and do something about it then.

In order to see something done about it, anglers must be vested in the system. Right now we are not. We have never been a serious player. We have never been vested like they are talking about in all these different commissions — Seafood and Aquaculture, Marine Fisheries.

The best way for us to become a vested and legitimate player in this system is by a marine recreational license. It does a variety of things. First, it identifies who we are and how many we are. It makes for a concrete economic contribution to the DMF and the MFC. It makes our voice heard by numbers and by dollars that people cannot refute. It allows us to be organized. It allows us to speak with an organized voice.

For those three reasons, the ACCA supports the concept of a saltwater fishing license with several provisos. First, the money must be mandated to marine fisheries conservation and recreational angler issues. If it goes into the general fund, we will fight it as hard as anybody.

Now, it would be foolish to think that if North Carolina got the license in two to four years it would lead directly to more fish. I don't know of any way it would do that, and I don't know of any license that has ever done that. But it will lead to more accurate representation, a better voice and a much fairer system of managing and allocating the marine fishery.

Carol Lohr is the director of tourism for Carteret County.

As director of tourism and an avid fisherman — I have been fishing recreationally since I was 7 or 8 years old — I know this is a very controversial issue. I want to give you some background on what Carteret County does to attract tourists.

Tourism is our number-one industry, contrary to what you might occasionally read in the *Carteret News-Times*. The tourism bureau spends \$468,000 in advertising to get tourists to come to Carteret County. We generated more than 82,000 inquiries in 1992 alone. Of those, 6,000 indicated interest in recreational fishing. Now, that doesn't sound like a lot, but 6,000 of 13,000 calls indicated that interest. The other inquiries came by mail, and of course they didn't voice any interest other than in vacation information.

Statistics provided by N.C. State University's tourism department tell us that the economic impact on tourism in Carteret County is \$210 million. That is a lot of money, and it affects a lot of people and a lot of jobs.

Now that you know what we do to get tourists to Carteret County, I want to tell you how businesses that I spoke with related their interest in a saltwater license for anglers. I interviewed pier owners, headboat owners, charter boat captains and tackle shops first. They were all adamantly opposed to the tax based on their lack of knowledge — not knowing where the money would go, how it would be collected, where the data would go once it was collected and how that would be collected.

The hotel and motel operators learned a hard lesson with the occupancy tax in August 1989. Basically, there was so much controversy about whether we should even have an occupancy tax — where that money would go, what it would do, who would regulate it — that they would not commit without more information.

Carteret County raises over \$1 million in occupancy taxes. The tourism bureau gets 55 percent of that money to promote the area, to bring the tourists back. The rest is divided among the seven municipalities and the county for tourism-related projects.

I can tell you the license will be a very controver-

sial issue until it is made clear where the money would go, how it would be collected, whether there would be a blanket permit for headboats, charter boats and piers. And until those items are defined, this won't get much support in Carteret County.

Sherri Evans-Stanton is counsel for the Joint Legislative Study Commission on Seafood and Aquaculture.

The commission has not had an opportunity to study the recreational license for saltwater anglers. And so I want to go over some of the issues that other states have resolved before coming up with a proposal.

A member could introduce this type of bill during the 1992 session. Otherwise, the study commission will not have an opportunity to look at it after the end of the session, September or October. There is time to work on these issues before a bill is introduced in the 1994 or 1995 session.

The first issue is the type of fee that will be charged. Will the residential and nonresidential fees be different? Will there be daily fees, weekly fees, annual fees or a lifetime fee? Is the fee intended to cover the cost of the program or to support other related programs? And do you want any exemptions, for example, senior citizens, children, disabled veterans?

One thing to consider, rather than exempting anglers and confusing the data base, is giving them a free or reduced license so that you can track them without charging them.

Will there be reciprocal agreements with other states? If this went through the study commission, my job would be to research what the other states around us are doing.

Who should have this license? Only anglers who fish from a boat or everyone who fishes? And would there be restrictions on particular areas or species? For example, an angler in Virginia doesn't need a license to fish ocean waters and adjoining tributaries. Alabama has limitations on species; it prohibits licenses for sturgeon and paddlefish.

Also, since the Marine Fisheries Commission is looking at combining existing licenses, you might want to think about combining it with the Wildlife Resources Commission's freshwater license. Some states offer the option of getting a fishing license or a hunting and fishing license. Texas, South Carolina, Georgia, Florida, Alaska and Alabama all have an option for a hunting and fishing license. So there are possibilities for consolidation there.

It would also put people at ease with the license to establish where it can be purchased, especially for

the weekend anglers. Will it be purchased from the division or from agents? And if agents sell it, what will their cut be?

These are ideas that need to be looked at, but they don't have to be resolved before the license is drafted and brought up for discussion. They do require consensus, however, before a bill is passed.

Bo Nowell is president of the Atlantic Coast Conservation Association-North Carolina (ACCA-NC) and past president of the Raleigh Salt Water Sportfishing Club.

I have looked at the concept of a license for a long time. At the outset I didn't really like it, but I realized that saltwater fishermen for and against it need to be involved. Fishermen have to be involved in the debate. And then, if a license is passed, they need representation and a voice in how the money from the license will be spent. That is very important.

Also, there is a trinity among the angler, the government and the resource that has to be managed. The license is desired by state and federal governments to raise revenue to fund their programs, to do their job for the public resource. If anglers are not involved early and the license passes, the chance is greater than the money will not be used the way they want it to. It could be eroded by special interests. It might be diverted into other projects.

In Florida, the bill was split 30-30-30. But it didn't say the money had to be spent 30-30-30 in one year. So basically, the money is being allocated a little heavily in certain areas now, in the early years of that license structure. It's important that anglers have input in the wording of a bill.

And the resource, again, is part of this trinity that has to be managed, protected and enhanced. There are no new funds with dwindling money and rising costs. Government is slowly learning it has to do the same thing with less. And this will mean fewer services in the industry and marine fisheries. That's bad news because there is very little money going in there now.

Speaking to the pros of a license, the state could use the money it generates to enhance, improve and monitor the fishery. The Wallop-Breaux fishery restoration funds now give 25 cents on the dollar. If the state can come up with 25 cents, Wallop-Breaux matches it with a dollar. Is there a businessman out there who doesn't think that is a good deal?

And this is not federal money. It's the money that you paid into a pool when you bought the rods, the reels and other equipment. We want to get that money back to North Carolina. It could, again, provide a head count of recreational anglers and double the

revenue of the Division of Marine Fisheries. As a result, recreational angling would be recognized as an important customer to the division. As the source of that much money, recreational fishermen could become a voice on the issues that call for protection and enhancement of the resource and help fund the studies to show whether certain gear is destructive.

The money could support and subsidize ventures and events that increase travel and tourism. Take, for example, what is happening in Maryland and the Chesapeake Bay. There, the license money was used to tag fish. And anybody who catches a tagged fish at a certain time from a pier or charter boat has a chance to win \$10,000. If that isn't an innovative way of increasing business for the coast, the charter boats and piers, I don't know what is.

There are a lot of innovative ways to channel this money into improving and enhancing tourism. And government has to be more innovative, get ideas from the tourism industry, tackle shops and pier owners.

If government could get real innovative, it might return some of this money to the piers, for instance, as low-interest loans to build or enhance. It might buy certain lands for more access to the beaches. If you explore the possibilities, there may be a way to turn a negative into a plus.

I would love to see more land purchased so I could go to certain beach areas, park and surf fish. I usually fish on the National Seashore because it belongs to the federal government, and I can still drive the beaches. I don't ever want to see that ended. I would just love to see it on some other beaches.

Against the license is the argument that it is another user tax. I have to admit it's a user tax and it could be abused by government. That's why anglers need to have a strong voice and a panel of watchdogs over how the money is spent.

Another con I hear a lot is that the ability to fish for free in salt water is considered the last freedom from government taxation. That's probably true, but with 12 states already licensing saltwater fishing, it's another one of our freedoms we may be moving toward paying for. We'll see.

And sometimes a license that is priced too high may discourage people from fishing or hunting, for instance. There may be an argument to that. I think that the true sportsmen — the hunters and fishermen who have seen the improvements — appreciate where their license money is going. There are some people who phase in and out without really caring that much. But there could be a negative effect there. Again, there may be innovative ways to work with that.

When the license was being discussed in 1984 or 1986, Billy McCaskill, owner of Whalebone Tackle, said he'd have to hire another person to process all the

licenses. He thought the license would cover surf fishermen and he'd be selling licenses and no tackle. He said he'd have to hire somebody.

Of course, that sounds like a con, but it might also mean that the unemployment rate goes down because businesses are hiring more people. I'm not sure. It may mean higher prices. Who knows?

Whatever, I think it's important that fishermen have some input into this. If it ever comes to pass, we need to participate in the debate, stake our claim, come up with something innovative, and hopefully the net result will be something that will enhance and protect the resource and provide better fishing for tomorrow.

John Newbold is a board member of the N.C. Beach Buggy Association, which has opposed the idea of a license in the past.

On behalf of the board of directors and nearly 4,000 members of the N.C. Beach Buggy Association, I would like to make a few statements about why we are against a saltwater license.

North Carolina is a general revenue state. There is no guarantee that any money collected by the sale of a license will ever come back to maintain or finance state fisheries. Above and beyond this, states traditionally don't like to spend money on resources that can leave. You can spend money on migratory saltwater fish, put baby fish in your creeks and they swim out and go to another state. States have a lot of trouble with a resource that swims away.

And there's the cost of a license versus the costs of selling, maintaining records and enforcing. Who would sell the licenses? Tackle shops, municipal governments? There is a cost with this.

More people would have to be hired and trained to enforce such a license. And there would probably be a surcharge on out-of-state tourists.

The problem is determining the cost for people who surf fish or fish from private boats, headboats, charter boats or piers. Not mentioned here, but factored in, is the exception mentioned by Florida and South Carolina for senior citizens and people under 12 or 15. It's interesting that both states exempt people who fish from the beach. That would take me right out of here.

As already mentioned, most recreational saltwater fishermen in North Carolina are from out-of-state. They rent cottages and motels. What about a guest who fishes in front of his rental unit with his family? North Carolina advertises this type of fishing in paid magazine ads and videos in other states.

Since much of the fishing is from beaches, enforcement of the license would be impossible

without the additional expense of law enforcement personnel, training and vehicles. We believe the cost of an enforced licensing program would exceed any revenues it generates.

David Bradley is owner of the Sportsmen's Pier in Carteret County.

Proposals for a saltwater fishing license have come up before. A couple of years ago, Bill Barker of New Bern and Bill Hogarth (director of the Division of Marine Fisheries) were thinking about asking the piers and charter boats to charge \$4 a head, which would have doubled our price. Obviously, we had problems with that. We didn't think it was practical. If we thought we could get \$8, we would've already done it.

We have heard from South Carolina, Florida and Virginia, which have a different structure that wouldn't really affect pier operators. We already pay \$500 to \$600, depending on the length of the pier, for a commercial license. And if we were to adopt the structure of these other states' licenses, pier operators wouldn't be affected at all, other than to tax other people.

So I will mention some concerns about the recreational fishery and the license. As Dick Brame mentioned, we have a lack of adequate representation in this entire process.

I serve on a Carteret County advisory board for marine fisheries issues. And after some of the marine fishery hearings, I'd hear jokes about how Brame and the recreational fishing lobby were asking for certain things. Board members laughed at him, and obviously he had no impact at all because the vote went right over his head. We share some real concerns about that kind of situation.

As Charles Moore of South Carolina said, if the system won't conserve the resource, then the fishermen aren't going to support taxes based on that idea. The brunt of this tax will be borne by tourists and the North Carolina recreational fishing industry to the tune of about \$1 billion. The sportfishing industry is at least as big as commercial fishing, if not bigger, but it has only four representatives on a 15-member board. We basically have no pull, as Hogarth mentioned by the absence of legislators in attendance. That's a concern to us.

At the marine fisheries workshop in Atlantic Beach, the largest block of votes brought forth no conservation methods. It appeared to me they wanted to avoid impacting anybody over and above the methods used now.

Recreational fishing interests have been unsuccessful in removing enough damaging gear from the

water. And we have tried to resolve some commercial and recreational conflicts but have been unable to change any commercial practices that affect these. There is no willingness on the other side to help solve the conflicts.

At any rate, other states have had more success at solving this problem. They seem to have a better situation in terms of the recreational industry, and I think we can do that here. My tackle shop pays a lot of Wallop-Breaux tax. About \$4,000 to \$6,000, depending on the year, goes out of my shop to the federal government. And then Mike Street at DMF tries to get some of it back. Obviously, I would like to get some of it back. It's a funny argument — you have to pay a little bit more to get it back; you already paid it. At any rate, that's the way it is.

As indicated by the first proposal, there isn't a realistic understanding of how the tourism industry works off of this in order to avoid killing it through taxing. We need to be involved in that.

There is no tourism representative such as Carol Lohr sitting on the Marine Fisheries Commission. We need that. We are concerned that the fees would grow too high. We pay \$500 to \$600 now. We are also concerned about the specific uses of the funding.

There are some conflicts with piers and boats. By taxing and paying for other access, the state is taxing them to pay for competition. To a certain extent that's true, and to a certain extent it's not true. We think enough people will be drawn to the area and use the resources. So it's not a major concern, but it has been mentioned.

I think there are some good reasons for it, as mentioned by Brame. And business owners and the tourism industry would probably support a license if it is administered properly, it isn't unreasonably high so that it discourages people from coming to the state and it doesn't exempt so many people that the data collection means nothing. Also, support would grow if the recreational industry gets better representation on the councils that make decisions and oversee these funds.

Audience Discussion

Bill Brocker: I am a part-time resident of Chatham County and a part-time resident of Hatteras Island. I fish both fresh and salt water. I gladly pay for a freshwater license and I carry a lifetime sportsman's license.

My perception is that fresh water is being managed first for the resource and then for the recreational angler. That is not my perception of the saltwater resource. We have no regulation against netting in North Carolina that is meaningful. Behind

my cottage on Hatteras Island, it is almost impossible anymore to get my boat out without running over somebody's net, they are so thick. And yet Bill Hogarth suggested that we really don't have a problem with nets in Pamlico Sound, only in the creeks, and that is totally wrong. It is a disgrace what has happened to Pamlico Sound. It is absolutely criminal.

I take for granted that we will eventually get a saltwater license. There were some comments today that struck home with me that I want to repeat.

Nonresident fees. Friends and relatives from three other states visit me on Hatteras Island. I think that the explosion of costs for nonresident license fees is anti-American. We are all citizens of the United States. I like to fish in those states. They like to fish in my state. The question of a private boat license is excellent. Picking up a license for a guest at the last minute is a terrible and awkward thing. If we do get a saltwater license, I would like to see a reasonable fee for a boat license.

I would also like to see a direct relationship between the fees raised by a saltwater license for recreational fishermen and the fees raised by commercial fishermen for their license. It was stated earlier that saltwater commercial fishermen raise only \$675,000. But a recreational saltwater license could raise millions. So why shouldn't we have two or three times the representation in the control of the resource? It's a significant consideration for recreational fishermen when they're deciding whether to support a saltwater license.

Administrative fees. Representatives of four states have spoken about administrative fees for a saltwater license. In South Carolina, no more than 25 percent can be used for administration and law enforcement; in Florida, 5 percent can be used for administration. In North Carolina, \$5 of the \$12 under consideration would be used for administration. That's 40 percent, and that seems wrong.

Dick Brame: I want to make a quick comment. We are fortunate to have Michael Orbach in attendance. One of the first rounds of public hearings that I attended was scoping the overall license package that the Division of Marine Fisheries and the Marine Fisheries Commission had put together for ideas. It was killed, but that was a pet project for Orbach. And I think it's good to see him here listening. He will be a key player on the commission in any move toward a license.

All the discussions that I've heard about a license focus on the need for a goal. Our goal is just to document people who fish once a year or more in salt water. If you agree that is a good goal and all that money goes back to marine fisheries, then you settle

the details. And the details could be a pier license, a charter boat license, a private boat license, whatever. You must keep in mind the goal of sampling these people, their water catch, where they live, how much money they spend and how much effort they use.

A combination of three licenses — for recreational saltwater fishing, fish sales and gear — will tell whom a regulation affects, what gear it affects. Right now, we have virtually no idea about these three components in North Carolina.

Did you know this state doesn't have a gear license? A fisherman can buy a license, stick it on his boat and use as much gill net as he wants. He can pull any size trawl he wants. He can use long hauls. But it is virtually impossible to come up with the amount of gear these folks are using. They report 8.4 million yards, and we know that is not accurate. It might be only 10 percent of what is out there. It might be 200 percent. But we don't know.

