



INTERNATIONAL ASSOCIATION
OF ASTACOLOGY

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NEWSLETTER OF THE INTERNATIONAL ASSOCIATION OF ASTACOLOGY

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EIGHTH SYMPOSIUM OF ASTACOLOGY--Symposium dates are 22-26 April 1990. Place is Baton Rouge, Louisiana (USA) and host is the Louisiana State University Agricultural Center. The symposium will be held at the Baton Rouge Hilton Hotel which has arranged a very reasonable rate for participants (\$45 US single/double per night). A day long tour of the Louisiana crayfish industry is included as part of the meeting. Side trips to New Orleans and Louisiana-French Acadiana will be possible before and after the symposium. Registration rates are: Member, \$150, Non-Member, \$190, Student, \$100, and Spouse, \$75. Conference packages have been forwarded to all IAA members. Further information can be obtained from:

Mr. L. W. de la Bretonne, Jr.
Louisiana Cooperative Extension Service
Knapp Hall - 202R
Louisiana State University Agricultural Center
Baton Rouge, Louisiana 70803 USA
Phone (504) 388-2052 - FAX (504) 388-4143

NINTH SYMPOSIUM OF ASTACOLOGY--It is never too early to plan a

symposium. President-Elect David Holdich is planning the Ninth Symposium of Astacology. Tentative location and dates are: Reading, England, 5-10 April 1992. More information will be provided when available.

HONORARY LIFE MEMBERS--IAA recognizes significant contributions to our association by conferring honorary life membership on distinguished members at our international symposia. Those wishing to nominate someone for the honor may do so by sending a letter of nomination with justification and seconding statement by another IAA Member to President James F. Payne, Department of Biology, Memphis State University, Memphis, Tennessee 38152 USA. Honorary membership will be conferred upon a three-fourths vote by secret ballot at a business meeting of the Association (the Baton Rouge meeting in this case).

PROCAMBARUS CLARKII NOW IN PHILIPPINES!--Articles in the September 1989 (vol. 19, No. 9) issue of "Greenfields, The Philippines' Leading Agricultural and Agribusiness Magazine" and Vol. 3, No. 9 1989 issue of "Agriscopes, The Philippines' Agribusiness Magazine" both feature Procambarus clarkii as an aquaculture candidate in the Philippines and refer individuals seeking more information to: Crayfish Dept., Bio Research, 8362 Dr. A. Santos Ave. (Sucat Road), Sucat, Parnaque, Metro Manila, tel. nos. 828-7264; 827-1257; 828-9866. The articles state that Bio Research is successfully cultivating this crayfish but do not indicate the extent to which it has been distributed, if at all, in the Philippines. Promoters are looking to the USA and Europe as markets for Philippine production.

LOUISIANA ASSOCIATION RELOCATES OFFICE AND ANNOUNCES ANNUAL MEETING--The Louisiana Crawfish Farmers' Association is largest organized group of crayfish farmers in the world. It has relocated its office from Lafayette, Louisiana to New Iberia, Louisiana. The new address and phone number are: Louisiana Crawfish Farmers' Association, P.O. Box 9656, New Iberia, Louisiana 70562, tel. (318) 367-5861.

The LCFA has also announced that its annual International Crawfish Tasting and Trade Show and membership meeting will be held March 2-3, 1990 at the Cajundome in Lafayette, Louisiana. Inquiries should be directed to new office.

DISCUSSION OF CRAYFISH INTRODUCTION FRENCH POLICIES AT AQUACULTURE EUROPE '89--Past-President Pierre Laurent presented a working paper on crayfish introduction French policies during the "New Developments in Shrimp and Crayfish Culture in Europe" session at the Aquaculture Europe '89 meeting in Bordeaux, France, October 2-

5, 1989. Professor Laurent's points are summarized below and certainly warrant discussion at our Baton Rouge symposium.

Concerning the crayfish policy in France, one must take into consideration the situation also in neighbouring countries. The fisheries laws, also those covering the crayfish, vary in content between the EC countries, even by Provinces and by States (Lander). Thus it may be difficult to arrive in a common policy concerning the use, capture and regulation of crayfish and crayfish stocks, as every area has its own special interests. There is thus need for better harmonization of such laws within the EC. There occur nowadays seven crayfish species in the EC countries, three of them originally introduced from North America.

