AQUANEWS

Sustainable Aquaculture for a Secure Future

POND DYNAMICS/AQUACULTURE COLLABORATIVE RESEARCH SUPPORT PROGRAM NEWSLETTER

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Africa Project Under Way in Kenya

by Jim Bowman

This has been a year of intense activity for the Kenya Project, beginning with the signing of a Memorandum of Understanding with the Fisheries Department of the Government of Kenya on March 10, continuing on through the posting of Karen Veverica, the CRSPs permanent US on-site researcher, at Sagana Fish Farm in late March, and culminating in the initiation of our first pond experiment on October 31.

Several major activities have been completed or gotten under way since Veverica's arrival at Sagana on March 31. The most significant of these include the major tasks of renovating the existing chemistry laboratory and several of Sagana's ponds to prepare them for the CRSP research program, training laboratory technicians and farm crew in the procedures needed to carry out the research program, getting university students involved in research projects at Sagana, and convening a workshop for the purpose of planning future efforts under the CRSP program.

JIM BOWMAN

CRSP researcher Karen Veverica samples fry in a Clarias *nursery pond at Sagana Fish Farm, Sagana, Kenya.*

Work on pond renovations commenced immediately upon Veverica's arrival and continued through September. Twelve new research ponds were created in place of three of the original 3600-m^2 ponds in Sagana's D line. The new ponds measure 20 x 40 m, giving them surface areas of 800 m^2, with depths of 100 cm and freeboard to allow maximum water depths of 120 cm. In addition to the twelve new research ponds, five other ponds were reconfigured and are now available for use as spawning, nursery, or fingerling production ponds. The research ponds were completed and ready for use by the end of October. Laboratory renovation work completed includes the installation of correct electrical grounding in the original laboratory room, as well as the construction of laboratory counters, installation of electrical wiring, and modifications of the windows in an additional room that is being converted for laboratory use. Laboratory renovations continued into October with the installation of plumbing, countertops, and shelves. A datalogger for recording weather data is now up and running.

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Meanwhile, In Other News...

One of the participants in the September Sagana Workshop was Mathias Wafula, assistant director of fisheries in Kisumu, Kenya. While Mr. Wafula has witnessed huge increases in fry production at the Sagana Fish Farm due to the efforts of the PD/A CRSP Kenya Project, he has also been carefully following another, more menacing form of growth explosion: the infestation of Lake Victoria by water hyacinths.

Water hyacinths are choking Lake Victoria, the nearly 70,000-km^2 body of water bounded by Kenya, Uganda, and Tanzania. As the fast-growing plants spread, they choke everything in their path, crippling the fishing industry and threatening the food supplies, trade, transportation, and hydroelectricity for millions of lakeside residents.

Mr. Wafula said the amount of fish caught in Kenya's Lake Victoria waters dropped by more than 3,409 tons between 1995 and 1996. He estimates the catch will decline a further 11,363 tons by the end of this year.

The water hyacinth, a South American native that has been spotted in Kenya as

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Host Country Collaborators Orientation

by Marion McNamara and Kris McElwee

The Education Development Component of the PD/A CRSP conducted a training program for host country collaborators from 20 October to 8 November 1997 in Oregon, Alabama, and Florida. Eneida Ramírez, Assistant Chemist at the La Lujosa Water Quality Laboratory (Honduras); Fernando Alcantara-Bocanegra, Principal Investigator (PI) from the Instituto de Investigacíones de la Amazonia Peruana (Peru); Bethuel Omolo, Head of Station at Sagana Fish Farm (Kenya); and Antonio Circa, PI from the Freshwater Aquaculture Center at Central Luzon State University (Philippines) participated in the training, which was designed to orient new collaborators to the CRSP. The three-week program gave the participants an opportunity to learn about the projects in the others' countries, brought them up to speed on the status of CRSP research projects, and gave them an overview of US aquaculture activities. One of the greatest benefits of the training, according to the participants, was spending three weeks getting to know one another, discussing their work, and relating the others' experiences to their own.

The program began with an overview of the Program Management Office at Oregon State University. Kelvin Koong, PD/A CRSP Board member and Associate Dean of the College of Agricultural Sciences; Jack Van deWater, Dean of International Programs; and Hillary Egna, Director of the PD/A CRSP, welcomed the participants to a week of activities in Oregon. The participants had an opportunity to have an in-depth meeting with Egna to discuss the increasing role that host country collaborators will be taking in the future. As the CRSP moves away from a model of supporting expatriate US researchers on site in every country, the increased participation of host country collaborators will become more important. Egna encouraged the group to assume more active roles, including increased leadership on the Technical Committee and subcommittees, and greater involvement in workplan development and the allocation of funds.

MARION MCNAMARA

At Oregon Aquaculture, in Newport, Oregon, OSU Graduate Student Gabriela Montaño (left) and Peru PI Fernando Alcantara inspect oysters being cultured. Montaño, who is completing a Ph.D. in Marine Science, provided Spanish interpretation during the EDC-sponsored orientation and study tour for host country collaborators.

MARION MCNAMARA

Ingvar Elle, PD/A CRSP Systems Administrator (left), helps Peru PI Fernando Alcantara "surf the Web" during an introductory session on using the Internet to find aquaculture information during a workshop at OSU. Graduate student Gabriela Montaño (right) looks on.

During six days in Oregon, the participants attended several seminars. Topics included gender considerations in USAID-sponsored projects, given by Candace Buzzard, Interim Director of OSUs Women in Development Office; and experimental design, offered by Jim Bowman, Wilfrido Contreras, and Martin Fitzpatrick of Oregon State University. They also attended three computer workshops. The first, given by John Bolte and Doug Ernst, familiarized participants with the POND© decision-support software;

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Publication Announcement

Dynamics of Pond Aquaculture
1997, 437 pp., ISBN: 1-56670-274-7

Editors—Hillary S. Egna and Claude E. Boyd

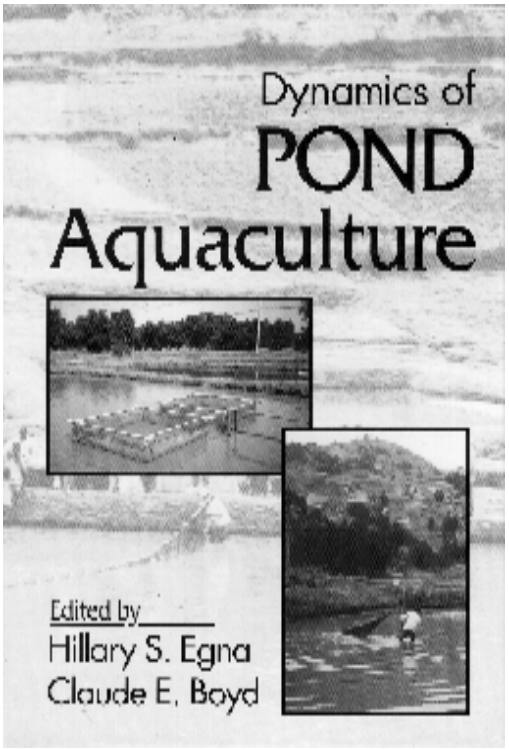
The culmination of over a decade's worth of research by the PD/A CRSP, *Dynamics of Pond Aquaculture* not only explains the physical, chemical, and biological processes that interact in pond culture systems, but also presents research findings and considers the people who depend on these systems. This book uses data from CRSP field research sites in East Africa, Southeast Asia, Central America, and North America to present a complete picture of the pond aquaculture system and the environment in which it exists.