So I think it is important to come up with our goals and then settle the details.

Sherri Evans-Stanton: I want to clarify that \$5 is a very rough estimate based on a hypothetical bill that North Carolina doesn't have yet. It is also a self-supporting program that does not have any funds from the General Assembly. So if the General Assembly were to appropriate money, then the percentage spent on administering it would be less.

Frank Martin: I am a recreational fisherman from Wilson, N.C. My question is for Dick Brame. Will the ACCA get a list of the saltwater license holders?

Dick Brame: I think a license list is available from the Wildlife Resources Commission to a nonprofit group for the cost of retrieval. It is a public document.

Frank Martin: Hogarth stated earlier that we are underrepresented in the political arena; we have only 2,000 members. Assuming that the Atlantic Coast Conservation Association could get the list, it seems logical that you'd have the name of everyone who is fishing recreationally in salt water and our membership could mushroom by 20,000 or 30,000. And wouldn't it be logical then that we could have more political influence?

Dick Brame: There are selfish reasons for wanting this license, but that isn't the goal. I think it is more important, whether they're Atlantic Coast Conservation Association members or not, that we identify these anglers and give them a voice. Right now, we're a faceless blob to the regulatory agencies.

We need to speak with one voice.

Frank Martin: Keep in mind when you say selfish, we are only selfish in the sense that we want to protect the resource and not exploit it.

Robert Goldstein: I am from Raleigh, and I think we're positioned as a bunch of people demonstrating for something without regard to the broader sense of the subject or to other people's opinions. Let me give an example. We've been talking about the need for a saltwater license and problems with having one in North Carolina. And yet there is no license on the table for anyone to debate. There should be something there to talk about, something on paper. It has to be drawn up by the people who would pay for the license. And until they draw up a license they can agree on, they don't have anything to take to the Legislature to argue the pros and cons.

So right now we're talking about the worst of all possible licenses. That isn't a good thing to talk about. We ought to be talking about a particular piece of paper. We had that a year and half ago, when a couple of legislators drew up a saltwater license and said it could be used to build factories in the district to grow commercially harvestable striped bass. Obviously that didn't fly.

The point is if you want something to fly you have draw up a license, propose it with all the conditions that you want and itemize those things you want to put on the table. You negotiate and identify those things that aren't negotiable. Unless you have that, there's no room to talk.

Let me go back another step from the license. We are all talking about the benefits of a license. One of the benefits is supposed to be more clout from having a tally of recreational saltwater anglers. But numbers of people don't have clout. Numbers of letters received by legislators have clout. Numbers of names on petitions don't have clout. Go back again. Numbers of letters received have clout, not the numbers of those who signed.

We aren't talking about what we will do with the money or how much we need. We should first decide how much money is needed to do what we want, and what requires letters and involvement but not money. And then we should look at the options for getting the money, the alternatives. A license is one way. What are the other ways?

Rather than using a license to get more money from Wallop-Breaux, we should put our clout to work in Washington to say there's something wrong with Wallop-Breaux when North Carolina contributes so much money and gets back less than other states that contribute less.

The license should not be the only criteria on which a state can get its money back. We should perhaps sue for our fair share, with or without a license. We can argue that we have a good commission that works hard to protect the resource and that should count for something, perhaps more than a license in another state that does no conservation.

So we have a lot to discuss, but we also need to talk about alternatives to getting what we need. And when we talk about a license, write it out. Let's argue it among ourselves and then take it the Legislature, but not before.

Bob Lick: I am from Raleigh. And if it sounds like I'm supporting a saltwater license, be aware I am only speaking in support of a proper license. I would fight like hell to beat down a bad license.

I want to talk about the tourism issue. I've traveled almost all my life to fish, from Maine to North Carolina each year and sometimes as far south as Florida. And I have been doing that since about 1960. Last year alone I had beach vehicle permits in three states, which cost from \$25 to \$125.

As sportfishermen, we face a lot of obstacles to catch fish. We have all fished in rotten weather. We have all seen the prices for fishing lures and motels increase. The biggest threat to tourism in North Carolina is the lack of fish or the inability to get to those fish. If the fish are there, the stocks are healthy and you can get to them, the tourists will come. There will be no vacancy signs up during the fishing season. I think that as a representative of the tourist bureau, you should embrace anything that will get more fish in the waters.

Dick Brame: I think it's appropriate that the resource often in trouble is the angler who can't compete with the nets and depleted fish stocks. For all intents and purposes the recreational weakfish fishery has been exterminated. Croakers are headed the same way. And we don't see any movement to restore the recreational fishery for anglers.

But you can imagine what they've done in Texas and Florida and other places that have regulated nets and protected fish. The fish have come back. The angler catch per unit effort goes up. People will come.

Lib Heverley: I represent a small beach business, and I agree with this gentleman 100 percent. Anybody who doubts that should look back at the year we had the red tide. The fishermen were not there, and if we had several years like that we'd have to close our doors. Also, the pier operators and I believe the charter boats already pay a user fee. Would this be an

additional fee?

Sherri Evans-Stanton: It depends on how you write it. It doesn't have to be. Some states just make it apply to boats.

Dick Brame: That is what Robert Goldstein was talking about. We have to decide what our goals are and whether we should have the license and then decide these details. And the decision-makers should be the folks sitting in this room and coastal businesses. I like other states' idea of a blue ribbon committee that travels the counties and cities to explain the license and gather input.

Lib Heverley: We might need to condition our support upon the Marine Fisheries Commission being more fairly aligned to represent us.

Dick Brame: Amen.

Carol Lohr: The tourism bureau would support anything to better the resource off the coast of North Carolina. Again, I have been fishing a mighty long time and I have seen some changes. And once the bill is in place, I think the tourism bureaus and businesses will support dedicating a big portion of the money to improving the resource.

David Bradley: I got some numbers from Mike Street at the Division of Marine Fisheries that I want to share. There were 1.03 million recreational anglers in 1991 compared to 15,000 to 20,000 commercial anglers. That's quite a discrepancy when you consider that they have 50 percent more representation on the Marine Fisheries Commission.

George Clark: I am a member of the N.C. Marine Fisheries Commission and I represent the sportfishing community as well as I can. I want to say that I believe the fishing license would be a good thing. But we have no plans for doing anything about the most important issues that need to be addressed. We have no current plans to restrict the stop nets. We have no current plans to restrict trawling anywhere. We have no current plans to restrict gill netting or haul seining anywhere. In my opinion, these matters should be a higher priority than the licenses we're talking about now. The sportfishing representatives on the commission are doing what we can, but we're only four out of 15, and we're not making much progress. It's disappointing.

Bill Hogarth: I think there is some misunderstanding of what I said earlier about Pamlico Sound. I

meant that Pamlico Sound can handle gear that the bays and rivers cannot. There is no doubt that overall we have too much gear. But there is gear that could be fished in the Pamlico Sound and not New River or the upper reaches of the Neuse River. So we need to look at where we allow certain gear. Pamlico Sound to me is an extension of the ocean, a type of sound not many states have.

Now, to address the recreational license, there has been a new room tax, a new meal tax and I don't know how many more taxes on travel and tourism. The last time I was in Nags Head, there was an 8 or 10 percent tax on a room per night. During the summer, rooms are \$100 to \$150. That is \$15 a day in taxes. We have to help provide a resource for the tourism industry that is going to rent those rooms. To me it is somewhat shortsighted not to want to spend \$10 to \$20 a year to improve the resource.

And I have one question for the Beach Buggy Association. Most of the members of the Beach Buggy Association are out-of-state, correct?

John Newbold: I would say more members are in Virginia than in North Carolina.

Bill Hogarth: I think the number you quoted earlier is 50 to 60 percent out-of-state.

John Newbold: If you need the answer, I can get it. I don't have it now.

Bill Hogarth: I just wondered. I thought that's what it was. Is your position on the license a result of polling each member or a decision by the board of directors?

John Newbold: The board of directors is empowered to make decisions for the Beach Buggy Association. Many of our members who are Virginia residents own some property in Dare and Currituck counties. Most of the Virginia members would be domiciled in Virginia.

Joy O'Neill: I am from Avon. What will enforcement of this license be like? And what role should the National Park Service play in enforcing the license on park service land?

Dick Brame: The National Park Service is empowered to enforce fishery regulations on park service land. And in general it abides by North Carolina fishery regulations. So the park rangers would have the authority to check for licenses on the beach. Enforcement has always been a problem in marine fisheries. As you've already heard, there are

47 officers for 2 1/2 million acres of water. So we definitely need more and better enforcement.

John Newbold: I have one observation simply from being on the beach. The rangers have their hands full managing crowds. And the marine fishery officers will check the catch and licenses. That is just an observation. It doesn't mean the park service doesn't enforce these rules, but it's not their primary job.

Mac Currin: The National Park Service rangers do monitor licensing and hunting on their property on the Outer Banks. So there is a precedent for that.

Richard Dana: I am from Southern Pines. The point has been well made that the Marine Fisheries Commission is represented by six of 15 members who are commercial fishermen and only four sportfishermen. But what about the other five members? It seems to me that if we could get at least two or three of those folks on the side of sportfishermen, we'd have equal weight on the commission.

Dick Brame: Three of those seats are designated for scientists. They must have a background and training in natural resource management. And the commission has three very good scientists right now. Mike Orbach, Dirk Frankenberg and Jerry Hardesty are very good. And JoAnn Burkholder is a scientist in an at-large seat. They tend to address resource issues first, so it's not like they are adversarial at all.

Bob Hoffsteder: I am from East Carolina University in Greenville, N.C. Does anyone know how many jobs, law enforcement or others, that licensing would create for the eastern North Carolina economy?

Sherri Evans-Stanton: I think it is too early to tell. We need a proposal first.

Mac Currin: That is a good question and there have been others posed for which there are no answers. But I think the intent of the steering committee here is to explore the concept of a license, not to present a license package to view and critique.

Mark Feldman: I am from Raleigh, N.C., and a member of the N.C. Beach Buggy Association. I support the saltwater fishing license and I am disappointed with the current representation. I have found three flaws in the association's position against the license. One, John Newbold mentions the general revenue issue as being primary, but that's not about

the license. Two, he says the state would have a problem spending money on a migratory species and a resource it can't properly manage. If other states such as Virginia and South Carolina are doing the same, then one neighbor is helping another and the resource is being enhanced. Finally, he talks about exceeding the revenues. Well, before a license is enacted, the costs and benefits must be analyzed. Other programs such as the North Carolina freshwater fishing licensing program, which appears to be making a profit and enhancing the resource, would be evaluated.

Lee Roberts: I am from Asheville, N.C. The N.C. Wildlife Resources Commission has no problem implementing statewide hunting and fishing licenses. The lifetime sportsmen's license is an excellent program. We are also buying migratory duck stamps that affect a migratory species. Why can't we do something about our fish? I don't understand the exclusion of people who fish on the beach. That group is definitely fishing from North Carolina. When we are fishing from a boat, we are often in federal waters. I have no problem buying this license, but what is the reason for excluding onshore fishermen?

Virginia Vall: When the debate began in Florida, one strike against the license was the inalienable right to fish salt water without paying an extra tax. As I understand it, it came down to licensing selected individuals or selected activities or nobody. So this was a compromise to license offshore and resident fishermen and all tourists. We do not license resident shore fishermen. I believe that is coming. It's in discussion and will happen probably in the fairly near future because there's a feeling that this whole segment shouldn't be excluded.

Mac Currin: In instituting a license, the important thing is to get the structure through the Legislature. And then changes like this can be made. So compromises certainly play a large part in this.

Mike Orbach: I have listened to all these comments about the potential effects and the costs and benefits. And all of that is very important to me. As one of the Marine Fisheries Commission's scientists, we need to assess that beforehand. The commission will go out in the coming year, I hope in conjunction with the private industry and other government groups, to talk to the coastal and inland communities about these issues. But one thing that comes to mind is a project that a colleague of mine did a couple of years ago on underutilized recreational fish. He

studied why people fished for certain species and not others. And he came up with a series of promotional booklets. A lot of charter boats distribute these to anglers and tell them that there are other fish to catch besides king and Spanish mackerel, which they're limited on. And the point is, they got together with us to promote conservation and greater use of all resources.

I hope that when you folks go back to where you live, where you work, especially the people in the coastal communities, you'll ask how to move forward from here. What is the right thing to do? What will conserve our resources and how can we help out-of-staters conserve and use the resources here?

But I think when we frame the question, it shouldn't be only whose ox is gored, although that is important. The question should be what is the right thing to do and how can we help?

John Newbold: I want to address the Beach Buggy Association member who spoke. We need to understand a couple of things. The board of directors for a recreational surf fishing club — this is what the Beach Buggy Association is — does not poll every member on every decision. That is impossible. That is why there is a board of directors. So it is certainly very possible that the board does things that displease somebody. There are beach buggy members who are commercial drop netters. We don't invite them; people come to us. There is no way that our board can please everybody. But by consensus, the board of directors has taken this stand. Also, I said that states traditionally don't like to spend money on a resource that goes out the back door. And I think that is a fair observation. I think it is great when states do. I would vote heartily to spend money for rockfish.

So you have to understand that as a director, I speak as an organization and part of that board. What was your third point, sir?

Mark Feldman: You said that the costs would exceed the revenues.

John Newbold: The state can put a license in place for \$12, and each municipal government can make people queue up to buy the license, which makes it difficult to purchase. Or tackle shops and restaurants can sell it and get a piece of the pie for selling it. If Bill McCaskill has to hire another employee to sell licenses, he should be compensated.

If you've ever been in a blitz where fishermen are losing tackle and trying to replace it and another group wants fish measured for citation, it's bedlam. A tackle shop has to dedicate a person to just issue citations. I have been pulled in from fishing to help

tackle shop owners measure fish for citations.

But based on the \$5/\$12 idea, the board doesn't think it would economically work. And I think it would cost North Carolina money to enforce it in terms of additional people, training and vehicles. But understand, as a board of directors we know we don't please all members.

Mark Feldman: I realize you cannot please all the people all the time. But looking at the other side of the coin, a saltwater license would enhance the resource over time and afford the opportunity for future tourism, more money for the tackle shops, so there is a blue blitz 10 years from now.

John Newbold: I don't see a correlation between your position and what the board is presenting, but that doesn't make your position any less or more true.

Bo Nowell: We are talking about the sale of licenses as a logistical problem. If the money is available, the technology is there. Again, if we are more innovative and provide the money, there is telephone technology, credit cards and voice response that a caller can use to get information and key in an order that is charged to his credit card. The license is mailed to him. There are many ways that technology can eliminate hassles. It's a matter of turning a negative into a plus. And that's what the years of hearings it would take to study this process should look at.

Robert Goldstein: With regard to the Beach Buggy Association position that the board of directors is charged to represent, I want to point out that you are not a corporation that is looking out for the interests of the stockholders. There is something you are trying to protect. I am a small businessman and a member of the National Federation of Independent Businesses, which has membership of many thousands of people all over the country. Like the Beach Buggy Association, it yields to political issues. It doesn't go to Congress and take stands; it does poll the membership and distribute packages with the pros and cons of every issue. That's the position it takes to Congress and represents. You hear from the federation first and it represents you. It doesn't presume to speak for the whole. And I advise the Beach Buggy Association to consider that as a sensible way to operate. By the way, I am not dumping on the association because a lot of sportfishing organizations operate the same way. But I think it's the wrong way to operate. You should poll membership.

Also, I want to address the point that the license won't make money. South Carolina makes money on

its \$5.50 license because it costs practically nothing to administer. And I'm sure that North Carolina can come up with something similar.

Finally, one of the principal arguments for a saltwater license is a tally of the recreational anglers for better representation. But I find that a curious argument when the Division of Marine Fisheries can predict how much money the license will raise based on the number of fishermen out there. How can DMF know how much money will be raised by the fishermen but need a license to count them?

Mac Currin: Those are based on estimates, and we're not sure how accurate they are.

Dick Hunnicutt: I agree that the fishing license is a secondary issue. It is my understanding that it's the job of the Division of Marine Fisheries and the Marine Fisheries Commission to take care of our resource. And according to Dick Brame, about 8 percent of North Carolina's species are stressed or overfished. It doesn't take a rocket scientist to realize that we don't have the fish we had a decade or two ago.

If North Carolina implements a license, all it will do is generate revenue. And this revenue will be spent by the same group that up until now has not done a good job. That is probably because it is weighted toward the commercial fishing side. So I think recreational fishermen should have the General Assembly, or whoever is responsible, rearrange the makeup of the MFC. After that, a license would provide more money to do better work.

Randy Hawley: I am a recreational fisherman representing the Sierra Club. I am also a member of the North Carolina Beach Buggy Association, but I don't think I will be much longer.