The following is a list of aims and objectives (and of means) for a crayfish policy that we wish to promote:

- Protect the existing stocks against pathogenic risk from diseases and parasites;
- Protect the (native) natural crayfish resources;
- Avoid the total occupation of traditional crayfish waters by exotic species that are also of lower value;
- Stop uncontrolled introductions;
- Yet do not prevent commercial trade on crayfishes;
- Permit the development of crayfish culture and stock development without the existing constraints set for the protection of leisure fisheries;
- Promote the commercial catching of exotic species, such as the American crayfish, but it should be limited to areas already occupied by the species and not allowing any further extension of the area;
- Promote the crayfish production to satisfy national and European needs, without forgetting the need for necessary diversification of the agriculture.

The following means could help crayfish protection and reach our aims:

- Ban the importation to Europe of crayfish alive for human consumption;
- Prohibit the use of native or exotic crayfish for aquariology;
- Prohibit the use by anglers of crayfish alive as fish bait;
- Clean of crayfish by use of an appropriate astacicide the pell mell pond fishes used for restocking purposes;
- Enforce crayfish farmers to be licenced;
- Sale of crayfish alive for human consumption by licenced crayfish farmers allowed all year round as long as the animals are recognised disease free;

- Restocking of crayfish under a strict control of competent authorities and after a careful check of good health.
- Encourage crayfish commercial fisheries on wild unexploited populations of American crayfish but limit transportation of crayfish alive to restricted areas around the fishing place (for example in France "arrondissement");
- Limit the transportation of crayfish alive by sport fishermen to the same restricted area;
- Make a reliable health survey of wild populations of native and acclimatized exotic crayfish.
- In case of "plague" or any grave disease, stop angling and forbid transportation of crayfish alive;
- Ban all transportation of Procambarus clarkii alive;
- Punish all unofficial crayfish propagation;
- Form the public opinion to crayfish protection.

Of course some of these aims and objectives may be contradictory with each other, but we hope these theses could serve as a starting point for further discussions and elaborations of crayfish policies in both France and in the wider European context.

This text is a summary of the following publication: Laurent, P. J. and Neveu, A. 1989. Proteger les ecrevisses par la loi: esquisse de mesures a proposer pour la France et pour l'Europe. L'Astaciculteur de France 20:2-8.

WEST GERMANY RESTRICTS IMPORTS OF LIVE CRAYFISHES--The West German government issued new regulations governing the import of live crayfishes on 24 July 1989. It is my understanding that non-native crayfishes can no longer be imported alive. Individuals who are involved in crayfish commerce with West Germany should contact the appropriate authorities to obtain copies of the new regulations.

PROCAMBARUS CLARKII EXPORTS TO EUROPE CONTINUE FROM KENYA--Member Dr. A. C. Drinkwaard (P.O. Box 135, 1790 AC Den Burg, Isle of Texel, The Netherlands) has sent a picture of large living P. clarkii received at the international airport in Amsterdam from Lake Naivasha in Kenya. Date was August 1989. No information on the volume of crayfish exported to Europe was available.

SOFT-SHELL CRAYFISH SALES SERVICE OFFERED BY ASSOCIATION--The Louisiana Soft-Shell Crawfish Association is offering soft-shell crayfish for sale at competitive prices. According to President Dan Moran, the association is selling crawfish provided by members to generate income for promotional purposes. The LSSCA is a non-profit association. Information: Louisiana Soft-Shell Crawfish Association, P.O. Box 80125, Baton Rouge, Louisiana 70898 USA.

Telephone (504) 387-3347.

INFORMATION ABOUT CRAYFISHES IN JAPAN--Member Tadashi Kawai (Yokamachi 2-156-1, Fisheries Division, Kuji City, Iwate Prefecture, Japan) has sent the following observations about P. clarkii in his country. "...I tell you about Procambarus clarkii in Japan. Now P. clarkii is not used for food in Japan. Consequently the study on the P. clarkii is very rare. P. clarkii is disliked for rice farmer because the farmer thinks that P. clarkii is a very harmful animal." Dr. Kawai studies Gambaroides japonicus and sent a Japanese language article about the life history of this species. The article is well illustrated with black and white pictures which would make it of interest to all astacologists.

