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Virginia Sea Grant College Program
Virginia Institute of Marine Science
The College of William and Mary

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Virginia Sea Grant is administered by the Virginia Graduate Marine Science Consortium, whose members include the College of William and Mary, Old Dominion University, University of Virginia, and Virginia Tech. Dating back to 1966, Sea Grant is a national partnership of university, government, and industry focusing on marine research, education, and advisory service.

The art and science of boatbuilding, repair, and maintenance were once firmly embedded traditions throughout Tidewater, Virginia. The retirement of many of those tradespeople, however, has left a gap in Virginia's workforce proficient in such skills. In addition, newer-generation boats are equipped with sophisticated electrical systems and equipment, and require an expanded knowledge base for troubleshooting repairs. Read inside how a new marine trades training program in the Northern Neck hopes to draw workers from coastal Virginia and beyond to give them the skills and knowledge needed to keep pace in the dynamic world of boat and yacht maintenance.

Many of those boats traverse the Atlantic Intracoastal Waterway (AIWW) each year, moving with the change in season in search of more temperate climates. The AIWW, which runs from Norfolk to Miami, accommodates not only these "snowbirds," but charterboats, barges, and tugboats, as well as small cruise ships and commercial vessels. Read about the history of small, coastal villages strung together by this water highway, and why Sea Grant programs throughout the Southeast want to conduct an economic assessment of its benefits to both commercial and recreational traffic.

Finally, we provide a snapshot of the state of marine aquaculture across Virginia. What began in the late 1990s as an effort to identify the most popular marine species likely for culturing success has now evolved to significant initiatives in applied research by Sea Grant researchers at Virginia Tech, VIMS, ODU, and other Virginia universities. Those efforts will pay off in terms of new economic opportunities for businesses struggling to diversify or maintain a foothold in Virginia's seafood industry, while helping satisfy Americans' growing thirst for fresh fish.

Any reflections on the coastal environment at home dim when cast against the backdrop of the world's latest natural disaster along the coastal fringes of the Indian Ocean. The magnitude of this event is still unfolding in terms of loss of human and marine life, property damage, and personal tragedy and grief. Sea Grant researchers and other representatives are involved in recovery efforts, and the BRIDGE has posted information and links to help teachers translate the science behind the tsunami to their students. Our thoughts remain with all who have been touched by this tragedy.

Gloucester Point



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Cover photo: Boaters traveling the Intracoastal Waterway encounter waterfront communities like Georgetown, South Carolina (shown here), whose economic survival remains tied to commercial fishing.

Breathing New Life Into an Old Trade

By Sally Mills

Sometimes, the best ideas come to you while doing time behind the windshield of a car. That's what happened to Don McCann one afternoon as he was traveling along the back roads of Lancaster County.

McCann, at the time a planner with the Northern Neck Planning District Commission (PDC), was thinking about what he often thought about – how to revive the local, maritime-based economy. Like other coastal communities strung along Virginia's sandy shores, those on the Neck are struggling to find the right formula to keep jobs – and the younger generation attached to them – at home, rather than migrating to neighboring metropolitan centers.

As he crossed through the soybean fields and occasional pine stand, McCann's eureka moment struck: Boat building and repair! However faded compared to its historical imprint, the construction and repair of boats and related equipment continue as a viable trade in Virginia's Northern Neck with known, respected craftsmen. But those craftsmen are aging and some, leaving the area.



Who will step in when they disappear? Who will service the new generation of outboards and the older diesel engines and perform the high-quality carpentry and seasonal maintenance needed to keep recreational boating thriving here? As acknowledged by small businesses of every stripe, finding skilled workers can be a tremendous challenge in rural markets, including coastal Virginia. Without an adequate pool of qualified employees, the marine trades industry cannot flourish, and the entire coastal economy suffers.

With wheels spinning, McCann approached PDC director Jerry Davis to make the case. "We have the opportunity to create a training facility for the Northern Neck and the entire region!" he argued. And from that point forward, it was a matter of confirming his instincts and lining up the appropriate partners. Just as important, through the PDC network he helped navigate the government institutions likely to give grant support for pursuing the idea. Funds to perform an industry needs assessment, for example, came from the Virginia Department of Housing and Community Development and from the USDA Rural Development program.

Support from the Virginia Sea Grant program allowed economist Tom Murray to design a survey to take the pulse of local businesses. That survey was mailed to some 1,300 boatyards, marine services and suppliers, and boat dealers across the mid-Atlantic. Responses verified both the need for and the interest in establishing a marine trades training program. Of the specific training needs queried, certification for both outboard and diesel mechanics were rated as the most acute. The need for fiberglass technicians and electrical technicians was also highly rated—here in Virginia and across the region.

The survey also indicated support from employers from New Jersey to North Carolina to pay for training. When asked if they'd be willing to cover enrollment fees, lodging,

and other travel expenses for employee training offsite, an average of 84% of respondents – roughly 270 firms – indicated they would. And that, according to Murray, was perhaps the strongest signal of endorsement for the idea.

Members of the Tidewater Marine Trade Association were brought into the discussion. Ken Knull found the new trades program a perfect match to his ongoing work with a workforce enhancement project in Lancaster County. Ken and his wife Karen own Yankee Point Sailboat Marina situated on Myer Creek off the Corrotoman River, and have been active in local business affairs since their move here five years ago.

He's painfully aware of the lack of opportunities for young people graduating from area high schools. For those who don't pursue a college track, jobs are sparse and limited to entry-level positions in healthcare, fast food, and a few resorts and B&Bs. The workforce enhancement partnership program had previously surveyed students about their plans upon graduation, and according to Knull, the resounding reply was, "I want to get out of the Northern Neck."

"The kids have the idea that there's no future for them here. We have the need; we have the opportunity," he adds.

Economics makes sense

That opportunity, according to Deltaville Boatyard owner Keith Ruse, represents one of the oldest skilled professions in Tidewater – and one that makes a big impact locally.

"A medium-sized boatyard business employing 14 technicians, as an example, pumps about \$500,000 into the local economy through payroll every year," Ruse projects.

But that's just part of the story: it doesn't include boatyard output or the indirect impacts generated by that production. Murray estimates the total economic impacts from filling the 86 full-time vacancies (identified by survey



results) in Tidewater marinas and boatyards would translate to \$8.7 million in output, \$4.3 million in income, and 186 full-time jobs overall to the area.