We are talking about a fee for a license. I don't care about a fishing license compared to the amount of money I spend to trade in my old truck for a four-wheel drive or to buy tackle. In terms of quality of experience, all I want is to have a decent chance of catching fish. And that's what we should be talking about today.

Others have mentioned responsible use of the money that comes from this license. I would pay \$50 without it bothering me a bit. I don't think it would bother most of the people in the N.C. Beach Buggy Association.

John Newbold: I am going to speak as John Newbold now. Forget the jacket I am wearing. I agree with you. I have heard nothing today that correlates better fishing and the price of a license. In fact,

people have said there is no guarantee of better fishing. Truly, we are faced with dwindling stocks in every species. There is less of everything and more of us going after it, and we have to work together to solve the problem.

Wytold Lebing: I am a sportfisherman from Raleigh. It seems to me we are talking about kinds of fishing licenses, and some people see that as a sacrifice if we have to spend x-number of dollars, whether it's \$5, \$10, \$20 or \$50. It also seems to me that we're asking a lot of other people to sacrifice for the quality of life issue. That means a lot of commercial fishermen will have to change the way they do things so we can have better fishing. Well, if we're going to ask other people to change, we should be ready to start changing the way we do things. And that will mean getting together and taking charge of this issue to get the license we want and the funds going where we want them.

Sam Walters: I am a Durham recreational fisherman. It sounds like people are going at cross purposes again, and I'd hoped this forum would eliminate some of that. We have people from all walks of life, different job backgrounds and a lot of intelligence. We need to start working together to take care of this problem. We have a lot of people in the Beach Buggy Association who have different opinions. If you don't agree with what's been said on the podium here, take your opinion back to the association and voice it there. And if changes are needed, make them in the association to strengthen the group and get others involved. Use that forum to write the Legislature. Get people involved with the N.C. Wildlife Resources Commission, work with the Raleigh Salt Water Sportfishing Club and the Atlantic Coast Conservation Association. Band together with large organizations for a big voice and get something done.

And where are these recreational anglers coming from? How will the licenses impact people from other states? That is a big issue. First of all, we need to know whether licensing would help pinpoint where these people are coming from. Is there something that we can do to help pay for the impact that outside anglers are having on our state resources?

We as residents are having a huge impact. We have new highway systems, new bridges, new modes of transportation to get ourselves to these coastal waters, and we are fishing more. We have new technology to find the fish, and we are going to have a larger and larger impact every day. Those of you with kids will have a bigger impact because you're taking your children down with you.

People say salt water is the last area where we are not taxed. If there is something wrong with our natural resources and we scream hard enough, somebody is going to try to fix it. But what can we do? We have to pay taxes at some point to get things taken care of. If a license can help pay for it, let's do that. At least here, if we band together, voice a strong opinion and generate a basis for the license that we can agree on without too much taxing, then we are paving the road and not letting somebody tell us how it will be run.

A blue ribbon committee was mentioned earlier. Does anybody have an idea about how we as a group, or the Beach Buggy Association or the ACCA, can get a committee together to get this thing rolling?

Carol Lohr: I agree. From the tourism standpoint, I think a blue ribbon or ad hoc committee would be a step in the right direction to present our idea once it's formulated. I appreciate the comment about target markets. We do conversion studies every year to find out where our target markets are. And out of 82,000 inquiries coming into Morehead City, I can tell you exactly where each of them is from. The majority of those markets are where we place our ad dollars. And it's paying off. Our revenues are up. And I would be very interested in serving on that committee if it comes about and using that list to help in our advertisement placement.

Mac Currin: Letters specifically to the N.C. Marine Fisheries Commission expressing your opinion, your desire to have a blue ribbon panel look into a saltwater license or any other concerns, would at least start that process.

Sherri Evans-Stanton: You might also want to petition the governor to get this panel going, because it was the suggestion of either the governor or secretary of the Department of Environment, Health and Natural Resources to do that. And the other way, of course, is to get it done through the study commission because it will be conducting hearings all over the state before any kind of license is ever enacted.

Dick Brame: I think that this administration will be very favorable toward a license, given that we can generate public support. I would like to see — and I believe the Atlantic Coast Conservation Association would like to see — a blue ribbon or ad hoc committee that reports to the Legislature. I'm not saying legislators shouldn't be on it, but I'd hate for them to take the lead. I'd rather the ACCA, the Marine Fisheries Commission, the Beach Buggy Association and any other group go around and talk to their peers.

A lot of misinformation is generated. So we need to have our own committee, and we need to have state government involved. But we should forge ahead in order to introduce something, should we decide to, in 1995. It will take two years to educate and then introduce a license.

Bo Nowell: I want to defend my friend John Newbold here. I am president of the Atlantic Coast Conservation Association, but I am also a Beach Buggy Association member. The association fights for my rights to drive on the beach, and it has taken up some real tough issues. It has called for game fish status for red drum and the end of some trawling. It has been going through some changes. We may not agree on the license, but I will defend his right to speak and I don't hold it against him, because the ACCA, the Beach Buggy Association, the chambers of commerce and the pier owners all need to work toward fixing the problems.

Lawrence Lineberry: At the risk of trying to add some humor to this otherwise somber occasion, I want to tell a story of the 1938 or 1939 Washington Senators baseball team. The coach at that time was making his report to the Washington Press Club, and he allowed that baseball drew fans on the basis of home runs hit. He added, "I am here to tell you that I have acquired the best representatives and pitching staff for bringing people in to see our baseball games." He hadn't won a game in 100.

In my experience, after 31 years in the conservation field, it seems that wherever the commercial and sportsmen's interests collide, the commercial interest always prevails. What about a license coupled with a saltwater sportsmen's fishing commission?

Dick Brame: The inequity in representation is one of the main things people have talked about. I don't know that we need a separate commission for sportsmen. But I would like to see an advisory committee, largely of recreational anglers, to talk about the issues. Anglers tend to be shy; they don't speak up much and they're not as passionate. Also, the Marine Fisheries Commission has largely refused to take issues to public hearing that anglers care about passionately. If it would do that, more folks would turn out.

Jim Murray: It seems to me there is a real danger in any new task. You can read the newspaper and see that the General Assembly doesn't have a whole lot of extra dollars to play with these days. A recent study on artificial reef management observed that a variety of states are suddenly using the Wallop-Breaux funds

to subsidize the money appropriated by the General Assembly. So in other words, if North Carolina has an \$8 million budget and suddenly gets a license that adds \$4 million, what would prohibit the General Assembly from reducing those appropriations to \$4 million? We'd be no better off. Is there a legal way to preclude that situation?

Sherri Evans-Stanton: The legislation could create a separate fund for the direct deposit of this money so that it would be used only for the specified expenses. I don't know if it would be approved by the General Assembly. You can also create dedicated funding that is spent according to a formula, so that the money is deposited in the general fund as it comes in and goes back only for those projects. Now, across-the-board cuts would affect that programming. But they couldn't take that money out and give it to something else.

Virginia Vail: This was also a concern in Florida, that license revenues would end up as a substitute for the prior year's general revenues. In the language establishing the license, there was a provision that said the Legislature would continue the general revenue appropriations in future years at the same level they were for that current time. And it passed. Nobody said anything. Again, this is a point where the public is left with the understanding that general revenue funding will continue at the same level it was in 1988-89. However, one year's Legislature cannot obligate another year's Legislature to continue an activity.

And this is a personal opinion. With our budget problems over the past year, programs funded by license revenues that were dedicated trust funds fared much better in the long run because the availability of license revenue at least helped to maintain steady state. Around us, people were losing their programs. So it is a stability mechanism too. If your sole source of funding is general revenue, a recession is going to cut you back. There is no choice. There is no money. There is no continuation.

Jennifer Bucher: I attend East Carolina University. Some fellow students and I were wondering if any of the revenue from this proposed license would be allocated to habitat generation and restoration and artificial reefs, given today's exploitation of coastal resources to development. What is the good of stocking if there is no habitat left for the species?

Dick Brame: Habitat protection is something that the Marine Fisheries Commission is trying to get into in a big way, protecting submerged aquatic vegetation

beds, oyster rocks and vertical relief on the bottom. So I would hope that a substantial portion of this money would go toward habitat protection. That is where the fish will be produced.

JoAnn Burkholder: As a member of the Marine Fisheries Commission, I am very interested in trying to promote the habitat issue. Until now, the main frustration has been that we really don't have much legal recourse in protecting habitat. But we intend to form a liaison between our commission and the Environmental Management Commission. Also, some of our members are strongly active in research to help habitat. I am now researching grass beds and ways to better protect fish from toxic dinoflagellates. Bill Hogarth and other members of the Division of Marine Fisheries may also help us out.

Bo Nowell: An article by the *Miami Herald* says that some of the Florida license money is going to projects for shoreline restoration, which includes planning, marsh vegetation, mangroves, seawall softening, planting sea grasses, impounded marsh restoration, artificial reef development, repair of damaged natural reef, fish hatchery stocking and modification of the estuarine system. Florida has allocated some of the money for these issues, and obviously it must be legal if the state is getting the federal funds and the fishery restoration funds to do that.

Mac Currin: I think those uses were broadly grouped under enhancement.

Charles Moore: In South Carolina, our law specified that funds generated by the stamp could not be used to replace existing funds to the Department of Wildlife and Marine Resources and to the recreational fishing programs. That was so minimal it really didn't matter anyway. But the comments here on both sides of the issue are very similar to those made in South Carolina and I am sure in Florida and every other state. I think you are right on line. It is important to remember that the license is certainly not an end. It is a means. The health of the resource is the key. When you talk about a license and issues, it is always good to keep the alternative in mind. If you don't have a stamp, what are you going to do? Is the resource going to get better or worse?

Mike Street: I am from the Division of Marine Fisheries, and I want to address the topic of diversion. The Wallop-Breaux Trust Fund was established by the Sportfishing Restoration Act in 1984, which greatly increased the items that are taxed to provide

funds for the act and new revenue sources. In one year, revenue went from \$30 million to about \$100 million nationwide. And now it is in excess of \$200 million nationwide.

Well, that kind of money has been of great interest to congressmen for various little projects and for deficit reduction. And since 1986, there have been three or four attacks on the Wallop-Breaux fund for other purposes, including just capping it and diverting the rest for deficit reduction. All of those attacks have been defeated by the people paying the tax who rise up and say, "Absolutely not. We are putting this money in for sportfish restoration, and that is what it shall go for. Congress made a contract with us when we agreed how that money would be used. You break it and we are going to put you out of office."

And that is exactly what the sportfishermen of North Carolina would have to do because it is absolutely true that the Legislature does what it pleases. So the users would have to prevent a diversion, as with any fund in state government.

Mac Currin: Congressmen are very important people to write on the national level, especially for issues like this.

John Newbold: On the heels of that, I want to say if the money is dedicated to fisheries, the Beach Buggy Association would be 100 percent behind the license. It's just that there's no guarantee of that in a general revenue state. But if there was a guarantee — if we could negotiate in a committee and convince your state government to do that — it would be terrific.

Howard Cummings: I live in Raleigh. There has been a lot of discussion about what would be done with revenues and who would get it. When I volunteered this year to head the Wake County chapter of the Atlantic Coast Conservation Association, I asked myself how to get in touch with recreational anglers of this area to talk about the issues. And like George Clark said, the questions are all about commercial gear, about gill nets. I don't know how to get up with those people. If somebody could give me a list of all the recreational anglers in North Carolina, I wouldn't care whether we had a license or not. I am in favor of a license, but how am I going to get up with these people if I don't know who they are? And the only way to get the issues resolved is to get in touch with all those people.

When I buy a duck stamp at the courthouse, they give me a little card. At the end of the season, I should write on that card my comments and activities for the year. If we could get in touch with everybody

who buys a license and find out about their questions and comments, we could at least contact them and say, "This is a problem at the Division of Marine Fisheries. If you want to do something about it, this is who to talk to."

I just think there are a lot of things about a license that are complicated by the various revenues, but the ability to identify and contact recreational fishermen would be a benefit. And if we start with the premise that we can identify them, get them together and hear them on the issues, then we will work out the problems with the exemptions and the money.

The Sargassum Ecosystem and the Habitat Protection Issue

Jerry Schill is executive director of the N.C. Fisheries Association, a post he's held for six years. A voice for commercial fishermen, he works hard for their issues and positively influencing fisheries management. He is also a member of the Sea Grant Advisory Board and the South Atlantic Fishery Management Council. He chairs the habitat committee that dealt with the sargassum ecosystem.

I am chairman of the Habitat and Environmental Protection Committee of the South Atlantic Fishery Management Council (SAFMC), which is one of the eight regional councils that manage the fisheries resources in the 3- to 200-mile federal zone.

The council's jurisdiction reaches from North Carolina to Florida. But the council would like the support of fishermen to change the Magnuson Act, which governs the councils, to get a vote on the Mid-Atlantic Fishery Management Council because Cape Hatteras is the breaking point for southern and northern species.

Although Dennis Spitzbergen and I sit on a committee that has a vote on the Mid-Atlantic Fishery Management Council, North Carolina is not a voting member. But there is precedent for this. For example, Florida is on the SAFMC and the Gulf of Mexico Fishery Management Council. There is a lot of support to include North Carolina in the Mid-Atlantic council, but that hasn't come to pass yet.

And I'd be remiss in not mentioning this. The SAFMC has 13 voting members. Two of us represent commercial interests. So we hear a lot about the power of commercial interests. But on the SAFMC, that certainly isn't true. I don't mean to imply that the other 11 are anti-commercial. That isn't what we are charged to do. Even though I represent the commercial industry on the SAFMC, when I raised my right hand, I didn't say I would blindly represent my

members. I don't. I bring certain expertise to the council, but the resource is considered first and foremost.

On the issue of the sargassum ecosystem, I won't go into a lot of detail about Larry Settle's master's thesis. He works for the National Marine Fisheries Service in Beaufort and has been an observer on a vessel that has harvested sargassum. That particular research is not finished yet, although he gave me some information that is fairly up-to-date. It will be finished this spring.

Now I want to talk about what the council has done with regard to the sargassum harvest. The first time that our Habitat and Environmental Protection Committee considered this issue was at a Nov. 1, 1990, meeting in Wrightsville Beach. At that time, Bud Cross, who is the director of the NMFS lab in Beaufort, gave a brief overview of a preliminary report. He explained that sargassum harvesting has been taking place off the North Carolina coast since the 1970s. One company, Aqua 10 Corp., is now harvesting sargassum. The company is in Beaufort, and the owner's name is Bill Campbell. It harvests about 50 tons a year; that's wet tons, 90 percent water.

At that meeting, some wild scenarios were painted about how much tonnage was being harvested. I thought that the rumor mill was invented by the commercial fishing industry, but I am not so sure after sitting through that meeting. Of course, hearing some of the things here today, I am wondering if maybe you all invented it.

The question was asked, is this a habitat or a resource issue? Is there a bycatch problem with sea turtles and juvenile recreational gamefish? Will this be handled through the Magnuson Act, under the auspices of the council, or under the auspices of the Endangered Species Act, which NMFS handles directly? As a result of that discussion, the committee members discovered that we didn't know much about it. We requested that the Department of the Interior and NOAA review the issue of critical habitat and advise the council on appropriate options that are available under the Magnuson and Endangered Species acts.

Campbell, the owner of Aqua 10, sent the council a letter in December 1990. He had never heard of the SAFMC, but he'd heard from a friend who knew something about the council process that his operation was going to be shut down. So he wrote the letter that said Aqua 10 had harvested a total of 135 wet tons of sargassum since he started. He mentioned that he extracts a liquid from the seaweed to get 200 dry pounds per wet ton. And after sun drying, the product is ground to a powder and extracted. Products are

used for soil, plant, poultry, livestock and medicines.

In February 1991, the habitat committee met in Brunswick, Ga., to put Aqua 10's harvest in perspective. The committee learned that Aqua 10 needs a specific chemical composition in the sargassum to process it. And Campbell wrote in a letter that inevitably captains would take a fuel-saving shortcut and harvest sargassum from the west of the Gulf Stream rather than the east. He could tell by the chemical composition that it wasn't the sargassum he needed. So he just wouldn't pay for that particular trip.

At this meeting, the committee looked at a number of possible impacts: loss of offshore pelagic habitat, direct loss of juvenile and larval finfish, loss of the food basis for these fish, expansion of the sargassum harvest, conflict between the harvester and recreational fishermen, loss of habitat for sea turtles and direct interaction with sea turtles.