CRAYFISH IMPORTS INTO NORWAY--Member Jostein Skurdal (County Environmental Protection Dept., Statsetafenes hus, N-2600 Lillehammer, Norway) has sent information about the import of frozen, cooked crayfish into Norway. Annual imports have been as high as 200 tonnes during the 1980's but have averaged around 100 tonnes for the past several years. Procambarus spp. and Astacus leptodactylus are the species involved with few A. leptodactylus being imported in the past several years. Most Procambarus spp. comes from Louisiana but some now comes from Spain. The Norwegian consumers appear to want well prepared (Swedish recipes), good quality (9-11 cm) crayfish at fairly low prices (50 Norwegian Crowns/kg). Imports of poor quality crayfish have caused some reduction in demand.

ORCONECTES RUSTICUS EXPORTED FROM NORTHERN USA TO SWEDEN IN 1989--Member Robert Pagel (217 W. Liberty St., Deerfield, Wisconsin 53531 USA) sent a photograph of a plastic pail containing frozen cooked O. rusticus prepared in Wisconsin (USA) for export to Sweden. Total exports, according to Mr. Pagel, probably did not exceed 100 tons for 1989.

IAA DISSERTATION/THESIS INFORMATION SERVICE--The IAA is considering establishing a regular feature of the several symposium volumes to enable members to gain access to materials not usually covered by standard bibliographic sources. One of the largest problems encountered by many of us is trying to keep up with the literature exemplified by unpublished theses and dissertations. And these seem to be increasing as more academic institutions recognize the commercial and scientific value of crayfishes. For example, in Canada and the U.S.A., the publication Dissertation Abstracts will pick up most Ph.D. theses, although one must wade through many different biological titles to locate those that deal with crayfishes; most master's theses never come

to the attention of scientists.

A section, "Theses and Dissertations on Crayfishes," could appear in each symposium volume. It would contain the items produced in the interval since the last volume. It would cover all graduate student productions, REGARDLESS OF LANGUAGE, and it could also include reports and circulations by others that do not normally appear in standard bibliographic works.

For this work cooperation of the membership is necessary. Each of us would have to be aware of what is happening in the institution with which we are associated. When we learn of an item produced, it would have to be transmitted to an individual who would collate and eliminate duplications, etc., and then prepare the copy for the volume. Often the title itself does not reveal the fact that crayfish are involved. Thus, a transmitter could add a one-sentence annotation to such items indicating the nature of the work (NOT an abstract). Also the person transmitting the information need NOT be the major professor; he only needs to know of the existence of the work.

J. F. Fitzpatrick has agreed to serve as the initial collator, at least during the period when its feasibility is being tested. Please transmit to him your feelings on this matter and any items that you think should be included in the volume which will appear after the Baton Rouge meeting. His address is: Prof. J. F. Fitzpatrick, Jr., Department of Biological Sciences, University of South Alabama, Mobile, Alabama 36688 USA.

CRAYFISH STUDIES IN SOUTHERN FLORIDA USA --Member Mike Miltner (Florida Game and Fresh Water Fish Commission, 3900 Drane Field Road, Lakeland, Florida 33811 USA) writes that "...we're committed to spending more time and research effort looking at P. [Procambarus] alleni culture potential in ricefield areas of the Everglades Agricultural Area south of Lake Okeechobee. There appears to be some interest in 'wet crop' alternatives to cane [sugar] and winter vegetable production in that area, both of which contribute to soil loss and nutrient loading problems in Lake Okeechobee and the Everglades...."

NEWS FROM THE SWEDISH BALTIC ISLANDS--Member Rolf Gydemo (Akso Laboratory, Box 4, S-620 30 Slite, Sweden) sends some interesting news about his work on Gottland.

"...since 1982, we have performed investigations on Astacus and the possibilities of culture, both intensively and extensively. In 1986, the first farmers started building ponds. In 1987 even more farms were started and today there are about 20

farms covering a pond area of more than 35 ha. So far most of the produced crayfish has been used and sold for stocking (livestock), but this year more than 300 kg reached the market. The farmers are organized in an interest association (with more than 50 members planning to start). The association negotiated a price of 350 skr/kg + VAT (23.46%) for crayfish 10-12 cm and 450 skr/kg + VAT for crayfish more than 12 cm. The retail price was 585 skr/kg (approximately 90 US\$) for the 'deluxe' crayfish. All crayfish was marketed on the island through one department store. The company stores in Stockholm wanted to buy the whole harvest at the highest price, but did not get any this year. Next year the farmers expect to market at least 1000 kg. As a comparison, the signal crayfish was sold (retail) at about half the price of the noble crayfish in Stockholm (585 skr).

