

Parasites in paradise...see page 4

Black pearl industry continues to expand

The Micronesian U.S. Affiliated Pacific Islands have a small but rapidly expanding pearl farming industry based in the Republic of the Marshall Islands (RMI) and the Federated States of Micronesia (FSM). While only three farms are currently operational all show signs of expansion and growth, indicating the enormous potential for pearl farming in the region.

At the forefront of expansion is Black Pearls of Micronesia Inc. (BPOM) based in Majuro, RMI. Started by Hawaii residents Neil Sims and Dale Sarver some years ago, BPOM had their first pearl harvest last year and have undergone rapid expansion in the last year. Included in this expansion are a new farm site and hatchery in Majuro. BPOM is also looking for joint venture partners in an effort to ramp up their expansion efforts. Dale Sarver said in a recent press release, "As well as expanding BPOM's own 'nucleus' farm, we would like to involve local Marshallese partners in developing 'satellite' farms in the surrounding lagoons." Sarver added, "We have now reached the stage where we would like to begin this expansion." BPOM currently employs 19 full-time staff.

Also based in the RMI is the Robert Reimers Enterprises (RRE) Pearl Farm at Nam Lagoon on Arno Atoll. Started five years ago, RRE also had its first pearl harvest in 1998 and currently has about 11,000 shell under cultivation. Hampered in his expansion efforts by a chronic shortage of pearl oyster spat, RRE's CEO, Ramsey Reimers recently collaborated with CTSA and the University of Hawaii (UH) Sea Grant extension

service in a spat collection trial on Jaluit Atoll. Mr. Reimers is also exploring the possibility of hatchery production of spat and expansion of the RRE pearl farm through joint venture partnerships.



This year marked the first harvest of black pearls at Nukuoro pearl farm in Pohnpei.

Photo - Maria Haws

About 1000 miles southwest of Majuro is the tiny atoll of Nukuoro in Pohnpei State, FSM, which is home to the third operational pearl farm in the U.S. Affiliated Pacific Islands. Started in 1995 with significant technical assistance from the CTSA regional aquaculture extension agent, this community-owned and operated farm had its first pearl harvest in 1999 and is currently the only operating farm that sustains itself on wild spat

fall. The Nukuoro pearl farm, which is managed by CTSA Industry Advisory Council member Toshiyuki Rudolph, has 14,000 shell under cultivation. A grafting technician has been scheduled for early in the year 2000 to "seed" 11,000 of the farm's oyster stocks. The Nukuoro community was also the recent beneficiary of a CTSA/UH Sea Grant sponsored workshop on making jewelry out of pearl oyster shell, an important aspect of maximizing pearl farm profits.

CTSA, in conjunction with the UH Sea Grant Extension service and the College of Micronesia Land Grant program continues to support the expansion of the pearl industry in the U.S. Affiliated Pacific Islands. By learning from the successful farming in other Pacific Island nations such as French Polynesia and the Cook Islands, it is hoped that pearl farming will eventually contribute significantly—and sustainably—to the economies of these developing island nations.

Second annual HAA conference scheduled for February 2000

The Hawaii Aquaculture Association (HAA) is hard at work planning an encore to their very successful conference held this past February.

The Second Annual HAA Conference is scheduled from 8 a.m. to 8 p.m. on Thursday, February 24, 2000. The location will again be at Windward Community College on Oahu in Kaneohe, Hawaii.

The conference will follow the format of last year's event, with two morning and two afternoon sessions. Farmers and researchers will be able to exchange information and discuss

the challenges and opportunities found in today's expanding aquaculture industry.

Conference organizers have plans to serve up a "second helping" of last year's popular *Taste of Hawaii Aquaculture*. Last year's attendees gave high marks to the delicious farm-fresh foods expertly prepared by Hawaii's top chefs.

For information on registration and conference prices, please contact Jeff Koch between 8 a.m. and 5 p.m. at (808)637-3137 on Oahu or email him at jkoch@aloha.net.

