



EARTHWATCH INSTITUTE FIELD REPORT

Earthwatch Institute Mission: *Earthwatch engages people worldwide in scientific field research and education to promote the understanding and action necessary for a sustainable environment.*

Project Title: Reef Fishes of the Virgin Islands

Principal Investigator (s): Paul Sikkel, Ph.D

Position/Affiliations: Assistant Professor, Centre College

Research Site(s) (geographic location, include coordinates if known, e.g. Lat/Long):

St. John/St. Thomas, US Virgin Islands

Local Management Status of the Research Site(s) (e.g. National Park, RAMSAR Site, World Heritage Site, IBA etc.):

Virgin Islands National Park

Scientific names of primary species being studied (if appropriate):

Acanthurus coeruleus, *Acanthurus bahianus*, *Acanthurus chirurgus*, *Stegastes diencaeus*, *Periclemenes pedersoni*, *Gnathia* sp.

25 November, 2007

Dear “Fish team” members:

I have had a chance to sort through some of the data we collected over this past summer and wanted to share some of the highlights with you. I also wanted to thank you once again, and let you know how much I appreciate your participation in this project. We accomplished far more than you may realize, and far more than we could have without your help.

As you may recall, we conducted several all-night “catchathons” and processed the fish to determine the host range of the monogenean parasite *Neobenedenia meleni*. During the course of the summer, we sampled over 300 individuals of over 30 species of fish. *N. meleni* was almost exclusively limited to diurnally active fish. This supports our hypothesis that these parasites infect fish when they are resting in their shelter holes at night. The winner of the *N. meleni* derby so far is the blue tang, with second place going to the spotted trunkfish, and third place going to the honeycomb cowfish. It will take us another season to complete this part of the study, but we are quite happy with the progress we have made so far.

You also helped with our study of the effects of shelter site characteristics on gnathiid infestation. We had to really push the last day to get a large enough sample size, but we did it! Damselfish in shelters that don’t allow gnathiids to see them suffer lower infestations than those in shelters where fish can be seen. Students at Centre College are now using electron microscopes to determine whether the gnathiids we collected at night have larger eyes (compared to body size) than those that infect fish during the day.

Perhaps most exciting is the result of our shrimp experiment at Coral World. We are extremely grateful to Peter Noah and the staff at Coral World for allowing us to use the Coral Reef Exhibit for our experiment. As you know, all of our blue tang in the enclosure were exposed to monogeneans, but only half of the fish had access to Pederson cleaner shrimps. Fish that did not have access to cleaner shrimp had more than three times as many monogenean parasites as those that did. That shrimp control monogenean populations was not terribly surprising. What surprised us was the magnitude of the effect. These data suggest that environmental changes that negatively effect shrimps may also contribute to higher parasite loads in fish. As monogenean infections are one of the biggest problems faced by Coral World and other educational and research aquariums, our findings may offer Coral World an effective and inexpensive means of controlling its parasite problems.

I hope you have a happy and productive 2008 and I hope to hear about your experiences and adventures. Please let me know if I can be of any help. Maybe I’ll see you on another Earthwatch expedition.

Best fishes!

Paul Sikkel

Key Research Objectives (5-8 brief bullet points):

- 1) Determine the primary host of the monogenean parasite *Neobenedenia meleni*
- 2) Determine the effectiveness of Pedersen cleaner shrimp in controlling populations of *Neobenedenia meleni*
- 3) Determine how gnathiid isopods locate hosts, and the effect of nocturnal shelter hole characteristics on infestation of damselfish by gnathiid isopods.
- 4) Determine whether Caribbean surgeonfishes are faithful to nocturnal shelter sites.
- 5) Determine the causes of variation in parasite loads among sites.
- 6) Determine the time of day when monogeneans infect hosts.
- 7) Determine whether nocturnally and diurnally active gnathiids are the same or different species.

Date this report was completed:

26 November, 2007

Data Collection and Results

- a) Give a concise account of the data you have collected during the past field season.
 - 1) Conducted macrocosm experiments to determine the effectiveness of the cleaner shrimp *Periclemenes pedersoni* in controlling monogenean infections on blue tang, *Acanthurus coeruleus*.
 - 2) Screened over 300 fish from over 30 different species to determine the primary host species for the monogenean *Neobenedenia melleni*
 - 3) Conducted preliminary experiments to determine the mechanisms by which gnathiids locate hosts.
 - 4) Conducted preliminary experiments to examine the diel infection dynamics of *N. melleni*.
 - 5) Conducted experiments to determine the effect of shelter sites on infestation by gnathiid isopod larvae.
 - 6) Conducted field observations on nocturnal resting site fidelity in surgeonfishes.
 - 7) Began DNA analyses with Dr. Robert Ziemia to determine whether diurnally and nocturnally active gnathiids are different species..

- b) What progress have you made towards achieving your original objectives?

We feel we have completed our first objective and are about half way toward completing the other objectives.

- c) Please provide a summary of your results (even if they are preliminary).

Major findings/ Accomplishments:

- 1) Cleaner shrimps have a strong effect on the number and size distribution of monogeneans on blue tang hosts.
- 2) Of the over 30 species examined, *N. melleni* appears to be limited almost entirely to diurnally-active species, and is most abundant on blue tang.