A thorough study of the principles and practices of aquaculture, the book reflects the state of the art in pond aquaculture and incorporates recent advances that have changed the science in the last decade or so. It provides a thorough review of the many methods, techniques, and ideas that comprise this area of study. This text:

- Includes chapters on fish diseases, fish reproduction, extension, social and economic considerations, and environmental effects;
- Describes improvements in pond management techniques including seed fish production, pond preparation, fertilization, feed composition and manufacturing, aerator design, and harvesting;
- Addresses the need for greater quantification and standardization in research;
- Provides a synopsis of the methods, techniques, and ideas explored by aquaculture practitioners and researchers.

This textbook is useful to researchers, students, field workers, technicians, and engineers involved in aquaculture research, agricultural engineering, bioresource engineering, fisheries and wildlife programs, and environmental studies.

Price—$89.95 (within U.S.)
$108.00 (outside U.S.)√



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Contents:

Winners

The PD/A CRSP is proud to announce that CRSP Director Hillary Egna was presented with the first "Women in Leadership" award by the Pacific Northwest Chapter of UNIFEM (The United Nations Development Fund for Women). UNIFEM supports the development initiatives of women worldwide.

The presentation was made in Eugene on October 16, during a luncheon, award ceremony, and seminar on the theme of "Women in Leadership." The Pacific Northwest Chapter of UNIFEM instituted this award to recognize and honor women and organizations who have made outstanding contributions to the advancement of the status of women, families, and communities. Also honored by these awards were Vangy Smith (UNIFEM), Community Outreach Inc., District 8, Zonta International, and La Leche League of Washington.

BRIGITTE GOETZE

The Pacific NW Chapter of UNIFEM recognizes Hillary Egna (second from right) as one of its 1997 awardees.

The CRSP is also proud to report that Dr. Rebecca Lochmann of the University of Arkansas, Pine Bluff, has received the B.D. Mayberry Young Scientist award. This award is specifically aimed at professors who have been awarded their doctorates in the last five years and who have demonstrated outstanding achievements in research. Dr. Lochmann's work for the CRSP involves the use of carbon isotopes to determine the sources of food (natural and supplemental) ingested by tilapia. The award was presented on October 3, 1997, at the Association of Research Directors of the US Chapter of the World Aquaculture Society meeting in San Antonio, Texas.√

The PD/A CRSP Aquanews Prize Drawing

The lucky winner of the PD/A CRSP *Aquanews* Prize Drawing, made at Oregon State University, was Laurence Cotton, of Portland, Oregon. Ironically, Laurence was one of the 5% of respondents who had replied in order to cancel their *Aquanews* mailings. Nevertheless, the CRSP keeps its word. So, Laurence Cotton will not be receiving future copies of *Aquanews*, but instead has been sent a bag of CRSP-logoed mugs and pens. Other winners were Alfred Beeton, of Ann Arbor, Michigan, and Mike Thuruwe of Zomba, Malawi.

We would like to thank all respondents for participating in the competition and allowing us to learn more about our readership. The replies indicated that the bulk of *Aquanews* readers are employed in research (49%) and/or are government employees (29%).√

Honduras Workshop

by Marion McNamara

Carole Engle, Principal Investigator (PI) from University of Arkansas at Pine Bluff, presented two workshops in Honduras last October. Engle's primary purpose for traveling to Honduras was to complete surveys on aquaculture production, but additional support from the Education Development Committee (EDC) enabled her to conduct workshops on Aquacultural Economics and Business Planning to over 30 participants in San Pedro Sula and Choluteca, Honduras.

The workshops were truly a collaborative effort. The original recommendation to conduct business management training came from the EDC's Honduras Advisory Panel, a body with representatives from the Asociacion Nacional de Acuacultores de Honduras, (ANDAH), the Federation of Agricultural Exports of Honduras (FPX), the Direccion General de Pesca y Acuacultura (DIGEPESCA), the Pan-American Agricultural School (EAP). ANDAH and FPX co-sponsored the workshops in Choluteca and San Pedro Sula, respectively, providing a training site and helping make room arrangements and provide refreshments. Bart Green, US PI, facilitated communication and helped coordinate the logistics for both workshops. The EDC provided logistical and financial support, including sponsoring the attendance of DIGEPESCA representatives at each site. The workshops were advertised to the aquaculture community through the Honduran newspapers, and by the Advisory Panel through word of mouth.

Participants represented shrimp production farms, tilapia production farms, the government fisheries agency, the banking sector, consultants, and others. Their evaluation of the workshops was enthusiastic. Almost 100% of the participants reported being

The following abstracts of articles by CRSP program participants appeared recently in the Journal of the World Aquaculture Society and are reprinted here with permission.

Comparison of Tilapia Monoculture and Carp Polyculture in Fertilized Earthen Ponds

Shafiqul Hassan, Peter Edwards, and David C. Little

Abstract

A comparison of a monoculture of Nile tilapia *Oreochromis niloticus* and a polyculture of carps (silver carp *Hypophthalmichthys molitrix*; rohu *Labeo rohita*; and mrigal *Cirrhinus mrigala*; ratio 4:3:3) was carried out in 200-m^2 earthen ponds fertilized with cattle manure and supplemented with inorganic fertilizer at 3-kg nitrogen and 1.5-kg phosphorus/ha per day. A control treatment of a tilapia monoculture without fertilizer inputs was included to assess the effect of pond basal fertility. Net yields of 23.5 kg/pond per 112 d (3.8 t/ha per 1 yr) in the tilapia monoculture and 19.2 kg/pond per 112 d (3.1 t/ha per yr) in the carp polyculture were not significantly different; net yields from unfertilized tilapia monoculture ponds were negative. In the carp polyculture, silver carp was the dominant species at harvest contributing 73% of the total net fish production compared to 9% and 19% by rohu and mrigal, respectively. Water quality data suggested that tilapia yields could have been further improved by increasing fertilization rate but that critical dissolved oxygen concentration constrained this option for carp polyculture.

Journal of the World Aquaculture Society 28(3):268-274.

