Researchers Follow Up on a Controlled Oil Spill

In 1984, two experimental oil spills were planned and carried out on the Atlantic coast of Panama in three tropical environments: mangroves, seagrass, and coral reefs. Biological and chemical data have been collected at several intervals over the past 10 years to determine the effects of oil alone and dispersed oil on the designated areas.

The monitoring program is sponsored jointly by the Marine Spill Response Corporation (MSRC), the American Petroleum Institute (API), and the National Oceanic and Atmospheric Administration (NOAA). The 1994 study team members included Nova Southeastern's Drs. Bart Baca (Center adjunct) and Richard Dodge, Anthony Knap of the Bermuda Biological Station, Tom Sleeter of the Government of Bermuda, and Sam Snedaker of the University of Miami.

Each team member was responsible for monitoring certain spill areas. Dr. Dodge monitored the status of the corals, and Dr. Baca evaluated the health of the seagrasses and mangroves. In general, the team found that even after 10 years, the oil spill effects were still visible in each area being evaluated. Fortunately, partial if not complete recovery has been noted in some areas.

As for the corals, Dr. Dodge learned during his dives that they have made a dramatic recovery since they were last monitored two years after the spill in 1986, when damage was severe. "I could not distinguish the controls from the damaged corals in 1994," he reports. He also notes that "we were very surprised that we found the original oil that was spilled in 1984." The chemists (Drs. Sleeter and Knap) did a study to determine that it was indeed the same oil, using a "finger-print" method of identification.

The seagrasses monitored by Dr. Baca soon after the spill indicated the death of all of the animals, "but the seagrasses completely recovered over several years and now they are back to normal," according to Dr. Baca. He also reports that "mangroves were the heaviest impacted by the spill, but they came back on their own. I could see from the small"
Sea Turtle Nesting Is Still on the Rise

According to Dr. Curtis Burney, principal investigator for Broward County’s sea turtle conservation project, the historical pattern of total nesting continues on the rise. Three different species of sea turtles are the subjects of this study: loggerhead (C. caretta), green (C. mydas), and leatherback (D. coriacea).

The purpose of the project is to protect sea turtle nests and their hatchlings along the entire stretch of Broward County beaches, from Hallandale north to Deerfield Beach (with the exception of Lloyd Beach State Park, which has its own monitoring system). Each day, starting in mid-April, Center workers, under the direction of Dr. Burney and Bill Margolis, hit the beaches before dawn to look for evidence of overnight nesting. When nests are identified, it is determined whether or not they are endangered. If they are, the nests are dug up and relocated in designated areas along Hillsboro Beach to protect them from beach cleaning equipment, as well as from road traffic and artificial lighting.

“The number of sea turtle nests deposited on Broward County beaches has increased significantly in the past decade,” says Dr. Burney. As shown in the first chart below, in 1981 only 1,216 nests were counted for all species. By 1993 the total number had risen to 2,181, and in 1994 the number increased to 2,314. Total nests investigated in 1994 consisted of 1,830 loggerheads, 82 greens, and just 4 leatherbacks. There was one surprise: a hawksbill nest. To Dr. Burney’s knowledge, it was the first such nest reported since the inception of the project.

As seen in the second chart, loggerhead nests increased slightly from 1993. “This year was odd because the season started off very strong, then dropped off fast compared to other years,” Dr. Burney comments. “I have no explanation for this behavior.” The last chart shows green sea turtle nests (top line) and leatherback nests (lower line). “This year greens are up compared to 1993, but this apparently is due to their alternate-year nesting cycles,” as can be
A leatherback hatchling dwarfs loggerheads.

People on the Move

Dr. Barry Klinger traveled to the Massachusetts Institute of Technology in Cambridge, where he presented, on January 20, a seminar entitled "A Kinematic Model of Wind-driven Meridional Heat Transport." He also attended a session of the MICOM meeting at the Rosenstiel School of the University of Miami on February 8. The three-day conference brought together a large number of ocean modelers from around the country and abroad.

Dr. Julian McCreary and Ms. Jan Witte will attend the TOGA 95 International Scientific Conference in Melbourne, Australia, April 2-7. The conference is being organized by the Bureau of Meteorology Research Centre (BMRC) in Melbourne. The BMRC expects "in excess of 500 people" to attend. Dr. McCreary will serve as co-convener of one of the sessions, entitled "Simulation and Predictability." The TOGA (Tropical Ocean Global Atmosphere) program concluded its 10-year stint on December 31, 1994. The purpose of this international gathering is to provide a showcase for the program’s latest research results and an indication of where this area of study is headed. Dr. McCreary and Ms. Witte have served as editors of the program’s bulletin, TOGA Notes, which has been published by the Nova Southeastern University Press since 1989.