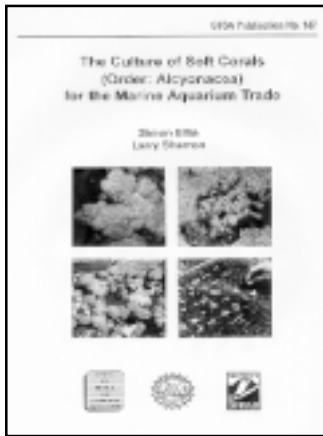


An alert reader caught an oversight in our last issue of *Regional Notes* (Volume 10, No. 4). Our listing of new Industry Advisory Council (IAC) members neglected to include Richard Masse. We are still trying to figure out how we could have missed one of our most enthusiastic new members!

Masse is president and co-owner of Mangrove Tropicals in Kahuku on the island of Oahu in Hawaii. He is highly regarded in the aquaculture industry for his culturing of a variety of marine ornamentals.

We appreciate hearing from our readers. Please send your *catches*, comments, or suggestions for articles to Jean McAuliffe, editor.

Soft coral manual now available



The eagerly awaited CTSA Publication #137, *The Culture of Soft Corals (Order: Alcyonacea) for the Marine Aquarium Trade* is now available.

Simon Ellis, the extension agent for the U.S. Affiliated Pacific Islands co-authored the manual. The extension agent program is funded through grants from CTSA and the University of Hawaii Sea Grant program.

Ellis spent many months researching and writing the seventy-three-page manual that provides information on cultivating this popular addition to marine aquariums. A section

containing 19 color images is included that provides a valuable reference for identifying a number of soft corals discussed in the manual.

If your needs don't require such an extensive manual, then you may be interested in related CTSA publication #140. The recently published Aquafarmer Information Sheet, *Farming Soft Corals for the Marine Aquarium Trade* is a six-page publication that still provides a significant amount of information for its length.

The publications can be downloaded in Adobe Acrobat format from the CTSA home page at <http://library.kcc.hawaii.edu/CTSA>. Or you may request a copy while supplies last by contacting Alcian Clegg at the CTSA Administration Center by phone (808) 259-3168, by fax (808) 259-8395, or by email at aclegg@teligentmail.com.

IMPORTANT NOTE:

Before starting a coral cultivation project, it is critically important that you become familiar with local and international laws regarding the collection, cultivation, and possession of live corals. Please contact your local government agencies to obtain information regarding current regulations in your area.

CTSA Regional Notes

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is printed on recycled paper.

CTSA seeks suggestions for priorities

A journey of a thousand miles begins with a single step. If the CTSA Plan of Work can be compared to such a journey, then that first step can begin with *you*.

Do you have an interesting suggestion for aquaculture research, extension, or education that would help aquaculture development in the region? Have you experienced an aquaculture problem that has stubbornly eluded a solution? If so, then this is your chance to share your thoughts by responding to CTSA's request for suggestions for the Year 14 Plan of Work.

In February, CTSA will present your suggestions in the form of pre-proposals to the Industry Advisory Council (IAC). The IAC members spend two full days discussing and voting on the various pre-proposals. A majority vote by the IAC is required for a pre-proposal to become a priority area.

Once the priority areas are selected, they are developed into full proposals using the Project Work Group method. The Project Work Group may or may not include the individual who submitted the pre-proposal. It is also important to note that projects can be initiated directly with private individuals or commercial enterprises, but must be supervised financially by a nonprofit organization such as a university or research institution. Although CTSA welcomes ideas from any interested persons, first priority will be given to suggestions from the people who are oftentimes most aware of the needs of the industry—*farmers*.

To play a part in this important process, just follow the guidelines and submit your suggestion by the deadline.

