

COAST WATCH

Courtesy of the Exxon Corp.



Oil-drilling platforms off Louisiana, in the Gulf of Mexico

Offshore oil: what's in it for North Carolina?

When oil companies finally plunge their drills into North Carolina's outer continental shelf, chances are that folks on the beaches won't even know the drilling is going on.

But that hasn't stopped them from asking questions. They want to know what an oil find would mean for the state. Will there be economic benefits? Will the drilling mean more jobs? Will it pose a harm to the environment? In

short, they want to know, what will be the costs and benefits of offshore oil drilling for North Carolina?

The fact is that no one knows for sure what it'll mean for the state. We can't look to other states for answers because what's happened with offshore oil drilling there doesn't always apply in North Carolina. The water is much deeper off our coast and the currents much stronger.

And then there are those who point out that any discussion of these questions is premature. After all, there may not even be any oil out there.

What we do know is that for now, while companies are still in the exploration stage, there probably won't be any boom towns on the state's coast. Eric Vernon, coordinator of the state's Outer Continental Shelf Task

Continued on next page

Force, says there are no plans for any major onshore facilities such as a refinery. And even if oil companies go all the way to production of oil, the direct benefits to North Carolina would be minimal.

But he doesn't exclude the possibility of North Carolina gaining from the oil exploration since any offshore oil operation has to have an onshore support base. (Morehead City has been chosen as the site for a support base.)

As development offshore increases, says Vernon, onshore activity will increase and that will generate some revenues in the state.

Angela Waldorf, associate director of the N.C. Petroleum Council, says local merchants will benefit when the oil companies contract for services for employees on the drill ship.

Chevron, the company first in line to begin drilling, estimates it will be buying food for three meals a day for a crew of 100 as well as supplies to maintain the drill ship.

But as for local residents looking to land a job on an oil rig, Waldorf says that probably won't happen because the state's work force isn't technically trained for oil drilling.

Most of the workers will be from out-of-state. They'll work on a rig for two weeks, then take a helicopter to the airport and fly home.

The federal government stands to gain considerably from offshore oil exploration, whether oil is discovered or not. In 1981, total receipts from

bonuses, rents, rights of way, royalties and interest on leases put \$12 billion into the federal treasury.

Some of that money comes back to the state in the form of the Coastal Energy Impact Program (CEIP), but at this point, there are no direct funds coming to the state as a result of offshore oil leases.

will have "several unavoidable, adverse environmental effects," all of which will be "temporary, localized and reversible."

According to the report, air quality will be affected by emissions from the ship during drilling, but breezes will quickly disperse the fumes. Water quality will be affected by releases of

We can't look to other states for answers because what's happened with offshore oil drilling there doesn't always apply in North Carolina.

This could change if a bill passes in this session of Congress requiring sharing of revenue from offshore oil and gas exploration. The legislation would give North Carolina and other coastal states a share from the sale of offshore drilling leases. The bill's sponsor, Rep. Walter Jones, D-N.C., estimates North Carolina would gain \$9.3 million from leases during the 1984 budget year. House hearings on the revenue-sharing bill were scheduled for March 1 and March 10.

On the cost side, there's only speculation. Could we be harming our environment with offshore oil development?

The most obvious concern is an oil spill. (See story on next page)

But there's more to it than that. In a report submitted to the state's Outer Continental Shelf (OCS) Task Force, Chevron says the exploratory drilling

drill cuttings and of muds used as a drilling lubricant.

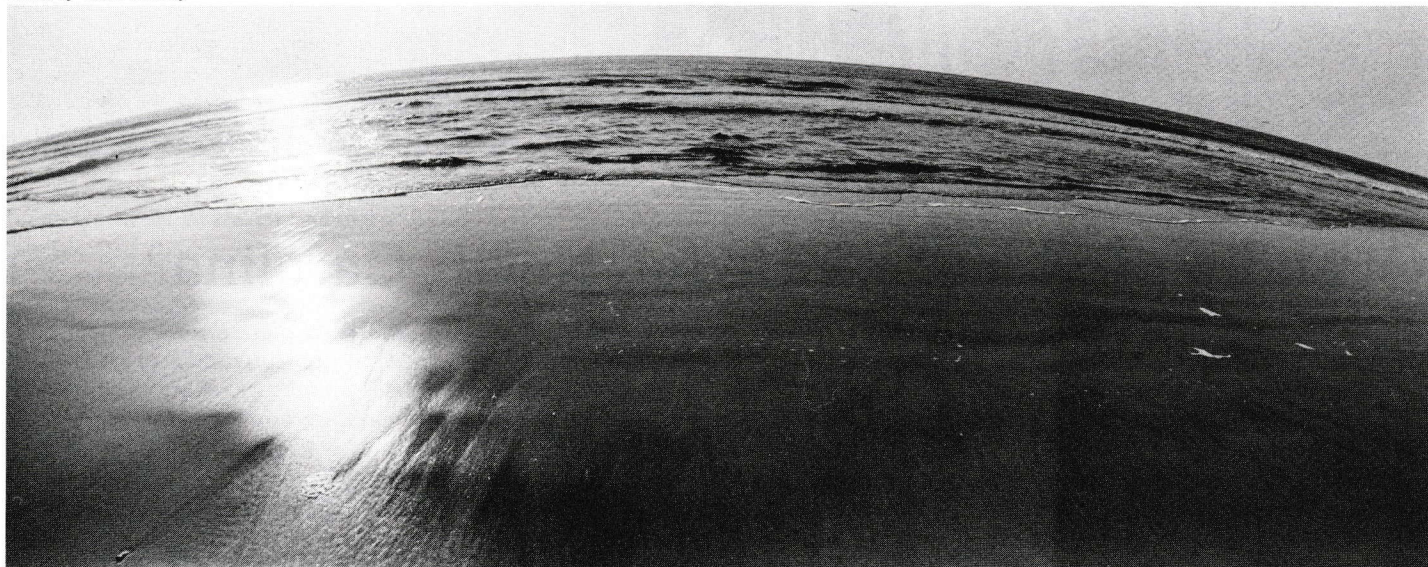
The rock cuttings are discharged continuously with little effect. There is concern, however, over the muds.

Made of clay minerals, some minor components of some drilling muds have been found to be toxic in the laboratory, says Bill Kirby-Smith, an associate research professor at Duke University Marine Lab in Beaufort. But he adds that, in field situations, the toxicity is much reduced by dilution of the muds as they are dispersed in the water.

In areas of strong currents, the finely textured muds remain in the water column until they're carried away from the drilling site and dispersed in a wide area. In weaker currents, the majority settles to the bottom, says Kirby-Smith.

That causes more concern. National

Photo by Steve Murray



The view offshore, distorted by a wide-angle lens: Oil companies say that because of Earth's curvature, offshore wells would be hidden from North Carolina beaches

Marine Fisheries Service fishery biologist Gene Huntsman says the cuttings and muds could bury reefs in the area of drilling—reefs that support substantial fisheries off North Carolina.

To protect those reefs, oil companies must comply with the biological stipulations attached to offshore leases, says Guido De Horatiis of the Minerals Management Service. As part of its pre-drilling permit process, a company must conduct geophysical surveys to determine if the drilling site is a hard bottom area. Since living things such as sponges and corals often attach to such hard bottoms, thereby attracting a community of fish, the companies must prove the discharge of materials from the drilling will not affect the area.

Chevron's report points out that companies have been drilling in the Gulf of Mexico for over 20 years without any significant effects from mud discharges, even in the shallower waters.

If oil companies do find oil and go into production, there's the problem of how to get the oil to shore. Yates Sorrell, a North Carolina State University Mechanical and Aerospace Engineering professor, looked into the problems of pipelines from offshore wells to onshore.

Sorrell says it's important to place the amount of potential impact in perspective. "Shrimp trawling in North Carolina's inside waters annually disturbs a far greater volume of sediment than would be disturbed by a number of major pipelines."

Sorrell says most of the problems associated with pipelines can be alleviated with careful planning.

There's always the possibility that oil companies won't find commercial quantities of oil. Even if they don't, Vernon says nothing will be lost. He recalls a previous sale off the coast of Georgia. "Everything was geared up, everybody was ready to go and they just didn't find anything. They drilled six holes and they were all dry and they abandoned their efforts," he says.

He adds that the process took three years once the lease sale had been conducted. Vernon predicts North Carolina may be in for a similar wait before we know for sure what will be the impacts of offshore oil drilling in this state.

—Nancy Davis

Photo by Hilda Livingstone



Bags of oily sand during cleanup in Dare County, after a 1980 spill.

Spills—the trouble with oil

Oil spill. The words are so married by consonance as to make the event they describe seem practically inevitable. Where you have oil, you'll have spills—right?

Not according to the petroleum industry. In public meetings up and down the coast, oil company spokesmen have been assuring North Carolinians that we will probably never see oil spilled from a rig offshore. The gist of their argument is: First of all, it is highly unlikely that oil will turn up in quantities sufficient to attract much drilling off North Carolina. It is even more unlikely that any oil would spill, should the drilling commence. And, even if there is a spill, it is unlikely to approach the coast. And, even if it did, cleanup teams would mop it up before it came ashore.

So with unlikelihood piled upon unlikelihood, the companies argue, risks of a destructive oil spill reaching our beaches or marshes from drilling offshore are "extremely remote."

But are they? Research has not entirely settled the questions about oil spills, but studies do help show some of the factors involved—the speeds and directions of currents, the sensitivity of marshes and beaches to oil damage, the so-called "fate" of oil in the environment.

Len Pietrafesa, an oceanographer at North Carolina State University, has conducted a set of research projects,

funded by Sea Grant and others, in which he studied the paths of currents off North Carolina, recording data on winds, sea level, temperature and salinity. In a research supported by the Bureau of Land Management, he compiled such information for the outer continental shelf from Cape Hatteras to Cape Canaveral. Pietrafesa's reports have drawn no conclusions about the oil-drilling process, but his work has been cited by state officials concerned about leasing tracts nearest the coast.

Pietrafesa says that the chance of a spill reaching shore depends upon where offshore the spill occurs, the time of year, and where in the water column the oil is released. "For instance, if you were to have a spill from, say, September through February, if the spill were near Cape Lookout and at the surface, there would be a ninety-five percent chance of oil reaching the beach," he says, as long as the spill is within twenty miles of the coast. "In other areas, say twenty miles off Cape Hatteras during April, oil would have a twenty percent chance of reaching the beach."

Pietrafesa says that if a spill occurred in the Gulf Stream, it wouldn't necessarily flow north and miss the state. Every week and a half or so, waves from the Gulf Stream (called Gulf Stream frontal events) push a

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load of sediment, nutrients and larvae into coastal ecosystems. Such waves, Pietrafesa says, might also carry oil.

Using sophisticated wave and current-monitoring gear, Pietrafesa has accumulated a collection of data that he says will help scientists predict the path of an oil spill, should one occur. Such information is vital, since the high-energy waves, winds and currents off North Carolina would pose unique problems during a spill.

"Our coastline is clearly more energetic than anyplace else on either the Atlantic or Pacific coasts," Pietrafesa says.

And though the oil companies say their engineers can design drilling rigs to withstand such forces, they are taking a hard look at the high currents and deep waters. Wally Worthington, offshore district drilling engineer for Arco Oil and Gas Company, a division of Atlantic Richfield, says that his company's leases are in water 1500 to 2000 ft. deep. When Arco begins its test-drilling, perhaps sometime in 1984, it will use drill ships and the cost will run about \$100,000 a day.

"We have drilled in waters fifty-eight hundred feet deep in the Mediterranean," Worthington says, "The technology isn't new; it's just unproven, particularly in a high-current area. We have drilled in high currents but not in deep water with high currents. That's why we check, double-check and triple-check our planning."

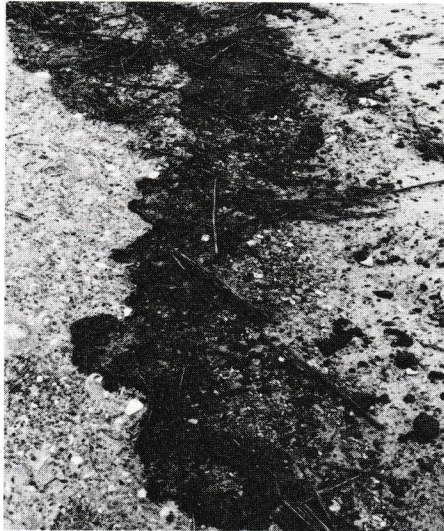
To help protect themselves from liability in the event of an oil spill, companies have allied to hire a single contractor to look after their oil-spill cleanup operations in the Atlantic. The contractor, Haliburton Services, says it will set up shop in Morehead City sometime before drilling begins, and will keep gear, such as floating oil-containment booms, ready to go. The firm estimates that it could have a team on the site of a spill two hours after it occurs.

But as is the case with drilling rigs, the techniques for containing oil are untested in conditions like those off North Carolina. And, while the booms perform well in the calm waters of the Gulf of Mexico, they are not designed for seas greater than eight or 10 feet.

And what if oil does spill, does evade the cleanup, and then makes its way to shore? The familiar pictures of oily shorebirds and blackened beaches con-

vey the ugliness of an oil spill, but not much about its effects on the environment. Most scientists agree that the effects of an oil spill on beaches seem to be moderate and reversible. Studies of coastal oil spills have for the most part shown that, although some marine organisms die off immediately following a spill, their populations are reduced by no more than occurs during seasonal variation. The most toxic parts of an oil spill—the aromatic compounds—evaporate soon after a spill, so that often only the heavier, less deadly "tars" reach shore.

Photo by Hilda Livingstone



Tar-like remains of oil slick

For three weeks in 1970, an estimated 65,000 barrels of crude oil were discharged from a Chevron oil-production platform 11 miles east of the Mississippi River Delta, in the Gulf of Mexico. Researchers estimated that between 25 and 30 percent of the oil evaporated during the first 24 hours. Ten to 20 percent was cleaned from the surface of the water. Less than one percent dissolved, and less than one percent turned up in sediments within a five-mile radius of the platform. The remaining oil emulsified and dispersed to undetectable levels, biodegraded or photo-oxidized.

Oddly enough, few regions of the country have had more experience with spilled oil than the Outer Banks of North Carolina. During the first six months of 1942, German U-Boats sunk 100 merchant ships off the East Coast, spilling about 484,200 metric tons of petroleum products into American coastal waters. Nearly one-quarter of this petroleum was concentrated in the

waters surrounding Cape Hatteras.

In a report published in 1977 by Sea Grant at the Massachusetts Institute of Technology, researchers concluded that fourteen slicks totalling about 161,500 barrels of fuel oil were released near Ocracoke Island during 1942. Three of the slicks reached shore. Residents elsewhere on the Outer Banks remember oil on the beaches almost constantly during the period. The report states that although there are no data available on the impact of fisheries and wildlife, residents and newspaper reports claimed that fishing and duck-hunting "were as good as ever."

The scientists also found that the Outer Banks acted as a natural barrier to drifting oil, protecting the more sensitive and productive inland waters of Pamlico Sound.

The report concludes: "It would be desirable to draw from these results the conclusion that nature would recover its losses in all cases given the required amount of time. Although this may be true, the results of this study will not prove this assertion. It can, however, be said that in two cases, regional wildlife and economy survived with minimal difficulty."

In fact, the most serious damage to North Carolina beaches from a modern oil spill might be economic: tarred beaches put a damper on tourism and slicks can temporarily disrupt fishing and boating. But if oil did make its way into marshes and estuaries, the stakes would be much higher.

Scientists say that much more study is needed before they can be sure of the effects of oil spills on marshes and estuaries. In some areas, the damage has been dramatic. After the Amoco Cadiz spill in 1979, miles of invaluable marsh and wildlife habitat along the Brittany Coast of France were destroyed. (Researchers Ernie Seneca and Steve Broome of North Carolina State University have been helping the French re-establish new marsh with planting techniques they developed during a UNC Sea Grant project.)

And even when the results are less obvious, oil causes subtle changes in marsh ecosystems. Frederick Phaender, a scientist from the University of North Carolina at Chapel Hill, has studied the effects of petroleum on marsh grasses in experiments near Morehead City. Phaender and a student, Earl Buckley, used a synthetic

crude oil in their test plots. They found that oil inhibits cellulose mineralization, the natural breakdown of plants in the marsh.

"The bacteria, instead of using the marsh grass, switched over and used oil," Phaender says. And while the diet of oil did not seem to harm the bacteria, Phaender says more study will be necessary to show missing links in oil's progress up the food chain.

"One thing we don't know," Phaender says, "is what happens if the zooplanton, which feed on the bacteria, don't like the taste of oil."

After a spill May fifth of last year from a tanker in the Cape Fear River, the U. S. Coast Guard spent \$100,000 to clean up heavy fuel oil, but did not

have the means to clean nearby marshes as well. And although the effects of the spill seem to be gone, state officials want to study the site, not only to evaluate the damage, but to help predict the effects of other spills.

Such spills from tankers bringing oil into North Carolina may indeed already pose a greater threat than offshore drilling platforms ever will. A draft environmental impact statement published by the U. S. Department of Interior concludes that "spills resulting from existing leases in the region are projected to number approximately one. The greatest number of spills is associated with the transportation of hydrocarbon products. Thus, should the proposed

sale be cancelled, the risk of oil spill occurrence would still exist due to the present volume of oil being imported through the region."

Even so, North Carolina officials want to play it safe, assume the worst, and discourage drilling on tracts nearest shore. According to Eric Vernon, chairman of the state's Outer Continental Shelf Task Force: "The outer continental shelf offshore oil industry has an excellent safety record, so that helps. But there will be spills—there's no question about that—as long as the activity goes on. We just hope that by proper planning and the use of the best kind of technology, that those spills can be minimized."

—Neil Caudle

If, when, maybe And then again

Chevron USA may begin drilling North Carolina's first offshore exploratory well for oil and gas this year. Then again they may not. Chevron may bring in a large sophisticated drill ship to do actual drilling. Then again they may not.

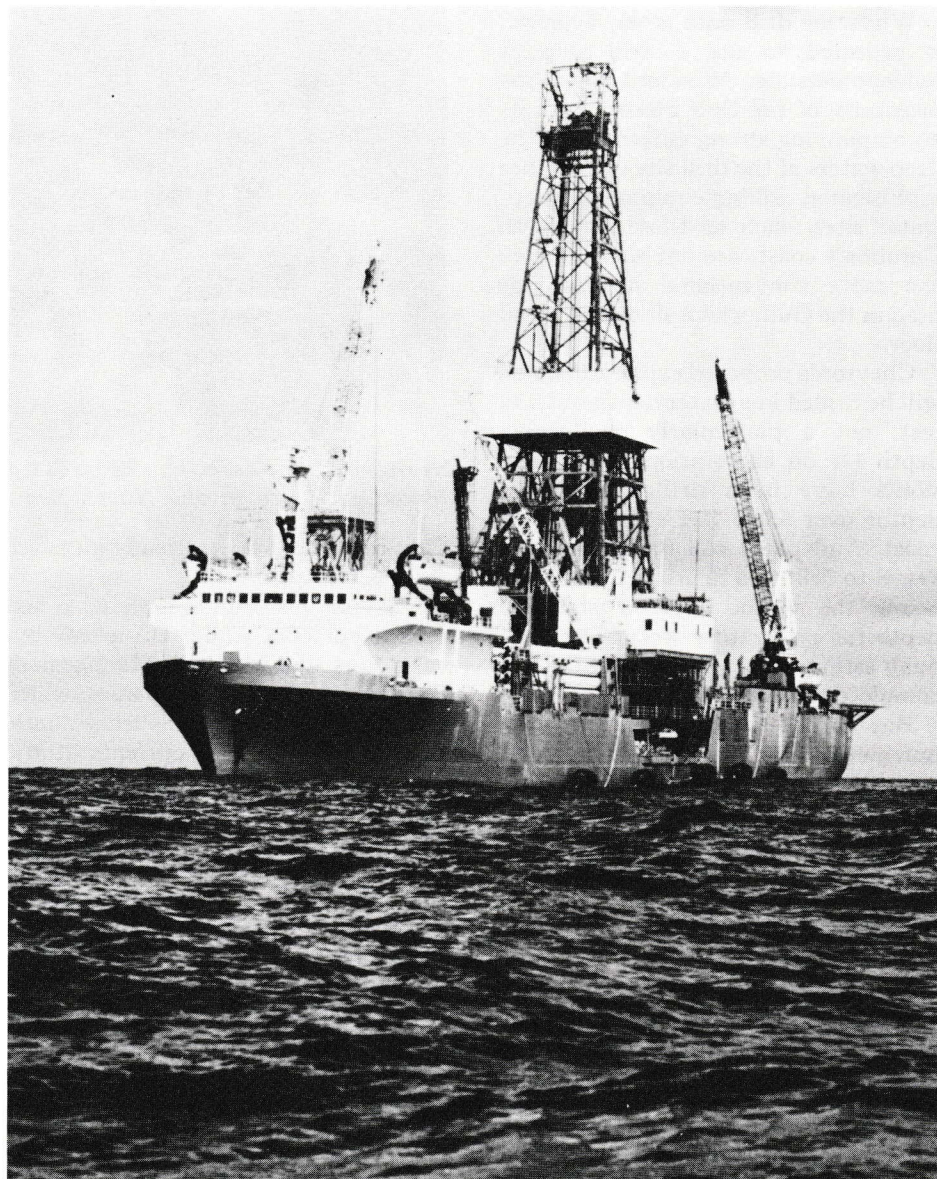
Sound a little uncertain? It is. Until the drilling actually begins, plenty of avenues are open for change. And North Carolina's outer continental shelf offers the oil companies a few extra challenges—deep water, a strong Gulf Stream current—that require added precautions, money, expertise and time for planning.

State and federal officials predict Chevron USA should be the first oil company to emerge from the maze of permits, plan-approvals and bargaining needed to assemble an exploratory well. Chevron would like to begin drilling on Manteo Block 510 in tract 18, 38 nautical miles east-northeast of Cape Hatteras, during 1983, says R.L. Woodard, Chevron's division exploration manager for the northern division. But the schedule is far from set.

Chevron is negotiating with companies to finance the well, and no agreement can be reached on a drilling date, Woodard says. Chevron purchased Block 510 with Conoco Inc. and Shell Oil Co., in Lease Sale 56, paying over \$26 million. Other com-

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Courtesy of Phillips Petroleum Co.



Drill ships: one of the maybe/maybe nots

panies with nearby blocks, such as Mobil, Amerada Hess and Marathon, are expected to share in the well's estimated \$20 million price tag and in the geologic information gleaned from exploration. But falling worldwide oil prices have left oil companies hesitant to gamble on exploration, Woodard says. "Our partners say, let's wait and see how things go," Woodard says. "But we (Chevron) would like to go ahead and drill this year."

Chevron had planned to drill with the *Sedco 472*, a top-of-the-line drill ship designed especially for deep-water exploration. But with the drill date being uncertain, those plans were cancelled, Woodard says. Chevron contracts with drilling companies to do exploratory work and the final choice of vessel depends on availability when the drilling time comes.

When the drill date is set, Chevron is expected to use a drill ship or semisubmersible. Woodard says the proximity of the Gulf Stream with its accompanying strong currents and the deep waters of the drill site will require sophisticated drilling equipment. Deep-water sites, such as those off North Carolina's coast, are not conducive to the more conventional drilling rigs used in the Gulf, which sit on the ocean floor.

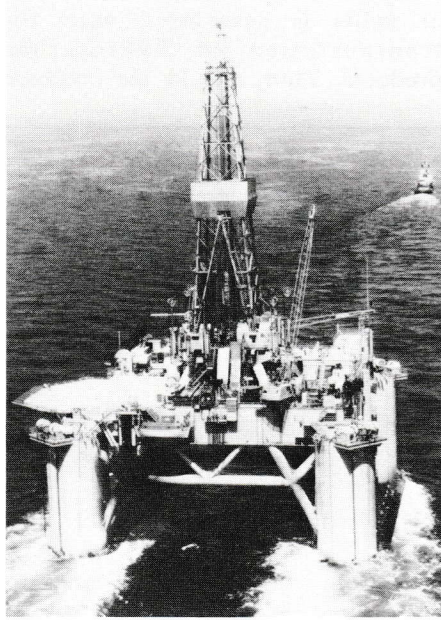
Chevron's proposed exploratory well will be drilled in a water depth of 2,132 feet, not a particularly challenging depth for oil exploration technology. Wells have been drilled in water depths over 6,000 feet off the French coast. And plans call for the drilling vessel to drill to a depth of 20,000 feet below the ocean floor, a standard depth for exploratory wells. The company estimates it will take 144 days to complete the exploration.

But before the first drill bit can burrow into the ocean floor, Chevron must obtain permits and plan-approvals that meet with state and federal regulations. Chevron has already received an Army Corps of Engineers permit that ensures the placement of a drill ship does not interfere with navigation or national security, and an Environmental Protection Agency discharge permit allowing effluent discharges into surrounding waters.

Chevron must also file an exploration plan and environmental report with the state. The Outer Continental Shelf Task Force reviews the plans to

see if they are consistent with the state's coastal management plan. Both the governor and the state Office of Coastal Zone Management comment on the plans based on the task force review, says Eric Vernon, coordinator of the task force. The governor makes his comments to the U.S. Dept. of Interior's Minerals Management Service, while the Office of Coastal Zone Management makes its comments to the U.S. Dept. of Commerce's National Oceanic and Atmospheric Administration, Vernon says.

Courtesy of Texaco Inc.



Semi-submersible rig being towed to a site in the North Sea

Chevron's plans have already met with the state's approval.

Chevron has also completed a six-month currents study. On a case-by-case basis, the Minerals Management Service is asking oil companies, which plan to drill along the South Atlantic coast, to complete a currents study, says Guido De Horatiis, team leader for the Mid-Atlantic District of the Minerals Management Service. The proximity of the Gulf Stream along with surrounding deep waters meant some extra engineering precautions might be needed, says De Horatiis.

The final step Chevron must complete before drilling is approval of a permit to drill from the Minerals Management Service. To satisfy one of the requirements for the permit to drill, Chevron must have an oil spill contingency plan that meets with U.S. Coast Guard approval. Chevron must

prove to the Coast Guard that it has the capability, both mechanically and with trained personnel, to deploy its oil spill cleanup equipment quickly and efficiently. Chevron's oil contingency plan has not yet been approved, says De Horatiis.

Federal standards also require Chevron to perform an oil spill drill that will demonstrate their oil spill cleanup capabilities. De Horatiis says Chevron plans to complete its demonstration at the drill site during some preliminary work.

The Minerals Management Service is requesting some additional information from Chevron before it makes its final review of their permit-to-drill request in early March, De Horatiis says.

When all its permits are in a row, Chevron need only choose a drill date and drilling vessel before setting up shop along the state's outer continental shelf. And except for occasional helicopters whirling overhead, coastal residents and visitors will never know Chevron is drilling, Woodard says. The curvature of the earth will prevent beachgoers from seeing the drilling vessel, and Woodard says that no oil or gas burn-offs will cloud the sky.

And Chevron isn't the only oil company preparing to drill. Arco Oil and Gas Co., a subsidiary of Atlantic Richfield Company, has begun the permitting process for drilling on Block 709 or 710 in Tract 28, which it bought along with Murphy Oil Corp. and Odeco Oil and Gas Co. for over \$2 million. Their exploration plan and environmental report has already met with state approval, Vernon says. Their plans call for using the *Aleutian Key*, another drill ship, for exploration.

But they lack some necessary federal permits. "They have not applied for their permit to drill and are still working on their currents study," De Horatiis says.

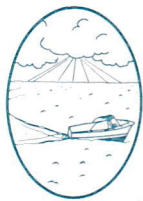
Wally Worthington, offshore district drilling engineer for Arco, says it will be 1984 before Arco begins drilling off North Carolina "unless Chevron gets started and makes a discovery."

But nothing is certain when it comes to oil companies, drill ships and schedules, says a spokesman in the oil industry. "What we say today could be different tomorrow," she says. "Things are always changing."

—Kathy Hart

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919)/737-2454).



In North Carolina, the charter boat season generally lasts from Easter weekend to Thanksgiving. But some boat owners have been booking groups since last fall. And most boats are already reserved for the more popular spring and summer weekends.

Jim Luxton at the Harker's Island Fishing Center says North Carolina has three traditional types of charter boat fishing. For the strong stomachs, there's fishing on the Gulf Stream. You could look forward to catching tuna, wahoo, dolphin and billfish. That's about a 12-hour trip with an average cost of \$500.

Charter boats also make in-shore fishing trips that last nine to 10 hours and average \$400 in cost. Your catch might include king mackerel or bluefish.

If it's bass, grouper or snapper that you're after, you need to go bottom fishing, says Luxton. That's about a \$350 trip.

While those prices are averages for North Carolina boats, Luxton says they usually include the boat for the day, the crew, bait, tackle and ice. He adds that most charter boat captains are willing to tailor the trip for the customer.

Most charter boats hold about six passengers. If you're looking for a less expensive fishing day, you might consider a head boat. They hold 25 to 75 people and cost \$40-\$45.

Luxton advises making reservations for a charter boat four weeks in advance.

Larry Giardina and Sam Thomas, of Sea Grant's Marine Advisory Services, will be displaying packaged and frozen seafood at the Carolina Food Service Expo, sponsored by the N.C. Restaurant Association, March 22-24 at the Charlotte Merchandise Mart.

They'll be answering questions from restaurateurs and food service operators—when the seafoods are in season, where they can be bought and how much they cost—and making contact with buyers. Giardina says he'll report back to seafood dealers in North Carolina so they can follow up on his leads.

The booth, "Seafood USA," is sponsored by the Gulf and South Atlantic Fisheries Development Foundation. For more information, contact Larry Giardina at (919) 726-0125.



John Sanders, Sea Grant's marine weather awareness specialist, has been spending a lot of time before the cameras lately. He has been helping the Educational Media Center at North Carolina State University (NCSU) put together a 20-minute film, "Before the Hurricane Strikes," warning people of the hazards of hurricanes and telling them how to prepare for powerful storms.

The film features old footage from Hurricane Hazel, new footage from Kitty Hawk, where 12 cottages were undermined by an October 1982 northeaster, and time-lapse satellite photography of the tropical areas where hurricanes are spawned. The film will also feature Pamlico Junior High School students going through the steps needed to prepare for a hurricane.

While the film is visually tailored for North Carolina audiences, it can be used in other Atlantic and Gulf states, Sanders says. "The script was written in such a way that the information can be used in any state threatened by hurricanes," says Sanders.

The film is part of a package, which

includes an instructional guide, that will be distributed by the Educational Media Center. The package will be available to schools, museums and other interested groups for a minimal charge. For information about the film, write Jeannie Seamon, Educational Media Center, 2318 D.H. Hill Library, NCSU, Raleigh, N.C. 27607 or call (919) 737-3971.

Luis Aguilar Valdez, a University of Mexico professor of animal ecology and aquaculture, will spend the next four months in Raleigh learning more about American methods of aquaculture. Ron Hodson, Sea Grant's associate director and director of the Aquaculture Research and Demonstration Center in Aurora, will serve as host for Aguilar.

Aguilar is participating in the Latin American Visiting Scholar Program. He will be learning more about tilapia, an African food fish. Aguilar wants to explore the feasibility of fertilizing culture waters with swine and poultry manure to increase blue-green algae growth. Tilapia feed on the algae. Hodson, who has also been conducting some tilapia studies, will be advising Aguilar.



Leon Abbas, UNC Sea Grant's marine recreation specialist, has been recognized by the N.C. Marina Association for "providing educational opportunities" to the state's marina industry.

Abbas received a plaque during the association's annual meeting, held Jan. 21 and 22 at Wrightsville Beach. Jerry Macon, past-president of the association, said that Abbas has "helped us with our projects, and with our communications with state agencies."

Abbas received a similar award two years ago, when the association honored him for providing information the group needed to organize its programs.

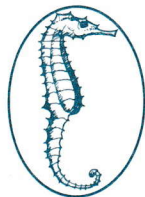
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UNC Sea Grant has published two Blueprints written by Sea Grant specialists, Sam Thomas and John Sanders. "Fire Prevention Safety Tips," written by

Thomas, a seafood specialist at the NCSU Seafood Laboratory in Morehead City, is designed to help seafood processors and food processors protect their processing plants from fire. For a free copy, write UNC Sea Grant, P.O. Box 5001, Raleigh, N.C. 27650. Ask for publication, UNC-SG-BP-82-2.

"Hurricane Safety Checklist," written by Sanders, Sea Grant's marine weather awareness specialist, provides step-by-step instructions for helping coastal residents prepare for an approaching hurricane. For a free copy, write UNC Sea Grant. Ask for publication, UNC-SG-BP-82-3.



When it comes summer, you can bet Lundie Spence has a calendar full of coastal workshops planned for teachers. And this year, Spence has three work-

shops on tap.

The first is set for the Teacher Institute in Belize, a small country south of Mexico. The ten-day workshop (July 7 to July 16) is designed for upper elementary and secondary science teachers. Participants will investigate rivers, mangrove swamps, grass flats

and coral reefs. In addition to science activities, teachers will visit Mayan ruins and canoe old Mayan trails. The Institute is designed to teach field science techniques, to provide teachers with an opportunity to work with scientists doing research and to help teachers make comparisons between North Carolina ecosystems and tropical ecosystems. The workshops will be limited to 15 teachers. It will cost approximately \$900. Teachers will receive certification renewal units and Gifted and Talented credit. The workshop will be sponsored by N.C. Dept. of Public Instruction's Division of Science Education and UNC Sea Grant. For more information or an application, write Lundie Spence, UNC Sea Grant, 105 1911 Building, North Carolina State University, Raleigh, N.C. 27650 or call (919) 737-2454.

The second summer workshop, "Coastal Beginnings—America's 400th Anniversary Celebration," is scheduled for July 17-24 at the N.C. Marine Resources Center on Roanoke Island. This workshop will focus on the nation's first colony—its culture and its environment. The workshop is limited to educators who teach North Carolina history. Spence is requesting that teachers apply in teams of three (one fourth grade teacher, one eighth grade teacher and one supervisor or administrative resource educator) from each of the eight educational regions. The workshop will cost approximately \$120 and is sponsored by Sea Grant, the 400th Anniversary Committee, the N.C. Marine Resources Center at Roanoke Island

and the N.C. Dept. of Public Instruction's Division of Social Studies. Participating educators will receive renewal units and Gifted and Talented credit. Write Spence for an application.

The final workshop, "The Sea and Science," will be held July 24-29 at the Cape Fear Technical Institute in Wilmington. Teachers will learn about the chemistry, biology and geology of the ocean and about beach and salt marsh communities. The workshop is limited to 25 educators—science teachers (grades 7-12), marine occupations teachers and career exploration teachers. The cost is approximately \$120. Educators can earn renewal units and Gifted and Talented credit. The workshop is sponsored by Sea Grant, the Cape Fear Technical Institute and the N.C. Marine Resources Center at Ft. Fisher. Write Spence for an application.

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