Following the Melbourne meeting, Dr. McCreary will visit the Oceanography Division of CSIRO in Hobart, Tasmania. There he will present a seminar entitled "A Four-Component Ecosystem Model of Biological Activity in the Arabian Sea."

Dr. Gary Kleppel is planning future travel. Recently he has been working on developing a research theme area on estuaries for Florida Sea Grant. A panel of experts from academic institutions throughout the state has been charged with examining the existing literature and data on estuaries, in order to develop a concept of their current state and the potential for future management. Over the next few months, Dr. Kleppel will attend several meetings with managers and public watchdog groups, and he hopes to be able to

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\[ 
\begin{array}{cccc}
\text{Species} & \text{NUMBER OF EGGS} & n^* & \text{NUMBER TURTLES RELEASED} & \text{HATCH SUCCESS PERCENT} \\
\hline
\text{In Situ Nests} & & & & \\
C. caretta & 43481 & 407 & 31192 & 71.7 \\
C. mydas & 4637 & 39 & 3211 & 69.2 \\
D. cortacea & 226 & 2 & 175 & 77.4 \\
\text{Total} & 48344 & 448 & 34578 & 71.5 \\
\hline
\text{Relocated Nests} & & & & \\
C. caretta & 156538 & 1423 & 96924 & 61.9 \\
C. mydas & 4989 & 43 & 2902 & 58.2 \\
D. cortacea & 246 & 2 & 144 & 58.5 \\
E. imbricata & 151 & 1 & 108 & 71.5 \\
\text{Total} & 161924 & 1469 & 100078 & 61.8 \\
\hline
\text{Overall} & & & & \\
C. caretta & 200019 & 1830 & 128116 & 64.1 \\
C. mydas & 9626 & 82 & 6113 & 63.5 \\
D. cortacea & 472 & 4 & 319 & 67.6 \\
E. imbricata & 151 & 1 & 108 & 71.5 \\
\end{array} 
\]

\[ n^* = \text{The number of nests actually investigated for hatching success percent.} \]

seen in the huge peaks and valleys over the past several years. For example, in 1992 there were 132 green nests, only 23 nests in 1993, and 82 nests in 1994.

The table above shows the number of relocated nests and the number of nests that were left undisturbed (in situ) for each species, as well as the number of eggs per nest. Note that the total number of loggerhead eggs exceeds 200,000! In addition there were 18,586 eggs from 157 partially predated loggerhead nests and 2,110 eggs from 17 green nests. Hatchling success rates given in the table show that of the approximately 100 eggs that are deposited in a typical nest, a certain number survive to maturity and hatch out; the rest do not survive, for any number of reasons. Significantly, the total success rate for relocated nests is just 61.8%, compared with 71.5% for the in situ nests.

In light of the success rate figures, Dr. Burney comments that "Mass nest relocation as a management practice has uncertainties as to whether it affects the hatchlings or not. If the eggs are disturbed during incubation, would this have an effect later in life? To continue this practice long-term is not viable. As nesting densities increase, we will need to move more and more nests, and we will need more and more manpower. Also, we are running out of relocation sites in Hillsboro, mostly due to beach erosion. The ultimate solution would be to leave the nests in situ and fix the lighting situation instead." As most readers are aware, when sea turtles hatch out, usually at night, they head for the nearest patch of light, which ideally would be the surf. If, however, they are attracted by street lights or headlights ... well, you can see the problem.

In view of the many uncertainties that intensive relocation creates, Dr. Burney explains that "this year it was decided to test the feasibility of leaving some nests in situ at the primarily residential section of Fort Lauderdale Beach. This area was selected because it is where beachfront lighting can be most easily controlled, and it is subject to lower pedestrian traffic than the beaches with direct access from Highway A1A. We caged these nests to protect them from damage during incubation and to retain the hatchlings in the event of severe disorientation."
Recent Center Seminars

The following seminars have been presented in the Richardson Library since publication of the last issue of Currents.


February 13: “Mechano Reception in Marine Copepods: Signals, Sensors, Sensitivity,” by Dr. Jeannette Yen of the State University of New York at Stony Brook. During the lunch hour Dr. Yen held a discussion group with female graduate students to grapple with women’s issues. She also worked with Dr. Gary Kleppel’s Ph.D. students in his laboratory during her visit.

