NATURAL BACTERIA

Vibrio parahaemolyticus, Vp, is important in maintaining the balance of nutrients in the marine environment, and high densities can occur naturally in oysters. Because an oyster feeds by filtering seawater, it can accumulate enough *Vp* to cause illness in a vulnerable consumer who eats uncooked oysters. Densities of these naturally occurring bacteria vary throughout the year in the marine environment, but they tend to be highest in warmer months when water temperatures are highest. The higher the water temperature, the higher the densities of *Vp* in the water, and potentially, in oysters.

PREDICTING RISK

Variations in density drive research efforts to accurately predict high *Vp* densities that could pose health risks to at-risk individuals who eat raw oysters. The Food and Drug Administration (FDA) has developed an experimental prediction model that uses temperature and salinity to estimate *Vp* densities and the associated risk to consumers.

The University of Southern Mississippi Gulf Coast Research Laboratory (GCRL) launched a collaboration in 2003 with federal and state agencies to take the model's use a step further. GCRL researchers are experimenting with satellite data on water temperature and other environmental factors for use in the FDA experimental prediction model.

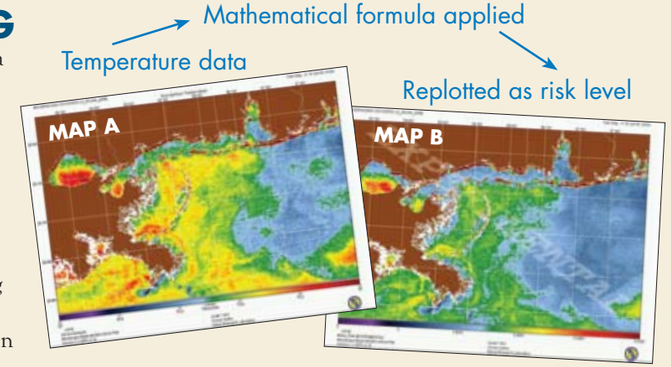
Funded by the National Oceanic and Atmospheric Administration's Oceans and Human Health Initiative, the breakthrough project uses sea surface temperature (SST) data that are already available from satellites. The project determines how well the remotely sensed data match that collected from boats on site in oyster-harvesting waters.

The ultimate goal of the project is to provide maps on the World Wide Web that accurately show changes in predictions of health risk as those changes occur, in essence, real-time monitoring of *Vp*. The value of remote sensing is that data needed for predictions can be obtained even when it is difficult or impossible to send people out on boats to specific areas.

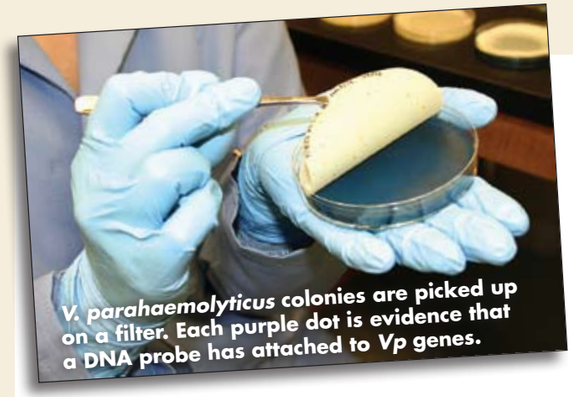
APPLYING REMOTE SENSING

GCRL scientists acquire the satellite temperature data from NASA's MODerate resolution Imaging Spectroradiometer (MODIS) satellite sensor. They then use the data collected at the John C. Stennis Space Center, Miss., to generate sea surface temperature maps. These maps illustrate water temperatures by using a range of colors. In this map (Map A) from May of 2004, for example, the blue color indicates water temperatures of around 22°C along the Mississippi Gulf Coast. Applying the FDA formula allows GCRL scientists to generate a second map (see Map B) that predicts the density of *Vp* in the water.

The maps are first steps toward generating maps that will show predicted densities of *Vp* and the resulting levels of potential health risk to consumers. Achieving that goal involves not only securing satellite data but also conducting environmental sampling to determine how well the data match from the two different methods.



Temperature maps of the northern Gulf of Mexico produced by NASA satellite data for the Naval Research Laboratory.



Ground referencing

Use of remote sensing data must include ground referencing – making sure the information the satellite collects is the same that someone on a boat measures with a thermometer. Once scientists find the degree of correlation between the two data collection methods, they can determine the reliability of predictions that are based on remotely sensed data.

STEPS IN GROUND REFERENCING:

Collect oysters, sediment and water samples

GCRL scientists measure water temperature from the boat with a hand-held thermometer each time they collect, and they bring oysters, sediment and water samples back to the lab for analysis of *Vp* densities.

Prepare samples

The scientists shuck oysters and process oyster meat and the liquor from the oysters in a blender. They shake water and sediment samples vigorously.

Incubate samples

Incubating the oyster samples and water samples at 37°C overnight allows bacteria to reach observable levels for analysis the next day.

Identify *Vp*

A final step in ground referencing is the researchers' use of molecular biology techniques to specifically identify *Vp* among the bacterial colonies. They use a filter to pick up the bacterial colonies and then analyze the bacteria in the colonies with a DNA probe to identify genes that are specific to *Vp,* such as thermolabile hemolysin (TLH).

Ground referencing will contribute to fulfilling the project's objective – development of procedures for generating accurate and easy-to-use maps that show real-time changes in predictions of *Vp* densities. The maps will provide an important tool for predicting potential health risks to consumers, and, as a result, will help preserve public health. The public health benefit can also be used as a marketing tool to educate consumers, maintain consumer confidence and further enhance the already well-established reputation of the Mississippi seafood industry.

Remote Sensing:
NEW APPLICATIONS FOR *SHELLFISH SAFETY*

The research project "The Use of Remote Sensing and Molecular Detection to Predict the Risk of Infection by *Vibrio parahaemolyticus*" is funded by the Oceans and Human Health Initiative of the National Oceanic & Atmospheric Administration. D. Jay Grimes, Ph.D., is principal investigator.

SUPPORTING AGENCIES:

National Oceanic & Atmospheric Administration

Oceans and Human Health Initiative

United States Food & Drug Administration
Center for Food Safety & Applied Nutrition,
Gulf Coast Seafood Laboratory
and
Division of Mathematics

Naval Research Laboratory

NASA, Applied Sciences Directorate

Mississippi Department of Marine Resources

Grand Bay National Estuarine Research Reserve

NOAA National Marine Fisheries Service

Dauphin Island Sea Lab

Mississippi-Alabama Sea Grant Consortium

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Remote Sensing:
New Applications for
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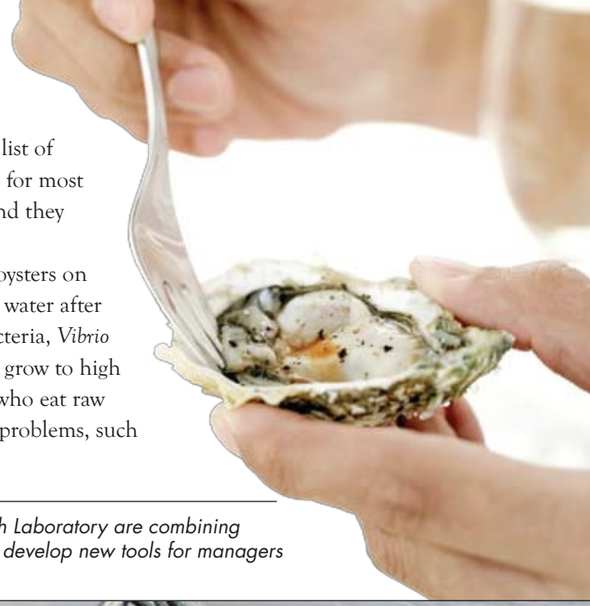
What's for dinner?



Gulf Coast oysters, especially raw oysters on the half shell, top the list of favorites for many Mississippi diners. Although these bivalves are safe for most people to eat, some consumers are at risk. Oysters are filter-feeders, and they sometimes accumulate large numbers of naturally occurring bacteria.

This bacterial content calls for simple safety steps such as keeping oysters on ice after harvesting, and washing hands thoroughly with warm, soapy water after handling raw oysters. If oysters containing the naturally occurring bacteria, *Vibrio parahaemolyticus*, or *Vp*, are harvested and not kept on ice, the *Vp* can grow to high levels. *Vp* in high enough densities can cause diarrhea in consumers who eat raw oysters, especially in those individuals who already have other health problems, such as weak immune systems, diabetes or liver disease.

Experiments at The University of Southern Mississippi Gulf Coast Research Laboratory are combining the use of satellite technology with traditional hands-on data collection to develop new tools for managers of shellfish resources.