Fry Production of Shire River Tilapia *Oreochromis shiranus* at Two Broodstock Sex Ratios

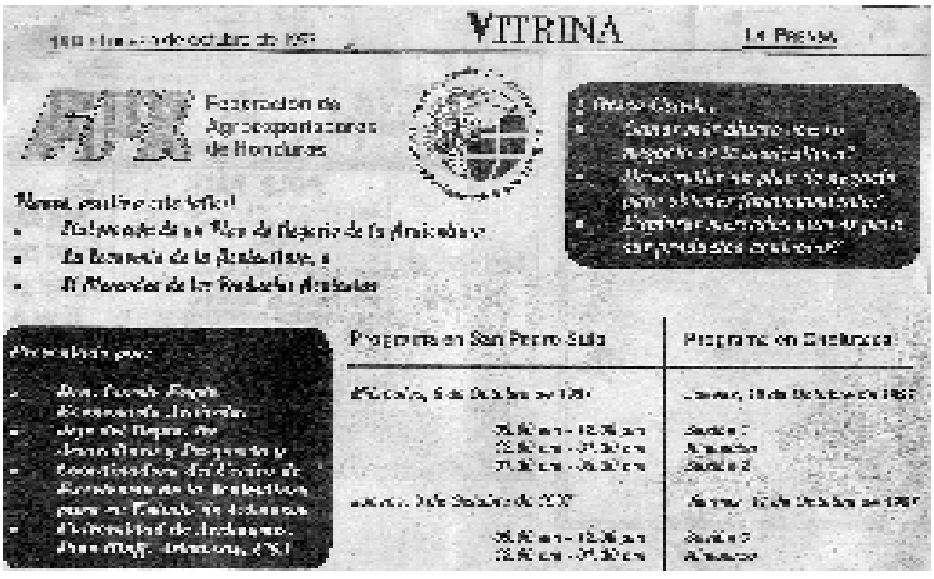
Tony M'Hango and Randall E. Brummett

Abstract

Shire River tilapia *Oreochromis shiranus* broodfish were stocked at a density of 1.25 fish/m^2 and sex ratios of either 1:1 or 1:3 (males:females). Two weeks after stocking, fry collection began. Fry were then harvested weekly for 9 wk with a fine-meshed dip net operated from the pond bank for 1.5 h each morning and afternoon. Ten weeks after fry collection began, all ponds were drained and completely harvested. Over the entire 84 d, fry production averaged 0.78 fry/m^2 per d and did not differ ($P < 0.05$) between treatments. Fry production per female was significantly higher ($P < 0.02$) in ponds stocked at a 1:1 sex ratio (111 fry/female) compared to a 1:3 sex ratio (66 fry/female).
To avoid inbreeding without sacrificing production, a broodstock sex ratio of 1:1 can safely be used when producing *O. shiranus* fry at a density of 1.25 fish/m^2 in earthen ponds. Competition among females is a possible cause of reduced fry production in densely-stocked brood ponds.

Journal of the World Aquaculture Society 28(2):188-192.

"Very Satisfied" with the quality of instruction and the competence of the instructor. As a result of attending the workshop, almost all participants felt they had a better understanding of the elements of running successful commercial aquaculture ventures, including looking at all kinds of markets. Participants suggested that they would use the new skills and knowledge gained from the workshop to improve their economic data gathering, to better measure their economic and financial profit, and to focus on marketing. Many participants indicated that they would like further, more in-depth training in business planning and aquacultural economics in the future. Given the positive outcome of these first workshops, more are sure to follow.√



Advertisement that ran in two Honduran newspapers prior to the Aquaculture Business Planning workshop given by Carole Engle last October. Engle conducted workshops in San Pedro Sula and Choluteca.

Africa Project

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Concurrent with these physical renovations, Veverica conducted basic training activities at Sagana between April and October. Laboratory staff were trained in water quality analysis. The seining crew and their supervisors received training in the use of new seines, including using a seine with a bag and using "dead men," fish handling, and on-station fish transport. Hapas and filter socks have been brought on to the station for the first time and are now used for several activities. Local makers of hapas and other fish farming supplies have been identified by Veverica. Improvements in fish handling practices have resulted in an increase in fry production from fewer than 5,000 fry (for sex reversal) per month in April/May to about 40,000 per month. Four university students are currently conducting thesis-related research at Sagana under Veverica's guidance. In addition, Mr. Bethuel Omolo, Head of Station at Sagana, attended the study-tour program for aquaculture development, conducted in the US by the CRSP Education Development Component between October 20 and November 8.

Perhaps the highlight of the new project's activities, though, was a planning workshop organized by Veverica and Omolo and held at Sagana from September 17 to 19. Members of the Kenya Fisheries Department and representatives of the Africa Project of the PD/A CRSP met during this time to evaluate the present status of aquaculture in Kenya, to identify major constraints to further development, and to formally initiate their new collaborative effort in Kenya. Participants in the meeting included Mr. Fred Pertet, Director of Fisheries, Kenya Ministry of Tourism and Wildlife; Mr. Omolo, Head of Station, Sagana; Provincial Fisheries Officers from around Kenya; Karen Veverica, CRSP Africa Project Co-Principal Investigator, Auburn University; Pierre-Justin Kouka, University of Arkansas at Pine Bluff; and Jim Bowman, CRSP Africa Project Co-Principal Investigator and Project Leader, Oregon State University.

JIM BOWMAN

Director of Fisheries Mr. Fred Pertet opens the workshop held at Sagana Fish Farm in September, 1997. This workshop marked the first opportunity for CRSP researchers and Kenyan Fisheries Officers to collaborate on plans for future activities.

Provincial Fisheries Officers and Kenya Marine Fisheries Research Institute (KMFRI) and University representatives who participated in the September workshop:

E.Z. Kariuki, Provincial Fisheries Officer, Central Province
Mr. Michael Obadha, Provincial Fisheries Officer, Eastern Province
Mr. B. Ayugu, Provincial Fisheries Officer, Rift Valley Province
Mr. Munyiri, Provincial Fisheries Officer (Rep.), Nairobi Province
Mathias Wafula, Provincial Fisheries Officer, Nyanza Province
Charles Oduol, Provincial Fisheries Officer, Coast Province
Miss Rachel Ajando, Provincial Fisheries Officer, Western Province
Mr. Abuga, KMFRI
Mr. Francis Kuria, KMFRI
Charles N. Chege, Moi University, Lecturer, Fisheries Department.

In addition to giving the US project members an opportunity to introduce the PD/A CRSP and describe its history and past successes to the Kenyan participants, the meeting provided an opportunity for the Provincial Fisheries Officers to report on the history, status, and problems of aquaculture efforts in their respective provinces. These presentations were followed by a session to review the primary constraints to aquaculture development in Kenya and identify those which might be addressed through collaboration with the CRSP. This exercise in turn established a basis for working sessions to develop activity proposals for the next PD/A CRSP Work Plan. A good portion of the workshop was set aside for these working sessions, and two key activity proposals came out of this group effort.

Other major outcomes of this workshop included the establishment of a common understanding of where we are and where we need to go, a strengthening of relationships between members of the Kenya Fisheries Department and the PD/A CRSP, and a heightened level of enthusiasm for this new collaborative effort.

With the completion of much of the necessary site development and preparation, the spirit of cooperation that emerged from the workshop, and the first experiment now under way, members of the Africa Project now look forward with enthusiasm to a productive collaborative effort in Kenya and the region.√

PD/A CRSP at ISTA IV

by Marion McNamara

The Fourth International Symposium on Tilapia in Aquaculture Conference and Trade Show was hosted by the Florida Aquaculture Association at the Coronado Springs Resort, Disney World, Orlando, Florida (9-12 November 1997). The PD/A CRSP co-sponsored the conference through the efforts of Marion McNamara, Education Development Coordinator. Other co-sponsors were the American Tilapia Association, International Center for Living Aquatic Resource Management (ICLARM), the Aquacultural Engineering Society, the Israeli Fish Farmers Association, the US Chapter of the World Aquaculture Society, the Livestock Production and Veterinary Medicine Department of the French agriculture research center (CIRAD-EMVT), and the Department of Fisheries of Mexico (SEMARNAP).