"Considering the fact that two farms, both started in 1986, supplied the major part of the crayfish (more than 100 kg each) and that this year's income has well covered the costs for interest and maintenance, the future looks bright...

"...The interest in crayfish farming is increasing in Denmark. Only Astacus astacus is cultured and there is a ban to introduce Pacifastacus leniusculus although there are some who want to introduce this species. There are about 10-20 farms, the majority are extensive operations or semi-extensive with hatching of juveniles in basins and stocking in lakes and ponds. The chairman of the organization is: Jorn F. Andersen, Assensvej 146, DK-5771 Stenstrup...."

CRAYFISH RESEARCH IN WISCONSIN (USA)--Member David M. Lodge (Dept. of Biological Sciences, University of Notre Dame, Notre Dame, Indiana 46556 USA) has sent the following information about research that he will be directing in northern Wisconsin at the University of Wisconsin-Madison's Trout Lake Station.

"Via a large-scale (five mesocosms of 500-m² each), relatively long term (3 years), manipulative experiment, a multi-lake survey, and small-scale field/laboratory experiments, we will evaluate the relative importance of biotic (predation and herbivory) and abiotic (calcium concentration and winterkill) factors in structuring the littoral zone community (including fishes, crayfish, gastropods, periphyton, and macrophytes) in northern Wisconsin lakes. Our proposed work builds on 5 years of collaborative research examining the major forces controlling the structure and function of the nearshore community. Our approach is comprehensive, evaluating complex interactions, direct, and indirect interactions among predators and their prey, and the cascade hypothesis, all recently applied to the pelagia of lakes,

but largely untested in the structurally-complex environment of the benthic, littoral community. The centerpiece for this effort is a mesocosm experiment in which densities of fish predators of crayfish and crayfish are treatment variables. Treatments in which we reduce fish predators of crayfish will mimic the impact of winterkill (an important disturbance in northern lakes) on the top trophic level. With our mesocosms, we use a scale intermediate between laboratory and whole-lake experiments, one that is tractable (these manipulators are impossible in whole lakes), realistic (small ponds do not have the diversity of crayfish, macrophytes or snails necessary), and absolutely required to make progress toward understanding those forces structuring the littoral community."

CRAYFISH STUDIES IN MEXICO--David N. de Leon Lopez (Aurelia Guevara 2579, s. r., Guadalajara, Jalisco 44810 Mexico) writes more about his crayfish studies in Mexico. He notes that in his studies of Chapala Lake, he has found the following species of crayfish: Cambarellus (C.) prolixus, C. (C.) chapalanus, and C. (C.) montezumae. His work is sponsored by the Instituto de Limnologia of the University of Guadalajara.

UKRAINIAN CRAYFISH BOOK TO BE TRANSLATED INTO ENGLISH--Past President Pierre Laurent has written to say that Dr. S. J. Brodsky's book on crayfish in the Ukraine will be translated and published in English by the Ministry of Research in Israel. A summary of its contents follows:

Fauna of Ukraine in 40 Volumes: Volume 26, Edition 3, Crayfish, S.J. Brodsky, Kieve: Naukova dumka, 1981-212p.

In this monography are presented the results of the author's research conducted for many years. They comprise ecology and taxonomy of crayfish in Ukraine and adjacent territories. It contains information about anatomy, ecological-populations dynamics, distributions of crayfish not only in the Ukraine and the Soviet Union but also in the whole natural habitat. Tables are given for the definition of subfamilies, genera, species and subspecies-20 species and subspecies in all. Special attention is played to crayfishing reserves in natural water reservoirs of the republic and also to rational organization of crayfish breeding and protection. The book is meant for zoologists, specialists in fauna, taxonomics, hydrobiologists, specialists in fisheries and agricultural economics, lecturers and students at colleges and universities.

Dr. Brodsky recognizes the following genera: Astacus.

Pontastacus, and Austropotamobius.

