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TWINE LINE

The educational newsletter of Ohio Sea Grant, covering issues, events, and research related to Lake Erie and the Great Lakes

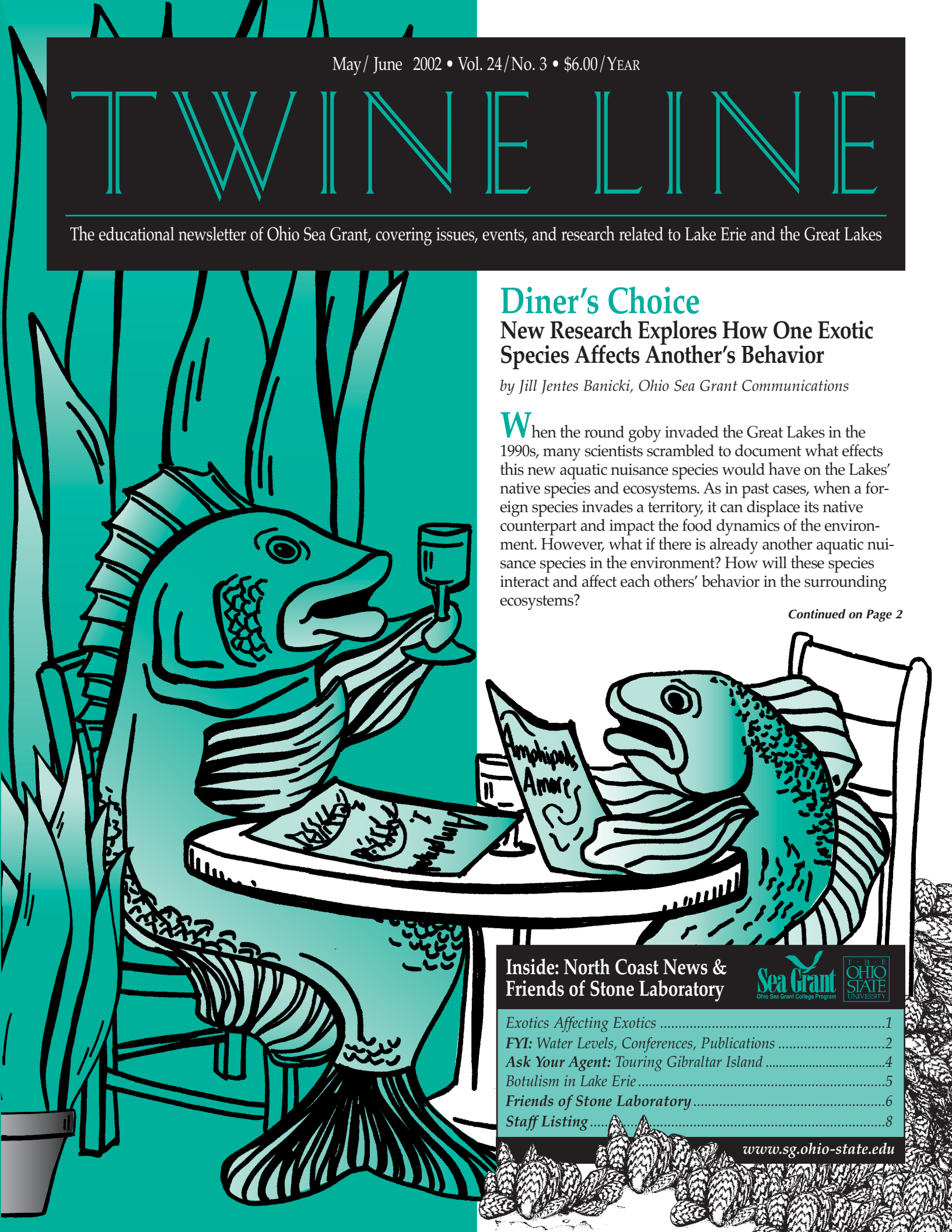
Diner's Choice

New Research Explores How One Exotic Species Affects Another's Behavior

by Jill Jentes Banicki, Ohio Sea Grant Communications

When the round goby invaded the Great Lakes in the 1990s, many scientists scrambled to document what effects this new aquatic nuisance species would have on the Lakes' native species and ecosystems. As in past cases, when a foreign species invades a territory, it can displace its native counterpart and impact the food dynamics of the environment. However, what if there is already another aquatic nuisance species in the environment? How will these species interact and affect each others' behavior in the surrounding ecosystems?