The PD/A CRSP presented its research work at the conference both through a display booth and through the presentations of CRSP-funded research. The space for the CRSP display booth in the exhibitions hall was secured in repyment for the hard work that McNamara contributed towards organizing the symposium. Interest in the booth created contacts with researchers and producers in countries without previous ties to the CRSP. One result of this is that further meetings and training activities with producers from the Philippines are being arranged for 1998.

The conference's welcoming address gave CRSP Director Hillary Egna the opportunity to introduce the Program to the attendees.

Conference proceedings, "Tilapia Aquaculture," have been published by the Northeast Regional Agricultural Engineering Service (808 pp.) in two volumes. Copies can be ordered from NRAES, Cooperative Extension, 152 Riley-Robb Hall, Ithaca, New York 14853-5701, phone 607-255-7654, fax 607-254-8770, email nraes@cornell.edu. Cost of the proceedings is $48.

The PD/A CRSP would like to express its thanks for such a smooth-running conference to the organizers: Kevin Fitzsimmons, Jane Davis (Curator for aquatic animals at Disney World), Ray DeWandel (American Tilapia Association), Mike Ednoff (Harbor Branch), Rick Martin (Fish Farming News), Marion McNamara, and Mike Timmons (Aquaculture Engineering Society).√

During the course of the conference the following presentations of PD/A CRSP-funded research were given:

Effect of feed storage time and storage temperature on growth rate of tilapia fry and efficacy of sex reversal. Smith, E.S. and R.P. Phelps.

Masculinization of Nile Tilapia (*Oreochromis niloticus*) by single immersion in 17α-methyldihydrotestosterone and trenbolone acetate. Contreras-Sanchez, W.M., M.S. Fitzpatrick, R.H. Milston, and C. Schreck.

Clinical trials to evaluate the efficiency of treating newly hatched tilapia fry with 17α-methyltestosterone. Teichert-Coddington, D.R., B. Green, and R.P. Phelps.

Secchi disk visibility and chlorophyll: A relationship in aquaculture ponds. Jamu, D.M., Z. Lu, and R.H. Piedrahita.

Mass production of *Oreochromis niloticus* and *Oreochromis aureus* fry in relation to water temperature. Green, B.W., E.H. Rizkalla, A. Nassr Alla, and A. Khater.

PD/A CRSP Central Database: An information resource for tilapia culture in ponds. Ernst, D.H., J.P. Bolte, D. Lowes, and S. Nath.

Other News...

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early as the 1950s, was first sighted on Lake Victoria, a source of the River Nile, in 1990.

Considered by many to be a beautiful and exotic species, the plant has been used as an ornamental decoration in some countries. But lakeside dwellers in Kenya quickly learned to be frightened by its overwhelming presence and amazing ability to double its size and volume every five to 15 days. Further, as they found, the plant thrives in polluted water, has a huge seed capacity, and can survive for up to 20 years.

Although Kenya has the smallest share of the Lake Victoria shore—six percent, as compared with Uganda's 43 percent or Tanzania's 51 percent—it has been afflicted most by the water hyacinth; more than one percent of Kenya's waters are said to be covered, and researchers say the rest could be swallowed up within five years.

The creeping menace has already captured part of the Kenyan capital. Water hyacinth swarmed over the lake formed by the small Nairobi Dam in just three months, preventing swimming and even halting the baptisms that once took place. Now, there are fears that the plant might sweep into the city's water and sewer systems.

Based on an article by Ann M. Simmons, Los Angeles Times, 28 October 1997.

Fishellaneous Items

Another record year seen for US tilapia

The tilapia farming industry in the United States has grown 300 percent in the past five years and will set new records this year, according to projections.

Last year output jumped from 15 million to 19 million lb, due mainly to increased effort in California and Arizona. But five other states are making use of geothermal springs to grow a variety of tilapia.

In addition, tilapia farming has also been initiated on the US Pacific island of Guam. Growers there reported to be earning as much as $2.95 a lb for their fish.

Estimates for 1997 forecast a total farmed production of 22 million lb, although quality and prices will vary widely. Farm earnings last year on the US mainland ranged from $1 to $2 a lb.

While outdoor geothermal farms are expanding in areas of Arizona, Texas, and Florida, intensive indoor recirculating systems still account for 75 percent of farm output. At the same time, unlike the catfish industry where most fish goes to processors, tilapia is a live fish market.

"Only about 25 percent of tilapia is processed," said Michael Mangel, president of Arizona Aquaculture Association. "Here and in California it is the *Oreochromis mossambica* which is in demand in the live markets."

At present, *O. nilotica* is the most commonly cultured species and is raised in a wide range of environments. These include ponds, raceways, cages, and tanks. Solar greenhouses and insulated buildings can be seen on the latest high-tech farms.

The largest US producer is Solar Aquafarms, which has constructed recirculating tanks using an activated sludge water treatment system. Although output is high, so is cost due to heavy initial investment. Farms like this need to sell at around $2 per lb, and any fall in price is a threat.

The American Tilapia Association is worried that uncertain prices will drive some farms out of business this year. Another factor is competition from imported fish.

"Expansion has been very fast," commented Ray DeWandel, president of the American Tilapia Association. "Tilapia consumption has now overtaken that of trout but profit margins for many growers are slim."

Source: Fish Farming International 24, no. 4, April 1997.

The Many Diverse Uses of Tilapia

Tilapia has long been considered likely to become the equivalent of the broiler chicken in terms of its capacity to produce high quality protein at low cost without expensive high grade fish meal or other animal protein diets.

It also seems to be serving an important role, similar to that of the fruit fly, as the ideal experimental animal for genetic studies.

Tilapia has also long been symbolic in the Christian religion as a fish which appeared in both the Old Testament of Moses, and as the star dish in the feeding of the 5,000 at Capernaeum.

These fish breed and grow very fast, but for five fishes to provide enough for 5,000 people must indeed have been a miracle!

Recently a UK supplier of tilapias for human consumption was criticized for producing them on the market as "St. Peter's fish." This is apparently a breach of the Food Labeling Acts in the UK, as the Atlantic John Dory is already called St. Peter's fish...

Recently, however, tilapias seem to have risen still higher in their importance to man. Canadian scientists have shown that they can be made to produce cells capable of synthesizing human insulin for diabetics.

It is probably no coincidence that Canadian scientists did this work, since Canadians have been the driving force behind insulin research since it was first discovered by the Nobel Laureates Banting and Best in Canada in the 1920s.

Now, it seems, Canadian fish geneticists have genetically engineered tilapias to grow human insulin producing cells which might even be transplanted into the hormone deficient patient.

It is likely to be some time before such technology reaches the hospitals, but it is certainly a novel benefit of aquaculture which none of us could even have envisaged 20 years ago.