There is no information now about when the translated book will be available. Those interested in contacting Dr. Brodsky may write to him at: Dr. S. J. Brodsky, Ramot A 34/3 Sullam Yakov Street, 97 729 Jeursalem, Israel.

CHERAX QUADRICARINATUS NOT TO BE CALLED "MARRON" AQIS--This is the title of an article in the Austasia Aquaculture Magazine, Vol. 4, No. 4, November 1989. It states that the policy of the Australian Quarantine and Inspection Service (AQIS) for freshwater crayfish exported from Australia is as follows:

"-All freshwater crayfish may be labelled as 'freshwater crayfish'.

"-C. tenuimanus may be labelled as 'marron', which may be preceded by the name of the State in which the fish were actually produced.

"C. quadricarinatus may be labelled as 'redclaw' or 'tropical blue crayfish' (similar, distinctive and unambiguous names may be permitted). The name 'marron' will NOT be permitted on export consignments or documentation."

YABBIE GROWERS ASSOCIATION NEWSLETTER--This new publication dated July 1989 was received recently. It is packed with information about yabbie, Cherax destructor, cultivation and would be of general interest to all astacologists. Some interesting titles included: Thelohania Research; Yabbie Farming: What's It All About?; The Search for the Perfect Yabbie Farm; Marketing Yabbies; and Hints, Tips and Ideas. The YGA has at least 110 members indicating considerable interest in yabbies. There is, however, no return address on the newsletter. I was first informed about the association by member Ric Fallu (Fish and Wildlife Service, 240 Victoria Parade, East Melbourne, Victoria 3002, Australia) who should be able to provide information about the newsletter and the anonymous secretary.

YABBIE GRABBER NOW AVAILABLE!!--Member Tony Bishop (Wy-Wurrie Marron, P.O. Box 287, Bordertown, South Australia 5268 Australia) has sent a series of pictures of a pump that he uses to pump yabbies, Cherax destructor, from sumps when he drains production ponds. Called the "Yabbie Grabber", it may have applications outside of Australia. Tony may be contacted for further information.

VEGETATION AS CRAYFISH FOOD--(1) An article entitled "The Crawfish

Queen" appeared in an 1989 issue of the popular American farm magazine "The Furrow." It describes a 26 ha Procambarus crayfish farm in South Carolina USA run by a Ms. Winnie Hawthorne. Ms. Hawthorne contends that the addition of green alligator weed, Alternanthera philoxeroides to her ponds has increased yields from about 1000 kg/ha to 1500 kg/ha. The material is scooped up with a drag line from ditches in swamps surrounding her ponds and put into them during May and June when rice forage has been consumed. (2) Member Paul Brown (Dept. of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana 47907) has moved but sent information about his last research project at the Illinois Natural History Survey. This also involved evaluation of the usefulness of vegetation as crayfish feeds. He did not, however, feed fresh plant material. Rather, he used dried material.

"We fed fourteen fresh aquatic macrophytes to O. virilis and quantified consumption and apparent dry matter digestibility. All eight submergent macrophytes were consumed to some degree, while only one of four emergents were consumed. Overall mean consumption estimate was 0.19% body weight/day indicating that macrophytes may not be major sources of nutrients for this species. Apparent dry matter digestibility (ADMD) coefficients were highly variable between palatable macrophytes and may indicate the presence of antinutritional factors. Except for the consumption estimate of one macrophyte (horned pondweed, Zannochellia palustris) consumption and ADMD values were not significantly different between male and female crayfish."

A manuscript, Consumption and Apparent Dry Matter Digestibility of Aquatic Macrophytes by Male and Female Crayfish (Orconectes virilis) by P. B. Brown, P. Tazkik, M. L. Hooe, and W. G. Blythe, is currently "in press" with the journal, Aquaculture.

IDENTIFICATION OF THE MOLT-INHIBITING HORMONE?--The molt-inhibiting hormone of crayfishes is reported to be xanthurenic acid. 3-hydroxy-L-kynurenine is secreted by the x-organ-sinus gland crustaceans and accumulates at the surface of the y-organs. It is then converted to the active xanturenic acid which has been found to repress ecdysteroidogenesis in vitro. RE: Naya, Y., M. Ohnishi, M. Ikeda, W. Miki, and K. Nakanishi. 1989. What is molt-inhibiting hormone? The role of an ecdysteroidogenesis inhibitor in the crustacean molt cycle. Proc. Natl. Acad. Sci. 86:6826-6829.