Continued on Page 2



Inside: North Coast News & Friends of Stone Laboratory

Sea Grant Ohio Sea Grant College Program — The Ohio State University

www.sg.ohio-state.edu

For Your Information

Ohio Sea Grant is proud to premiere our *Lake Erie Information Discussion Board.*
Beginning this month, the board can be accessed from our main home page (***www.sg.ohio-state.edu***). Our goal is to offer plain-talk answers on science issues, and provide a forum for discussing Lake Erie-related concerns. This board is likely to focus mainly on fishing-related questions at first, since interest in that topic is high. We look forward to answering your questions and concerns, and fostering the exchange of accurate information. *TL*

May Water Levels
Lake Erie's level rose during May. The mean level was 571.88 feet which is 0.32 foot higher than last month's mean level. The 2001 level is 0.85 foot higher than the May 2001 level and 2.68 feet above the Low Water Datum elevation reference system. *TL*

A Special Thanks
Special thanks to the following Ohio Congressmen who co-sponsored House Bill 3389 to reauthorize the National Sea Grant College Program and keep us in existence: Sherrod Brown, Paul Gillmor, Dennis Kucinich, and Steven LaTourette. We also want to recognize Congressmen Brown, Kucinich, and Michael Oxley, and Senator Mike DeWine for their letters of support during the appropriations process. *TL*

Publication Announcement
The Ohio State University's Ohio Agricultural Research and Development Center (OARDC) recently published a new fact sheet highlighting research jointly funded by OARDC Research Enhancement Competitive Grants Program and Ohio Sea Grant. The publication, *New Technology in Aquaculture for Raising Yellow Perch*, outlines Ohio State University's Dr. Konrad Dabrowski's aquaculture technology to farm yellow perch. For a free copy, please contact the Ohio Sea Grant office at 614.292.8949 or *cruickshank.3@osu.edu*. *TL*

State of the Lakes Ecosystem Conference 2002
SOLEC 2002 will be the fifth biennial conference in which the governments of Canada and the United States of America assess and report on the condition of the Great Lakes basin ecosystem. The conference will be held in Cleveland from October 16-18, 2002. Participants will focus on updating and assessing the state of the Great Lakes ecosystem components using indicators with an emphasis on biological integrity. Information about SOLEC and Great Lakes indicators can be found at ***www.on.ec.gc.ca/solec***. Invitations to participate in SOLEC 2002 are offered to Great Lakes stakeholders. For more information, please email ***SOLEC@ec.gc.ca***. *TL*

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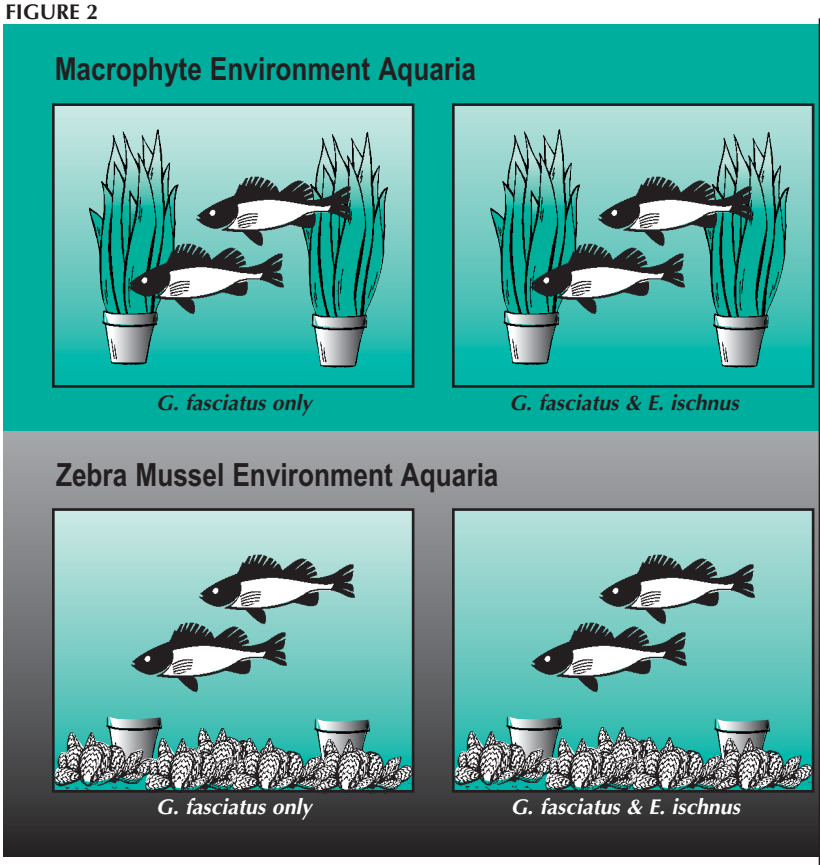
FIGURE 2



Continued from Page 1

Continuing Ohio Sea Grant research by Dr. María González of Miami University, is exploring the interactions among three exotic species, the round goby, the amphipod *Echinogammarus ischnus*, and the zebra mussel as well as the effect these exotic species have had on native species of amphipod and fish.