The male tilapia is a very aggressive virile and fecund lothario. If the Canadians can devise ways of genetically engineering that hormonal capacity into humans as well, they could transform the Canadian economy overnight!

Source: Fish Farming International 24, no. 5, May 1997.

Global Aquaculture Alliance Formed

Aquaculture producer associations and individual shrimp producing and marketing companies from throughout the world have formed a new trade association—the Global Aquaculture Alliance (GAA).

This new organization will work to develop and further sustainable and environmentally sensitive aquaculture technology and practices to ensure that this rapidly growing industry will play a key role in meeting increased world demand for fishery products.

While open to all species groups, the founding members of the GAA are producers and marketers of farm-raised shrimp. Shrimp farming is one of the fastest growing and most valuable segments of the aquaculture industry with major developments in Central and South America, as well as throughout South Asia.

Shrimp aquaculture has experienced environmental problems in some areas, resulting in a slowdown in growth for the industry and bringing it under attack by some environmental organizations.

The newly formed Alliance will work closely with the scientific, environmental, political, and regulatory communities to explore and implement existing and new technologies that will maintain shrimp aquaculture as a sustainable and environmentally sensitive industry. The first order of business for the Alliance will be the development of a comprehensive code of good practices for the industry. The Alliance will also communicate directly with the public, conveying the message that shrimp and other farm-raised seafood are produced in a environmentally and socially responsible manner and are essential to helping feed people and provide employment, particularly in developing nations, as the world population continues to swell. In addition, it will represent the aquaculture industry in the international arena at various meetings and events.

Acting GAA President George Chamberlain said, "The need for aggressive action by the shrimp aquaculture industry is apparent to assist producers throughout the world in the development and use of environmentally and socially responsible aquaculture systems. The Alliance will initially focus on development of a code of practices and a seal for product produced in accord with this code."

Formation of this new organization began at the World Aquaculture Society meeting held in Seattle in February 1997. At that meeting, 56 participants from 12 countries gathered to lay the groundwork for the Alliance. The Alliance took shape at an aquaculture conference in Tegucigalpa, Honduras, on April 23 with more than 60 representatives in attendance at an organizational meeting. More than 20 founding members have pledged funds to start up the new organization. It is expected that more than 50 producer associations and individual companies will become founding members.

The Alliance will be governed by a 15-person board of directors made up of producers, marketers, and representatives of scientific and consumer organizations.

For the remainder of 1997, the National Fisheries Institute (NFI), Arlington, VA, will serve as the Alliance's temporary headquarters.

Lee J. Weddig, Executive Vice President of the NFI, said, "The Institute is pleased to assist in the formation of this new group. Increased aquaculture production is essential to meet the growing demand for fishery products since most ocean resources are now being utilized close to their sustainable limits."

Source: The Aquaculture News 5, no. 8, June 1997.

Tilapia Trials (Cod battered—Nile tilapia found guilty)

Tanga Coastal Zone Conservation and Development Program (TCZCDP) in Tanzania is to begin breeding tilapia in saltwater, in a series of trials in cooperation with local people. The tilapia *O. mossambicus* species can survive high salinity ranges. Cage construction is completed. If successful, the trials will be enlarged towards eventual commercial production.

Source: Fish Farming International 24, no. 9, September 1997.

All About CRSPs

The US Agency for International Development (USAID), participating Land Grant Universities, and participating Host Countries cooperate to implement 10 Collaborative Research Support Programs (CRSPs). USAID recently published a booklet which describes each of the CRSP programs. This booklet, entitled "Global Research for Sustainable Development," is available from USAID, Global Bureau, Center for Economic Growth and Agricultural Development, Office of Agriculture and Food Security, Ronald Reagan Bldg., Room 2.11-006, Department of State, Washington, DC 20523. This booklet briefly describes each of the 10 CRSPs.

Source: Inside INTSORMIL, October 1997.

World Tilapia Association Up and Running

Mike Sipe has been working with tilapia for over 25 years. As a founding member of the Florida Aquaculture Society and co-founder of the American Tilapia Society, he thought it was time an international body was set up to deal with the needs of tilapia farmers around the world.

The World Tilapia Association (WTA), founded by Mr. Sipe early this year, aims to organize and improve communications between all sections of the tilapia industry.

He told FFI that the focus of the Association will be cooperation in solving the problems of tilapia culture, marketing, research, and extension. Setting standards for the industry with internationally-recognized classifications is also on the agenda.

The WTA will communicate to members on the World Wide Web. A site has already been set up for this purpose. A team has been put together to produce a regular international newsletter which will appear on the web site. Members will be encouraged to contribute to the newsletter with reports, stories, and related information.

Some material on the web site will be open to all, but only members will be given the access code to read the entire file. All articles will appear in English and in their original language...

The WTA proposes three different levels of membership: individual, student/local (i.e. those without their own Internet access) and institutional. The rates will be US$25 for individuals, $10 for students and local members, and around $250 for institutions like companies and universities with over 50 users.

The WTA will comprise an elected executive, area coordinators, and members. The first elections will take place at the end of this year.

Mr. Sipe told FFI that he already has 20 area coordinators in 12 countries, but he is still looking for more. Those interested should contact him.

"The only requirement is that you have an Internet capacity," he said. "Ideally, you should also speak English. Area coordinators will be expected to contribute to the newsletter and pass on information to local members. All coordinators will receive free WTA membership."

Source: Fish Farming International 24, no. 4, April 1997.

Israeli Fish Farmers Adapt to Change; Move Cautiously to Recirculation

The Israeli Fish Farmers Association was one of the sponsors of the Fourth International Symposium on Tilapia in Aquaculture (ISTA) at Walt Disney World in Florida on Nov. 9-12.

The host nation of the first ISTA event in 1983, Israel's reputation as a leader in successful tilapia farming was established in the early culture days of the fish. The following is a brief report to *Fish Farming News* on today's industry provided by Israeli farmers Avi Koren and Ramy Alon.

Fish farming in Israel has been a growing industry in recent years. It has received recognition as a direct protein-producing industry and, as such, has been getting more attention from the government and private sectors.

The data and knowledge up until recent years came from extensive and semi-intensive commercial fish farms and research and development (R&D) stations, especially in the northern parts of the country. During the past few years, with a growing shortage of water resources and the concern for environmental protection, water reuse and recirculating systems have taken big steps forward, especially in the southern dry region of the country.

With the advanced technology application, fish farmers are moving in the direction of intensification and improved efficiencies of recirculating super-intensive systems. The use of geothermal water and the optimal climate in the south are promoting aquaculture development there and also in other parts of the country, where farmers identify economical advantages for their projects.

The fish species that is receiving most of the fish farming attention is the tilapia and its different varieties. New lines of tilapia and their hybrids are always under study for better performance and ease of growth.

Other kinds of fish with different levels of commercial success are: carp, mullet, hybrid striped bass, and lately, there is some work being done with red drum in brackish water.

There is also commercial cage culture done in nearshore projects in the Gulf of Eilat and along the Mediterranean coast, producing sea bream and some strains of tilapia.