Among other industry folks involved are Guy Sorensen of the Chesapeake Marine Training Institute – which conducts seamanship and merchant marine courses – and Gayle Wood, director of the Workforce & Community Development Center at Rappahannock Community College (RCC). What began in early conversations about the feasibility of building a new facility to accommodate hands-on training eventually led to formation of an advisory board and a partnership with the RCC Warsaw campus.

Along the way, several potential models based on existing trade schools were examined, including the Landing School in Maine,

the Atlantic Boat & Yacht Council (or, the Council) in Maryland, and the New England Institute of Technology in Rhode Island. The advisory board drew bits and pieces from each to customize an approach that might best fit the needs of the Northern Neck and surrounding communities.

“We wanted to offer a local program, so that folks could affordably do it and not spend all their money on travel and on food and housing,” Knull explained. “Another priority was to tailor class offerings to the time of year that works for our industry.” Typically, January through March represents down-time in the marine trades world, as does the period of late August through the fall for certain sectors such as boat painting and finishing work.

As conversations about a training program continued, it became apparent that certifica-

tion was an important selling point to employers. “The Council conducts training and certification courses all over the country,” notes McCann. “They have really set the standard for the marine repair industry.”

Gayle Wood at RCC sees immediate benefits to the area’s student population and gets very excited when talking about the partnership. The Workforce Development Center at the College started about 11 years ago and originally focused on contract training work based on needs identified by area schools, businesses, and government. Those efforts have now expanded to include online programs, consulting work, and handling facility needs on campus – as well as a new suite of leisure courses geared to capture the interest of the growing segment of retirees who’ve come to the area.

As Wood observes of this new venture, “Welding, painting, fiberglass repair – all those trades are right here!” She has been instrumental in acquiring funds for lab space, new audio and video equipment, even tools for the engine repair classes. RCC has invested considerable time and resources to make this program a reality.

Wood has worked closely with advisory members to develop the course schedules and handle other administrative details. Over the years, she and her staff have worked with the Governor’s office. Speaking of the current Warner administration, she reports, “They’ve been extremely supportive and have helped in locating funds and other resources.”

Dr. Barbara Bolin, who serves as special advisor on workforce development to Governor Warner, echoes Wood’s enthusiasm. She sees the training program as an example of a great partnership, but only one piece to be covered by a much larger workforce development “umbrella” for marine trades needed across the state.

The boatyard at Yankee Point remains busy for repairs and maintenance throughout the year.

Courses offered

In order to implement a sustainable program, the Atlantic Boat & Yacht Trades School (ABYTS) was created in 2004 and will be operated under the auspices of the Rappahannock Community College. In late January, a foundation course on basic marine engines as well as certification courses for both diesel and gasoline engine repair were scheduled; those will be followed by two courses on outboards in February, taught by Grid Michal—a well-respected mechanic in the Northern Neck. A certification course on electrical systems will be offered in March.

All courses are short and intense, running 3-5 days on average. Such a framework allows potential students from outside the immediate service area – Maryland and North Carolina for example – to attend while keeping travel costs down. The ability to attract from a larger pool of clients is believed to be critical by those involved. Ken Knull concurs, “I’m convinced that the marine trades program must draw people from around the region to make it succeed. Doing so creates a ripple effect on





The workforce and community development center at RCC began its continuing education program about 11 years ago. The center typically enrolls 1,700-1,800 students a year from the surrounding 12-county service area. Many are upgrading skills to enhance their current jobs and marketability, and tend to stay in the area after completing coursework.

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For information about upcoming classes in the Marine Trades Training Series, go to: <www.rcc.vccs.edu/workforce> or contact the RCC Warsaw Campus at (804) 333-6828.

local economies – area hotels and other services – and that’s of great interest to all of us.”

At this point, the new facilities at RCC can accommodate all of the classroom training. But what comes next – courses on painting and fiberglass repair, for example, may require additional facilities or the re-tooling of existing structures nearby. “The right barn – retrofitted – might work,” Knull speculates.

Wood envisions that training down the road will be conducted by area craftsmen – not necessarily by Council instructors. Speaking of the Council’s “train the trainer” program, she suggests it would be a natural evolution to this sort of program. Others see it evolving into something offered in high schools across Tidewater – targeting those students for whom learning a trade is a more practical and achievable long-term goal.

McCann thinks that is a strong possibility, “Remember, most of these high school kids are only one generation away from a waterman. We need to convince them that, if trained properly, this is a very lucrative business.”

The enthusiasm in the air is palpable; the momentum, strong. Everyone involved seems in agreement that a successful marine trades training program could breathe new life into the region’s rural, waterfront communities.

Tom Murray is one. As an economist specializing in marine businesses, he has helped marinas and boatyards identify grant opportunities that enable them to expand capacity and accommodate the new mega-yachts traversing the Atlantic coast. Those yachts – often more than 100 feet long – bring with them sophisticated, state-of-the-art equipment and systems. Keeping pace with new technologies is mandatory for any trades program, of course. And as Murray sees it, waterfront communities that can advertise workers with those skills at hand will better position Virginia marinas to receive such luxury liners at their docks.

Speaking to the bottom line, Don McCann agrees, “If you raise the bar on training, you will attract a higher class of boats here. That improves the overall economy in the entire region.”



The Intracoastal Waterway: Connecting People & Communities

By Charlie Petrocci

A long, thin body of water snakes along the eastern seaboard, hugging the coastline of several states. In many places it bellies up to barrier islands, reaches across bays and sounds, and winds its way through a wilderness of brackish marshes where it takes on the tannic-stained color of week-old coffee. It is a migration corridor for countless birds, fish, and boaters who use this water highway seeking food, shelter, fuel, and warmer climes. It is the Intercoastal Waterway, the ICW, or what many frequent floaters affectionately call simply “the ditch.”

Technically the ICW goes from New England south to Texas, connecting well over a dozen states. This broader perspective of the ICW covers roughly 3,000 miles, partly natural, partly man-made, and all very scenic. For decades the ICW has provided sheltered passage for commercial, military, and pleasure boats from Boston to Key West and then along the Gulf of Mexico all the way to Brownsville, Texas.