NEW CRAYFISH BOOKS--

The Great Yabbie Farming Book. Yabbie Nippers. 1989. This blue soft cover book is authored by member Tony Bishop (Wy-Wurrie

Yabbies, Box 287, Bordertown, South Australia 5268, Australia). No price was given so inquiries will have to be directed to Mr. Bishop. When one considers all of the promotion given to Giant Freshwater Lobsters from Australia, this book provides some sobering information for prospective investors. The Yabbie, Cherax destructor, is, in fact, the smallest of the Australian crayfishes being cultivated and probably the hardiest. Target sizes are 60-100 g. Mr. Bishop takes the prospective yabbie farmer through all the steps in locating a farm site, building ponds, and raising, harvesting, and selling yabbies. He is very conservative in projecting the value of the finished product.

The Crayfish. 1989. This Russian language book is authored by member J. Cukerzis (Zirmunu 26/76, 232051 Vilnius, Lithuanian SSR, USSR. It is a product of the Academy of Sciences of the Lithuanian SSR, Institute of Zoology and Parasitology and published by Vilnius Mokslas Publishers. It deals primarily with the crayfishes of the Baltic region. It has a very extensive English language summary and is well illustrated.

CRAYFISH BROCHURES AND BULLETINS--

Identifying Freshwater Crayfish in Western Australia - This full color publication is available from the Fisheries Department of Western Australia, 108 Adelaide Terrace, East Perth 6004, Australia. Cherax spp. identified include: C. tenuimanus, the marron, C. plebeius/C. glaber, the koonac, C. destructor-albidus, the yabbie, and C. quinquecarinatus/C. crassimanus, the gilgie.

Freshwater Australian Crayfish Traders - This full color brochure features Cherax quadricarinatus, the redclaw. F.A.C.T. markets this species worldwide. Inquiries about the brochure should be directed to F.A.C.T., "Leawarra", M.S. 461, Kalbar, Queensland 4309, Australia.

Louisiana Soft-Shell Crawfish - This full color brochure features the soft-shell crawfish. Information on production, preparation, and cooking is presented. Inquiries about copies may be directed to: Louisiana Soft-shell Crawfish Association, P.O. Box 80125, Baton Rouge, Louisiana 70898 USA.

A Craving for Crayfish. Minnesota Discovers a Louisiana Tradition. 1989. No author is given for this Minnesota Sea Grant Publication. It features 9 interesting recipes including one for the traditional "Kraftor" parties in Sweden. It may be obtained from the Minnesota Sea Grant Extension Program, 208 Washburn Hall-Duluth, University of Minnesota, Duluth, Minnesota 55812 USA.

Northern Crayfish: An Update. 1989. J. Gunderson. This Minnesota Sea Grant publication discusses the development of fisheries for crayfish in the north-central USA and the possibilities for aquaculture there. Both hard-shell and soft-shell crawfish are covered. Copies may be obtained from the address immediately above.

Les Ecrevisses (Crustacea: Decapoda: Astacoidea, Parastacoidea) dans l'aquarium. 1989. Alessandro Mancini. RE: Revue fr. Aquariology 16(1):11-22. This beautiful full color French language publication discusses aquarium cultivation of the major crayfish species with a European orientation. Contact Dr. Mancini at: Fish House Milano, Via T. Signorini 9, 20092 Cinisello B. (MI), Italy.

Double Cropping Crayfish with Sorghum. 1989. M. W. Brunson. Louisiana Agricultural Experiment Station Bulletin No. 808, Baton Rouge, Louisiana 70803 USA. This useful publication discusses summer cultivation of various grain and forage sorghums (Sorghum spp.) with subsequent cultivation of crayfish (Procambarus spp.) during the later cool months. Residual plant matter serves as the carbon source for the crayfish. Crayfish yields in small plots was 1600-2200 kg/ha with good sorghum yields.

Evaluation of Rice Varieties for Double Cropping Crayfish and Rice in Southwest Louisiana. 1989. M. W. Brunson. Louisiana Agricultural Experiment Station Bulletin No. 812, Baton Rouge, Louisiana 70803 USA. This publication evaluates the suitability of 25 rice (Oryza sativa) cultivars for double cropping with crayfish (Procambarus spp.). Data include grain yield, regrowth of harvested stubble, biomass of plant material available to crawfish, and lodging of the plants.