A typical layout of an intensive tilapia fish farm in the southern part of Israel consists of the following: hatchery operation (self use and/or commercial), nursery ponds or tanks, production tanks or raceways, and water recirculation systems with mechanical and biological filters. Some farms use pure oxygenation, although high costs still make it hard to justify economically. Geothermal brackish water passes through the fish tanks, is recirculated at some level, and then is collected in a reservoir until it can be used for irrigation.

In subtropical regions, and at the desert areas where sunny days are plentiful in wintertime, solar energy absorption is achieved by the use of "Aqua Bubble" greenhouses. That gives the warmwater fish the best environmental conditions for growth and feed conversion, enabling a year-round production and supply of the product.

In the northern region, where fish used to be raised semi-extensively in large reservoirs during the warm months and "stored" in storage tanks during the winter, fish farmers are planning to use the advanced technology to convert their storage systems into covered, production recirculating systems.

...continued on p. 14

Notices of Publication

These Notices of Publication announce newly-published work carried out under PD/A CRSP sponsorship. Starting with the Summer 1997 issue, instead of mailing out individual NOPs, there will be a space reserved in each issue of *Aquanews* for publicizing recently published work of CRSP researchers. As with previous NOPs, to receive a full copy of a report, please contact the author/s directly unless it is otherwise noted.

CRSP Research Report 97-111

Solubility of selected inorganic fertilizers in brackish water

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Diammonium phosphate, monoammonium phosphate, triple superphosphate, and urea were dropped through a 1-m column of water which ranged from 0 to 40 ppt salinity. Mean solubility of nitrogen was 4.1% from diammonium phosphate, 11.8% from monoammonium phosphate, and 76.8% from urea. Mean solubility of phosphorus was 4.6% from diammonium phosphate, 10.4% from monoammonium phosphate and 4.4% from triple superphosphate. Salinity did not significantly affect the solubility of nitrogen and phosphorus from diammonium phosphate. Nitrogen solubility from monoammonium phosphate and phosphorus solubility from triple superphosphate significantly decreased with increasing salinity, but the correlations were low. Urea solubility and phosphorus solubility from monoammonium phosphate responded curvalinearly to increasing salinity. Solubility differences caused by salinity disappeared after 24 h of contact with water when all fertilizers dissolved completely regardless of salinity. No adjustment for salinity is necessary when fertilizer rates are calculated for brackish water or marine application.

This abstract was excerpted from the original paper, which was published in Journal of the World Aquaculture Society, 28(2):205-210.

CRSP Research Report 97-112

Water quality in laboratory soil-water microcosms with soils from different areas of Thailand

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Forty-five soil samples were collected from aquaculture areas in 23 provinces of Thailand to include six soil orders and wide variation in physical and chemical properties. Soil-water microcosms were prepared containing 5 g of soil and 150 mL of distilled water. Microcosms were held in an oscillating table shaker (150 rpm) for 1 wk at 25 C in the dark. Water pH and concentrations of dissolved nutrients, total alkalinity, and total hardness were measured. Differences in properties within soil orders caused wide variation in composition of solutions and differences in concentrations of dissolved substances and pH were not related to order. Regression analyses revealed significant correlations between concentrations of soil nutrients extractable in dilute acid (0.05 N HCl plus 0.025 N H_2SO_4) or in neutral, 1 N ammonium acetate and aqueous concentrations. Regression coefficients usually were higher for dilute-acid extractable nutrients than for ammonium acetate extractable ones. Regression coefficients based on dilute-acid nutrients follow: soluble reactive phosphorus (r = 0.816); calcium (r = 0.685); magnesium (r = 0.470); potassium (r =0.959); sodium (r = 0.977); manganese (r = 0.462); boron (r = 0.399). The correlation between soil and solution iron was not significant and aqueous concentrations of copper and zinc were below detection limit. Hardness was correlated with soil carbon (r = 0.710) and soil pH was a good predictor of alkalinity (r = 0.877). Soil pH and aqueous pH were highly correlated (r = 0.939). Findings suggest that soil characteristics can be used to predict pH and concentrations of several dissolved substances in soil-water systems under aerobic conditions.

This abstract was excerpted from the original paper, which was published in Journal of the World Aquaculture Society, 28(2):165-170.

Notices of Publication (cont.)

CRSP Research Report 97-113

Determination of phosphorus saturation level in relation to clay content in formulated pond muds

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An experiment was conducted to determine the amount of P needed to saturate simulated fish ponds sediments, formulated to contain six levels of clay (0, 30, 41, 64, 73 and 81% by weight). A series of cylindrical cement tanks were filled to 20 cm depth with the six sediment types and triple superphosphate (TSP) solution was added to reach P saturation in sediment. Results showed that all sediment types reached a constant inorganic-P concentration in the upper 5 cm after 12 weeks of TSP application, and P adsorption capacity of sediment increased with increasing clay content. Sediment P adsorption was slower and not significant (P>0.05) below 5 cm depth except in the sediment type containing 0% clay. Regression analysis showed that the rate and adsorption capacity of P in sediment are primarily governed by clay content and its dominant minerals. While organic-P and loosely bound-P are commonly deposited in sediment, most inorganic-P is adsorbed by cations to form cation-P complexes. The linear relationship between cation-P saturation level and the percentage of clay in sediment is highly significant (r^2 - 0.84, P<0.001) and, therefore, the maximum adsorption capacity of cation-P in pond sediment can be approximated by Y = 0.019X (where Y represents the 100% saturation level in mg P g^{-1} soil, and X is the percentage of clay in the sediment). In practice, the level of P saturation in sediment can be approximated by the intial cation-P and clay contents in the top 5 cm of pond mud using the equation: P saturation (%) = initial cation-P (mg g^{-1} soil) x 100/P adsorption capacity (mg g^{-1} soil).

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This abstract was excerpted from the original paper, which was published in Aquaculture Engineering, 15(6):441-459.

CRSP Research Report 97-115

Influence of Nile tilapia (*Oreochromis niloticus*) stocking density in cages on their growth and yield in cages and in ponds containing the cages

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An experiment was conducted for 90 days at the Asian Institute of Technology in Thailand to investigate the appropriate stocking density of large Nile tilapia placed in cages in earthen ponds where small Nile tilapia were stocked in open water to utilize the wastes derived from the cages. Large male tilapia (141 ± 11.1-152 ± 2.1 g) were stocked at 30, 40, 50, 60, and 70 fish m^{-3} in 4-m^3 net cages. One cage was suspended in each of 15 earthen ponds, and three replicates were used for each density. Small male tilapia (54 ± 2.3-57 ± 1.2 g) were stocked at 2 fish m^{-3} in open water of all ponds. Caged tilapia were fed twice daily at 3%, 2.5%, and 2% body weight day^{-1} during the first, second, and third month, respectively, with commercial floating pellets containing 30% crude protein. Water quality was analyzed biweekly.