Guidelines



Suggestions should include the following:

- ✓ Proposed title or main idea
- ✓ Proposed objectives
- ✓ Background and justification of the problem to be addressed
- ✓ Description of how the project results could be applied and who will benefit
- ✓ Suggested participants
- ✓ Proposed budget (not required, but if submitted, include detailed justification)

Format requirements:

- ✓ Typewritten on no more than two letter-sized pages
- ✓ Page margins - one-inch on all sides
- ✓ Font - at least 10-point Times New Roman

Mail, fax or email your suggestion to:

IAC Priorities Year 14
Center for Tropical and Subtropical Aquaculture
The Oceanic Institute
41-202 Kalaniana'ole Highway
Waimanalo, HI 96795
fax: (808) 259-8395
email: clee@teligentmail.com

DEADLINE: January 14, 2000

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AQUATIPS

Parasites in paradise: *ICH*

By Dee Montgomery, Hawaii State Aquaculture Development Program
James Brock, D.V.M., Hawaii State Aquaculture Development Program
Clyde S. Tamaru, Ph.D., Sea Grant Extension Service, University of Hawaii

This article was written as part of the work for the projects titled “Disease Management for Hawaiian Aquaculture” and “Expansion and Diversification of Freshwater Tropical Fish Culture and Ornamental Plants Culture” which are funded in part by the Center for Tropical and Subtropical Aquaculture under a grant from the U.S. Department of Agriculture Cooperative State Research, Education and Extension Service.

Ich (*Ichthyophthirius multifiliis*) or the equivalent marine form, *Cryptocaryon irritans*, are protozoan ectoparasites commonly encountered on ornamental fishes. Both parasites can cause significant mortalities especially when fish are in a crowded situation or experiencing various levels of stress. Both protozoans may be present on fish as a carrier state infection, mainly on wild-caught fish or fish that have been cultivated in ponds. The carrier state infection is a rather common condition and a major means for the spread of ich in the aquarium fish trade. Ich is readily identified by the commonly referred to “white spots” on infected individuals. In addition, other characteristics of an ich infection are the scratching and scraping behavior (e.g. flashing), individuals exhibiting rapid breathing, and the secretion of increased amounts of mucus. Mortalities for infected fish can be catastrophic with a heavy ich infection, however, recovery from an ich infection may impart host immunity to the parasite.

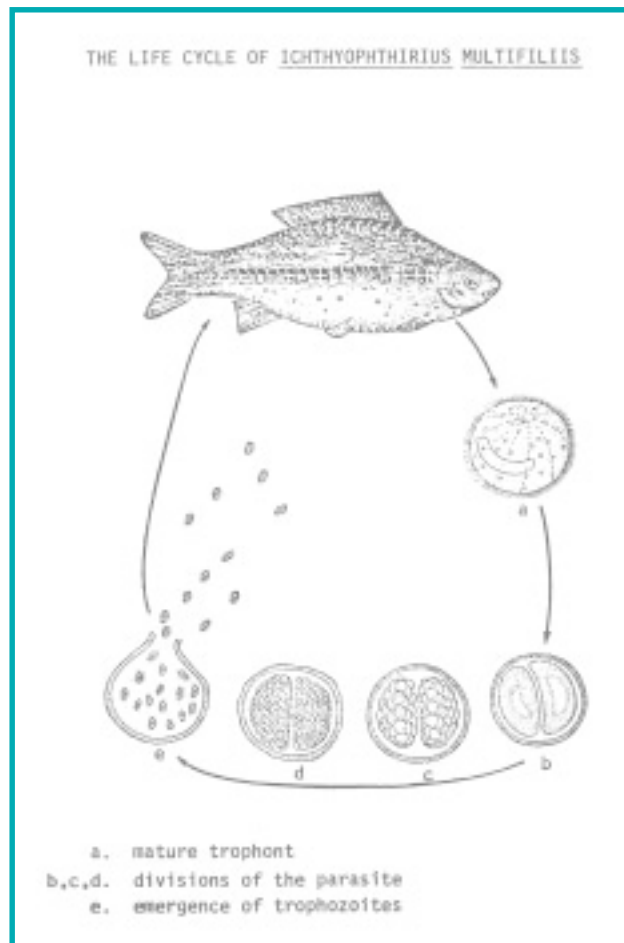


Figure 1. Life Cycle of Ich

LIFE CYCLE

Ichthyophthirius multifiliis and *C. irritans* require fish to survive. Without the fish host, the parasites cannot complete their life cycle. As shown in Figure 1, there are three major phases in the life cycle of these parasites. These are the:

- Trophant stage (a)** The parasite is on the host fish.
- Tomont (cyst) stage (b, c, d)** The parasite undergoes multiple divisions forming numerous tomites.
- Theront (swimming) stage (e)** Released with the rupture of the tomont stage.

As a tomont, the encysted organism undergoes 200 or more divisions over a period of a day or so at 25°C, releasing hundreds of individuals (theronts) into the water. Theronts will perish if they do not contact a host fish within 24-48 hrs and it is this

stage of its life cycle that it is most vulnerable to chemicals used to treat ich. Upon contact with the fish, the theronts burrow into the skin, begin feeding and within a few days at 25°C, mature into the trophont stage (Figure 2). Mature trophonts appear as tiny white spots

on the skin, fins and gills. The trophont stage is the only stage of ich that causes harm to the host and the extent of the injury is directly related to the number of trophonts present. Trophont infection of the gill lamellae probably causes the greatest injury to the infected individual. Once mature, trophonts drop off the host fish and fall to the bottom of the container and encyst to become the tomont stage.

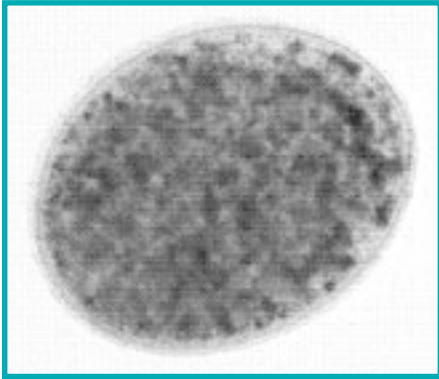


Figure 2.
Photomicrograph
of the trophont
stage of ich.

DIAGNOSIS

A diagnosis of ich is made by finding white spots on a fish and then confirmed by microscopic identification of the ciliated trophonts (Figure 2) in wet-mounts of skin or gill biopsy preparations. The trophonts appear round or oval in shape and individual organisms vary in size from 30 microns to 1 millimeter in diameter. In a wet-mount preparation, an individual ich trophont moves slowly by means of surface cilia.

TREATMENT AND CONTROL

Control of an ich outbreak can be approached in several ways depending on the features of the culture system and other factors.

Method 1: Fish can be isolated from ich tomites by transfer of fish to containers with tomite-free water. With this method fish are moved between two tanks every 24 hours for a duration of 15 days. After the fish are moved out from a tank, it is drained, scrubbed clean, vigorously rinsed, drained again and filled before the fish are re-introduced into the tank the following day.

Method 2: This approach traps and removes tomonts that are in the substrate (e.g., sand, gravel) of the holding container. A 0.5 cm (1/4 in) layer of clean sand or gravel is spread over the bottom of the tank. This sand layer is removed (by siphoning) and replaced with clean sand every other day for eight or more “sand transfers.” The tomonts that are attached to the sand or gravel are removed with the sand reducing the re-infection of the fish.

Method 3: A third approach that may be used to reduce further infection by theronts is to continuously and rapidly filter the water in the tank through diatomaceous earth or a membrane (20 microns or less) filter. The filter can trap and remove from the water many of the swimming theronts, which are about 30 microns in diameter.