A. Moore To Be Science Judge for a Day

Dr. Andrew Moore will serve as a judge in Science for the 12th annual Silver Knight Awards, sponsored by The Miami Herald. The competition will be held on March 21 at the Broward County Convention Center. After reviewing and ranking 20 or more applications, Dr. Moore will hold 15-minute interviews with the local high school seniors who have entered the competition in Science. Then 42 judges, consisting of 3-member panels in 14 categories, will pick one Silver Knight and three Honorable Mentions from the field of entrants. The awards ceremony will be held later that evening. Dr. Julian McCreary, dean of the Oceanographic Center, had served as a judge for six previous years.

Yule Party a Winner

The Oceanographic Center’s annual Christmas bash, held on December 15, was another winner. The many delicious gastronomic offerings provided a great sendoff for the holidays. The traditional five-foot sub sandwiches occupied much of the festive food table, and numerous delicacies created by Kathy Maxson and Melissa Dore really got the juices flowing. Ms. Maxson was the key planner, ably assisted by Ms. Dore and Helene Taylor. We were pleased to see the large number of guests who made the trip from Nova Southeastern’s main campus, as well as the return to the fold by several old-timers.
Recent Center Publications

Below is an update of scientific publications authored by Oceanographic Center faculty and staff since the Winter 1994 issue of Currents was published. Some papers are still in press.


(Continued from Page 1)

size of the seedlings that growth started up only three or four years ago.”

Long-term, post-spill studies were conducted in September 1994 and November 1994. Dr. Baca is scheduled to return to Panama in March to continue his part of the monitoring project.

“From the standpoint of science,” concludes Dr. Dodge, who was in charge of the monitoring operation, “the project was important because it remains the only study of an oil spill site that began under tightly controlled conditions. We will be completing the final report this spring.”
SPRING TERM SCHEDULE

M.S. degree specialties are Marine Biology and Coastal Zone Management. Each course carries three credit hours or may be audited. Tuition is $315 per credit hour (50 percent less for audit). Classes meet once a week from 6:30 to 9:30 PM at the Oceanographic Center. The spring term extends from April 3 to June 23, 1995. For further information, call Helene at (305) 920-1909.

Coastal Water Resource Impacts (CZMT-0622): Emphasizes development impacts on coastal ground and surface waters. Topics include residential, commercial, industrial, airport, port, and marina development; power plant sites; waste disposal facilities; flood protection; and wetlands loss. Guest lecturers from local, state, and federal agencies will deal with abatement, minimization, and mitigation of impacts. Instructor: Mr. Stacy Myers (Center adjunct; South Florida Water Management District). Starts Monday, April 3 (7:00 PM).

Methods in Plankton Ecology (OCMB-6310): Focus is on common measurement techniques used in water column biology. Emphasis is on field applications for calculating the distributions and evaluating the activities of phytoplankton and zooplankton. Another priority is development of creativity and problem-solving skills. Some classes will meet on weekends. Previous course work or experience with plankton would be helpful. Instructor: Dr. Gary Kleppel (Center faculty). Starts Tuesday, April 4.

Marine Geology (OCOR-5604): A CORE course. Describes the origin, form, and resources of the ocean basins and continental margins. Covers sea-floor spreading, trenches and island arcs, mountain building, coral reefs and atolls, sedimentation, ocean mining, coastal morphology, and the impact of wave action and human activity on beaches and coasts, continental shelves, and submarine canyons. Instructor: Dr. Pat Blackwelder (Center faculty). Starts Wednesday, April 5.

Oil Pollution Effects (CZMT-6340): Focus is on the impact of petroleum hydrocarbons on natural and human environments. Provides a background in petroleum chemistry, natural and human resource impacts, and spill contingency planning. Includes a spill drill and study of recent spill sites, area contingency plans, and oil spill response. Involves 7 evening lectures and a minimum of 4 Saturday field trips. Instructor: Dr. Bart Baca (Center adjunct). Starts Thursday, April 6.

Effects and Risks of Chemicals in the Aquatic Environment (OCMB-6196): Concerns the biological effects and risk of foreign chemicals in aquatic ecosystems. Topics include bioavailability and fate in sediment water systems, uptake, metabolism and accumulation in fish and invertebrates, and biodegradation in microorganisms. Also discussed are sublethal behavioral and physiological effects and environmental legislation and risk assessment methods. Instructor: Dr. Gary Rand (Center adjunct). Begins Friday, April 7.

Summer Term Schedule

The summer term extends from July 3 to September 15, 1995. Course descriptions will be presented in the next issue of Currents.

Marine Chemistry (OCOR-5605): This is a CORE course. Instructor: Dr. Curtis Burney (Center faculty). Mondays.

Dynamic Biological Oceanography (OCMB-6195): Instructor: Dr. Gary Kleppel (Center faculty). Scheduled for Tuesdays.