The council could take several possible actions. It could enact a Fisheries Management Plan (FMP) for sargassum, which is defined as a fish by the Magnuson Act. Under a sargassum FMP, the council could allow a specified tonnage for harvest. Or it could put sargassum under the coral fishery management plan as habitat. The council could prohibit harvest through an existing FMP, such as the snapper-grouper or the mackerel plans, if it appeared that the sargassum harvest would hurt those fisheries.

If the Office of Protected Resources at NOAA could designate sargassum a critical habitat for sea turtles, the council could not make any regulation or action other than to recommend something to the appropriate agency. The council didn't have any regulatory authority under the Endangered Species Act.

At that meeting, Andy Kemmerer, director of NMFS' Southeast region, suggested doing a sargassum FMP. One member stated strongly that one boat trawling for this stuff does not make it a fishery for inclusion in an FMP. That comment was based on the fact that you have to jump through specific hoops and have the best available data to enact a regulation through the Magnuson Act. At that time, the committee had no data at all. So we had to do whatever we could to collect that information. The committee, and consequently the council, passed a motion to prepare an FMP for sargassum.

On April 30, 1991, the Habitat and Environment Protection Committee met again in Charleston, S.C. Campbell attended and told us that 1.27 percent of his finished product is solids and 50 percent of that is sargassum. He said 1 ounce of this final product with fertilizer will cover 7 acres for a farmer. Now, this is a sales pitch, so I don't know how accurate it is, but

he said a farmer can reduce his fertilizer usage by 50 percent with this product. It can reduce fat in turkeys from 22 to 26 percent by using a half-ounce per lifetime of 39 turkeys. It also reduces the use of antibiotics.

Campbell said he uses 10-minute tows for sargassum. Aqua 10 currently harvests 50 wet tons per year, in contrast to the West Coast fishery that is capable of harvesting 150 tons per vessel per trip. Aqua 10 harvests seaweed from June to October.

He volunteered to allow an observer on his vessel. Cross, director of the NMFS Beaufort lab, said Settle was a researcher working on a master's thesis and he would be available to observe. We received a letter from Nancy Foster, then the director of the Office of Protected Resources, saying that "the results of our view are somewhat ambiguous, primarily because more information is needed on the nature and value of the sargassum environment to sea turtles and other species and the threats to its continued maintenance and well-being."

Settle's work on the sargassum habitat and the species it supports isn't ready. But he gave an update to the committee that I will summarize. The principal objective was to survey the early life of fish and sea turtles associated with pelagic sargassum on the North Carolina continental shelf. He wants to determine the species present and whether abundance changes by season or the distance from shore. Samples were taken up to 55 miles south-southeast of the Beaufort Inlet from less than 20 meters to 200 meters in depth and into the western sargasso sea.

There were 178 collections made at 61 stations. Analysis of data is incomplete, but Settle presented the committee with general trends and catch composition. He found that 67 species from 34 families were identified. In greatest abundance were cowfish and trigger fish, jacks and sargassum fish. Only one newly hatched loggerhead sea turtle was captured 20 miles offshore.

A few species of concern to the council, which were identified as fairly common, included red porgy and amberjack. In addition, larval swordfish and billfish were captured, but collections were not taken in spring and summer on the western sargasso sea, where a greater number would probably be captured.

He spotted a decline in the number of fish per kilo of sargassum from spring to winter. The mean fish abundance and biomass declined with increased distance from shore. It was emphasized that the survey only looks at larvae and juveniles. Adult finfish occupied the area below the sargassum, but they were not vulnerable to this gear.

The final report will be out in the spring. The next SAFMC meeting will be in Brunswick, Ga., in

April. If it's not ready then, it will be available in Florida in June. By then, we should have the information to decide what to do next.

So that's a wrap-up of the sargassum issue. It's a little disconcerting at best to read some of the information that has been out on this. It's one thing to deal with the facts, another to deal with rumors. A press release out of N.C. State University some time ago mentioned that the sargassum harvest was prosecuted by boats using giant winches. Actually, it was a shrimp trawler. It said there was so much concern about sargassum harvest that the federal government issued an injunction against any future harvest, which was totally untrue. I found that a bit troubling coming out of a university that should check its facts better. But that happens with controversial issues.

Bill Brocker: I am not a scientist, but it is my observation as a layman that wherever someone makes a profit, others will follow. And if Bill Campbell makes a profit, there are 150-ton ships off the North Carolina coast that will be hard to stop. To the best of my knowledge, turkeys are not an endangered species and fertilizer is plentifully abundant. Sargassum is clearly a desirable organism in our oceanic coastline. It is certainly habitat and it brings in the game fish.

Why let this industry get started? Why not nip it in the bud before North Carolina has a problem with sargassum? It is certainly desirable to the fishermen for it stay in place.

Jerry Schill: Legally, according to the confines of the Magnuson Act, the South Atlantic Fishery Management Council cannot arbitrarily and capriciously say to Bill Campbell that he cannot harvest sargassum without some quantification of what he is doing and the effect on a particular fishery.

Bill Brocker: Well, I am somewhat disturbed by your presentation, not because I think there is anything legally we can do, but because you seem to be in a position of defending Bill Campbell for harvesting sargassum. And it doesn't seem to me that would be desirable for the coast of North Carolina.

Robert Goldstein: I am a little disturbed by this entire issue. Let me give a little background to explain why. I am a Ph.D. biologist with an emphasis on marine sciences. I know how important it is for a graduate student to get a master's degree by going through a large number of data, learning how to interpret it, learning how to review literature and put it all together to demonstrate that he can be a researcher. And I think that is fine for Larry Settle to go

through that exercise.

What I do not understand is why the South Atlantic Fishery Management Council is awaiting the results of that particular master's degree before deciding what to do about the sargassum issue. Sargassum has been studied from day one, ad infinitum. I have with me a pile of literature on sargassum. Jerry Schill mentioned that Settle had given the council 67 species. But a 1984 study of sargassum looked at all the organisms; more than 100 species had been found representing large numbers of groups. And he is working on the western side, but that has been studied. The entire area has been studied. The 1983 *Bermuda Biological Station* — 307 pages, 29 authors — studies sargassum and the sargassum community. Wasn't the council aware of these things? It has technical advisory groups.

And perhaps Settle could learn something from that research, but I see no reason why the council should look at an unfinished master's degree when there is a wealth of scientific information available on sargassum.

Let me go a step further. I understand that the council can only deal with sargassum as a fishery. That is its orientation by law. There are no options. This question of harvesting the habitat should be looked at by all North Carolinians, all scientists from all agencies, the private sector and academia. Imagine the outcry if someone said he could save a turkey farmer 20 percent by harvesting the sea grass base in Pamlico Sound. The last prairie is out there in the Gulf Stream. Imagine if we asked how many buffalo it supports if we harvest some of it.

We aren't talking about that. We are talking about a habitat that plays a lot of roles, some of which we don't even know. We do know that the sargassum forest is essentially the source of all food for billfish, dolphin and many pelagic fish. We also know that sargassum provides nutrients for the ocean floor. What happens if you interrupt the entire cycle? Bill Campbell is doing that. I understand that is insignificant.

But it's also very important. It's no longer insignificant if we start talking about saving significant amounts of money for the poultry industry. We're talking about something that can change the entire Gulf Stream off the United States by eliminating a complete habitat because we are the biggest poultry producers in the world.

So when does it end? Should the U.S. Fish and Wildlife Service get involved? There was a similar situation with the live rock controversy in Florida a few years ago. Besides being an oxymoron, live rock is the coral rubble found on the shore side of a reef. Coral rubble was thought to be dead rock on its way

to becoming sand. And a lot of people were harvesting it for reef tanks, which is big business and growing by leaps and bounds.

Florida put an end to that, even though the harvest was rather small, when it was pointed out that the coral rubble on the near side of the reef contains 90 percent of the vegetation that supports coral reefs. It is the exclusive feeding habitat for creatures such as parrot fishes. So it is valuable habitat. And a large percentage of the organisms in coral rubble haven't even been described yet. A vast diversity of species live there, many of which don't have names. They have not been studied. So here, the state is protecting a critical habitat.

I submit to you that the sargassum is an equally critical habitat because we don't know all of the things that are out there. We do know there is an enormous diversity of species and a major habitat for recreational fisheries. I have no idea what other things might depend on it besides the recreational fisheries.

Jerry Schill: I'm not really sure why the South Atlantic Fishery Management Council didn't look at other information. Are you on the council's mailing list?

Robert Goldstein: Yes. And I was on the Shark Advisory Subpanel until I was replaced with a commercial shrimper.

Jerry Schill: You are well aware, then, that we had habitat meetings. And if you had that information, I think you had an obligation to give it to us, too.

Robert Goldstein: I tried to get on the advisory subpanel.

Jerry Schill: I know. I saw the name. But still, you are on the list and that information should have been given to us. I can assure you it will be considered at the next meeting.

In terms of where we go from the standpoint of a Fisheries Management Plan, if some researcher said sargassum from the eastern sargasso sea is going to cure AIDS, cancer and heart disease, the council still couldn't make a decision based on that fact. We have to go strictly by the Magnuson Act.

Now, I want to comment on a completely unrelated topic. It was gratifying to see people disagree with each other at a meeting other than a commercial meeting. I don't have to listen to you. I do have to listen to my board. There are some people trying to get me fired as we speak.

But I will say this. Until today, I never knew that

a recreational saltwater fishing license would be commercial vs. recreational. As far as my people were concerned, they were split. It was not a recreational vs. commercial issue. I won't say that you were wrong to discuss it in those terms, but making it a commercial vs. recreational issue is not the way to go. Commercial fishermen are split on it because they're also recreational fishermen. And politically, you build consensus, not split it. You bring people in. You talk to our organization and try to get us to support it rather than breaking us apart.

Look what is happening to the license to sell. You knew this was going to happen. My board of directors (N.C. Fisheries Association) voted unanimously to support an additional license. I nearly had a heart attack. Of course it meant I didn't get a raise because they knew they were going to pay more money.

The Southeastern N.C. Waterman's Association unanimously supported it. The Atlantic Coast Conservation Association of North Carolina supported it. The Raleigh Salt Water Sportfishing Club supported it. And the chance of getting it passed, even with these powerful people supporting it, is between nil and none right now. With the dissension that I've seen today, making a saltwater fishing license a commercial vs. recreational issue, there's no way it will get passed. I don't quite understand that. I have been director of the association for six years. I represent some of the finest, most hard-working people in the world. But I don't understand the attitude by some of my people and some of you people that it has to be a battle all the time. That is totally destructive.

Marine Reserves: Can They Help to Rebuild Stocks?

Gene Huntsman is leader of the reef fish team for the National Marine Fisheries Service at the Beaufort lab. He has been with NMFS for 26 years and has probably done more East Coast reef research than anyone else. He has been doing reef research with headboat surveys for about 22 years.

The Beaufort Laboratory of NMFS is the second oldest marine fisheries lab in the United States, with a long tradition of research. The laboratory was established after the pioneering efforts by Johns-Hopkins researchers and subsequently, researchers from Chapel Hill, N.C., in the 1870s. That work led to the establishment of this enduring laboratory in Beaufort.

Even though I am supposed to talk about marine reserves, I want to talk about reef fish, since the two are connected issues. Reef fish require warm water

and hard substrate, and North Carolina has both. I have some pictures that show the outer continental shelf has rocks with reef fish on them that supplied great catches in 1972. The fishery focuses on snappers, groupers, porgies and grunts. There are some 300 species of fish on North Carolina reefs, and at least 40 of them figure prominently in the catches. It is a very diverse fishery from a recreational point of view.

So that's the scene and the characters. Now let's find the crime. If you follow this fishery for 20 years and you want an indicator of what's going on off North Carolina, you can look at a chart of the average weight of species commonly taken by headboats off North and South Carolina.

For red snapper, scamp or gag (both grouper) and several other important species, there have been reductions in size to the tune of 75 percent or more. In other words, the fish are about a quarter the size they were in the early 1970s in North Carolina and South Carolina.

For 19 species chosen to represent the reef resource between Hatteras and the Dry Tortugas west of Key West, about 11 are currently overfished and some are dramatically so. The spawning stock ratio of the warsaw grouper, for instance, has been estimated over two years as either .02 of 1 percent or 5 percent on a scale of 0 to 100 percent, where values less than 30 percent represent overfishing. There are so few of them that it's hard to get a good estimate.

So now we have the crime. These population reductions can't be blamed on habitat changes or anything else. Every fisherman I ever talked to has a different criminal to whom he assigns the blame, but we all did it. Commercial or recreational, we have all taken home more than the system can produce.

We have implemented some fisheries management. We have some very elaborate and sophisticated schemes for garnering the agreement of fishermen. And principally, management has been through what I call conventional schemes, size limits and, to a lesser extent, bag limits and quotas for commercial fisheries.

Most fishermen and managers are quite comfortable with conventional management because we've been doing it for decades. But a lot of assumptions are forgotten in implementing this management scheme. These conventional management schemes are not guaranteed to work. They are based on what we believe we know about the fishery. But I don't think we really know all that we need to know or believe we know about these very complex systems, which occur 50 miles offshore, in 300 feet of water. Mankind has been exposed to them for only 20 years.

Conventional management implies that we know

the life history of the animal well; that we have defined growth, which we have for some; that we understand the reproductive biology, which we don't; and that we understand the implication of fishing on populations that change sex. Most groupers are thought to change sex at mid-life, so only the big old groupers are male. And some believe that hard fishing will leave too few males to sustain the population. With a reasonable approach to modeling, you can demonstrate that overfishing can cause excessive removal of males.

Conventional management implies that we understand the relationship between fishing and population levels. And generally, we think of this as a linear relationship; double fishing and you kill twice as many fish. Yet, there is strong evidence this isn't true on reefs. As the population decreases, the same level of fishing disproportionately removes larger and larger chunks of the population as fish keep reaggregating on the reefs and becoming differentially vulnerable. Fish disappear faster than you would expect.

Conventional management implies knowledge about the ecosocial factors in the population. We need to know how many grouper must remain in a population to sustain a spawning aggregation. And spawning aggregations appear to be a necessary feature of grouper reproduction. Grouper will come together from an area of a few miles and spawn periodically, once a year or maybe more. The groupers are known to do this in the Caribbean. Scamp and gag, two of the region's most abundant and important groupers, have been seen aggregating off Fort Pierce and in the northeastern Gulf of Mexico. So I assume they are aggregating off the Carolinas as well. But we don't know what level of population is required to sustain a successful spawning aggregation.

We assume the models we used for deciding whether a species is overfished represent reality in the fishery. Conventional management implies that we know the underlying values for building those models, such as natural mortality rate. And finally, conventional management implies that the criteria we have chosen are right. That is, 30 percent of the spawning stock ratio is correct. To be honest, we don't know whether it's 50 percent or 10 percent.

The marine reserve is another way to manage fish that does not require you to have as much knowledge.

Marine reserves are areas where reef fishing is precluded — not king mackerel fishing, not marlin fishing, nothing but reef fishing. The idea of reserves was generated by the reef fish plan development team of the South Atlantic Fishery Management Council, and in the South Atlantic it pertains only to reef fish.

Specifying that reserves pertain only to reef fish usually eliminates about 90 percent of the criticism about reef reserves.

Instituting a system of reserves implies that we know two things. One is survivability, and I will use that in a species and fish community sense. The assumption is that fish can get along without us. They have done this for 200 million years, which is about how long reef systems have been known on earth. Establishing reserves also implies that we can make reasonable guesses about how many and how big these reserves should be. Assuming we make a fairly reasonable guess at how to place and design reserves, the fish community ought to persist.

Reserves weren't dreamed up to harass fishermen with one more level of bureaucracy. They are favored because we realized the level of ignorance that the scientists and the councils were operating on and the level of uncertainty in the management process. And we thought the reef resource was too valuable to be left vulnerable to that uncertainty.

Reserves would provide four valuable features necessary to maintaining a fishery. We thought the reserves were needed to maintain the spawning potential of the populations, to maintain the genetic integrity of the species, to preserve the community structure that supports the fish and to maintain rare species.

First, let's deal with spawning potential. The larvae of most important reef fish are pelagic. They drift around in the open ocean. The eggs and the larvae float. Then marine reserves, where people can't fish, will become a source of larvae that would be carried to other areas by the ocean currents to provide a continuous source of young fish.

And if we choose, as this plan development team did, to establish reserves at the 30 percent minimum spawning stock level, the stock could never be fished below that point. If you caught every last reef fish outside the reserves, you would remain at the 30 percent level, which is a guarantee that would be important in preserving the stock. Or you might choose to go with 20 percent in reserves and take a chance that the other 10 percent will come out of the remaining 80 percent of the system.

Reserves are analogous to a very conservative, low-interest investment. These fish grow slowly and they live a long time. So you can build these reserves, live with them for 10 years and by and large, you won't lose any biomass. It will be growing and accumulating.