Before the round goby invaded Lake Erie, macroinvertebrates such as the native amphipod, *Gammarus fasciatus (G. fasciatus)*, were abundant in the western basin of Lake Erie. Zebra mussels plagued the Lake by the late 1980s and altered its habitat complexity and food availability like the mussels had in Europe. Benthic invertebrates such as *Gammarus fasciatus* increased dramatically. However, the zebra mussel made the Lake's ecosystem more susceptible to exotic invasions from species associated with zebra mussel colonies.

By July of 1995, the exotic amphipod, *Echinogammarus ischnus (E. ischnus)* was found in western Lake Erie. "We discovered that the exotic species represented 40 percent of the amphipods collected in the western Lake Erie basin," stated González. "This finding suggested that the exotic was displacing the native amphipod in the zebra mussel habitat before the round goby invasion."

Further field research in 1996 and 2001 observed that the exotic amphipod dominated the native species in the zebra mussel environments by over a 2:1 ratio in 1996 and a 10:1 ratio in 2001 *(Figure 1)*. However by 2001 (after the round goby invasion), the overall amphipod population decreased drastically. The abundance of the exotic amphipod dropped 95 percent and the native species dropped 98 percent from 1996.

But this exotic domination was only in zebra mussel environments. The study discovered that while the exotic amphipod was the prevailing species in a zebra mussel environment, the

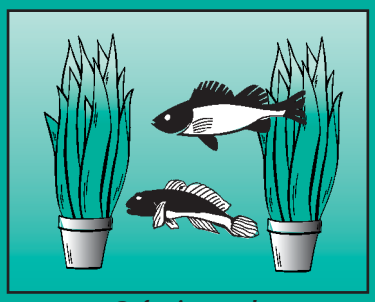
FIGURE 1

Amphipod Distribution in Lake Erie (W. Basin)

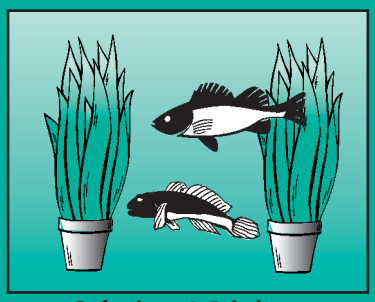
Continuing Sea Grant research finds a decrease in the total abundance of amphipods in zebra mussel colonies after the invasion of the round goby.

Amphipods per square meter

QTY	1996 (pre-goby)
1069	*G. fasciatus*
2293	*E. ischnus*
	2001
17	*G. fasciatus*
106	*E. ischnus*
186	*Unidentified juveniles (too small to identify)*

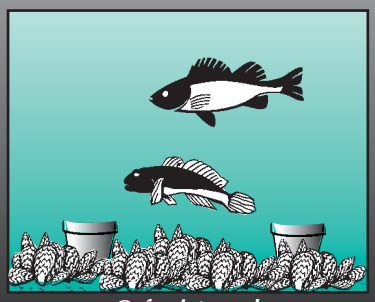


G. fasciatus only

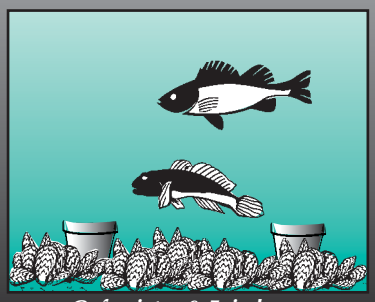


G. fasciatus & E. ischnus

González used a series of aquaria, imitating various fish and habitats. The study found that while the exotic amphipod was the prevailing species in a zebra mussel environment, the native amphipod was still the dominant species in the macrophyte environment.



G. fasciatus only



G. fasciatus & E. ischnus

G. fasciatus = Native amphipod

E. ischnus = Exotic amphipod

Yellow perch

Zebra mussels

Round goby

Pot with substrate

Pot with macrophytes and substrate.

native amphipod was still the dominant species in the macrophyte environment.

To explain why there was such a drastic difference in amphipod populations in the zebra mussel and macrophytes, González investigated 1) how the type of environment could affect fish predation patterns; 2) whether intraguild predation (predation among potential competitors) and cannibalism occurs in the amphipod populations; and 3) how the introduction of the round goby has affected the amphipod and yellow perch populations.