Coral Reef Ecology (OCMB-7012). Instructor: Dr. Joshua Feingold (Center Adjunct). Wednesdays.

Aquaculture (OCMB-6200). Instructor: Dr. Bart Baca (Center adjunct). Thursdays.
copepods and seston nutrients. "These relationships were normally species-specific," Carter states in his thesis. "However, the energy-rich nutrients (lipids and carbohydrates) appear to be important to the egg production of both an estuarine species (Acartia tonsa) and a continental shelf species (Centropages velifatus). A range of hypothetical ingestion rates suggests that copepods feed differently at the species level due, in part, to the different nutrient concentrations in their distinct environments."

Upon leaving our laboratory after "four happy years," Carter got a position as a marine biologist (surprise!) with the Water Resources Division of the Broward County Natural Resources Protection Agency. His duties are to conduct studies of the county's waterways, including its canals and lakes from the Intracoastal to Everglades conservation areas. "I am working on solutions to Broward's interesting water problems. I am mainly looking at water quality issues," he explains. Primarily he has been writing reports based on field data, but in January he experienced his first field work - got his feet wet, so to speak.

Robin Sherman Honored

Robin Sherman, a graduate student working under Dr. Richard Spieler, has been awarded an $8,000 Aylesworth Scholarship Award from the Aylesworth Foundation for the Advancement of Marine Science. She was notified of the award in December by Dr. James C. Cato, Director of the Florida Sea Grant College Program at the University of Florida. Ms. Sherman will be formally recognized on May 12 during the annual meeting of the Southeastern Fisheries Association, to be held at the new Florida Aquarium in Tampa. Congratulations!

Barbara Maloney defends M.S. Thesis

On December 14, Barbara Maloney successfully defended her master's thesis in Marine Biology. Her thesis topic was "Population Dynamics, Life Histories and Patterns of Emergence in an Assemblage of Inshore Cumaceans (Crustacea: Percarida) in South Florida." Her major professor was Dr. Charles Messing; others on her thesis committee were Drs. Richard Dodge (Center faculty), Susan Corey (University of Guelph, ret.), and Les Watling (University of Maine).

The purpose of Maloney's study was to increase our understanding of cumacean biology and the role that cumaceans play in marine ecosystems. "Some researchers feel that they could be used as indicators of change in benthic environments and water regimes," she explains.

Cumaceans are shrimp-like crustaceans that range from 2 to 35 mm in length. "There are about 1,200 known species," according to Maloney. "I found 16 species in my sampling belonging to 4 different families, and we feel that there possibly may be a new genus." Cumaceans are found in shallow to abyssal depths and from the tropics to the Arctic and Antarctic regions. Interestingly, however, there is no public record that they exist along the southeast coast of Florida.

"Cumaceans eat foraminiferans, diatoms, small crustaceans, and detritus," Maloney continues. "They can be either mud-dwellers, which are filter feeders, or sand dwellers, which scrape their food off sand grains or other small objects. In turn, they are important prey for demersal fish, such as flatfish, dab, cod, and flounder, and for sand shrimp, sea ducks, and old squaw ducks."

Maloney started working on her thesis project in 1991, spending the first six months perfecting the methodology to be used. The first sampling technique tested was an elutriation system, which was supposed to bubble and force the subject cumaceans to swim upward. It was discarded however, when Maloney found that they swam downward and were too quick to be apprehended. The next method used was a petite ponar grab sampler, but it grabbed too much material, and cumaceans were found only in the top 2 cm of the sediment.

As a result of these attempts, Maloney and Dr. Messing designed a small, square, plexiglass box sampler having a trap door made of lexon. "This was successful," Maloney says. "It gave me seasonal variation, population composition, and density." She also used plankton net tows to determine seasonal recruitment and spawning cycles over a 13-month period.

Maloney is now in a Ph.D. program in biology at Florida International University. She is staying with the marine environment, but she is now studying sponges specifically. Her main interest is in apoptosis, or programmed cell death, as seen in various developmental stages of different organisms. This activity can relate to human cell death and the aging process.
So, besides assessing the feasibility of leaving nests undisturbed, the study also has served to determine the degree of hatchling disorientation that might occur from such a management practice, and to examine the effectiveness of beachfront lighting regulations.

A green sea turtle returns to the sea.

At last! Released loggerhead hatchlings approach the surf.

FLASH! Don’t miss our annual Nova-MIASF barbecue at the Center on April 27, from 5 P.M. to 9 P.M., to benefit the sea turtle project and our scholarship fund! $15/person. Call Jan at 920-1909.

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