In the meantime, conventional management could be applied on 80 percent of the area. And if it's working fine, scrub the reserves. If it's not working, fine, you have money in the bank. You have municipi-

pal bonds or something that will take care of you in case your junk bonds (conventional management) go to pieces. And that's the whole notion of reserves with respect to protecting spawning integrity of the population.

For the greedy side of us, there is also the notion that adult fish will leave that reserve from time to time and sustain the fishery in its own right. There is a very good study associated with a marine reserve, Sumilon Reef in the Philippines, where that is exactly what happened. The reef fishery was great around a reserve there. They opened the reserve and catches went way up but then crashed for the entire area.

So there is documentation that marine reserves really work.

We want to protect the genetic integrity of the populations. As we have demonstrated with dogs, chickens and turkeys, we can change the populations rather quickly by just exerting enough influence on the population to increase mortality in those parts we don't want around.

For instance, if you get rid of all the small pups, bigger pups will occur. If you want no horns, keep killing all the cows with horns. It is easy.

And if we have fish in a natural system, the one reef fish live in, there is a high degree of uncertainty about survival of any given spawning. So almost all these species have evolved to spawn many times over their lifetime. They live a very long time, and the purpose appears to be able to spawn a long time. They are playing a crap game of life, throwing eggs and larvae into the system and hoping to make a hit and get a couple of survivors. Two offspring from any two fish are all that's needed to maintain a population in an unfished circumstance. And yet they lay millions and millions of eggs. That is some clue to how uncertain survival is in this environment.

And so in an unfished situation, the older fish, by and large, are producing the eggs. But under heavy fishing, young fish are all that's left. So it no longer pays to live a long time and spawn at an older age. You (a fish) will likely die before you spawn. It pays to begin reproduction as early in life as possible. And after a few generations under fishery selection, the fish don't get big and old. They begin shifting their energy into spawning and earlier reproduction. There's already some evidence that this is happening with vermilion snapper, a species that has sustained quite a bit of fishing.

Now a gag, for instance, is three times more likely to die from fishing than from natural mortality. So which is going to be the greater influence on the long-term genetic properties of the population, fishing or natural mortality? We are trying to prevent that from happening by providing reservoirs where

natural events shape the nature of the species.

I have already talked about preserving the age structure of the population in an unfished state because that structure may be important to spawning, sex reversal and maintaining reproductive fitness of population. But it's also important in terms of species composition of the stock. When you remove the predators, prey are liable to do some unexpected things.

I recently heard a very well-documented talk at Duke University about how the *diadema* sea urchins of the Caribbean — large, spiny, black sea urchins — are very common on heavily fished reefs of the Caribbean. When their predators are removed, they become abundant and eat all the algae, which are important for settlement of the fish larvae. So the fish system doesn't return until the area is rid of the urchins. That has happened with an epidemic in the Caribbean, but it was a very fortunate circumstance. It wasn't accomplished through management. So fishery systems can sit at stable equilibrium at different points and they can be driven there by excessive fishing.

So we want to preserve this native species composition. We don't want the entire South Atlantic shelf exposed to fishing. There ought to be a few places where the natural regime is allowed to remain.

Maintenance of rare species is the final issue I want to discuss. There are animals in both terrestrial and aquatic environments that are inherently rare and will never be abundant because of where they fit in the ecological system. They are high-order predators. They eat things that eat things that eat grass or other plants. For instance, there were never herds of grizzly bears. There were herds of buffalo. They ate grass. There were a few grizzly bears. They ate buffalo.

We have grizzly bears — large, rare predators — in the ocean. We have jewfish in the shallow waters of the tropics. In the deep waters of the Carolinas, we had grizzly bears too, warsaw grouper, which grow to 400 pounds. You won't find many of these now, but they were there. If you went to the mid-shelf reefs of the Carolinas in the 1970s, you'd have seen speckled hind in the 20-pound class. Today, the average size of speckled hind taken in the Carolinas is about 2 pounds. So we have really shifted that system around.

These predators are differentially vulnerable to fishing. They are very aggressive. If you were to fish on a Carolina reef in the 1970s, a speckled hind would be the first animal you would catch. They would apparently run right over and jump on your hook. And subsequently, you would catch the red porgies and vermilion and that sort of thing.

So these large predators are differentially vulnerable. Putting a quota on snowy grouper, which co-

exists with the warsaw grouper, won't necessarily protect warsaw grouper because they can be taken differentially quicker with respect to the snowy grouper. Right now there is a well-intentioned proposal to manage snowy grouper, a deep-water animal that cannot be released after capture, with a quota.

And finally, there is another rare grouper: the Nassau grouper. It is another kind of dominant grouper of the shallow reefs in the real tropics, the Keys and the Caribbean. And it is essentially extirpated throughout its entire U.S. range. There are still some, but the species is on a tentative proposed list of endangered species.

So it's apparent that a lot of these groupers are in real trouble. Reserves may be the only way to manage them. Size limits won't work, especially for the deeper-living species, because they'll die when they're released. Quotas won't work because big groupers are differentially vulnerable. Bag limits won't work. The catch is only about .0001 per angler day anyhow. There is only one way to preserve these animals.

As I mentioned earlier, marine reserves aren't a new idea. They are in place all over the world. There are some fishermen who believe that a bunch of nutty scientists want to try their pet theory, marine reserves, on them, and yet there are marine reserves in place on the Great Barrier Reef off Australia, New Zealand, South Africa, the Philippines and Bermuda. The grouper resources in Bermuda, like ours, were pillaged over a matter of about 20 years and marine reserves were the only apparent solution.

And so, marine reserves in the South Atlantic won't be new but only part of a growing trend in marine fisheries. Proponents of reserves are not trying to make life tough for fishermen. We are trying to get back to a system that produces quality fishing and maintains its integrity for the duration. So that is the story behind marine reserves and that is why some of us believe so ardently in them.

Robert Goldstein: I know there will be a lot of pressure and resistance from headboat fishermen and some others. They are going to say the reserves don't do any good because these fish don't migrate. There will be big fish in the reserves, but the fisherman is stuck with the little fish. Is there a plan for perhaps letting the reserve mature for 20 or 30 years, then opening it up and establishing another reserve adjacent to it?

Gene Huntsman: There are no plans for anything right now, so don't worry about dealing with reserves over the next two years. There certainly have been proposals of this kind called pulse fishing. The

problem is you will never establish the natural equilibrium in those systems because a reef population can be pruned down to the overfished state in a matter of a few weeks. You can accrue interest on your capital for 20 years and then bomb it back to where you were in a year. That's not the purpose of reserves. Reserves are supposed to establish this long-term steady state equilibrium of the fish population and invertebrates while 80 percent of the bottom is open to fishing. People think we are closing the whole shelf to fishing, and that's not true at all. There is 80 percent of the entire shelf open.

And certainly, we do not hunt on 100 percent of the land surface of the earth. We don't even hunt on 80 percent of it. But we can hunt right at this moment on every square inch of the South Atlantic shelf. From here to the outer edge of the shelf and to the Dry Tortugas there is not one spot that you can't fish. And that is, I think, an unusual circumstance. It certainly isn't analogous to the terrestrial system as we manage it.

Responsible Beach Bugging

John Newbold is a board member of the N.C. Beach Buggy Association.

I'm here to talk about responsible beach bugging and dealing with problems that occur on the beach. But I don't like the word "beach buggy," and I tried to get the name changed. I want to see us called "mobile sportfishermen," but there are some diehards who don't want to change the name. To me, it conjures up thoughts of little plastic-body cars with VW engines that dive over sand dunes. So get rid of that right up front.

If you have never been stuck in a beach buggy, it's like driving a motorcycle. If you drive it long enough, you are going to go down on it. No one has ever owned a motorcycle that he didn't go down. And it's the same thing with driving on the beach. Sooner or later you are going to get stuck. So I am going to mix responsible driving with a few other things.

A licensed vehicle is required in Dare County and other areas where I four-wheel on the beach. There are some remote northern areas near Corolla where you can tow a three-wheeler and run that unlicensed. But for the most part, it needs to be a licensed vehicle.

Be sure to check for local permits. Some people think they join the Beach Buggy Association to drive on the beach. I don't know where they get that idea. The Beach Buggy Association no more gives you permission to drive on the beach than buying a model

airplane kit qualifies you to fly a 747. So check for local permits. Nags Head requires a permit, which is just like a license plate. Other places up and down Carolina require the same permits.

Now, let's talk about basics. When you go on the beach, have a full gas tank. And be sure that you have plenty of oil and coolant and a full radiator.

People who live near the beach generally use radial tires, but weekenders who drive from the mountains sometimes drive military tires with big, heavy treads. Those big cleated tires are a job on the beach. Go for the radial if you have a choice.

I drive a Grand Wagoneer. I take my tire pressure down to 20 or 22 pounds and there's no problem as long as I don't make sharp turns. Dropping the air pressure saves wear and tear on the vehicle. It doesn't hurt the tires, it just saves beating up the vehicle.

As you go onto the beach, be sure about your transfer case selection. Put it in four-wheel high. Stay in high range with manual transmission and automatics. And in warm weather, don't run the air conditioner. That simply heats up the vehicle, and it's going to heat up tremendously anyway.

Enter and exit at designated ramps, which are at most access places where you can drive. Don't cut through somebody's yard or dune bust. You can put the car in gear and drive over a grassy dune in 30 seconds, but the damage will be around for 100 years.

Drive in the tracks of others. That area is already packed down and it's easier to drive. Loose sand is going to pull you down, but you can do it. The entrance at Oregon Inlet is probably a great definition of loose sand. Another is south of Avon where there's a crown and a steep gully. That is tough to run in, but it can be run in.

Avoid birds, vegetation, dunes and the heels of dunes. The heel of a dune is an easy place to drive. If you get into a jam and have to get off the beach, then you can drive here. But you shouldn't because you encroach on the little roots and damage this part of the dune. Drive here if you need to for safety; otherwise, run down near the water.

Let's also talk about rules of the road. First, people on the beach have the right of way. They are swimming and they can't hear you. There is noise and excitement and the last thing somebody on the beach is looking for is a car, particularly little people. When I see them, I just stop. If you see a child running around, the best thing to do is stop the car. I have stopped my car and had children run into it. The parents are screaming and I am stopped. The kid is fine, just scared. But if you see children and you don't know what they're doing, or their parents aren't looking, stop the vehicle to protect yourself. And

move around people with caution. Again, they can't hear because of the noise and children aren't looking for vehicles, bottom line.

If there is an established traffic pattern, drive like you would on a road. Stay right. Use your signals.

What about free-form driving? How do you like driving outside a shopping mall where there is marked parking, but it's late at night and you cut through and see another car coming? That's fine, right? Just pretend you're both boats and give the guy on your right-hand side the right of way. Free-form driving is easier where there's a lot of beach.

The best beach is in and around the tide line. The sand is tannish-gray and hard. It's an easy place to run. You get better gas mileage, and it puts less stress and strain on the vehicle.

But the width of the beach and configuration of the sand will change as you drive. There will be shells, gravel and the color changes. I go around that. There is no traction in gravel or shells.

As you are driving, look in your mirror. If you see water in your tire tracks, drive gently away from the ocean. You are down in a damp, wet area.

I run from 5 to 20 miles per hour, maximum. That's not to say I haven't driven faster, but there's no need for anything faster than that. The beach appears flat. But there are camels. You don't see anything, and all of a sudden the vehicle jumps and about throws everybody through the ceiling. At 20 or 25 miles per hour you can throw somebody out or turn the vehicle over.

Driving in front of vehicles fishing — there is a cute trick. Even though somebody may be very rudely set up on the beach, you can give him a home run if you drive in front of him. Go around him.

If you see a guy seine hauling, give him the same courtesy. He sets his nets out on the beach and pulls them in with a truck. He makes trips back and forth to bring in the net, and it will curl up on the beach. The last thing you want to do is run through that.

And be sure to watch the beginning and end of a net area where he has anchors. That is tough on the tires. As you drive, watch for logs, driftwood or dunnage. A lot of ships will lose dunnage in storms or simply throw it overboard. But you will see big pieces of timber, sometimes with big nails that will flatten a tire. So don't drive over timber. If you see huge pieces of wood, it's conceivable that it is an old shipwreck that had big spikes to hold the lumber together. That will stop you.

Also avoid the steep, narrow passes. Near the Sea Ranch in Kill Devil Hills, some of those passes are impassable for my comfort level. There is no need to take a \$15,000 vehicle and prove that I can go through that pass. Avoid those for your own comfort

and vehicle safety, because invariably you slide down sideways where the sand is real loose and sugary. And cutting your wheels will aggravate it. So be careful about these restricted, limited areas. It's an area I don't choose to run in.

Driving through overwash, where the sand is extremely soft, can get your vehicle stuck. Oregon Inlet is a great place for this, where the ocean comes in and puddles where the sand can't soak it up anymore. If you've ever walked on the beach and suddenly your feet just suck in, your vehicle can do exactly the same thing. Stay away from the edges of ponds where there is overwash because it can take you right straight down. Be careful when you drive at extreme low tides that you don't get trapped with water behind you.

Hot rodding, cutting doughnuts: I won't even talk about that except to say that I've seen doughnut cutters turn over. The rims dig in the sand and that just takes the vehicle and dumps it.

Drinking and driving on the beach — I think the results are the same as on the highway. You may not have a high-speed head-on crash, but you will certainly get yourself in trouble. And the park rangers deal with it in much the same way the police would.

If you're stuck, spinning your tires and throwing sand, make sure you're in four-wheel drive. Check for too much accelerator where the wheels are chucking sand back and too much air pressure. Check to make sure you're in the right gear, particularly on three- and four-speed, small V-8 engines. You can get in trouble in a hurry in those.

Again, the wrong tires can cause problems. The key is to remember you want to move the vehicle, not sand. And if you are throwing sand around, you are not moving the vehicle.

Suppose you start to chug down, your truck starts to chatter and you know you're getting stuck. You have some choices. A lot of people just use more gas, but as a rule, that hastens their demise. If your truck is chugging, invariably you are going to bury yourself. My suggestion is to stop right then while your tires are still up and you haven't framed out. Framed out means the vehicle is postured so that you've spun all the sand out from under the tires and the vehicle is literally sitting on sand. If you have positive traction and step on the gas, both rear wheels go, and most four-wheel drives don't have positive traction. The tires have to be able to dig and move freely. If I'm down that low, I might put the transfer case in four-wheel low and rock it back and forth a couple of feet to pack it and drive. Or I would dig out the sand and make a ramp for the wheels, perhaps out of driftwood. Clearing the path for your tires makes it easier and guarantees your chances of getting out. The best

gear in any vehicle is reverse. And I don't care if it looks silly, if you have to back a half-mile to get out of a jam, use reverse and back out. It is the strongest gear in your vehicle.

Or you can do something else. In jacking up, you can put boards under. Something I have done is jack up and push the vehicle. Now, you wouldn't want to shove a \$23,000 Explorer on a jack because that might damage the undercarriage. But if you have an old beach bomber, jack it up and push the back end. That changes the position where the rear tires will fall and gives some traction.

Fill the holes that you leave with sand. If you don't, the next guy is going to dump in it. Again, making a runway by rocking back and forth and then driving out generally works.

Towing is a neat way to get out. There are several things you can tow with — a chain, a rope and a bungee cord, the bungee being the best choice. You can hook them up, and the tow car goes fast; the cord gets stiff and pops the second car out. They are very slick. They don't do the damage that a chain does and you don't need the tension that you would on a rope or a chain. It works great.

If you are going to fasten a tow line, hook it to the frame and not the bumper or the steering arm. I have seen many a piece of plastic, which is all these cars are anymore, ripped right off in an attempt to tow. Somebody throws a rope around the front, starts and the grille and three headlights come off; the car is still stuck and the other guy is going down the beach with your grille. Get it on the frame. As I said, my choice is the bungee cord, then the rope and a chain is a last resort.

A power winch is terrific, though you don't see many of them on new cars. You can winch yourself out of a hole. People don't think that is true. If you have a power winch on your truck, you can pull yourself out without another vehicle. Dig a hole in front of your truck, wrap the tow line around the shovel and bury the shovel in the hole. Then the winch will pull the truck free.

These trucks are going to want to overheat, particularly in the warm weather or when you are running with the wind. If your truck overheats, turn into the wind, open the hood, idle the engine, turn on the heater full blast and get out. When you turn on the heater, you're opening some additional feet of hose. It lets the water run through a more expanded cooling system in your vehicle.