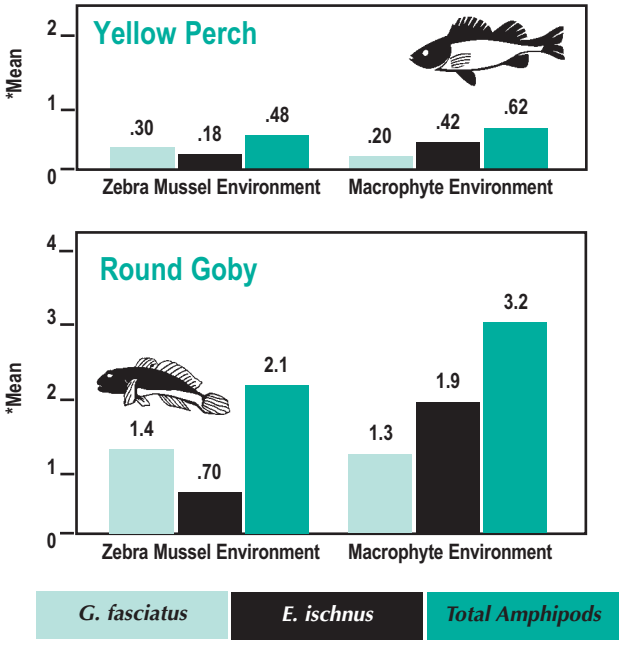
The study compared the predation rates of yellow perch and round gobies on amphipods under laboratory conditions using aquaria, imitating macrophyte and zebra mussel environments *(Figure 2)*. To represent macrophytes, a dominant regional macrophyte was used on the aquaria floor along with substrate material. Pre-measured zebra mussels attached to rock represented the zebra mussel habitat and two hundred amphipods (100 exotic and 100 native) were used. Two fish were introduced to each aquarium for 24 hours. After the 24 hours, the fish were removed and preserved for stomach content analysis.

"We observed that both round gobies and yellow perch had a distinct amphipod preference depending on which environment they were in," emphasized González. González's data suggest that both fish consumed a higher number of native amphipods than exotic amphipods in dreissenid colonies. However both fish consumed a higher number of exotic than native in macrophyte beds (*Figure 3*). This can have implications for the coexistence of both amphipod species. These laboratory experiments also showed that round gobies exhibited higher predation rates than yellow

FIGURE 3

Predation Rates of Yellow Perch and Round Goby in Zebra Mussel and Macrophyte Environments

González found that round gobies exhibited higher predation rates than yellow perch. These results indicate that round gobies are strong competitors for yellow perch in both zebra mussel and macrophyte environments.



** Number of amphipods consumed by each fish species per grams of fish.*

ASK Your Agent

A column devoted to frequently asked or interesting questions fielded by Ohio Sea Grant agents

John Hageman, Put-in-Bay

How Can I Arrange a Tour of Gibraltar Island?

by John Hageman, Ohio Sea Grant Extension

We are frequently asked about touring Gibraltar Island. Because of obvious security issues and disruption of classes or other scheduled events, the best option for visiting is through our annual open house or attending a guest lecture. If you, or your group are unable to attend one of the public events, a private tour can be arranged through our Bayview office.

Thursday Evening Guest Lectures
On most Thursday evenings during the summer, Stone Laboratory sponsors a guest lecture. The public is invited to join us as we welcome a variety of speakers giving presentations on a wide range of Lake Erie, Great Lakes, and Ohio issues. Boats depart from our dock next to the Stone Laboratory Research Building/State Fish Hatchery on South Bass Island (878 Bayview Ave.) at 7:15 p.m. so that guests can receive a quick tour of Gibraltar prior to the lecture. Refer to the guest lecture schedule (see page 7) for more details.

Annual Open House
During the Friends of Stone Lab Alumni Weekend, an annual Open House is offered to the public. This year's event will be on Saturday, September 14, with free transportation to Gibraltar from our dock next to the Stone Laboratory Research Building/State Fish Hatchery on South Bass Island. A program overview, laboratory exhibits, walking tour of Gibraltar Island, and entry into Cooke Castle are some of the activities that will be available. Concurrently, the South Bass Island Lighthouse will be open for tours. The Open House is from 11:30 a.m. to 4:00 p.m.