Digging the ditch

This water road was authorized by Congress in 1919 and is currently maintained by the U.S. Army Corps of Engineers. Congress got involved because after World War I and the advent of frequent, German U-boat sinkings off the mid-Atlantic coast, officials realized the need for a safer, “backdoor” waterway to protect domestic coastal shipping. The original plan called for a continuous channel from New York to Texas, but the necessary canal link through northern Florida was never completed. Thus, the ICW is actually considered as two distinct sections—the Atlantic and the Gulf. Furthermore, the southern piece of the Atlantic stretch has come to be known as the Atlantic *Intracoastal* Waterway.

But the story of the “ditch” reaches farther back than 1919. It goes all the way back to the roots of the country. The first serious considerations for building a canal connecting two bodies of water came during Lord Dunmore’s reign as governor of Virginia just before the

Revolutionary War. Even before that, however, George Washington and well-to-do investors got involved trying to connect the Elizabeth River to Albemarle Sound through the Dismal Swamp. The swamp lived up to its name, and these early attempts to build a canal were thwarted. But in 1790, both the Virginia and North Carolina General Assemblies passed the “act for cutting a navigable canal.”

In 1805, the privately owned Dismal Swamp Canal, much of it hand-dug by slaves and laborers, opened and small boats were charged a toll to pass through. In 1814, the first large commercial vessel eased through “the muddy ditch,” carrying “bacon and brandy.” By 1816, the federal government had gotten involved and stone locks replaced the old wooden timber ones. Soon, land traffic flowed alongside mule traffic down the towpath that ran beside the canal, and establishments such as the Lake Drummond Hotel became popular hangouts.

But in 1859 the nearby Albemarle and Chesapeake canal was finished and aggressively competed with the Dismal Swamp Canal. By the turn of the century this newly-built, larger and deeper canal proved more advantageous to boaters, and especially, commercial vessels.

Yet the Dismal Swamp Canal remains in use today. In December of 2004, Congress passed a bill to maintain the canal for navigation. The \$785,000 appropriation is to be used to keep the locks operating and the canal dredged and free of debris. So the 22-mile, 199-year-old canal, though overshadowed by its larger, sister passage to the east, remains open to

the 2,000 or so small boats that use it each year and will continue cutting a path through the famed Dismal Swamp.

Today the “0” marker for what most boaters consider the true, main section of the Intracoastal Waterway begins at the Portsmouth waterfront, just a stone’s throw from Nauticus (look for a small interpretive sign there). This “0” marker is located 193 miles south of the Susquehanna River’s entrance to the Chesapeake Bay. From here along the Elizabeth River at Waterside Park, the ditch continues south through the locks at Great Bridge, past a portion of Currituck Sound, then across Albemarle Sound and down the Alligator River to the Pungo River, eventually leading all the way to Florida.

For many, the real ditch journey begins after the locks at Great Bridge, Virginia. It’s here that vessels stacked up in the locks – power boats, commercial vessels, and sailboats – spill out when the gates open to enter the endless swamps and dark waters that defy any tangible border between Virginia and North Carolina. It marks the beginning of a gentle race, with scattered finish lines and no tangible prize except the journey.



Tour de force

Each day along the Intra-coastal is an adventure. It serves up an ever-changing pallet of bays, marshes, boats, towns, docks, houses, wildlife, and seasonal colors. Food changes according to change in latitude. Fried sea trout leads to Brunswick stew, which eventually gives way to shrimp and grits or low country boil. Inlets and towns appear and disappear in the fog. Houses of every style and form line

the water's edge. It seems the farther south you go, the more grandiose those houses become.

Huge, ante-bellum homes drenched in history stand on sand hills shrouded by live oaks and Spanish moss.

Downriver, walls of condos and town houses looking like barracks, are squeezed in between flashy marinas and golf courses. And in the long stretches in between sit isolated, old hunting lodges, sun-baked summer cottages built in the '40s and '50s, and hundreds of sparkling new waterfront homes so large that I often wonder where all the money is coming from.

For nature lovers, endless miles of pristine marsh and coastal habitat prevail. Depending on the season, a change in location means a change in species. I've seen black bear, wild boar, manatees, bald eagles, hordes of unidentifiable shorebirds, and even its namesake – an alligator – in the Alligator River.

For many pleasure boaters, cruising the ditch is a semi-annual event, almost a rite of passage. Beginning in the early fall, long lines of boats can be seen navigating the narrow ditch in a never-ending procession, as if on a pilgrimage. They come in all shapes and sizes. Large yachts and power boats blast by lazy moving sailboats which often fly a colorful assortment of international flags. Boat names



surpass the styles of vessels. The radio crackles of captain-to-captain dialogue, mostly focused on permission to pass either port or starboard. Some appear in a hurry to get to warmer weather; others, no doubt,

consider the waterway the best part of the trip. Come mid-March, the vanguard reverses itself as boats migrate back to northern ports.

Commercial traffic

But the Intracoastal is more than just pleasure craft. Big barges, chunky tugs, military vessels, sportfishing boats, and commercial fishing craft all vie for position in the ditch alongside the rest of the migration. With an assumed controlling depth of only 12 feet, the water column often dictates who goes where. Tugs and barges hold sway over smaller boats, while commercial fishing boats can intimidate for channel space with sailboats. Sport fishermen are seen heading for the inlet or bobbing in the wake of passing boats as they fish for red drum along the shorelines. Big burley shrimpers can be seen just over the dunes of a barrier island, dragging the shallow southern coast for shrimp. When at rest, their outriggers and high bows thrust out from old fish docks lined with gulls. The thousands of traveling boaters who take in these scenes regularly provide an economic boost to the towns perched along these shores each migration season.

The most important common denominator of the ditch is water depth. It makes all boats equal as far as need. In some areas, the passage is so narrow that water displacement occurs from a boat's weight, sucking water off the bottom as it passes and, in the process,

Left, historic forts such as St. Augustine stand as sentinels along the waterway. They are bastions of history, reflecting the struggles of far away empires carving out a new land. Above, bridges are ubiquitous along the Intracoastal, connecting isolated island communities to the mainland. Page 10, travelers get to see fishing villages, walls of condos, and boats of every shape and size.

exposing fish, turtles and ancient tree stumps. Dredging the ditch thus becomes a never-ending responsibility.

The Army Corps of Engineers constantly monitors the ditch, trying to identify the most dangerous spots. Spoil mounds line the waterway for its entire length. Some have now matured and become bird rookeries, while others make great respites to fish or camp. Bulky dredges manned by contract operators can be seen in the same inlets and narrow stretches year after year. Their black pipes and hoses lay

roll off the tongue like sand off a bar. Islands like Jekyll, Sullivan, Daufuskie, Hilton Head, Cumberland, and Bogue Banks once hosted huge plantations, small rough-hewn fishing camps, and robber barons—the power brokers of the early 20th century. All of these ports compete for attention among the larger waysides such as Norfolk, Charleston, Savannah, and St. Augustine.

Connecting the mainland with outpost islands along the waterway's path are assorted bridges. They come in all shapes and sizes



along the shores like sunning snakes. Systematic digging of the waterway is testament to the fact that encroaching barrier islands and seasonal storms will always have the upper hand in this man-made, water world.

What's in a name?

The Intracoastal allows boaters to see and experience towns from a water-view perspective. Place names such as Bellhaven and Coinjock, Pungo, Oriental, Bertha, Frying Pan Landing, Beaufort, and Beaufort (pronounced differently), Calabash, McClellanville, and Matanzas

including fixed bridges, swing bridges, lift bridges, and draw bridges. Recreation seekers wait in anticipation before each one: some open on the hour; others, on demand. Boats jockey to get in line as they head for the next marina on their travel list.

Forts such as Jackson, Pulaski, Sumner, Fisher and St. Augustine remind one of the struggles and bloodshed that took place along this once contested coastal corridor. It didn't take long for Colonial powers to realize that the wealth of this country lay not in gold and precious metals, but in the natural resources

found within easy access of its coastal bays and rivers. You can sometimes smell these working waterfront towns – Georgetown, Brunswick, and Amelia – before you ever get there. Their pulp mills and lumber operations release pungent odors of pine tar and pitch that waft through the air when the wind is just right.

Many small villages along the Intracoastal were very wealthy at one time. Sprawling plantations covered the islands, and boats or rail cars carried the goods. You can see it in their stately manors, live oak-lined streets, and in the downtown shops, many now empty. Some of these communities owed their fortunes to rice, others to cotton, and still others to the indigo plant, which produced “blue” gold for its cultivators. But much of this old wealth accrued from the labor of slaves or share croppers, and the Civil War broke their economic backs.

Today, the descendants of land owners along the Intracoastal cling to their cultural heritage and traditions. Tractors and combines remain visible along many stretches, complementing the commercial and sport fishing boats hugging the land. Boat building and navigation are skills taught in local schools, and spicy coastal cooking rivals the more sophisticated restaurants to the north.

A journey down the Atlantic Intracoastal Waterway is a journey for the mind, soul, and senses. It offers the traveler a taste of the beauty of this watery frontier, but also a glimpse into the enterprises and cultural diversity that shaped the success of this coastal corridor. The ditch, even with all its faults, connects in a very tangible way towns and docks with people, their livelihoods, and their history.

ECONOMIC ASSESSMENT OF AIWW NEEDED

Sea Grant programs in the southeast, along with BoatU.S. and the U.S. Army Corps of Engineers, sponsored a series of town meetings from Norfolk to Miami in 2003 to discuss the future of the Intracoastal Waterway (AIWW), in light of diminishing appropriations for maintenance and dredging. Among the related issues discussed was the need for a regional, economic assessment of the waterway. Such an assessment could offer valuable insight into the benefits provided by both commercial and recreational traffic to the coastal communities along the waterway’s path.

A comprehensive review of the AIWW is sorely needed, as recreational use has never been formally tracked. According to Rosemary Lynch of the Atlantic Intracoastal Waterway Association, “We estimate that between 5,000 and 11,000 recreational boats use the waterway a year. And, that’s probably a conservative number.”

When considering that the average boater spends about \$300 a day on fuel, food, lodging, and related trip expenses, marina operators have long known that they bring big money into the region. Many of these travelers are retirees who enjoy a comfortable standard of living. “They shop in local stores and gift shops. Small towns rely on them to keep going,” Lynch adds.

But with increased shoaling and unpredictable controlling water depths, many boaters have experienced severe damage to their boats and props. The Army Corps of Engineers cannot put a hard number on it, but Penny Schmidt of the Wilmington District now receives daily phone calls from boaters who are contemplating a trip and want specifics on depth conditions (see <http://www.saw.usace.army.mil/nav/>). Maintaining the waterway to its mandated water depth is critical to a broad range of business interests and local jobs. Lynch used Hatteras Yachts in New Bern, NC as just one example, “They employ 1,000 or more employees. If the waterway shoals in from lack of maintenance, we know what will happen to those folks. The difficult part is getting Congress to recognize that impact.”

The INDOOR Ocean: A View of Marine Finfish Aquaculture Across Virginia

By Angela I. Correa

In Virginia, reducing the pressures of harvesting on native fish stocks is a challenge that has been addressed in a number of ways, from size and season restrictions to quotas, by-catch reduction, and catch-and-release education. All of these efforts have had positive impacts, but most still agree that the overall demand for seafood, especially in the U.S., exceeds the capacity of many commercial fisheries. Even with the best intentions of fisheries regulators, and the full compliance of all harvesters, world fish populations will likely not keep pace with worldwide demand for seafood.

Few would suggest a reduction in overall seafood consumption as a viable strategy – as protein sources go, you can't get much healthier than fish and shellfish. Far from the coasts, where once upon a time the only fish to be found was either canned, or breaded and boxed in two shapes (sticks or squares), Americans seem to have lost their inhibitions, creating demand for new varieties as well as increasing demand for standard seafood case offerings.

Recreational fishing is viewed in much the same light. Virtually no one wants less of it. Recreational anglers enhance community identity, build tourism revenue, and generally go home happy.

Resource managers, while still employing the tested population management strategies discussed above, have turned their attention to

aquaculture as a potential source of answers. Bringing fish into a controlled environment makes it easier to understand certain aspects of their biology, yielding insights into what they need to thrive in the wild. We have an incomplete understanding of the life cycle and habitat requirements of many fish species, and as such, species management plans developed with the best information available may leave out crucial considerations. Aquaculture has the potential to boost wild populations through stock enhancement, hatching and raising fish to the juvenile or early adult stage, then releasing them. Aquaculture can also be used to produce a constant supply of bait fish for anglers.

Further, aquaculture offers the potential to supplement or supplant wild harvesting for seafood production. Fish and shellfish are the last bastion of wild harvesting to be found in the commercial food chain, and most industry observers agree that the current landings may be unsustainable in coming years. With ocean-going harvesting operations at or past their peak, aquaculture will continue to increase as a reliable source of product. A thriving seafood industry is a most effective engine for spurring resource development, and increasingly, the seafood industry sees merit in exploring aquaculture either for stock enhancement, or for full cycle fish production.

In Virginia, the focus on aquaculture increased throughout the 1990s, giving rise to a number of research programs at both the Virginia Institute of Marine Science (VIMS) and at Virginia Tech's facilities in Hampton and Blacksburg. The programs increased the level of science and understanding of a number of key marine and estuarine species, including summer flounder (*Paralichthys dentatus*), cobia (*Rachycentron canadum*), hybrid striped bass (*Morone saxatilis* × *Morone chrysops*), yellow perch (*Perca flavescens*), and spot (*Leiostomus xanthurus*).

Earlier aquaculture efforts in Virginia had been centered on raceway and pond production, but these methods weren't suitable for marine species, so researchers turned to methods that included some recirculation of the growing waters.

Summer flounder

The Virginia effort to culture this species was almost a given, due to its status as one of the top commercial and recreational catches in the Commonwealth. Summer flounder is accustomed to shallower waters, and is relatively stress tolerant and easy to handle, making it appear a good candidate for aquaculture. Another motivating factor was the ominous downward slide in landings recorded by the flounder fishery in the 80s and early 90s.

Flounder, despite its mellow demeanor, proved to be exceedingly difficult to spawn. Early research efforts at the Virginia Institute of Marine Science (VIMS) in Gloucester Point and the Virginia Seafood Agricultural Research and Extension Center (VSAREC) in Hampton both relied on fertilized eggs obtained from university aquaculturists in New Hampshire or Rhode Island, and substantial difficulties were encountered in larval rearing to metamorphosis.

VSAREC aquaculture specialist Michael Schwarz worked extensively with the young fish, refining larval rearing techniques in the 60-day post-hatch (DPH) period to achieve survival rates in excess of 90%. During this

period, larval flounder are fed a succession of live feeds, before being weaned to dry food, and must successfully negotiate metamorphosis. Prior to metamorphosis, flounder larvae resemble many other fish, with a symmetrical body and eyes on both sides of their head. At approximately 30 DPH, however, larval flounder gradually undergo a change befitting their eventual benthic lifestyle – the right eye migrates to the left side of the head, and they attain their characteristic flattened appearance. Aquaculturists usually experience high larval mortality rates during this transition.

Schwarz's success in raising juvenile flounder, funded by the National Marine Aquaculture Initiative of Sea Grant, was presented at the 2003 meeting of the World Aquaculture Society and made a number of additional Virginia projects possible, including feed optimization work by Drs. Steven Craig and Ewen McLean at Virginia Tech. In this work, lipid levels in the flounder feed were manipulated to optimize weight gain in the fish. Several hundred young flounder were also returned to the University of Rhode Island and to the Harbor Branch Oceanographic Institute to conduct pigmentation studies and foster collaborative research.



Tanks hold 30,000 just-metamorphosed summer flounder.



Researchers work on the flounder holding facility

In late 2003, Schwarz again succeeded in conducting the first controlled flounder spawn of F-1 broodstock in Virginia. The breed's typical resistance to tank spawning was overcome with photothermal (light and temperature) manipulation, and a limited amount of strip spawning — a process where gametes are gently collected from the fish and then fertilized in vitro, making it possible to accomplish scheduled spawns. Over 2 million fry were produced, and nearly half of these were shipped to a commercial grower in advance of Hurricane Isabel. The valuable F-1 broodstock was also preserved.

More recent work has the potential to directly benefit commercial harvesters. Live hauling boxes are being evaluated for the holding and transport of flounder to distant markets. These boxes are flooded with oxygenated seawater in a specially designed aquaculture system, and can keep fish alive and healthy for long periods. Flounder seem to tolerate this holding method very well, since it takes advantage of their natural habit of layering themselves on the ocean floor. Holding live fish makes it possible for flounder processors to deliver live fish to premium markets, reduce waste, and to time the entry of filleted product to maximize profits.

Cobia

Cobia is a highly prized foodfish that has met with great interest as a candidate for aquaculture, due to its incredibly fast growth, delectable flavor and texture, high resistance to disease, and high survival rates in culture. Researchers at both VIMS and VSAREC have worked extensively with the species, with the first project conducted by Michael Oesterling at VIMS. Oesterling started his work with wild-caught adult specimens. A 1999 grant from the National Sea Grant Technical Program resulted in one of the first successful controlled spawns of cobia in the U.S., the first spawn that resulted in raising cobia larvae to fingerling size, and the first U.S. cultured cobia raised to market size in a recirculating system.

More recent work has evaluated feed conversion ratios, growth rates, and the organoleptic qualities of cobia fillets, and sought to develop, in collaboration with researchers in Texas, South Carolina, and Mississippi, an integrated approach to the development of cobia culture in the U.S.

Oesterling is currently focusing his group's efforts on the use of aquaculture to support stock enhancement efforts for cobia. In 2003, he initiated a tagging and recapture program with a small number of cultured cobia. The tank-raised fish appeared to have no handicap when returned to their native waters, and reports of their capture are helping to round out information on cobia biology and migration patterns.

At the VSAREC, cobia work includes studies on larval rearing optimization, lipid and protein requirements, feed development, and growout protocols. Michael Schwarz



at the VSAREC has worked extensively with economist Daniel Kauffman and feed specialist Steven Craig to refine and improve larviculture and growout techniques. As with summer flounder, fish that were raised at VSAREC have been transferred to VT's Blacksburg facilities to further nutrition work. Steve Craig said that the cobia grew so fast under experimental conditions that the planned 8-week nutrition trial had to be cut short after just 6 weeks, because the specimens outgrew the tanks! "These fish grow like weeds," remarked Craig.

The remarkably fast growth is encouraging, with many estimating that fish could be brought to market size in just 6 months. Commercial success will depend on the continued determination of researchers to overcome some of the difficulties encountered, such as cobia's resistance to growth when stocked at water volumes lower than 1 fish/liter. Collaboration and communication is key for commercial tank culture of cobia to advance.

To this end, Schwarz, Craig, and Kauffman have worked closely with European researchers and private industry to organize a

workshop and lecture series that will serve to coalesce an international cobia research group. The Paris meeting, scheduled for early February 2005, will present the current status of cobia culture activities, and focus attention on the problems that need to be resolved before foodfish culture of cobia can expand.

Hybrid Striped Bass, yellow perch, and inland farmers

Earlier Virginia Sea Grant work on hybrid striped bass and yellow perch culture is paying off for a number of Virginia aquaculturists. In one example, a former poultry grower in central Virginia converted his operation to raise hybrid striped bass. He has seen annual improvements in his production and profit over the last 4 years, with his fish going live to the DC area, as well as being provided fresh on ice. This farmer is very pleased with the venture, and is currently expanding and upgrading his system with the assistance of Michael Schwarz and other Virginia Sea Grant researchers at Virginia Tech.

Another example can be found deep in the

mountains of western Virginia, where a family farm has been converted into a yellow perch farm. The first sale of fish from this facility took place in the spring of 2004. The operator



(Previous page) Marine scientist Mike Schwarz holds a 6-month-old cobia. Here, researchers Dan Sennett and Mike Oesterling at VIMS release tagged cobia into the York River.

of this culture facility has relied on the expertise of aquaculturists at the Southwest Virginia Aquaculture Research and Extension Center (part of Virginia Tech). The buyer of the fish was enthusiastic to find a new source of high-quality yellow perch during the off season, and paid premium prices for the fish. These types of ventures fit squarely within the outreach mission of Virginia Sea Grant's aquaculture programs, fostering new sources of economic development.

Spot

Typically a low-value species costing just 10 or 15 cents per pound, aquaculturist Mike Oesterling (VIMS) is raising this species' market appeal by providing them as live bait to recreational anglers on Virginia's coast. Oesterling, in collaboration with an industry partner, collected mature specimens in the fall of 2002 and developed a recirculating culture protocol to spawn and raise the fish. Live bait dealers were given the opportunity to evaluate the 3- to 5-inch fish, and all gave high marks for the product's potential. In the fall of 2003, fish were made available at bait and tackle shops, at a price of \$10.75/lb, and demand far outstripped the available supply. Many dealers reported repeatedly selling out of their week's supply of spot within two days of delivery. This highly successful project will continue to expand in the coming years, with the continued support of VIMS aquaculturists.



◆ ◆ ◆
This is just a small sampling of the work that has been performed to advance marine aquaculture in Virginia. Sea Grant researchers in various locations across Virginia continue to find ways to supply the world's growing demand for high-quality seafood, while protecting natural populations. Future projects will expand frontiers with culture of species such as mummichog (*Fundulus heteroclitus*), black sea bass (*Centropristis striata*), or red drum (*Sciaenops ocellatus*), and support a number of forward-looking aquaculture enterprises in the region, including a multi-species marine hatchery that just broke ground in Newport News in September 2004. Aquaculture will continue to play a key role in reducing pressure on wild fish stocks, reducing waste, and transforming the face of Virginia's seafood industry in the years to come.

Aquaculturist Dan Sennett prepares grader and culls juvenile spot approximately 8 weeks of age.



Clean Marina Program Welcomes 2 More to its Ranks



Congratulations to Coan River Marina and Yankee Point Sailboat Marina, the latest entrants to the Virginia Clean Marina Program!

In August, Yankee Point Sailboat Marina became the 20th Virginia marina to receive the VCM designation. The marina, located on Meyer Creek off of the Corrotoman River in Lancaster, has wet slips for 105 boats. It operates a full-service repair yard with mechanics and technicians certified by the American Boat & Yacht Council (see related story, page 2). Owners Ken and Karen Knull have declared the marina a “no discharge” zone. In addition to dockage and repair services, the marina hosts a pump-out station, ship’s store, and gas and diesel fuel. Yankee Point recently put into service a fire boat to have on hand for such an emergency.

Coan River Marina was awarded the VCM designation on November 17th. The marina is located at the mouth of the Potomac River in Lottsburg, on Virginia’s Northern Neck. Coan River is a full-service marina with wet slips for 56 boats and dry storage for 12. Owners John and Linda Hornby provide professional, courteous service to both power and sail boaters alike. In addition to offering a full range of maintenance and repair services, the marina has a pump-out station, a fish cleaning station, and a ship’s store.



The Virginia Clean Marina Program is administered by Pete Hall, past president of the Tidewater Marine Trade Association of Virginia, in association with the Virginia Coastal Program and Virginia Sea Grant.

For program details, contact Pete at (804) 684-7768, or visit our web site at: <www.virginiacleanmarina.com>.

News from the Point

The job of fisheries bycatch specialist has been filled by Dr. Christian Hager. Hager grew up in York County, Virginia on the shores of Queens Creek, and after attending college at Washington and Lee University became a waterman. This career, though short-lived, provided invaluable experiences and prompted a redirection in his professional aspirations.



Hager earned his Masters at VIMS, conducting research to design and test a bycatch reduction device (BRD). The device allows small fishes to escape pound-nets before harvest, and thus decreases mortality of undersized fish while increasing the fisherman's catch per unit effort. Hager remained at VIMS to attain a PhD. in marine biology. Through an intensive sampling program, the effectiveness of his BRD design was validated and, at the same

time, a dietary analysis of fishes within the site was conducted.

In his new position, Hager will assess sturgeon bycatch in the early spring striped bass gill-net fishery. Short-nosed sturgeon are already on the endangered species list, and Atlantic sturgeon may soon be listed if stocks continue to decline. Hager also hopes to research the hook and line release mortality of resident striped bass during warmer months.

Welcome, Dr. Hager!

CHARTERBOAT WORKSHOP SCHEDULED

The Mid-Atlantic Sea Grant extension programs are sponsoring a workshop for Delmarva charterboat captains, owners, and operators. The 2-day workshop will address business, tax, liability, and changing bay and offshore concerns of the industry. A tentative date of March 30-31 has been set for this workshop to be held in Ocean City, Maryland. For more information, contact:

- ◆ John Ewart, Delaware Sea Grant, at (302) 645-4060, <ewart@udel.edu> or
- ◆ Tom Murray, Virginia Sea Grant, at (804) 684-7190, <tjm@vims.edu>.

FISHING SHOW IN VA BEACH

Mark your calendar now for the "Tidewater Fresh & Saltwater Fishing Show" to be held March 11-13 at the Virginia Beach Pavilion. Sea Grant marine advisory specialists and others from research-conservation organizations will present fishing seminars and techniques, and exhibit tackle-fishing gear as well as artwork. For more information, contact Darcy Potter at the Pavilion, at 757-437-7616, or <dpotter@vb.gov.com>.

Once again, professionals and students from Virginia's culinary schools joined scientists and the interested public to exchange ideas and learn about the latest seafood-related research underway at the Institute. Highlighting this year's program was a panel discussion on the status of the native oyster as well as the non-native, *Crassostrea ariakensis*.

Hands-on cooking demonstrations by Chef John Maxwell and by Mike Hutt (shown here) of the Virginia Marine Products Board explored the potential of croaker, while Bob Fisher of VIMS featured the Rapa whelk.

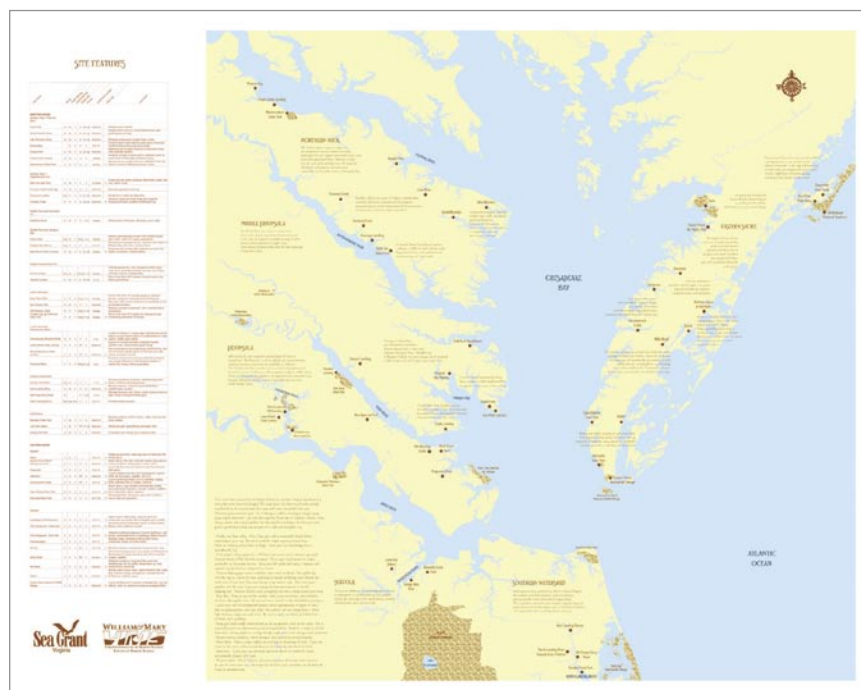


Chefs and students from Hermitage High School in Henrico County, Colonial Williamsburg, and the James River Country Club prepared a delicious lunch featuring two different seafood chowders. Following that, oyster cooking demonstrations were conducted by Richmond chefs Matthew Tlusty of Limani Fish Grill and Dale Reitzer of Acacia.

The American Culinary Federation-approved continuing education program is made possible by the Virginia Sea Grant Marine Advisory Program and the Virginia Chefs Association.

WATER TRAILS MAP TO "GO LIVE" SOON

A newly developed map highlights water trails in the tidewater area and provides information about parking, access, and special site features. Geared to non-motorized and small boats, the map will be available this spring online at the Marine Advisory Program web site, <www.vims.edu/adv/>.



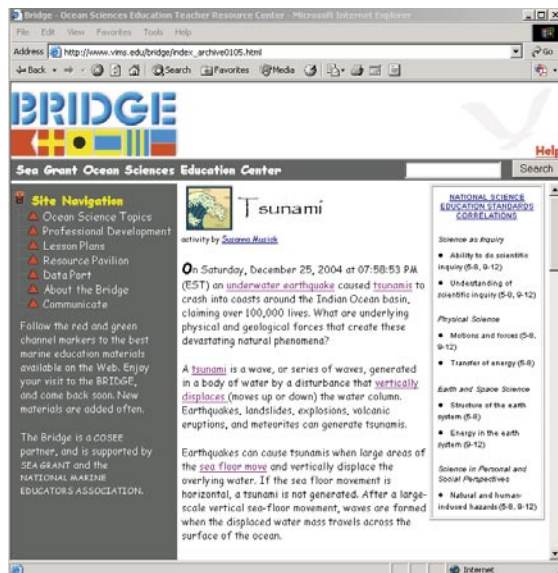
MARINE ADVISORY PROGRAM GETS CYBER FACELIFT!

The Virginia Sea Grant Marine Advisory Program is pleased to unveil a new look and feel to its web pages. Among the new features to visit are announcements and news items, and direct links to programs and services such as seafood seminars and annual tagging reports.

Perhaps most exciting to those looking for information is a brand new, statewide database of Virginia Sea Grant publications and educational resources. Visitors can perform a database search by author, title, or keyword(s) and retrieve information from any of the three repositories at VIMS, UVA, or Virginia Tech.

“The idea is to provide seamless access to any Virginia Sea Grant funded research, education, or extension project, regardless of university affiliation or location,” said communications coordinator Pauli Hayes of the Charlottesville office. The database is still undergoing refinements, but is currently active online at <www.vims.edu/adv/pubs>. Many publications, including this magazine, are available for retrieval as PDF files and are noted as such.

You will also find the latest news about ongoing research, grant opportunities, the clean marina program, commercial fisheries, and much more. Come visit us online!



TSUNAMI DATA TIP POSTED

On Saturday, December 25, 2004 at 07:58:53 PM (EST) an underwater earthquake caused tsunamis to crash into coasts around the Indian Ocean basin, claiming over 155,000 lives, as of this writing. What are the underlying physical and geological forces that create these devastating natural phenomena? In an effort to answer this question for students and teachers, the Bridge posted a Tsunami Data Tip <http://www.vims.edu/bridge/index_archive0105.html>. The Tsunami Data Tip includes background information about tsunamis, National Science Education Standards correlations, and data activities involving seismic and historical tsunami data.

New Publication

A new publication compiled by Sea Grant researchers Oesterling, Adams, and Lazur encapsulates the findings from a workshop exploring the culture of marine finfish for bait. Titled, "Marine Baitfish Culture: Candidate Species & Considerations for Commercial Culture in the Southeast U.S.," the document identifies nine species considered to be prime candidates for aquacultural development:

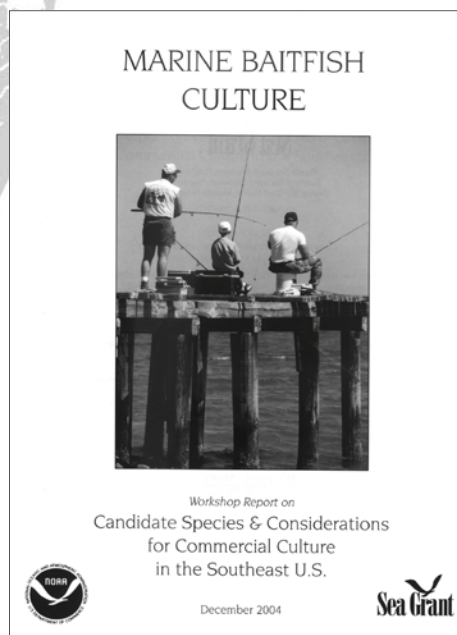
- ◆ Minnows
- ◆ Spot
- ◆ Pinfish
- ◆ Pigfish
- ◆ Croaker
- ◆ Mullet
- ◆ Silver perch
- ◆ White perch
- ◆ Fat sleeper

The workshop focused on identifying existing impediments to viable culture activities, which generally fall into the following categories: regulatory, technical, economic, and environmental impact. That discussion, as well as an up-to-date assessment of research knowledge, is included for each species considered.

To receive a copy of this 28-page report, contact:

Sea Grant Communications
Virginia Institute of Marine Science
P.O. Box 1346
Gloucester Point, VA 23062
(804) 684-7170

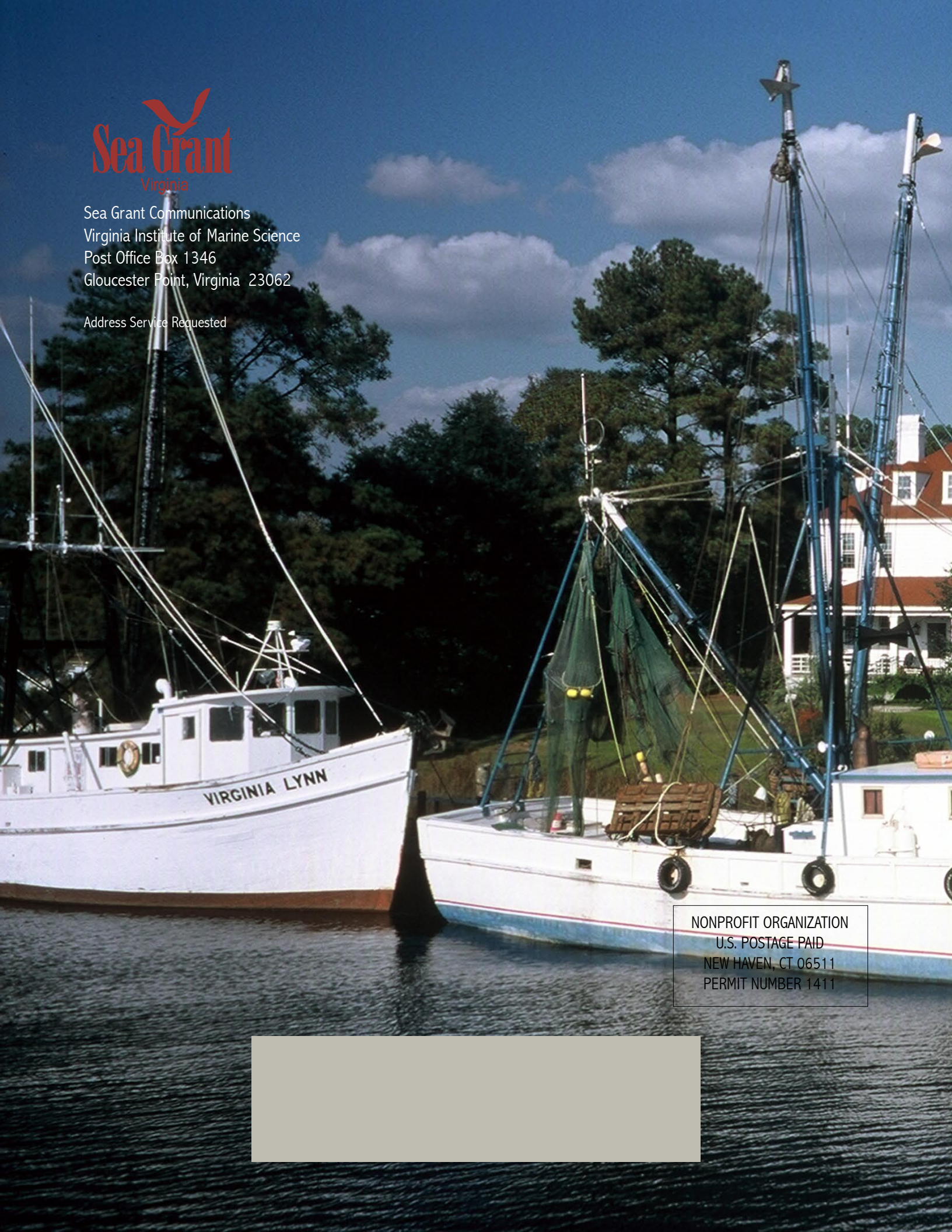
and ask for Marine Resource Advisory No. 77.





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