Method 4: The use of salt is another alternative for treating the freshwater form of ich. The suggested concentration is 3-5 ppt (3-5 g salt per liter of fresh water) used in a prolonged bath for a duration of at least 16 days. Note that not all species of fish will be able to tolerate these levels of salt and if the treatment is to be done directly in the holding tank, many of the water plants will be damaged if left in the tank during the salt treatment. Remove the plants and place in a separate container for the duration of the treatment or place the fish in a separate treatment tank. The salt should be non-iodized and should not contain yellow prussiate of soda (YPS), because prussic acid is toxic to fish. Dosage information is given in Figure 3. Apply the salt in three or five equal amounts every 12 hours to achieve the final concentration of 3-5 ppt.

SALT TREATMENT

3 ppt salt solution is equivalent to a 0.3% salt solution, which can be made using any of the following ratios:

- 3 grams of salt per liter
- 11.4 grams of salt per gallon
- 0.4 ounces of salt per gallon
- 3 teaspoons of salt per gallon
- 3 pounds of salt per 100 gallons

5 ppt salt solution is equivalent to a 0.5% salt solution, which can be made using any of the following ratios:

- 5 grams of salt per liter
- 19 grams of salt per gallon
- 0.6 ounces of salt per gallon
- 5 teaspoons of salt per gallon
- 5 pounds of salt per 100 gallons

Figure 3. Salt treatment dosage information.

Method 5: Chemical treatment can also be applied to control an ich infection. A common chemical used is a solution of formalin/malachite green. Both of these chemicals affect the theront (swimming) stage of the parasite. Commercially prepared formalin/malachite green solution can be purchased directly from a pet store. For

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treatment, be sure to follow the instructions on the container label as to the amount of the liquid to add. Do a 50% water exchange and repeat the treatment every other day at least eight times. The fish should be exposed to the medication for a minimum of 16 days. Treatment using a homemade formalin/malachite green solution is as follows:

Step 1: In a clean container mix 0.378 g of zinc-free malachite green, 90 ml of concentrated formalin and 910 ml of tap water to make one liter of working solution.

Step 2: Apply the working solution every other day at a rate of one ml per gallon of tap water at least eight times.

Step 3: Change 50% of the water every other day prior to adding the formalin/malachite green solution.

Caution: When preparing the working solution, it is essential that gloves be worn and the work is done in a well-ventilated area to avoid contact with malachite green and concentrated formalin. Do not use this treatment with fish intended for human consumption. Know how to recognize and avoid formalin that has deteriorated into paraformaldehyde, which is very toxic to fish. Do not treat catfish or tetras with formalin/malachite green.

FURTHER ASSISTANCE

Contact the following agencies for assistance with the diagnosis and treatment of diseases of ornamental fishes:

Aquaculture Development Program
Disease Management
c/o Anuenue Fisheries Research Center
1039 Sand Island Parkway
Honolulu, Hawaii 96819
phone: 808-832-5004/5005
fax: 808-832-5012

The University of Hawaii Sea Grant Extension Service
2525 Correa Road, HIG 205
Honolulu, Hawaii 96822
phone: 808-956-2873
fax: 808-956-2858

GLOSSARY

Ectoparasite - A parasite that is associated with the skin of the host.

Epithelial cells - Cells that form the barrier between an organism and the external environment.

Carrier infection - A symptomless animal that bears and may transmit the causative agent of a disease.

Gill lamellae - Gill filaments

Mucus - A thick, often opaque, slimy fluid secreted by mucous glands.

REFERENCES

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Post, G. 1987. Animal parasites of fishes, Chapter VII, pp 159-214, *Textbook of Fish Health*, T.F.H. Publications, Neptune City, N.J. 288 pp.

ACKNOWLEDGMENTS

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Farmers applaud Chorulon® approval

After many years and the combined efforts of a number of organizations, the Food and Drug Administration (FDA) Center for Veterinary Medicine (CVM) recently announced the approval of Chorulon for use in both male and female finfish. The prescription drug, sponsored by Intervet, Inc., is a Human Chorionic Gonadatropin (HCG) used to induce spawning in a variety of cultured fish.

The last original approval of a New Animal Drug Application (NADA) was in 1986, when formalin was approved as a fungicide on selected fish eggs and as an external parasiticide on selected fish. A supplemental NADA was granted in 1998 to extend the 1986 approved formalin applications to all fish eggs and fish.