Group Tours
Tours can be arranged for groups (50 people maximum) by calling our Put-in-Bay Office at 419.285.2341 or 614.247.6500. A $10.00 per person fee covers boat transportation to and from Gibraltar and South Bass Island, a program overview, and a walking tour of Gibraltar Island. Lunch may also be arranged for $8.25 per person (15 person minimum). Tours for families, couples, or small groups (five people or less) are available at no charge depending on staff availability. Call our office to make reservations. ***TL***

perch. "These results indicated that the round goby is a strong competitor for yellow perch in both habitats," explained González.

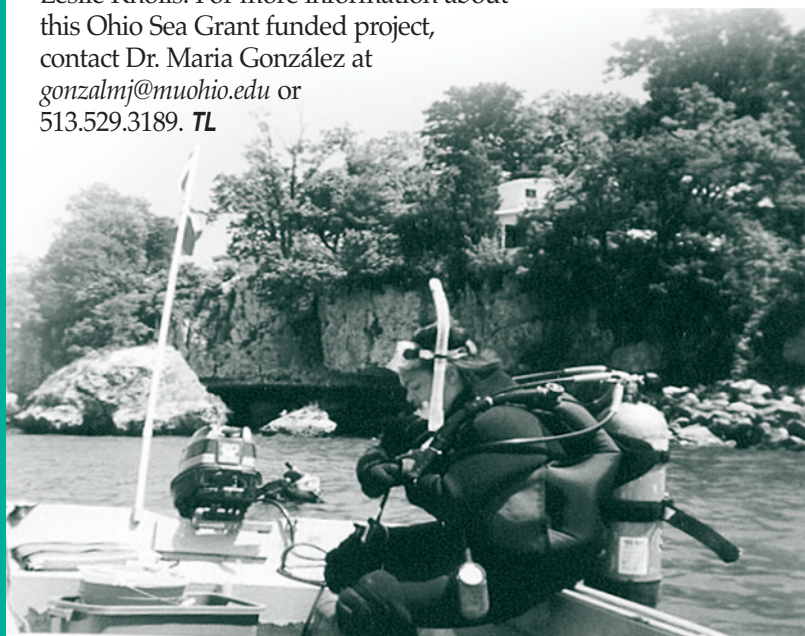
The differences between the fish predation in macrophyte environments versus those in zebra mussel environments may be partly due to variations in the amphipods' coloration, shapes, and behaviors. González's study observed that whereas the native amphipod likes to cling to surfaces, the exotic species has a tendency to swim, making it easier to become prey. The native amphipod possesses a gray color matching the macrophyte environment, the exotic species maintains a very contrasting brown color highlighted with red antennae. Since fish are visual feeders, the exotic amphipod is more vulnerable to predation in a macrophyte environment.

In a zebra mussel environment, González found that the amphipod body shape may determine an amphipod's resistance to capture. Because the exotic species are more slender in shape than the native counterparts, the exotic amphipods may hide easier in the clustered zebra mussel crevices to elude fish.

The study also investigated whether predation between the two-amphipod species could play a role in the drop of amphipod populations. Under laboratory conditions, González's early research results found that the native amphipods appeared to be more aggressive than their exotic counterparts. Therefore predation of the native amphipod on the exotic is greater than the predation of the exotic amphipod on the native. Males were more aggressive than females or juveniles.

González and her students plan to conduct a large-scale enclosure experiment later this year to test the effect of the round goby on yellow perch growth rate. "Fish managers should be aware of the potential effects of fish enhancement projects which may provide gobies with advantages over more desired species. By comparing the competitive interaction among exotics to their native counterparts, we hope the findings from this study could be incorporated into the decision-making process involving future habitat restoration projects," concluded González.

This project was made possible with the help of graduate and undergraduate students including: Greta Burkart, Lisa Jeter, Kim Kozac, Janelle Duncan, Zackary Sutphin, Leslie Knolls. For more information about this Ohio Sea Grant funded project, contact Dr. Maria González at *gonzalmj@muohio.edu* or 513.529.3189. ***TL***



When Birds No Longer Fly

Botulism in Lake Erie

by Jill Jentes Banicki, Ohio Sea Grant Communications

As Lake Erie visitors venture to the lake this summer, many will look to the sky to guide them. A sure sign that Lake Erie is near is the number of gulls and loons that proliferate the Lake's sky. But the last two years have caused many people to be concerned. Botulism has again crept into Lake Erie's waters, killing birds and fish and the cause is unknown. Recently a group of researchers, government officials, and other interest groups came together for a Sea Grant-sponsored workshop to explore the history of disease in fish and bird populations, along with developing a research agenda to begin to solve the mystery of its appearance in Lake Erie waters.