There is some equipment that I take to the beach. Fishing gear stow, bungee cord, fire extinguisher, a board in case I have to jack up, a shovel that folds up and a flashlight. I also carry oil, transmission fluid, fresh water, a tire gauge, first aid kit, spare tire, litter

bags and a tiny tire pump that plugs into the cigarette lighter. It's a 12-volt air compressor that requires seven to nine minutes to pump each tire. But it's slick and it really works. I've also seen very sophisticated vehicles where people have compressed air tanks in the vehicle and they fill up their own tires.

You will see a lot of interesting stuff. If trucks interest you when you are on the beach, look at them. There are a lot of neat ideas, a lot of neat stuff.

Once off the beach, wash the car. I spend 20 minutes under the car with a hose. Sand and salt will pack up underneath and in the wheel wells and the rocker panels. Periodically, I cover the distributor with tinfoil and hose down the engine with fresh water. I also change the oil often. If I overheat, I change the oil, period. Service the four-wheel drive hubs once a year.

Watch areas that are roped off for turtles or nesting birds. Get maps if you're on the outer barrier islands because they're difficult to see.

Hook-and-Release

Dale Ward of the N.C. Division of Marine Fisheries showed a film on catch-and-release, "Pass It On." The 28-minute video was produced by the National Marine Fisheries Service with Sosin Communications using a MARFIN grant. It explains how to release a fish so that it has a chance of survival — a skill that is increasingly important as stocks decline and regulations limit the catch an angler may keep. The video can be borrowed from NMFS by calling 813/893-3144 or writing Ron Schmied, NMFS, 9450 Koger Blvd. St. Petersburg, FL 33702.

The Newly Discovered Attack Alga and its Relationship to Fish Kills

JoAnn Burkholder is an associate professor of botany at N.C. State University and a member of the Marine Fisheries Commission. She discovered an attack alga associated with recent fish kills in the Pamlico Sound.

I am here to talk about a new toxic dinoflagellate that you might have heard about. It's been called a "phantom" alga, and it does exhibit attack ambush behavior toward fish. Those things are true. But there is a lot of spectacular information about it that isn't true. It has appeared in the *National Enquirer* as a killer slime that comes up and attacks people on the beach. None of that is true.

We are starting to accumulate a lot of information

about this alga. And one reason why I'm giving this presentation is to encourage estuarine fishermen to help us hunt for it. We really need your help.

First, I want to give some information about what dinoflagellates are. They are microscopic, one-celled algae, primitive types of plants. The toxic varieties photosynthesize like normal plants do, but they can also act extremely animal-like. At the same time they are photosynthesizing like plants, they can be attacking an animal or another alga, engulfing it or causing it to die and then feeding from it. They walk a "twilight level" between plants and animals.

Normally, a transverse canal or groove that goes around the middle of the cell gives the appearance of an upper and lower area. There is also a longitudinal groove in the lower part of the front of the cell. There is usually a flagellum that girdles or encircles the cell. It has a helical structure that causes the cells to spin through the water. And then a longitudinal flagellum trails out at the posterior end. These cells are usually 5 to 50 micrometers in diameter, although there are a few species that are visible to the human eye.

North Carolina is not the lone host to these toxic dinoflagellates. They are occurring increasingly around the world and spreading to new areas in what some scientists are calling a global epidemic of harmful alga blooms. The species I'll be discussing here is notorious because it is referred to as an especially "bad actor," which it is. But around the world in the past decade, at least eight new species of toxic phytoplankton have appeared out of nowhere and caused fish to die in massive numbers. We didn't even know these algae existed before a few years ago. And not only are these species there now, they're coming in massive numbers and killing fish. North Carolina is not alone in this, but it was the first place where the algae that I will discuss was discovered.

Researchers think that this global epidemic can be linked to the nutrients we have put into our estuaries over the past 50 to 70 years. We have poured fertilizer bag after fertilizer bag of nitrogen and phosphorus into our estuaries. And one hypothesis is that the environment has slowly shifted in favor of these organisms.

In places like New England, the waters can get depleted in silica; and whether or not silica becomes a problem, nitrogen and phosphorus all over the world are increasing through these fertilizer effects. Our waters are rich in silicate clays, and the beneficial algae such as diatoms will not run out of silicate. The diatoms use silicate to make their cell walls, but most algae don't need it. Just the same, this ratio of nitrogen and phosphorus and silica concentrations is shifting in our waters to favor flagellates — among them, toxic dinoflagellates — over the beneficial

diatoms.

Our story began in the N.C. State University veterinary school. Two fish pathologists, Ed Noga and Steve Smith, collected some water and fish from the Pamlico River and distributed it among their experiments. They were set to do experiments on fish pathology when suddenly their fish began to die. They tested the water for all known pathogens, heavy metals, toxicity, potential pesticides, but all the results were negative. They scrubbed out their aquaria and filled them with artificial seawater that they mixed themselves. They also bought some fish from a shop that they knew wouldn't be contaminated from anything in the estuary and tested the aquarium to make sure that their cleaning process had been effective. Within two weeks their fish were dead again.

They tried concentrated acid. It didn't work. Whatever it was was sticking to the sides of the aquaria. In later tests, we learned that the cysts or dormant structures of this alga can be immersed in strong acids and bases, and a small percentage will survive and produce toxic cells when they are placed back into seawater with live fish.

Noga and Smith determined that a small alga was swimming in the water when the fish were dying, but it disappeared when the fish were dead. They thought they might have a toxic dinoflagellate in their aquarium. And when we looked at a water sample they gave us, we saw a toxic dinoflagellate.

This alga is about 10 micrometers in diameter, or about 1/20,000 of an inch. It can actually transform within two minutes from a plantlike, flagellated swimming cell to an animal or an amoeba stage, and in fact, many different stages. But we didn't know this at the time, and when we showed one of the transforming stages to state biologists, they thought it was a fungal spore.

Given the strange behavior we saw in culture, this alga seemed to be very abundant in the water when fish were dying in the vet school aquaria. But once the fish were dead, it disappeared by forming cysts and dropping to the bottom in a dormant structure. Only the presence of live fish seem to stimulate it to come up and kill by excreting a very potent toxin. We really didn't have much more to go on except its behavior at this point.

But we began to put two and two together. Smith and Noga weren't certain where this alga had come from. They suspected the Pamlico River. My lab associates and I decided that perhaps a fish kill in progress would be the only chance we'd have of tracking it down; perhaps when the kill was over it might be too late to detect it.

In May 1991, Kevin Miller, a state biologist in

Washington, N.C., collected water samples at a menhaden kill in the Pamlico River when fish were still dying. We took the samples back to the laboratory, and the dinoflagellate was swarming in the water. When the state biologists returned less than a day later, there was almost no trace of it left in the water, although floating fish carcasses still remained.

We verified in culture that it was the same species that we'd seen in the vet school culture contaminant, and we tested it to see whether it was toxic to fish. Sure enough, it exhibited the same strange behavior that we had seen in the original unknown origin culture contaminant.

We conducted three repeat-trial experiments by putting fish into some water with the alga to see what would happen. In each trial, the first fish was added at day one. The trials differed only at the point when a second live fish was added. (See Figure 1.)

In trial one, the fish died after three days and the active, toxic flagellated vegetative stage of the alga declined as it encysted. The concentration was at about 1,000 dinoflagellate cells per milliliter (1 mL equals .03 fluid ounce). There was no bloomlike coloration of the water. When the second live fish was added after 10 days, this alga was really stimulated because it had been recently metabolically activated to produce its toxin — it had been given another fish. It killed the fish after three days, but produced many more cells while doing so. Upon fish death, the cell numbers subsided. The alga produced cysts and went down to the bottom of the aquarium.

In trial two, the first fish was added at day one and died after six days at a cell count of only 300 dinoflagellates per milliliter. The second fish was added only three days after the death of the first. In the first trial, a substantially longer period had passed before the second fish was introduced. But in trial two, the curve shifted to the left and the fish died more quickly. The alga was strongly stimulated, the cell numbers really increased and when the fish died they went down to the bottom of the aquarium again.

In trial three, the second fish was added only one day after the death of the first fish. The curve shifted to the left as expected, with the same bizarre behavior in response to fresh fish.

The alga cues in on a substance in fresh fish excreta that we are working to identify. A little of this substance also appears to be in shellfish excreta. When the fish die, bacteria can enshroud them within only a few hours and probably cut off the chemical signal. And then the cells "lose interest"; the toxic flagellated vegetative stage of this alga simply isn't interested in the carcass.

We became very interested in the biology of this species, what its life cycle is like, when we saw this

bizarre behavior. Graduate student Cecil Hobbs and I tried to develop some good microscope techniques to really see this alga. It required scanning electron microscopy, which produces more highly magnified photographs than light microscopy.

The photographs show that the cells come out of their cysts a few hours after a live fish is added to the aquarium. They have the typical dinoflagellate morphology, a transverse groove in the cell, longitudinal groove. Most had excysted, and they probably were becoming metabolically active after this live fish was added.

When this cell is at its optimal salinity — about 15 parts per thousand, or midway along an estuary — it becomes very swollen in the presence of live fish and doesn't need the fish right next to it. One of the first effects of the toxin is it literally begins to strip the skin off fish, especially striped bass. Other fish are less susceptible but similarly affected. The dinoflagellate can be separated from direct contact with fish by a finely porous membrane that allows chemical communication; the toxin can still get through to the fish, and the substance in fish excreta can pass the other way to the alga. The alga goes through its whole life cycle, but it isn't very excited about it. It doesn't produce very many cells, but it will reproduce.

But when fish are placed in range of direct contact with the alga, or when we feed the alga little flecks of fish skin or tissue, it becomes very swollen and a tongue-like extension called a peduncle attaches to the fish tissue and sucks out the contents. The peduncle sometimes has fingerlike extensions that literally burrow into the fish tissue as it consumes it.

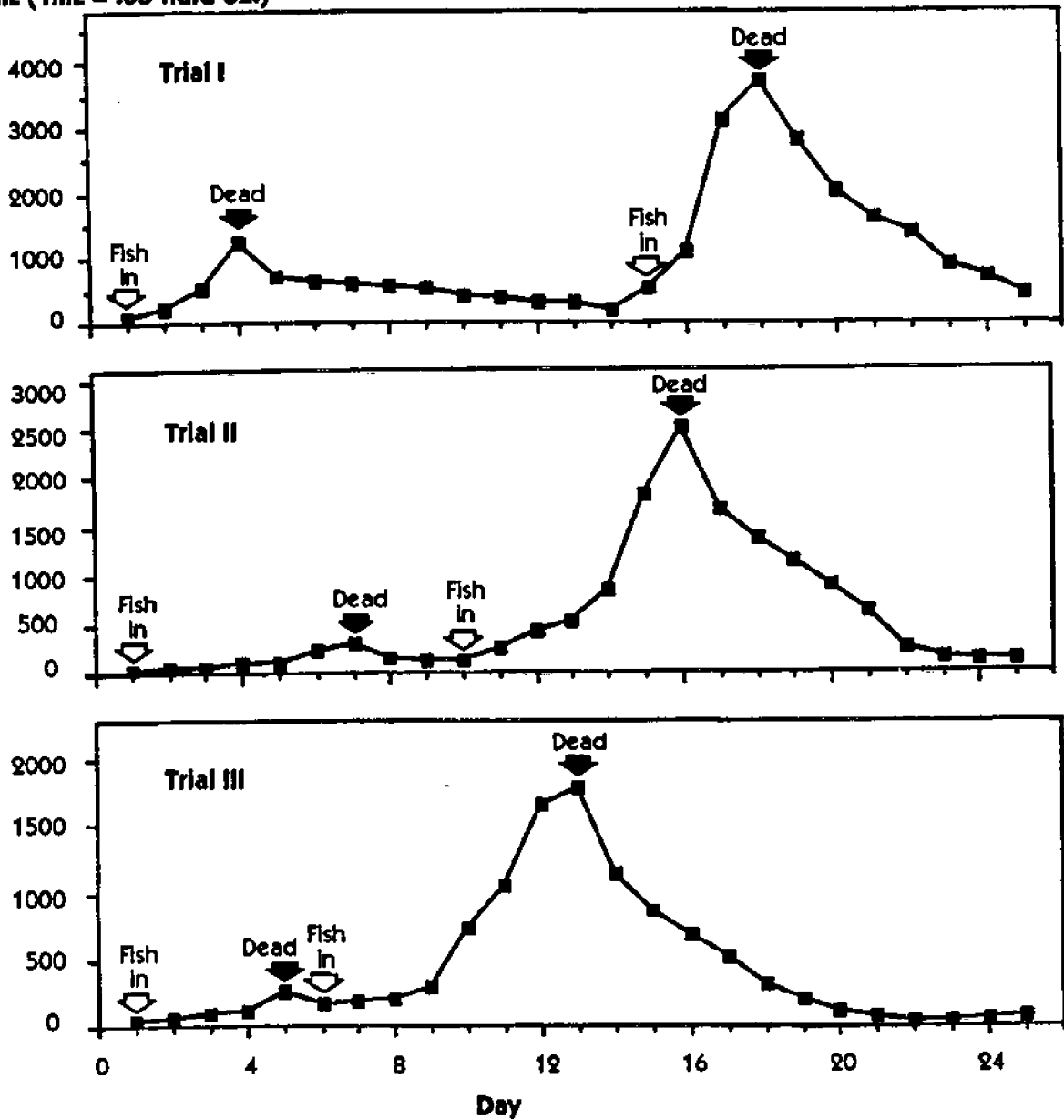
This alga is only stimulated to undergo sexual reproduction when it is killing fish. The male and female gametes only fuse when in the presence of dying fish. However, if fish are removed and phosphate is added, although the gametes don't complete sexual reproduction (i.e., don't fuse), they do keep reproducing more male and female gametes. And if a school of fish swims into the area, the gametes then complete sexual reproduction, resulting in more toxic cells that begin to kill.

So it turns out that this dinoflagellate does indeed cue in on phosphate. The gamete stage is very strongly stimulated by phosphate enrichment even without fish. So given a naturally phosphorus-enriched estuary, perhaps "helped out" by additional phosphate availability from Texasgulf Inc., it is probably no accident that the majority of the fish kills caused by this dinoflagellate have occurred in the Pamlico. The alga seems to be mildly "interested" or stimulated by low concentrations of nitrate, but it shows no response at all to ammonium. We don't

Figure 1

**Repeat-Trial Experiments
Rate of Fish Death When Introduced to Dinoflagellate**

Cells/mL (1mL = .03 fluid oz.)



Response of the dinoflagellate (toxic flagellated vegetative stage) to tilapia fish (3 cm long, 40 days old) in repeat-trial experiments. The trials were conducted in batch-culture aquarium bioassays, which varied in time interval between death of the first fish and addition of the second live fish (5 cm long). The toxic vegetative stage attained greatest abundance just before fish death, followed by rapid decrease in abundance as the cells encysted or formed nontoxic, colorless amoebae and settled out. As we reduced the time interval without fish, the second fish died more quickly (from Burkholder et al., 1992, *Nature* 358: 407-410).

think that the stimulant in fish excreta/secreta is an inorganic simple nutrient, because dead fish have a lot of ammonium, for instance; but the toxic flagellated vegetative stage of the alga does not remain active when fish carcasses are available — only when live fish are available.

The gametes, however, accumulate under phosphate-enriched conditions even without the fish, so they can serve as an inoculum in the water column. If a school of fish swims by and the gametes are available, they will fuse and start to kill the fish. It is not necessary for the cysts on the bottom sediments to be able to detect fish, so the substance in fish excreta doesn't have to travel as far — the gametes are in the same area as the fish, up in the water column.

Therefore, the alga is extremely versatile. It has an inoculum in the water column that is ready to go; it has another one in the sediment that is ready to produce toxic cells when a school of fish comes into an area.

When we take the live fish away, the little toxic flagellated vegetative cells begin to do one of two things. We have found them encysting, spinning a weblike material with little scales at the bottom, to form dormant benthic cysts that sink out of the water column. The cysts have very tough walls to protect them. They are capable of surviving desiccation for 35 days, and they can lie dormant for two years and then come out and kill fish. These are the structures that withstand concentrated acid and concentrated base. The toxic flagellated vegetative cells can also form animal-like amoebae with pseudopodia.

If we want to reverse the process and cause more of the toxic vegetative cells to appear, we add live fish, and the algae quickly emerge from the cysts or excyst.

If live fish aren't added, the algae will continue to encyst until cyst formation is complete. The new cyst is covered by scales with long hairlike structures at the end. This type of structure would be easy to see in sediments, but after a month or so the long hairlike structures fall off. It also looks like the scales fall off pretty easily too. So they may not be that easy to identify in sediment with a smooth cyst wall.

As I stated previously, we need your help translating this information into what the alga is doing to cause fish kills in our estuaries. Prior to its discovery in the Pamlico in 1991, we can only speculate. But even there, the data are interesting. For example, we went back to 1988 when the Pamlico Environmental Response Team was active. That year, 82 fish kills were tracked by state workers and volunteers between June and December 1988. And 22 of those, or one-quarter, had no known cause, though the fish exhibited the same symptoms as the fish in the lab experi-

ments. They suddenly began to exhibit panic, they looked like they were suffocating. The skin flecked off and lesions developed fairly rapidly. In some cases, the fish actually tried to leave the water and beach before they died because the toxin attacks the nervous system and paralyzes the muscles so that they suffocate. These fish are sometimes trying to get out of the water, gulping for oxygen as they die. Diseased fish were found in 22 additional kills, so we were suspicious that this alga could have been causing a major proportion of fish kills in the Pamlico, at least.

Figure 2 shows some of the kills since 1991 in which we have actually documented the alga swarming in the water. We also confirmed toxic activity by taking some of the water back to the lab, putting it into aquaria with live fish and verifying fish death in response to the alga.

In most cases, the alga was actually "swarming" at 300 cells/mL or higher when it was causing fish kills. In the Pamlico, the temperatures varied from 9 to 31 C/48 F to 88 F, but we now know that this alga kills or is capable of killing from just above freezing to bathwater (4 C to 33 C/39 F to 91 F). And the salinity ranges from 3 to 35 percent in documented fish kill areas, but we also have caught it causing a major striped bass kill in an aquaculture facility at zero parts per thousand salinity or freshwater, when the water was high in divalent cations like dissolved calcium. So the dinoflagellate has extremely wide salinity tolerance and a wide tolerance for temperature when it kills.

The longest kill on record that was caused by this dinoflagellate occurred in 1991 during a six-week period on the Neuse River in the Minnesott Beach/Cherry Point area. Menhaden were literally bulldozed off the beaches during that time, and it's estimated that about 1 billion died.

There have also been quite a few kills this winter in places like the National Marine Fisheries Service office in Beaufort, so there have been aquaculture-related kills since the July data. The most recent was in the Dept. of Zoology aquaculture facilities near Varsity Drive at N.C. State University.

Noga is studying fish lesions that are caused by this organism. When the dinoflagellates are in aquaria with fish for a period of time, they cause lesions and hemorrhaging. This dinoflagellate really likes fish blood, so we believe that the hemorrhaging helps it to feed.

Now I want go quickly through what this alga can do in the water. When I say it is versatile, I'm not just talking about versatility across temperature and salinity gradients. I'm also talking about the many forms or appearances it can assume.

Figure 2
Fish Kills
May 1991-February 1993

And documented activity of North Carolina's toxic fish ambush predator dinoflagellate.

Date	Location	Salinity (0/00)	Temp. C/F	Affected Fish	Dino (Cells/mL)
1991-					
May	Pamlico, Blount Bay	6	28/82	Menhaden (net)	1,300
June	Pamlico, Tripp Pt.	8	28/82	Menhaden, others	1,100
Aug.	Pamlico, Washington	6	30/86	Menhaden	600
Aug.	Pamlico, Hawkins Bend	12	29/84	Flounder "walk"	800
Sep./Oct.	Neuse, Cherry Point	8-10	18-27/ 64-81	Menhaden, Blue crabs	1,200
Dec.	Wrightsville Beach	30	17/63	Menhaden	40
Dec.	Taylor Creek	30	15/59	Flounder "walk" (Flounder, eel)	35,000
1992 -					
Jan.	Aquaculture (Pamlico R.)	0	6/43	Striped bass	Subdom.
Feb.	N.C. Maritime Museum Beaufort (Newport R.)	27	21/70	Fish spp.	All stages
Feb.	National Marine Fisheries Service, Beaufort	24	19/66	Fish spp.	All stages
July	Pamlico, Hawkins Bend	10	27/81	Menhaden, others	280
July	Neuse, Minnesott Beach/ Cherry Point	9	26/79	Menhaden, others	340
Nov.	NMFS, Beaufort	25	14/57	Flounder	N.A.
Dec.	Topsail Beach	29	9/48	Menhaden	N.A.
1993 -					
Jan.	NMFS, Beaufort	28	20/68	Bay scallops, sea urchins	Large amoebae
Jan.	Dept. of Zoology, NCSU	15	20/68	Tilapia, white perch	All stages

State agencies and universities are launching full-scale efforts this summer in Delaware Bay and the Chesapeake Bay to go after this organism, but they don't know what to look for. These areas have sudden-death fish kills. We already have tracked it to the Delaware Bay, but it is difficult to identify this dinoflagellate because the alga is incredibly versatile in changing shape. It can form long, starlike arms going into amoeboid formations. That is, it can actually transform into what we would normally consider an animal. A much larger cell, a zygote, is formed from sexual reproduction (fusion of the gametes). And most specialists who study phytoplankton have told me that they would never have linked these forms as all part of the life cycle of the same organism.

The dinoflagellate can do other bizarre things as well. It can form one or two puffy, bloblike extensions; normal flagellated vegetative killing cells; or amoeba with long armlike (lobate) structures. It doesn't stop there. It can form completely colorless amoebae that are 20 times longer than the vegetative cells. That is much bigger than the little killing cell that we initially thought was the only stage it produced. When these amoebae are in the presence of fish, they can produce little sporelike flagellated cells that develop into the toxic vegetative cells again and start to kill. Meanwhile, we kept vials of this material in a dark cupboard for four months, and when we opened the bottle, these amoebae were oozing along the bottom, feeding on bacteria. We now know that these amoebae are all over the estuary, whether fish are present or not.

And this type of amoeba is also toxic. It acts like the little flagellated cells — it can come up, kill fish, go back down to the sediment, just like the little swimming cells can. But it's 20 times longer than they are. This means it is the same size or bigger than potential predators — rotifers and copepod zooplankton that would be able to consume the little flagellated cells. These large toxic amoebae apparently are especially active under colder conditions.

We have discovered some rotifers that will consume this dinoflagellate. This work is being completed mostly in my laboratory in conjunction with Michael Mallin, a visiting professor at UNC-Wilmington. Although it looks as though rotifer egg production is not affected when the dinoflagellates are a food source, they do slow down and appear somewhat narcotized.

My hope, however, was mostly in the first predator of this dinoflagellate that we discovered, a ciliated protozoan called *Stylonichia*. I was very excited when I saw this little animal in our cultures eating the toxic flagellated vegetative cells of the

dinoflagellate. Unfortunately for *Stylonichia*, it seems to do something the rotifer doesn't do as much. After a certain period of time, it apparently excretes some substance that the dinoflagellate reacts to and it swarms around the protozoan like crows attacking an owl. If we follow it through the microscope, we see this little protozoan trying to slink out of the way, but the cells keep attacking it. And then the remaining zygotes, or the larger cells from sexual reproduction, quickly convert to the large toxic amoebae, which engulf the protozoan.

We would really like to know the dinoflagellate's history in North Carolina estuaries and elsewhere. It's probably been here for a long time, but again, it is likely that nutrient enrichment to our estuaries has slowly shifted the environment more in its favor. We can get some of this information by taking sediment pours if we can figure out how to identify the smooth-walled cysts.

What and where is the seasonal distribution of the various life history stages in our estuary? Pat Tester, a NMFS research scientist, is helping us work on this question. How important is this organism in causing fish kills? That is a key question that we want to go after. The last two years of data — 1991 and 1992 — identified it as the causative agent in at least one-third of the major kills in the Pamlico and Neuse estuaries. Major kills cause the death of more than 1,000 fish. (See Figure 3.)

What is the potential for chronic synergistic interactions with fish pathogens? Noga's preliminary data suggests that just one sublethal chronic hit from this alga will cause long-term effects on the fish's reproductive ability and weaken the fish, making it more susceptible to opportunistic pathogens such as fungi.

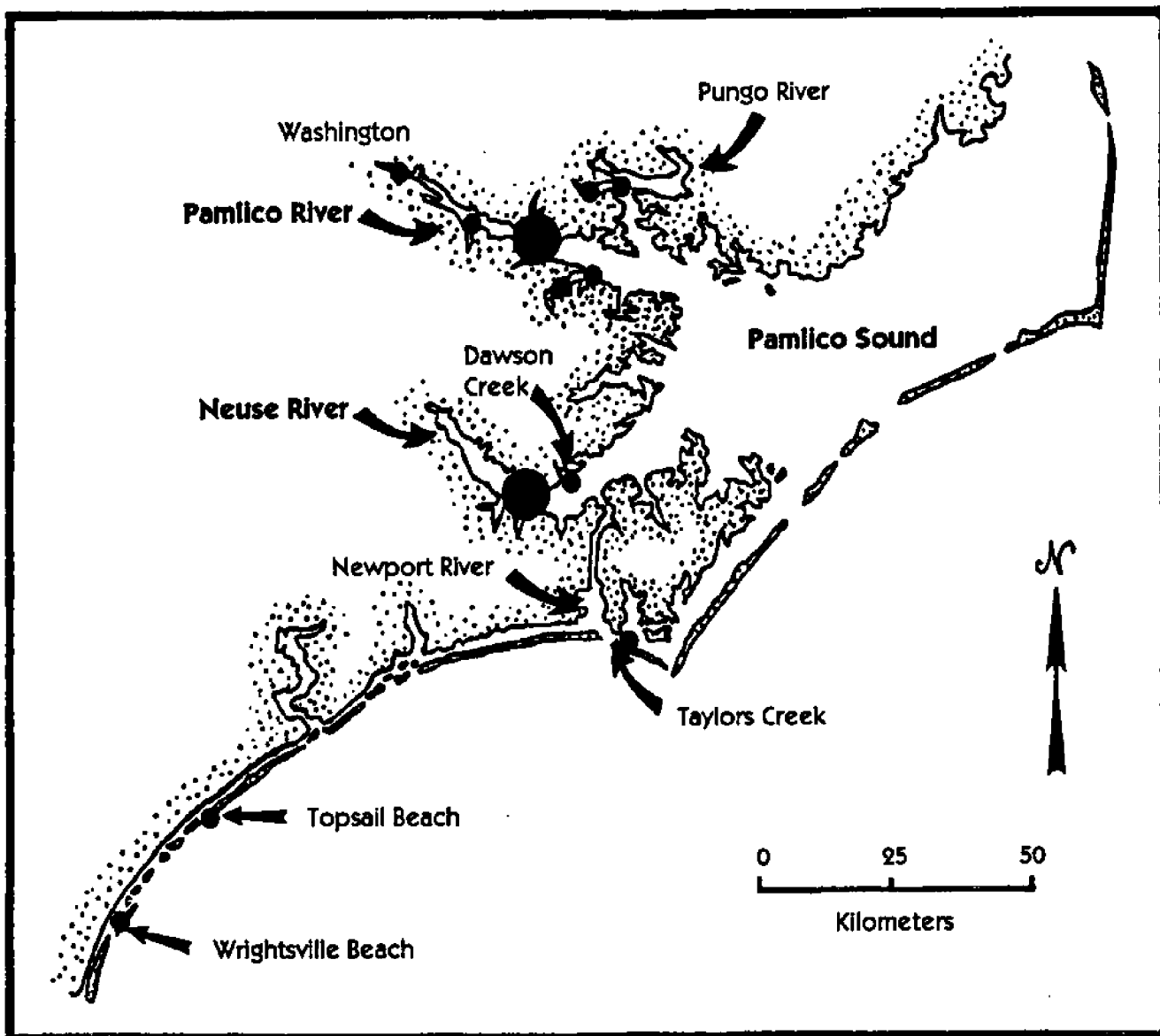
In food interactions, we know little other than the preliminary work with potential zooplankton predators. We don't know how it interacts with other phytoplankton. As the amoeba, it could be eating other animal and algal prey. How does it affect recruitment stages of commercially important fish? We want to go after that question. We do know that menhaden eggs won't even hatch when flagellated cells are in the water.

And finally, do we have much hope for biocontrol with natural predators such as the rotifer? I don't hold much hope for *Stylonichia*, but the rotifer may offer some possibilities for biocontrol.

As I mentioned, 14 other countries, as well as states along the mid-Atlantic, Gulf and Pacific coasts, are now hunting for this alga because they have increasingly encountered sudden-death fish kills with neurotoxic symptoms, the kind of event this alga would cause. It cannot be easily detected unless the

Figure 3

Fish Kills Associated with Toxic Dinoflagellate



Locations of fish kills associated with the new toxic dinoflagellate, *Pfiesteria piscimorte*. Kill sites are designated by blackened circles, with large circles representing sites where fish kills are most frequent with considerable area affected. The large circle on the Neuse River at Minnesott Beach-Cherry Point represents the highest known loss of 1 billion American menhaden, wherein fish were bulldozed from the beaches over a six-week period (from Burkholder et al. 1993, final report to the Albemarle-Pamlico Estuarine Study).

water is sampled while fish are dying — the biologists would have to be at the scene of a fish kill, or shortly thereafter. So with well-timed sampling, we are starting to develop programs to track it.

I'm sure of one thing: we really are not alone. In February 1992, a Maryland report described neurotoxic symptoms followed by sudden death of sheepshead minnows and other fish in a tributary to the Chesapeake Bay. Similar kills have occurred there with menhaden. And similar kills have been reported spring through fall for the past three years. In each case, there was no oxygen stress and no other discernible cause. During each kill, the small dinoflagellate was swarming while fish were dying — but shortly afterward it disappeared.

Unidentified Speaker: In all the water samples you took, did you see what the phosphorus content was?

JoAnn Burkholder: We are working on that now. We have little phosphate data from state records, but we are getting nutrient data from recent kills. We are also trying to determine the chemical trigger that causes the toxic dinoflagellate cells to come out of excyst. We're pretty certain we know the compounds from fish excreta that trigger toxic activity, but we need to test those compounds with high performance liquid chromatography and other fine-scale techniques.

Unidentified Speaker: When it's present, does it attack all fish in the area or are certain species more susceptible?

JoAnn Burkholder: Striped bass are most susceptible. Every exotic and naturally occurring estuarine species that we have tested has died, including blue crabs, scallops, striped bass, mullet, menhaden, spot, croaker, guppies, goldfish and many others.

So whatever it is, the trigger is a general substance that is excreted by fish. Obviously that substance isn't toxic. Fish produce it all the time. So it's possible that over time we might develop some way of putting this chemical in water, tricking the alga to come up and then killing it. But we would probably kill everything else in the area at the time.

The map shows most of the fish kills so far. If you see a kill in progress, or it has recently happened, dip a container into the water to elbow's length. Keep it shaded and call us. We will reimburse you for the call, and we will arrange for the samples to be sent to us. (See protocol for sampling water on page 57.) Catching this dinoflagellate in the act of killing fish is

difficult because this is an ambush attack predator and it is ephemeral. It is very short-lived in its most toxic form in the water column.

Unidentified Speaker: If these are as widespread as you say they are, why aren't fish in Pamlico Sound attacked all the time?

JoAnn Burkholder: That's a good question. It reaches a threshold. Most of the kills occur in upper tributaries or midway up the Pamlico or Neuse rivers. In fact, the two biggest circles on the map of fish kills are almost in line geographically, midrange up in the estuary.

But in tributaries that are shallow and poorly flushed, fish may linger and feed for an extended period of time. They get hit a lot there, especially menhaden. Now, naturally if a fish is feeding at the bottom of the water column, the toxic dinoflagellate may detect it and kill it. But nobody notices one or two fish. All the fish in a school, however, are excreting in higher concentrations. And remember, the toxin first affects the skin and causes the fish to lose more of the substance that stimulates them. Also, one of the first effects of the toxin is to "drug" or narcotize the fish, making them lethargic so that they tend to stay in the area.

So this substance from fish excreta will accumulate in the water at some threshold that is adequate for the cysts to detect or the gametes to begin to fuse and forming the toxin. And that's what we think is going on. It explains why we don't think there will be many kills in open waters that are better flushed, although there have been a couple. Remember, the alga was present but not swarming. There were kills off Topsail and Wrightsville beaches, which are open areas. But the dinoflagellates were not at the concentrations that we've seen in shallower, poorly flushed waters where that fish-excreted material can accumulate.

Unidentified Speaker: How does aquaculture get infected?

JoAnn Burkholder: By bringing in Pamlico or Neuse river water or waters from other estuaries that are contaminated with this dinoflagellate. But some white perch from the Neuse River caused the kill that just occurred off Varsity Drive. It is widespread. Certain conditions are needed for it to accumulate enough to become toxic and kill, but when it starts, 300 cells per milliliter or very low concentrations can kill fish.