PUBLICATIONS OF INTEREST TO ASTACOLOGISTS--

xx. Arbas, E.A., C.J. Humphreys, & B.W. Ache. 1989. Morphology and physiological properties of interneurons in the olfactory midbrain of the crayfish. J. Comp. Physiol. A. 164:231-241.

xx. Arnesen, S.J., & R.F. Olivo. 1988. The effects of serotonin and octopamine on behavioral arousal in the crayfish. Comp. Biochem. Physiol. 91C:259-263.

xx. Austin, C. 1988. Genetic considerations in freshwater crayfish farming in Freshwater Aquaculture in Australia. P. Owen & J. Bowden (eds.). pp. 73-78. Rural Press Queensland, Brisbane, Australia.

xx. Baran, I., R. Rahe, I. Oray, & E. Soylu. 1989. Investigations on a disease causing serious mortalities in crayfish (Astacus leptodactylus Esch.) in Turkey. Aquaculture - A Biotechnology

in Progress. N. De Pauw, E. Jaspers, H. Ackefors, N. Wilkins (eds.). European Aquaculture Soc., Bredene, Belgium.

xx. Belanger, J.H. 1987. Temperature acclimation of the caudal photoreceptor response in the crayfish *Orconectes rusticus* (Girard). Can. J. Zool. 66:1168-117.

xx. Bianchini, M.L. & L. Lombardi. 1989. Crayfish culture in Italy: a trial with *Procambarus clarkii*. Aquaculture - A Biotechnology in Progress. N. De Pauw, E. Jaspers, H. Ackefors, N. Wilkins (eds.). European Aquaculture Soc., Bredene, Belgium.

xx. Chapelle, S., J.C. Nevenzel, & A.A. Benson. 1988. No effect of environmental acidity on the ether glycerophospholipids of crayfish gills. Comp. Biochem. Physiol. 89C:311-314.

xx. Creed, R.P. 1989. Evidence for a selective, indirect facilitation of a micrograzer guild by omnivorous crayfish. Bull. Ecol. Soc. Am. 70(2):88-89. Abstract.

xx. Davies, M. 1986. Pond production and growth [Australia Aquaculture] in Freshwater Aquaculture in Australia, P. Owen & J. Bowden (eds.) pp. 61-64. Rural Press Queensland, Brisbane, Australia.

xx. Hall, M., K. Soderhall, & L. Sottrup-Jensen. 1989. Amino acid sequence around the thiolester of alpha 2-macroglobulin from plasma of the crayfish, *Pacifastacus leniusculus*. FEBS Letters 254:111-114.

xx. Hasiotis, S.T. & C.E. Mitchell. 1989. Lungfish burrows in the upper triassic chinle and dolores formations, Colorado plateau-Discussion: new evidence suggests origin by a burrowing decapod crustacean. J. Sedimentary Petrology 59:871-875.

xx. Henttonen, P., M. Ruotsalainen, & O.V. Lindqvist. 1989. Some new tests about *Psorospermium haeckeli* - a parasite in crayfish. Diseases of Fish and Shellfish. IV EAFP Int. Conf., Santiago de Compostela, Spain, Sept. 24-28, 1989. Abstract.

xx. Holm, J.C. 1989. Atlantic salmon parr (*Salmo salar*) and noble crayfish (*Astacus astacus*) in doculture. Aquacult. Eng. 8:79-94.

xx. Hutchings, R. 1988. Biological problems with freshwater crayfish in Australia. in Freshwater Aquaculture in Australia. P. Owen & J. Bowden (eds.). pp. 115-118, Rural Press Queensland, Brisbane, Australia.

xx. Jewell, C.S.E. & G.W. Winston. 1989. Oxyradical production by hepatopancreas microsomes from the red swamp crayfish *Procambarus clarkii*. Aquat. Toxicol. 14:27-46.

xx. Johansson, M.W. & K. Soderhall. 1989. A cell adhesion factor from crayfish haemocytes has degranulating activity towards crayfish granular cells. Insect Biochem. 19:183-190.

xx. Johansson, M.W. & K. