UNIVERSITY OF NORTH CAROLINA
SEA GRANT COLLEGE
NEWSLETTER

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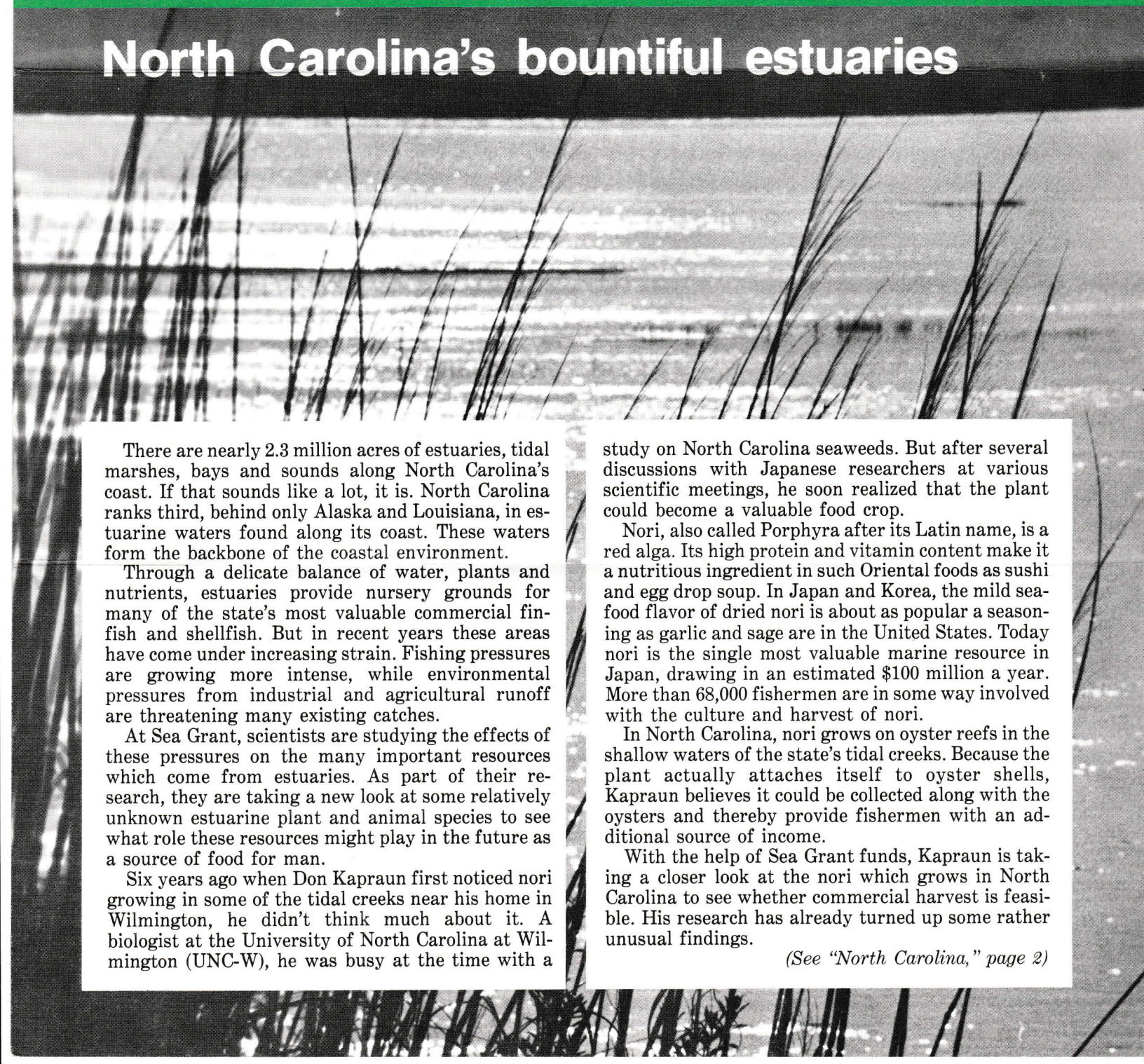
North Carolina's bountiful estuaries



There are nearly 2.3 million acres of estuaries, tidal marshes, bays and sounds along North Carolina's coast. If that sounds like a lot, it is. North Carolina ranks third, behind only Alaska and Louisiana, in estuarine waters found along its coast. These waters form the backbone of the coastal environment.

Through a delicate balance of water, plants and nutrients, estuaries provide nursery grounds for many of the state's most valuable commercial finfish and shellfish. But in recent years these areas have come under increasing strain. Fishing pressures are growing more intense, while environmental pressures from industrial and agricultural runoff are threatening many existing catches.

At Sea Grant, scientists are studying the effects of these pressures on the many important resources which come from estuaries. As part of their research, they are taking a new look at some relatively unknown estuarine plant and animal species to see what role these resources might play in the future as a source of food for man.

Six years ago when Don Kapraun first noticed nori growing in some of the tidal creeks near his home in Wilmington, he didn't think much about it. A biologist at the University of North Carolina at Wilmington (UNC-W), he was busy at the time with a study on North Carolina seaweeds. But after several discussions with Japanese researchers at various scientific meetings, he soon realized that the plant could become a valuable food crop.

Nori, also called Porphyra after its Latin name, is a red alga. Its high protein and vitamin content make it a nutritious ingredient in such Oriental foods as sushi and egg drop soup. In Japan and Korea, the mild seafood flavor of dried nori is about as popular a seasoning as garlic and sage are in the United States. Today nori is the single most valuable marine resource in Japan, drawing in an estimated $100 million a year. More than 68,000 fishermen are in some way involved with the culture and harvest of nori.

In North Carolina, nori grows on oyster reefs in the shallow waters of the state's tidal creeks. Because the plant actually attaches itself to oyster shells, Kapraun believes it could be collected along with the oysters and thereby provide fishermen with an additional source of income.

With the help of Sea Grant funds, Kapraun is taking a closer look at the nori which grows in North Carolina to see whether commercial harvest is feasible. His research has already turned up some rather unusual findings.

(See "North Carolina," page 2)

North Carolina nori receives high marks

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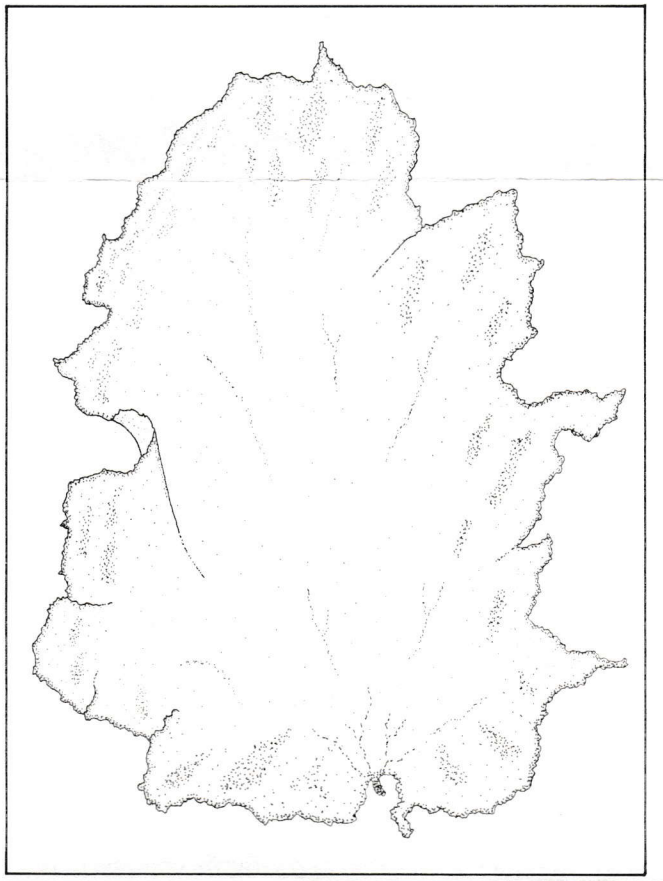
During its lifetime, nori has essentially two life phases. In warmer months, it grows as tiny microscopic filaments known as conchoceli. Sometimes these filamentous blobs appear as dark stains on oyster shells. With the arrival of cooler weather, during late October and November in North Carolina, the combination of shorter days, lower light intensity and cold temperatures triggers a change in the algae and the conchoceli begin to develop into ribbon or leaf-like blades. Within a month the blades are ready to harvest