Avian botulism is a paralytic and often times fatal disease for birds. Produced by the bacterium, *Clostridium botulinum*, the ingestion of its neurotoxin affects a bird's ability to fly by paralyzing its legs, progressively immobilizing its inner eyelids, and numbing its neck muscles. "As the disease attacks the bird's ability to move its neck, many birds tend to die from drowning or suffocation by a condition called "limpneck" before possibly dying from respiratory failure," states Dr. Mike Campbell of Mercyhurst College. The toxin produced by the bacterium spreads through what is called a bird-maggot or carcass-maggot cycle (*see Figure 1*). After the affected bird dies, maggots consume the carcass and concentrate the toxin in their bodies. Other birds will ingest the toxic maggots and the cycle continues.

Two types of botulism toxins have affected populations in the Great Lakes. Although similar in their progressive symptoms, type C and type E avian botulism are different in how and what type of organisms they affect. The type C botulism, primarily affecting dabbling ducks and bottom-feeding waterfowl (although shorebirds can be affected by both types), is widely distributed in wetland habitats. In type C botulism, the spores become anaerobic and produce no toxin unless they are infected by a specific "phage" or virus. Type E spores, on the other hand, are carried by primarily bottom-feeding fishes in offshore habitats to fish-eating birds. The birds either become carriers or become sick and die from the toxin.

While botulism's spread has been examined, how it got to the Great Lakes and its continual migration still remain a mystery. By studying previous botulism outbreaks from 1963 to 1983, researchers are currently investigating the commonalities of the outbreaks along with what roles lake levels, water temperatures, and round gobies may play in the spread of the disease. In past outbreaks, loon die-offs often occurred in isolated events or "waves." Similarly, many of the bird deaths reported in the current series of outbreaks arose in episodes following major storm events accompanying cold fronts. Researchers wonder whether these die-offs could be related to the lake's drastic temperature change or lake thermal phenomena.

Recent botulism outbreaks may also be related to changing lake levels. Analysis of historical hydrological data for Lakes Michigan and Huron indicates that similar to current lake levels, larger bird die-offs occurred during periods of very low or rapidly declining lake levels.

The presence of aquatic nuisance species may also play a role in the botulism mystery. Ward Stone of New York's Department of Environmental Conservation, believes the round goby might be a major participant in the transfer of botulism. The round goby is one of the few fish species that eats quagga and zebra mussels, key species that feed on the lake sediment. The botulism toxin eaten by mussels could be picked up by feeding gobies and transferred to fish-eating bird populations.

Human botulism has typically involved the type A or type B botulism toxin. Human, dogs, and cats are generally considered resistant to type C. However, several cases during the 1960s in the Great Lakes basin involved type E where humans ate improperly smoked or cooked fish that contained the toxin. To protect yourself, stick to the following:

Storage of Fresh Fish

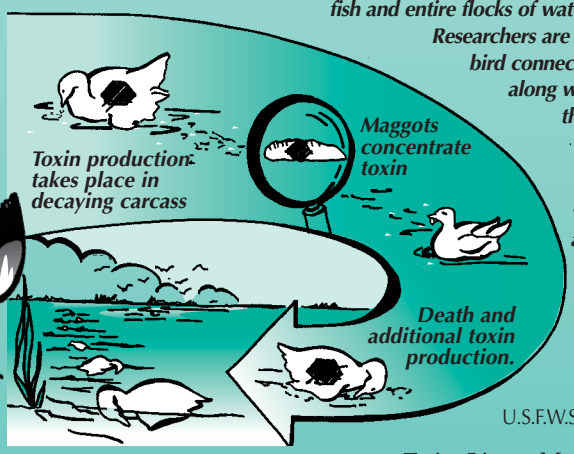
- Store cleaned fresh fish in a refrigerator in a covered container and use within two days.
- For longer storage, meat and fish should be frozen immediately after smoking. Temperature in freezers should be 0˚F.
- Type E botulism can be produced at temperatures as low as 37˚F. Be sure refrigerator is set at the correct temperature.
- Do not eat any stored fish with "off-odors."
- If a canned lid is bulging, do not eat!

Food Safety Preparations

- When canning or smoking fish or waterfowl, use methods that incorporate heat with the temperature reaching at least 240˚F to kill any toxin-forming bacteria.
- When smoking fish or waterfowl:
  - Soak in brine (saltwater) for at least 30-45 minutes.
  - Meat/fish must reach a consistent internal temperature of 160˚F for at least 30 minutes.
  - Meat/fish should be kept in the refrigerator below 36˚F and consumed within 14 days after smoking.
  - Store in the freezer for no longer than 2 months. TL

Carcass - Maggot Cycle

Botulism is a bacterial disease that has affected fish and entire flocks of waterfowl in Lake Erie. Researchers are examining the fish-bird connections to the disease along with possible factors that have caused the recent outbreaks.