Stocking densities of caged tilapia had significant (P<0.05) effects on the survival, growth, and food conversion ratio of caged tilapia, and on the growth of open-pond tilapia. The survival of caged tilapia decreased from 91.4% ± 5.0 to 57.2% ± 8.1 with increased stocking densities from 30 to 70 fish m^{-3}, while survival of pond tilapia was higher than 90.0% in all treatments. The average treatment mean weights of tilapia harvested from cages ranged from 509 ± 26.0 to 565 ± 13.9 g. The growth of pond tilapia was quite slow, with daily weight gain increasing from 0.30 ± 0.02 to 0.47 ± 0.08 g per fish day^{-1}, in response to increased feed inputs to caged tilapia. The combined net yield of both caged and open-pond tilapia was highest in the treatment with 50 fish m^{-3}. Water quality analyses indicated that the wastes from caged tilapia were insufficient to generate abundant natural food for the growth of open-pond tilapia.

*Corresponding author.

This abstract was excerpted from the original paper, which was published in Aquaculture, 146(1996):205-215.

Notices of Publication (cont.)

CRSP Research Report 97-116

Chemical and physical characteristics of bottom soil profiles in ponds on haplaquents in an arid climate at Abbassa, Egypt

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Soil cores were taken from ponds at the Central Laboratory for Aquaculture Research, Abbassa, Sharkia, Egypt. Three ponds received little management since construction in the early 1980s. Three other ponds were fertilized heavily in 1993 and 1994 to stimulate tilapia (*Oreochromis niloticus*) production. Thicknesses of S, M, and T horizons in soil profiles averaged 5, 7.5, and 10 cm, respectively. The S horizon contained more silt than clay, but T and P horizons were 60% clay. Concentrations of total carbon, total nitrogen, total sulphur, phosphorus, calcium, and potassium were greatest in the S horizon and lowest in the P horizon. Intensively managed P-ponds had higher concentrations of phosphorus and lower concentrations of organic matter and sulphur in S and M horizons than B-ponds. Because of high moisture content, low dry bulk density, and greater concentrations of organic matter and nutrients in the S horizon, reactions in this layer probably have a greater influence on pond water quality than those in deeper horizons. For general purposes, soil sampling should be restricted to the S horizon or the upper 5-cm layer where depth of the S horizon is not known. Compared with pond soils from a humid climate in Auburn, Alabama (USA), pond soils at Abbassa had greater concentrations of sulphur, calcium, magnesium, potassium, and sodium, and lower concentrations of iron, manganese, zinc, and copper in S horizons.

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This abstract was excerpted from the original paper, which was published in Journal of Aquaculture in the Tropics, 11(1996):319-329.

CRSP Research Report 97-117

Water effluent and quality, with special emphasis on finfish and shrimp aquaculture.

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Estuaries are coastal watercourses that are subject to both marine and riverine influences. Their principal hydrographic controls are morphology, tides, freshwater inflows, meteorology, and density currents. The propagation of tides and the distribution of salinity are important indicators of circulation in an estuary. Circulation in particular imposes a limit on the ability of an estuary to assimilate wastes without degrading its water quality. This is an important constraint on concentrated aquaculture operations that circulate water, since these produce a large volume of wastewater and also require a supply of uncontaminated water. A general procedure is outlined for determining the "carrying capacity" of the estuary. This requires (1) specification of the water quality parameter(s) that form the basis of water quality evaluation, (2) determining the parameter value(s) of acceptable water quality, (3) development of a water quality model appropriate for the estuary, and (4) establishing the conditions that are critical for water quality.

The water quality model is central to the procedure: it is a combined hydrodynamic and mass balance calculation, designed to reflect the space-time scales controlling the water management problem. Its development requires an extensive base of field data. The model is applied to predicting the water quality regime that would result under a hypothetical distribution and volume of wasteloads. The largest volume of wasteloads that results in water quality equal to the level judged acceptable under critical conditions is the assimilative capacity. It is important to note that assimilative capacity is a function of position in the estuary, and depends upon both local and larger scale hydrography. Single values of "carrying capacity" or "flushing time" applied to an entire estuary are of little use. A case study is presented of shrimp aquaculture in Golfo de Fonseca, Central America. A preliminary analysis of the operations around Estero Pedregal is performed using a one-dimensional model, to illustrate the kinds of analyses that can be carried out and the types of results that can be obtained. These results indicate that shrimp aquaculture in this area is already approaching a level of being self-limited.

This abstract was excerpted from the original paper, which was published in Proceedings of the Twenty-Fourth U.S.-Japan Aquaculture Panel Symposium, Corpus Christi, Texas, October 8-10, 1995, p. 71-84.

Notices of Publication (cont.)

CRSP Research Report 97-118

A COLLABORATIVE PROJECT TO MONITOR THE WATER QUALITY OF ESTUARIES IN THE SHRIMP PRODUCING REGIONS OF HONDURAS

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A long-term water quality monitoring project in estuaries of the shrimp producing regions of Honduras was initiated in 1993 as part of the Honduras Pond Dynamics/ Aquaculture Collaborative Research Support Program. This project is a collaborative effort of universities, the private sector and the public sector. A technical cooperation agreement that describes specific responsibilities of each participant was signed by all participants. The goal this agreement is to provide a scientific basis for estuarine management and sustainable development of shrimp culture in Honduras. Specific objectives, design and implementation of the project are described. Currently, water quality is monitored every one to two weeks at 19 sites on 12 estuaries. This project has generated the only known long-term data base on the impact of shrimp farming on estuarine water quality. Project results to date indicate no long-term trend in eutrophication in either riverine or embayment estuaries during the period 1993-1997. Nutrient concentrations in riverine estuaries follow a cyclical trend controlled by season; higher nutrient concentrations are observed during the dry season. Factors contributing to project success are discussed.

This abstract was excerpted from Proceedings IV Ecuadorian Aquaculture Conference, 22-27 October 1997.

Host Country Collaborators

...from p. 2

the second, given by Doug Ernst, centered on the CRSP Central Database; and the third, by Ingvar Elle of CRSPs Information Management and Networking Component, concerned the use of the Internet as a source of aquaculture information. Trainees also toured commercial, university, and government facilities and saw examples of private sector, university, and extension services personnel working together. One example was Oregon Aquaculture, which uses research and employs graduate students from OSUs Hatfield Marine Science Center. Trainees toured a salmon hatchery, a commercial feed producer, and OSUs Seafood Laboratory in Astoria, where they also attended seminars on seafood processing and biochemistry.

For the second week of the training, operations moved to Auburn, Alabama, and the focus switched from cold-water aquaculture to production of catfish, the leading US aquaculture product. Following a welcoming luncheon and overview of the industry, participants took a five-day tour of the catfish industry of western Alabama and of the Auburn Marine facilities. Workshops at Auburn demonstrating standard CRSP water quality and fish sampling techniques began the third week, after which participants headed for Florida. There they saw a recirculating system at the Harbor Branch Oceanographic Institute and toured aquaculture facilities in the Fort Meyers area. Among the non-technical activities the participants enjoyed were a football game at Auburn University and trips to Cape Canaveral and Disney World in Florida, and to the Newport Aquarium, Multnomah Falls, and Bonneville Dam in Oregon.√

Israeli Fish Farmers

...from p. 10

Projects with researchers on board direct the development of intensification since there is still plenty to study and understand. The recirculating biological systems are quite sensitive to changes and fish farmers have to stay informed of new findings in order to maximize their capabilities. With energy costs on the rise, limited water supplies, high market demands, and more, fish farmers in Israel today have to be alert, creative, and open-minded to stay ahead in this business.

New fish are studied regularly and fish farmers apply research directly into their commercial operations so knowledge can be shared and understood. The interaction between R&D and commercial fish farming has to be on a continuous basis.

Introduction of the technology and knowledge from Israel to the international tropic and subtropic regions is highly welcomed and is already fruitful in different parts of the world–starting from fish farms to increase protein supply for the local population to sophisticated super-intensive hatcheries and fish farms as profitable projects.

Source: Fish Farming News 5, Sept/Oct 1997.

Upcoming Conferences and Expositions

Date	Topic/Title	Event Location	Contact Information
Jan 15-16 1998	North Carolina Aquaculture Dev. Conf. '98	New Bern, NC, USA	Tom Ellis, North Carolina Department of Agriculture; Tel 1-919-733-7125
Jan 30-Feb 1	24th Annual East Coast Commercial Fishermen's & Aquaculture Trade Expo.	Ocean City, MD, USA	Betty Duty, 1805A Virginia St., Annapolis, MD 21401, USA; Tel 1-800-421-9176; Fax 1-410-269-6635
Feb 3-5	5th Fish Farming Trade Show	Greenville, MS, USA	Tel 1-601-981-0807; Fax 1-601-981-0506
Feb 4-6	InterAQT '98, 2nd International Aquaculture Technology Expo	Kobe, Japan	Kazuo Ide and Associates Exhibition Office, Sumitomo Bld 4F, 8-10-24 Akasaka, Minato-ku, Tokyo 107 Japan; Tel 81-3-5474-9516; Fax 81-3-5474-4333
Feb 15-19	World Aquaculture Society, Aquaculture '98	Las Vegas, NV, USA	Aquaculture '98 Conference Manager, 21710 7th Place West, Bothell, WA 98021, USA; Tel 1-206-425-6682; Fax 1-206-483-6319; email worldaqua@aol.com
Mar 3-7	FISAL '98, Chile's International Aquaculture and Seafood Exposition	Puerto Montt, Chile	Peter J. Neilson, Organizacion, Produccion y Marketing de Eventos y Ferias, Manquehue Norte 1407 Of.33; Tel 224-4162 or 202-3010; Fax (56-2) 224-4162
Mar 5-6	Missouri Aquaculture Convention	Springfield, MO, USA	Missouri Aquaculture Association, PO Box 6864, Jefferson City, MO 65102-6864, USA; Tel 1-314-526-6666
Mar 13-14	Wisconsin Aquaculture Conference '98	Eau Claire, WI, USA	Erwin Sholts; Tel 1-608-224-5137; Fax 1-608-224-5111; email bobertl@wheel.datcp.state.wi.us
Mar 18-20	Aquaculture International '98	Glasgow, Scotland, UK	Emap Heighway, MEED House, 21 John Street, London WC1N 2BP, England, Fax 44-171-831-2509
May 25-30	International Symposium on Agro-environmental Issues and Future Strategies	Faisalabad, Pakistan	Dr. Jehangir Khan Sial, Faculty of Agricultural Engineering and Technology, University of Agriculture, Faisalabad, Pakistan; Tel 0092-41-30281-89/ext 434; email iqrar@ptccuaf.fsd.brain.com.pk
May 31-June 3	Aquaculture Association of Canada, Aquaculture Canada '98	St. Johns, Canada	Contact information not available
July 8-11	International Institute of Fisheries Economics & Trade, IIFET Tromso '98	Tromso, Norway	IIFET Secretariat, Oregon State University, Dept. of Agricultural and Resource Economics, Corvallis, OR 97331-3601, USA
Aug 30-Sept 3	3rd International Symposium on Aquatic Animal Health	Baltimore, MD, USA	Division of Comparative Medicine, Johns Hopkins University School of Medicine, 720 Rutland Ave, Baltimore, MD 21205, USA; Tel 1-410-955-3273; Fax 1-410-550-5068; email wellfish@welchlink.welch.Jhu.edu
Sept 2-4	FishEco '98, International Symposium on Fisheries and Ecology	Trabzon, Turkey	Dr. A C Dincer, Faculty of Marine Science, Karadeniz Technical University, 61530 Camburnu, Trabzon, Turkey; Fax +90-462-752-2158; email fisheco@risc01.bim.ktu.edu.tr
Oct 7-10	Bordeaux Aquaculture, 5th Biennial Conference, Workshop,and Exhibition	Bordeaux, France	BCS, Palais de Congrès, 33300 Bordeaux Lac, France; Fax +33-5-56-43-17-76
Nov 11-14	5th Asian Fisheries Forum	Chiang Mai, Thailand	Dr. Padermsak Jarayabhand, Aquatic Resources Research Institute, Chulalongkorn University, Bangkok 10330, Thailand; Tel 66-2-2188160-62; Fax 66-2-2544259; email ardic@chulkn.car.chula.ac.th
Nov 13	Asian Fisheries Society, Symposium on Women in Asian Fisheries	Chiang Mai, Thailand	Asian Fisheries Society, MC PO Box 2631, 0718 Makati, Metro Manila, Philippines; Tel 63-2-818-9283; Fax 63-2-816-3183; email e.tech@cgnet.com
December	ExpoPESCA '98, Latin American Total Fish Show	Santiago, Chile	Sue Hill, Emap Heighway, Meed House, 21 John St., London WC1N 2BP, England; Tel 44-171-470-6340/6302; email sueh@meed.emap.co.uk

Workshops and Short Courses

	Title/Topic/Site	Contacts
Year-round	Work Experience in Hatcheries Techniques/ Asian Institute of Technology, Thailand	Aquaculture Short Course Unit, Ag & Aquatic Systems, School of Env, Resources & Development, GPO Box 2754, Bangkok 10501 Thailand; Fax 66-2-524-5484; email somchai@ait.ac.th
Year-round	Training & Research in Fisheries & Stock Mgmt/Wageningen Agricultural University, the Netherlands	G. van Eck, Dept of Fish Culture & Fisheries, PO Box 338, 6700 AH Wageningen, The Netherlands; Tel 31-8370-8330; Fax 31-8370-83937; email gerrie.van.eck@alg.venv.wau.nl
Year-round	Tropical Aquaculture Advanced Training in a Third Country/Escuela Agricola Panamericana (EAP), Honduras, and Asian Institute for Technology, Thailand	Zentralstelle fuer Ernahrung und Landwirtschaft (ZEL) Feldafing/Zschortau, Deutsche Stiftung fuer Internationale Entwicklung (DSE), D-82336 Feldafing, Germany; Tel ++49/8157/38-0; Fax ++49/81 57/38-227
Apr 20-June 12 1998	Auburn University Aquaculture Training Course–Practical Warmwater Aquaculture in Earthen Ponds/Auburn University, AL, USA	Dr. Len Vining, International Center for Aquaculture and Aquatic Environments, Auburn University, Alabama 36849-5419, USA; Tel 334-844-4786; Fax 334-844-9208; home page http://www.acesag.auburn.edu/dept/faa; email lvining@acesag.auburn.edu

AQUANEWS

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