Prior to the NADA approval, the use of an HCG product was regulated under the terms of an Investigational New Animal Drug (INAD) permit granted to Intervet, Inc. The INAD, granted in 1996, provided a means of legally obtaining and using HCG until the product received formal approval.

Robert Bullis, DVM, Director of the U.S. Marine Shrimp Farming Program and Technical Director of

Animal Health at The Oceanic Institute, welcomed the approval and commented on its various applications.

Bullis said, "Because Chorulon is approved for both male and female broodfish of any species, it can be used by any aquafarmer who spawns fish, be they large-scale farms producing products for human consumption, smaller breeders who specialize in ornamental fish for the aquarium trade, or wildlife and zoo officials who run endangered species programs."

Commenting on the fact that the drug can be used only under the supervision of a veterinarian, Bullis said, "Such a doctor-client relationship is likely to be required in future NADAs and confirms the importance of the veterinarian's role in the prescription and administration of drugs to animals intended for human consumption."

For more information, contact Joan C. Gotthardt, Center for Veterinary Medicine (HFV-130), Food and Drug Administration, 7500 Standish Place, Rockville, MD 20855, (301) 827-7571. Additional information is also available at the Joint Subcommittee on Aquaculture Web site at <http://ag.ansc.purdue.edu/aquanic/jsa>.

Conditions of Chorulon Use in Finfish

Amount
50 to 510 I.U. per pound of body weight for males, 67 to 1816 I.U. per pound of body weight for females, by intramuscular injection.

Indications for use
An aid in improving spawning function in male and female brood finfish.

Limitations
May administer up to three doses. The total dose administered per fish (all injections combined) should not exceed 25,000 I.U. (25 milliliters) HCG in fish intended for human consumption. Federal law restricts this drug to use by or on the order of a licensed veterinarian.

CTSA wants to hear from you!



CTSA welcomes your feedback and suggestions for articles for future issues of Regional Notes. If you are a new reader and would like to receive this quarterly newsletter, please complete the form below and mail it to us. Please also let us know if you are receiving duplicate copies or if you had a change in address. If you prefer, you may email the information to jmcauliffe@teligentmail.com. Thank you.

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COMMENTS _____

Center for Tropical and Subtropical Aquaculture

The Center for Tropical and Subtropical Aquaculture (CTSA) is one of five regional aquaculture centers in the United States. Established by the U.S. Department of Agriculture, the centers integrate individual and institutional expertise and resources in support of commercial aquaculture development. CTSA was established in 1986 and is jointly administered by The Oceanic Institute and the University of Hawaii. The CTSA offices and staff are located at The Oceanic Institute's Makapu'u Point site on windward Oahu. A Board of Directors is responsible for overseeing the programmatic functions of CTSA.

The mission of CTSA is to support aquaculture research, development, demonstration and extension education to enhance viable and profitable U.S. aquaculture. Unlike the other centers, which work within a defined geographical region, the CTSA "region" encompasses tropical and subtropical species wherever they are cultured. Research projects span the American Insular Pacific, using its extensive resource base to meet the needs and concerns of the tropical aquaculture industry.

Each year's program is developed by CTSA's Industry Advisory Council and Technical Committee, reflecting the Center's mix of commercial and scientific expertise. Council members represent financial institutions, aquaculture and agriculture enterprises, government agencies, and other business concerns. The Technical Committee includes researchers, extension agents, and fisheries officers. Both committees include representatives from American Samoa, the Commonwealth of the Northern Mariana Islands, the Federated States of Micronesia, Guam, Hawaii, the Republic of Belau, and the Republic of the Marshall Islands. For further information on the CTSA program, contact Cheng-Sheng Lee, Ph.D., Executive Director, by phone **(808) 259-3107**, by fax at **(808) 259-8395** or by email at **clee@teligentmail.com**.

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