We've tried crab experiments. We brought in 10 crabs from the Neuse River near Taylor Creek, and

Protocol: Sampling for the New Toxic Dinoflagellate

1. When a fish kill is in progress (finfish and/or shellfish), please observe whether the water is discolored in the vicinity of the kill. Also, note whether the fish are exhibiting erratic behavior, "sudden death" over a short period or other symptoms that lead you to suspect that the toxic dinoflagellate may be involved.

2. If you suspect a toxic alga, please contact JoAnn Burkholder or Howard Glasgow at N.C. State University (919/515-2726 or 515-3421) or Ed Noga (919/829-4236). Messages can be left on the answering machines, which will be checked at least twice per day.

3. We would very much appreciate your help in obtaining grab samples from water in the kill area (an elbow's length below the water surface), including:

- about 1-2 cups of water without preservatives, kept in the shade at field/room temperatures;
- about 1/2-1 cup of water preserved with acidic Lugol's solution, which we will be glad to supply. Just add enough (dropwise) to make a golden-orange color (.01 percent solution — can be judged roughly by eye, from water color).

Any clean, well-rinsed plastic or glass container can be used. It would be best if the samples are collected in the same manner by all who would like to help. If you are only able to sample in one location, please collect water where the most fish are still dying; or, if the fish are already dead, then sample where there are high numbers of dead fish that are drifting toward shore. If you don't happen to have preservative with you, please collect fresh samples — they will still be very helpful.

4. We would like to help sample, especially in moderate and large kills, so we'd really appreciate contact as soon as you learn than a substantial kill is occurring (or has just occurred). We will mobilize quickly and get to the site to collect many other types of samples that would be helpful in tracking this dinoflagellate.

5. To facilitate testing for potential toxic dinoflagellate activity, it would be best to receive the samples as quickly as possible. Please send them to us by state courier mail (#536121) or call us so that we can make other arrangements. Include a note that briefly describes the kill (date and time, types of fish affected, how dying fish looked or were acting, kill location, whether birds were eating the dead/dying fish and other details that might be of interest). Also, mark the bottles so that we can determine where, within the kill area, each sample was collected.

We will be able to confirm the presence of this toxic dinoflagellate within one day of receiving water samples (the procedure involves settling the preserved material overnight). However, it often requires several days to two to four weeks to confirm toxic activity, depending on whether the alga has encysted by the time we receive the live (fresh, unpreserved) samples.

all but one died in separate aquaria because the dinoflagellate was carried in with them and grew. We even put the crabs in different rooms nowhere near dinoflagellate cultures, but they died because they came in with cysts of the dinoflagellate sticking to their shells. These dinoflagellates were allowed to grow in the aquaria and produce their toxin.

Unidentified Speaker: Some of the work that the National Marine Fisheries Service did indicated that the red tide probably came from southern Florida in a water mass. Is there any possibility that these two events could be related?

JoAnn Burkholder: No, it is different. The red tide that arrived from Florida was caused by a well known organism called *Gymnodinium breve*. Its name has been changed three times, and at the time of the 1987 North Carolina red tide, it was called *Ptychodiscus brevis*. That alga has caused \$20 million to \$40 million in damage to Florida over the past 20 years, and it was carried up on a meander of the Gulf Stream in a very unusual set of weather conditions — drought and almost no wind. These conditions allowed the bloom to develop and become concentrated, and then it drifted ashore.

But that alga looks and acts different. It is nothing like this one. So far, ours is endemic to North Carolina and Delaware, although the Indian River in Florida may have it. This dinoflagellate is ephemeral in the water column — it doesn't form discolorations and usually stays up in the water for hours to days, not weeks or months like *Gymnodinium breve*.

Unidentified Speaker: Do you have any theories that it may thrive in high phosphorus conditions until it comes into contact with the fish?

JoAnn Burkholder: If you consider what this species is doing in the estuary, yes, it cues in on fish excreta. But fish excreta does not exist in a vacuum. In other words, there is a certain medium, a set of environmental conditions, that is also conducive to growth. And then the "magic" substance, fish excreta, will cue it. It seems to require phosphorus in higher concentrations than other algae. Only one other red tide toxic dinoflagellate has been studied for phosphorus stimulation. Many toxic dinoflagellates seem to cue in on nitrogen enrichment.

But at least one of the other toxic "red tide" dinoflagellates actually uses the phosphorus to make its toxin, and that could be happening here, too. But the fact is it likes a naturally phosphorous medium. Add the fish excreta and it will be stimulated — it's a set of conditions.

The Gulf Stream and Its Eddies

Len Pietrafesa is chairman of the Marine, Earth and Atmospheric Sciences Department at N.C. State University. A physical oceanographer with degrees in fluid dynamics, he has been at NCSU since 1973 and has chaired the department for five years. Pietrafesa is chairman of the National Council on Ocean Affairs (1993-95), which advises Congress on ocean issues, and he's a member of the regional Marine Research Policy Board for the National Oceanic and Atmospheric Administration. A nationally recognized expert, he will talk about the Gulf Stream, its eddies and a new program he is launching.

First, I want to explain some science about these physical phenomena we call Gulf Stream frontal eddies and filaments, as well as their biological importance. I will also talk about the Charleston trough and how we first became aware of the existence of these features and ultimately their importance to North Carolina's coastal waters. First, we consider the setting.

The region between Cape Canaveral and Cape Hatteras is called the South Atlantic Bight. Mooring locations are the places where we, the physical oceanographers in the department, have put instruments out for periods of four to six months to measure the current speed and direction, temperature, salinity and water pressure. From this information, we get a long time series of how the water was moving, what its salt content was and what its temperature was throughout the entire South Atlantic Bight.

These programs were started in 1974 off the North Carolina coast and they continue today. They actually started with funding from the Energy Research and Development Agency, which was the child of the Atomic Energy Commission, and the North Carolina Sea Grant College, a sponsor of this forum.

North Carolina had a particular problem back then. There was interest in dumping sewage into the coastal waters, and the question was, where would it go? Sea Grant was willing to invest some money in the research.

The North Carolina coast is rather wide in the sense that it is about 60 miles from the beach to the shelf break, which is about 210 feet of water. It's very shallow and slopes gradually. Then, at 210 feet, it dives off into the abyssal plain. The bottom bathymetry map, derived from contours provided by the U.S. Defense Mapping Agency, shows this rather dramatically.

We put out instruments that are moored upright

by hollow steel balloons. We simply lower them off the boat and let them free-fall to the bottom where they anchor. The anchor is actually a symmetrical set of railroad wheels. So we have littered the North Carolina coast with railroad wheels over the last two decades.

We string instruments vertically, and they record data every five or 10 minutes for periods of four to six months. Then we retrieve the instruments and recover the data. The recorded data includes: currents, indicating which way the water moved and how fast; temperature of the water mass as it passed; salt content of the water mass; and water pressure.

What you get is a quasi-continuous time series of currents and hydrography. The data can show, for instance, that in general the currents are changing rapidly over three- to four-day periods off the North Carolina coast. The currents can be moving northeast and the water will be very warm, around 23 or 24 C/ 73 or 75 F, and suddenly they turn south for two to four days at speeds of 1/2 to 1 knot/ .6 to 1.2 miles per hour; over that period, the water will have gotten very cold, perhaps 12 or 13 C/ 54 or 55 F. This insight into the incredibly dynamic nature of currents off the North Carolina coast was unknown until the mid-1970s. The literature contained no reports of these kinds of currents, or the rapidly turning currents and changing temperatures, before our Sea Grant studies in 1975-78. When we first saw these currents, we weren't quite sure what they were; but in 1965, some studies had been done off the North Carolina coast by Ferris Webster and William von Arx. At the time, technology hadn't advanced to the point that they could put out meters and measure currents every five or 10 minutes for a period of months. So they conducted hydrographic cross sections, and they found that the Gulf Stream off our coast was moving back and forth, left and right. They called these meanders.

Then, satellites began to fly in the early 1960s and '70s, and we began to collect visible imagery and sea-surface temperature imagery from space. I was able to get a NASA grant in 1974 to collect some of the sea-surface temperature data. At that time, you had to be a NASA fundee in order to get the data. In 1975, I was able to start collecting moored current meter data off the North Carolina coast and discovered that the Gulf Stream was doing more than just meandering laterally. It appeared to have wavelike features on its western boundary, which is the part of the Gulf Stream that affects the North Carolina coast. And in fact, these wavelike features seemed to be moving on and off our coast.

Now, back then, the satellite sea-surface temperature data covered a 12-kilometer/ 7.5-mile area with a

5-mile resolution. That means that every data point, every temperature measurement, was 5 miles from the one that preceded it. This wasn't awfully good.

Today we collect data from Jordan Hall, a six-story glass building at the corner of Western Boulevard and Avent Ferry Road. On the roof of that building is an antenna that tracks six satellites daily. It also tracks the space shuttle. And whenever any of those six satellites is as close as it will get to North Carolina, the antenna automatically swings into position and downloads the data. From this, we produce sea-surface temperature maps for the coast. In fact, we actually produce maps extending from Cuba up to Nova Scotia.

The Gulf Stream appears on these sea-surface temperature images as a very dark red current. It moves due northeast off north Florida and Georgia, moves suddenly due east off South Carolina and snakes back toward the North Carolina coast. Now, this is a feature that we began to appreciate back in 1973 and 1974. And it turns out that it had been dutifully noted in 1880 in the log of Lieutenant Bartlett, who was doing soundings for the U.S. Coast and Geodetic Survey. He discovered that the Gulf Stream was farther offshore Charleston than anywhere else between Cape Hatteras and Miami. That was the only notation to that effect.

In 1974, we discovered a topographic hill off Charleston at the 650-foot to 1,000-foot isobaths. We call this feature the Charleston bump. It is a submarine hill, formally named Hoyt's Hill, sitting atop the continental rise off Charleston.

As the Gulf Stream is moving along at 2 to 4 knots/ 2.3 to 4.6 miles per hour, it encounters this little bump. And much as a skater can move her arms in or out to spin faster or slower, the Gulf Stream — a velocity-sheared, density-stratified jet moving northeast at very high velocities — deflects to the right when it encounters this bump. When it deflects to the right, the Gulf Stream suddenly encounters very deep water and moves back left to conserve its angular momentum. And so it effects an offshore and onshore movement, which is a very large-scale phenomenon. In fact, doing some mathematics, we were able to predict a 60- to 80-mile deflection of the Gulf Stream off Charleston due to this topographic bump sitting at the top of the continental margin. You can think of this Gulf Stream deflection, first away from the coast and then back, in much the same way that the jet stream deflects at the Rocky Mountains as it moves from the West Coast to the East Coast. You've all seen this in the TV weather reports, I'm sure. Now, as the Gulf Stream moves off and back on, it generates wiggles or very long waves, which we call meanders.

Satellites also can measure sea-surface height. So, looking at sea-surface topography, which we can extract from satellite altimeter, we can actually contour the surface of the ocean. In the Charleston area, you can see a ridge in the sea-surface contour map. As the Gulf Stream encounters the Charleston bump and deflects to the right, it leaves a depression in the sea surface on the order of 3 to 5 feet. This process actually creates a bowl-shaped feature about 50 to 80 miles across. This bowl, or hole in the surface of the ocean, is present about 80 percent of the year. This bowl is known to be a great place for fishing. If a current in the atmosphere or the ocean is moving counterclockwise, then things move up in the interior; it causes upwelling, and the circulation around this bowl is counterclockwise. The nutrients come to the surface and drive the biological productivity of the area. So it's great for fishing.

Satellite images can show the Gulf Stream deflecting off of Charleston and the nutrient-rich water entraining into the bowl. Downstream, wave-like features indicate that the Gulf Stream is actually moving like a wave.

Now, these waves can be 50 to 150 miles long, and as they propagate with the Gulf Stream they move laterally or horizontally back on and off, or toward and away from the shelf. Some of them actually grow unstable as they approach the coast and fold back at the crest to form filaments or tongues of warm water that come into North Carolina mid-shelf waters.

In summary, the Gulf Stream is moving north-northeast, encounters a topographic rise, the Charleston bump, deflects to the east, encounters deep water, comes back to maintain its angular momentum, creates the Charleston trough and then meanders downstream. And waves can actually fold back depending on phenomena such as the direction the wind is blowing.

The satellite images show the Gulf Stream as very hot water. On the shelf side, there is a counterclockwise rotating current in the offshore part or trough of these waves. It carries cold, nutrient-rich water upward and onto the shelf. This process then biologically enriches the water column and causes the fish populations to thrive. Looking back through the data, we see that there is at least one of these off the North Carolina coast every seven to 10 days.

This weekly frequency is important, because as these waves propagate from south to north, they are moving 10 to 50 miles per day. So it takes three or four days for each wave to march by the North Carolina coast, and since one is present every week, the coast is being enriched by nutrients weekly.

We also discovered that as the Gulf Stream

moves past topographic features such as Frying Pan Shoals and Cape Lookout Shoals, the shoals themselves will cause the Gulf Stream to deflect shoreward on the downstream or north side of the shoals, reinforcing the wave or meander process. We found this out by obtaining data stored in the National Ocean Data archives, which we then plotted along the entire coastline, from Cape Canaveral to Cape Hatteras.

We discovered that the water on the north side of Frying Pan Shoals and Cape Lookout Shoals was colder than water on the south side or in the middle of the bays, suggesting that these should be great fishing spots. This is also the case because the north side of the shoals are areas where nutrients are carried upward and onto the shelf. That is important because it means that the system is being driven biologically on the north side just in the lee of the shoals as the Gulf Stream moves by there.

We then discovered as we collected nitrate, silicate and phosphate data and plotted it against temperature data near or in the Gulf Stream that there was a 1-to-1 relationship. Gulf Stream water is very high in nitrates, silicates and phosphates. Now, you think about it, the North Carolina coast should be a biological desert because it doesn't have many big rivers feeding it. But the coast is biologically rich, and this is because of the Gulf Stream and its meanders and filaments offshore.

Now switching gears, we know that every winter the North Carolina coast gets buffeted by nor'easters. These same storms also literally bury the Washington-Boston corridor in snow and sleet. We have now studied the relationship between the presence of the Gulf Stream frontal features and the occurrence of these storms and have found that over the 13-year period of our study, while most of these storms occur between the months of November and April, the most intense occur in January. Satellite imagery over 13 years also shows that the Gulf Stream can be as close as 10 kilometers/ 6 miles to Cape Hatteras and as far offshore as 200 kilometers/ 124 miles from Cape Hatteras during these six storm months.

We have now discovered a statistical relationship between the occurrence of these storms and the location of the Gulf Stream and its frontal features. We have found that the closer the frontal features get to the coast, the bigger the temperature difference between the air at the coast and the offshore air above the Gulf Stream. The Gulf Stream and its frontal meanders and filaments warm the air above them. So if a cold front moves into the North Carolina Piedmont, it will make the air above the land cold. Now if a Gulf Stream meander or filament also happens to be present, then the air above will get warm. This creates

a strong horizontal temperature gradient in the air over a very short distance, perpendicular to the coast. What occurs next is phenomenal. The strong horizontal air temperature difference starts the wind moving counterclockwise in a tight cell, which starts to grow and becomes larger in the atmosphere.

So off the North Carolina coast, these Gulf Stream frontal features are responsible for creating the cyclogenetic lows that become the nor'easters. These storms form between Charleston and Cape Hatteras, depending on the location of the Gulf Stream and the kind of air masses that are in the area. Subsequently, these storms bring a lot of Chesapeake Bay water down to North Carolina. They also cause the flooding of our estuarine system and cause erosion of the Outer Banks.

Remember that these meanders and filaments bring nutrient-rich water onto the North Carolina shelf. These waters become fertile fish feeding spots. We think that the storms cue adult female finfish to spawn between November and February and subsequently carry the finfish larvae toward the coast and into North Carolina estuaries. Obviously then, these satellite images can tell you when and where the fishing is good.

We have a sea-surface temperature map that is being produced twice daily to show where water masses are. It can literally be faxed. An update comes 10 to 12 hours later. We are also trying to establish a 900 number that anglers can call for a gray scale map.

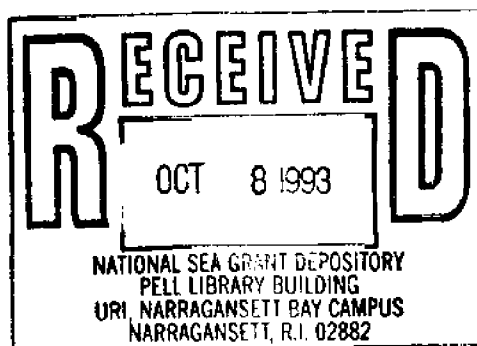
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