Reference: U.S.F.W.S. 1989, PA Sea Grant

Cycle accelerates - major die-off occurs

Dick Lorenz

Dear Friends,

This year the Friends are commemorating twenty years of service to Stone Lab. Over these two decades we have established a number of service traditions. Our work weekends on Gibraltar Island, where we contribute physical labor, are one such tradition we started early prior to developing financial resources. A more recent tradition is judging State Science Day Fair student projects and awarding scholarships to Stone Lab. Other traditions include annual support to visiting professors, researchers, equipment purchases, outreach activities and scholarships to high school and college students attending Stone Lab.

I am pleased to announce that we have reached our twentieth anniversary goal of creating our seventh permanent endowment, the Crites Research Fellowship. This endowment, which honors Dr. Crites for years of service as professor, researcher, and Stone Lab Associate Director, will soon begin a new tradition.

This summer, members will be receiving a request for their annual contribution to the Friends. Please consider continuing your support so we may continue our tradition of service to the Lab.

Sincerely,
Dick Lorenz,
FOSL President
mlorenz2@columbus.rr.com

FRIENDS OF
STONE LABORATORY
20 Years of Service

Back To The Future

Dr. Larry Cooper

What does a distinguished Stone Lab researcher, instructor, FOSL board member, and former manager of the powerful OSU supercomputer system do after retirement? Well, if you are Dr. Larry Cooper, you travel back in time, to recreate the early 1800s. Last summer, Larry volunteered as a historic interpreter at Fort Clatsop Historic Memorial in Astoria, Oregon.

Fort Clatsop is named for the tribe of Chinook people who resided on the South side of the Columbia River estuary. The Lewis and Clark expedition stayed there during the winter of 1805-06. Larry, dressed in appropriate costume, provided demonstrations of period crafts, flint and steel, and other historic topics. He also helped answer visitor's questions in the park's visitor's center. Larry says that if you are a Lewis and Clark history buff, or really like "green" places, then Fort Clatsop is a destination to include on your next trip to the Northwest. **FOSL**

Gibraltar Weeded Out

The weekend of April 20-21 saw a flurry of activity at Stone Lab. Many volunteers from FOSL showed up to support another work weekend on Gibraltar. A wide variety of tasks were taken on, from steam cleaning the carpet in the 3rd floor conference/lecture room, cleaning all of the windows and screens for the lab building, scrubbing floor to ceiling in the dining hall porch, cleaning out gutters on the various buildings, a variety of painting tasks, and many other miscellaneous chores.

In addition, this spring there was another group who came to share their expertise and work on the island. Fifteen Master Gardners from The Ohio State University Stark/Summit Extension office, working on a specialization in Ohio weeds, brought their own gardening tools, mulch, bulbs, a variety of plants, and plenty of energy. These volunteers, organized by Master Gardner Program Coordinator Denise Ellsworth, spread out over the island to clean up existing flowerbeds, remove invasive weeds, prune and/or doctor existing plantings, and even create some new flowerbeds. Gibraltar Island, while still a field station, took on a much more "civilized" look due to the efforts of this hard-working group.

On Saturday evening, many volunteers enjoyed an interesting presentation by Dr. Daniel A. Herms on the subject of phenology. Phenology is the study of climatic factors and their correlations to periodic natural events like flower blooming, seed germination, insect emergence, and bird migrations. The study and correlation of seasonal temperature norms with biological events, can allow for prudent and more efficient use of pesticides, or other control measures, to manage a home garden or a large agricultural business. Dan and his wife Kathy are both OARDC staff members and participated in the weekend clean up, along with fellow Ohio State OARDC staff member Doug Doohan and his son Thomas. **FOSL**

State of Ohio's Best

The Ohio Academy of Science State Science Day was held on May 11 at the Schottenstein Center at Ohio State. This event brings together the best science fair research projects from students throughout the state. For the 7th year, FOSL awarded scholarships to outstanding students who applied for consideration. The scholarship award covers the fees for room and meals at Stone Laboratory for a one-week, introductory course. Normally six scholarships are awarded, but due to the tough competition this year, seven awards were made. Many thanks to the following FOSL members who acted as judges or Stone Lab representatives: Lydia Bailey, Lauren Bradley, Bill Edwards, Michael McBride, Nick Utrup, Mike Heniken, and Dr. Jeff Reutter.