Nori blade (drawing by D. Kapraun)

Yet the species of nori in North Carolina has an interesting twist to it. Unlike the nori found in the Orient, the plant can reproduce and form both phases from either the blade or conchocelis.

"The Porphyra doesn't have any sex," explains Kapraun. The finding is important for many reasons. Aside from the purely scientific aspect, it may mean that nori can be heavily harvested without any affect on population since new blades or new conchoceli are formed from microscopic spores left in the water.

Because the blades mature in about four weeks, it also may be possible to harvest three crops per year—one in January, another in February and a third in March. This is an important advantage since it takes about 10 pounds of the fresh nori to manufacture one dry pound.

Nutritionally, North Carolina's nori may be on the same par as the Japanese Grade A variety. With the technical assistance of Dr. Carl Lundeen, a biochemist at UNC-W and biology student Doug Luster, Kapraun has been able to analyze the protein, lipid and carbohydrate content of the plant. Although further tests are needed, nori rated better than 37 percent protein per dry gram in initial studies.

According to Kapraun, one of the biggest advantages of the nori found in North Carolina is its distinctive appearance. No other leafy marine alga in North Carolina has a red-purple color.

Although nori also is found in the Northeast and along the West Coast, Kapraun doesn't think that it will be economical to harvest the plant in those areas because of the time and labor involved in segregating it from the many other similar plants that grow there. "It would be more like mushroom picking than berry picking because the flora is so rich," he explains.

Ironically nori seems to grow best in waters that have been polluted by organic wastes, such as sewage and agricultural runoff. Unfortunately, that could make the plant dangerous to eat. In North Carolina today more than 450,000 acres of estuarine waters are closed to shellfishing due to pollution, both natural and man-caused.

While plants do not generally concentrate viruses, Kapraun stresses that studies must be done to see whether the nori accumulates pathogenic bacteria, viruses or even toxic substances discharged into the waters where it grows.

And there are other aspects of the plant's biology that need to be better understood.

Researchers still are not certain just how much nori actually exists in North Carolina and how far its range extends. Natural populations of the plant may be too limited to support a commercial operation. If this is true, Kapraun believes that it may then be possible to enhance the amount of habitat available to the plant by actually creating shallow, shelly bottoms where it can grow in greater abundance. One alternative, he suggests, is the selective use of dredge spoil to create suitable bottom areas.

In Japan the demand for nori is so great that it is cultured and grown on huge networks of rope. Through an expensive and labor intensive process, the plant is harvested, shredded and dried in sheets. While this is not economically feasible in North Carolina, Kapraun thinks that enhancement of natural areas may be a key to establishing a viable nori industry in North Carolina. Japanese importers/exporters already have expressed an interest in his research. And nori is becoming a popular food item in many specialty stores in the United States.

With dried nori selling for $2.00 to $3.80 an ounce and as the search for additional sources of high protein food continues, it's a subject that may be of growing interest to many North Carolinians as well.

Rangia: cleaning up a bad reputation

You could hardly call it a seafood delicacy. Until twenty years ago it wasn't even found along our coast. But a sudden, unexplained extension of its range in the mid-1950s firmly established the Rangia clam as a regular resident of the shallow, brackish waters of North Carolina's estuaries.

It's hard to mistake the Rangia for a surf or hard clam. Its heavy, brown shell is shaped more like a mussel than a clam. And its taste . . . well, ask people who have bitten into the meat of a Rangia clam, and they will tell you that it is far different from any clam they've eaten before. Some say it tastes "musty." Others claim that it tastes similar to the smell of a rotten log.

Yet people do eat the Rangia. And some North Carolina seafood dealers, always on the lookout for new products, have hopes of reviving the Rangia market. In the late 1890s Rangia was marketed in Texas as the "Texas little neck." During the 1960s, a North Carolina seafood dealer sold the clam to markets in New York City for use in a clam cocktail.

But suddenly things began to turn sour for the Rangia in North Carolina. A shipment of fresh, shucked Rangia clams bound for markets in New York City failed to pass an inspection by New York health authorities. The reason: the clams contained a higher than acceptable level of bacteria. The entire shipment was seized and $10,000 worth of Rangia clams was destroyed.

Concerned by the incident, results from his own tests and the questions being raised by other North Carolina dealers interested in marketing the clam, Bob Benton, N. C. Shellfish Sanitation Program supervisor, turned to Sea Grant for help.

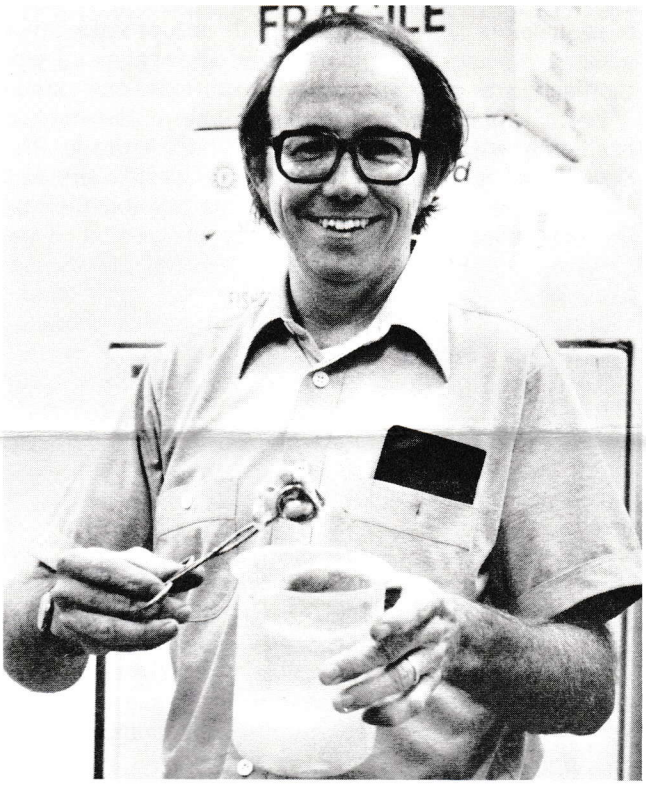
Immediately researchers Barney Kane and Donald Jeffreys of East Carolina University set out to determine the cause of the high bacterial counts and whether they posed a public health hazard.

With the assistance of graduate researcher Paul Comar, the scientists sampled Rangia clams at four different sites in Albemarle Sound over a 12-month period. The studies included waters that were both opened and closed to shellfishing, representing extremes in environmental and sanitary conditions.

In the laboratory, each sample was analyzed for bacterial content. And after a year of study, the researchers determined that the Rangia clams had a naturally high level of bacteria. More importantly, they found that samples taken from waters open to shellfishing did not contain any pathogenic (disease causing) bacteria.

If the bacteria in the clams were not pathogenic, why did New York health authorities reject the shipment of North Carolina Rangia?

New York, like many states including North Carolina, uses what is known as a standard plate count (SPC) to test for bacteriological safety. The test estimates the total bacterial content of a food; theoretically, a food with lots of bacteria (a high plate count) has somehow been contaminated.



Kane with pasteurized Rangia meat

Unfortunately, the SPC cannot discriminate between those bacteria which are harmful or pathogenic and those which aren't. As a result, the test does not always accurately reflect the true health hazard of a particular food.

According to Kane, a similar situation exists with the Rangia. "We have demonstrated that the high standard plate count is not at all indicative that these organisms [the Rangia] are accumulating higher levels of disease organisms than any other seafood," observes Kane. "There isn't a shred of evidence which indicates that they are more dangerous than any other shellfish," he adds.

While the Kane and Jeffreys study indicates that the Rangia may be safe to market from a bacteriological standpoint, there are still many questions that need to be answered before the clam can be given a completely clean bill of health.

Because the Rangia grows best in waters that are only slightly brackish, such as those found in the upper reaches of estuaries, it is exposed to more concentrated levels of waste runoff than are many other estuarine organisms. From a public health standpoint that's an important distinction. As filter feeders the clams ingest water and suspended sediments which pass around them. If toxic substances, such as pesticides and heavy metals, are present in the water,

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Taste, shelf life still pose problems

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it is possible that the clams will accumulate these poisons. Viruses from poorly treated sewage and septic discharges may similarly contaminate the clams.

From a marketing standpoint, one of the biggest problems with the clam is its short storage life. Because of its high bacterial count, freshly shucked Rangia meat turns sour quickly. One possible method for extending shelf life is through processing. Kane has already begun work with the use of pasteurization. While he is optimistic that it will work on the Rangia and even improve the taste of the clam, he emphasizes that more testing is necessary.

Both Benton and officials with the U.S. Food and Drug Administration have asked the researchers to identify the various kinds of bacteria found in the clam. "We know that they are not pathogenic," explains Kane. "But now we need to know what they are."

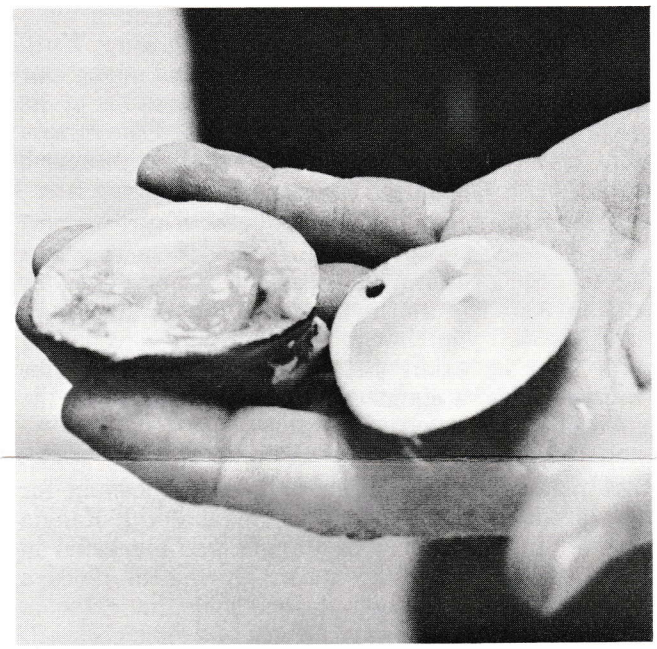
Kane believes this information is vital. It may ultimately help them to find out what is responsible for the "muddy" taste associated with many of the clams and whether it can be improved.

But there are even more basic questions: Can the clam's population support large-scale harvesting? Are there certain environmental conditions in which the clam grows best?

"We need to know more about the clam's population in terms of recruitment and replacement," asserts Kane. "I would hate to get all tooled up for something that may be only a flash in the pan."

Although it was once thought that the Rangia was restricted to Gulf Coast waters prior to the 1950s, fossil sediments from prehistoric times reveal that the clam did occur along North Carolina thousands of years ago. Why did the clam disappear for centuries and then suddenly reappear? Could it happen again?

The answers to these and other questions will require further research and careful study. But Kane and Jeffreys are confident that their studies support the overall bacteriological safety of the clam. And they believe that once problems with shelf life and poor taste are overcome, the Rangia clam could become another important food resource harvested from North Carolina's estuaries.



Rangia on the half shell?

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