- 3) Gnathiid isopod larvae appear capable of using both visual and olfactory cues to locate hosts.
- 4) Preliminary evidence suggests *N. melleni* infects hosts at night.
- 5) Fish in shelters where they are visible to gnathiid isopods experience higher loads than fish that are not. However, gnathids are still able to find fish they cannot see.
- 6) Blue tang exhibit greater shelter site fidelity than other Caribbean surgeonfishes, which could explain why they experience higher monogenean infections.

Significance/Benefits of Research

a) What is/are the significance/benefits of your research at the following levels?

- local (in the area of the research site)

Our data are made available to the management staff of the Virgin Islands National Park and include students from the University of the Virgin Islands. We have also made a significant contribution to the ability of Coral world marine park to manage their fish parasite problem.

- national
- international

(For example, do your findings, or do you expect your findings will contribute to management strategies or biodiversity conservation action plans at any of these levels?)

Our data contribute to our understanding of the ecology of host-parasite interactions on coral reefs, a grossly understudied aspect of coral reef ecology.

b) How do your findings contribute to issues of sustainability?

Sustainability requires an understanding of all ecosystem processes. Human activities can significantly alter the dynamics of parasites and their hosts by increasing habitat suitable for parasites or increasing susceptibility to parasites and diseases.

Dissemination of Results

a) Have you provided details of results from your research to or within:

- Scientific papers (indicate status; e.g., peer reviewed or in progress/press)
 - Please provide full references

We are in the process of writing three scientific papers based on our work.

- Management plans and reports (in progress or completed)
 - By who, for whom, and used by which agencies
- Presentations (given or planned)
 - Who was the audience? How many people attended?

- 1) Gulf and Caribbean Fisheries Institute, Belize, 2006, > 500 attendees

- 2) Association of Marine Laboratories of the Caribbean, St. Thomas, VI, 2007, > 500 attendees
- 3) Gulf and Caribbean Fisheries Institute, Dominican Republic, 2007
- 4) Society of Integrative Biology, San Antonio, TX 2008
- 5) International Coral Reef Symposium, Ft. Lauderdale, FLA, 2008

- Popular articles or films (in progress or completed)
- Books, chapters, illustrations

We would appreciate copies of any relevant materials you can make available to us.

SECTION II: VOLUNTEERS

Volunteer Tasks and Accomplishments

- a) How did the volunteers contribute ideas, skills, expertise and motivations beyond that which you anticipated?

My team was a teen team. What they lacked in experience, they made up with energy and enthusiasm. I was especially impressed with how the Earthwatch facilitator, Jeff, was able to organize the students, promote a team work ethic, and keep the morale high. I was very impressed with the diversity of skills. Some students were great in the water, while others excelled in the lab.

- b) How have volunteers helped you to achieve your research or educational objectives? Please give specific and quantitative measures of the volunteers' contribution to your data collection.

Our work is very labour intensive and requires large sample sizes. By providing help in the water and in the lab, catching, transporting, and processing fish, we are able to obtain sample sizes we could never obtain without a team effort.

Educational Opportunities

- a) Does your project directly or indirectly involve the following groups in your research topic?

- Local communities
- Students
- Early career scientists
- Other groups

- b) Please tell us the ways your research helps these groups better understand the conservation of a sustainable environment (see the UNESCO definition above).

- 1) Our data are made available to the Virgin Islands National Park and Coral World, a public, educational facility in the Virgin Islands. Because our main research site (VIERS) is an environmental educational facility that focuses mostly on local K-12 students, we benefit the local community by interacting with other students at VIERS.
- 2) Our teen team is, of course, comprised of students. Also during 2007, we involved students from the University of the Virgin Islands and Centre College in Kentucky. Our work is also being incorporated into classes at the University of the Virgin Islands.
- 3) Donna Nemeth, who assisted with the team for three days, is a collaborator and will be a Co-PI on our 2008 Earthwatch teams.

- c) Has your project helped lead to the completion of Masters' theses, or other educational research findings?

Amber McCammon is now an MS student at Florida Atlantic University. Her thesis work is based on our Earthwatch-funded project. Lillian Tuttle is using her experience with our project as

the basis for a Fulbright application to study fish parasites in France. Dr. Donna Nemeth at UVI is incorporating our project into her ichthyology course at the University of the Virgin Islands.

Partnerships

- a) List partnerships or collaborations with other organizations that you have developed or maintained in the past season.

We have collaborated with the University of the Virgin Islands, Coral World ,VI, and the US National Parks Service

- b) How have these organizations contributed to your project objectives?

UVI has provided logistic support, including use of space, transportation, staff assistance; Coral World has provided us with space to conduct our shrimp experiments, and access to their diving facility for collection of specimens;

The US National Parks Service has given us permission to work inside Park boundaries.

- c) How do you anticipate these organizations will use the results generated by the project, and in what timeframes?

Coral World will use these data to help control parasite infestations in exhibits and may use our findings as part of an exhibit featuring research conducted at the University of the Virgin Islands.

The National Park Service will use our data to make long-term decisions regarding management of coral reef communities within Park boundaries.

Our data also contribute to the BCCR (Biocomplexity of Coral Reefs) initiative of the University of the Virgin Islands. Our findings are used in courses at the University of the Virgin Islands.

Acknowledgements

In addition to Earthwatch, we are grateful to Virgin Islands NSF EPSCoR, the Virgin Islands National Park, the University of the Virgin Islands, the Virgin Islands Environmental Resource Station, Coral World, VI, Centre College, and Murray State University.