This year's scholarship recipients were: Richard J. Cates – Fayetteville HS, Bethany A. Frew – Carrollton HS, Mike J. Goetz – Benjamin Logan HS, Jacob Liu – Upper Arlington HS, Emily R. Lower – Sylvania Southview HS, Rachel D. Melson – Colonel White HS, and Kerri D. Seger – Minster HS. **FOSL**

Stone Laboratory Guest Lectures — 2002

All lectures begin at 7:45 p.m. and conclude at approximately 9:00 p.m. Transportation to and from Gibraltar Island is provided from the dock in front of the Research Building (near State Fish Hatchery). **The boat will leave at 7:15 p.m. before each lecture**.

Week 1	6/13	No Lecture
Week 2	6/20	Christopher Jones, Director, Ohio EPA *Is 'Environmentalist' a Noun or an Adjective*
		TERM 1
Week 3	6/27	Dr. Jane Forsythe, Bowling Green State University *The Geologic Setting of Lake Erie*
Week 4	7/3	Dr. Charles E. Herdendorf, Ohio State University *Exploring Shipwrecks of the New Kelleys Island Underwater Preserve*
Week 5	7/11	Dr. Richard King, Northern Illinois University *Lake Erie Water Snakes*
Week 6	7/18	Dr. Bobby D. Moser, Vice President and Dean, College of Food, Agricultural and Environmental Sciences, Ohio State University *Environmental Issues in Agriculture in Ohio*
Week 7	7/25	Transition between terms—No Lecture
		TERM 2
Week 8	8/1	Dr. Carol Stepien, Cleveland State University *Unlocking the Mysteries of Lake Erie Fishes and Invasive Species Using DNA Clues*
Week 9	8/8	Dr. Sam Speck, Director, Ohio Department of Natural Resources *Resource Management Issues Facing the Great Lakes Region*
Week 10	8/15	Chief Justice Thomas Moyer, Ohio Supreme Court *Law in a Scientific World*
Week 11	8/22	Finals Week—No Lecture
Week 14	9/14	Open House—11:30-4:00 Saturday—Open to Public Friends of Stone Laboratory Annual Meeting with Educational Programs and Tours of Gibraltar Island and the South Bass Island Lighthouse.

Sponsored by the Friends of Stone Laboratory, the Ohio Sea Grant College Program, and the Office of Housing, Food Service and Event Centers. **FOSL**

FOSL Dates

Ohio Sea Grant's 14th State Legislature/Congressional Day on Lake Erie
July 19, 2002

Stone Lab Open House & FOSL Annual Weekend
September 14-15, 2002

Buckeye Island Hop
A joint outing sponsored by FOSL, Biological Sciences Alumni Society, and OSU Young Buckeye Club
October 5-6, 2002

Open House

September 14-15, 2002

This year's annual Stone Lab Open House and FOSL weekend is slightly later due to the summer school schedule ending the weekend of the Labor Day holiday. Anyone who has visited Put-in-Bay over a major holiday knows the trials and tribulations that can ensue. This weekend will continue the celebration of "20 Years of Service" by the Friends of Stone Lab.

A special event scheduled for this year is the unveiling of two State of Ohio/Ohio Historical Society roadside plaques. One plaque honors the distinguished history of Stone Laboratory and will be located near the road by the Research Building. The second plaque commemorates the South Bass Island lighthouse and will be located near that facility.

Make your plans to come to this 20th annual FOSL member weekend. Enjoy the activities in P-I-B, as well as all of the Open House and FOSL activities. You may want to tour the historic South Bass Lighthouse during the Open House. Return to the "Rock" and meet some old friends, or make some new ones. Come prepared to participate in the 20th annual running of the "Carp Cup", no skill required!

Check the next newsletter for all of the details, or call the Stone Lab office to make reservations. **FOSL**

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Franz Theodore Stone Laboratory, Ohio's Lake Erie laboratory, offers intensive, hands-on university field courses from June to August in biology, geology, education, and natural resources. Workshops and group field studies are offered from mid-April through October. Research in aquatic, terrestrial, and island sciences has been conducted year round since 1895. Stone Laboratory's association with other programs based at The Ohio State University—the Ohio Sea Grant College Program, the Great Lakes Aquatic Ecosystem Research Consortium (GLAERC), and the Center for Lake Erie Area Research (CLEAR)—has made it an important research facility. Stone Laboratory is located on Gibraltar Island, across the harbor from Put-in-Bay.

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The Friends of Stone Laboratory (FOSL) began in 1981 as a support group to "bring Stone Laboratory into the 21st century with the best possible facilities, equipment, and professors, and make this an unequaled learning experience available to all outstanding students." Members of the Friends provide a way for former students to support the facility by raising awareness and funds for scholarships, research, and equipment.

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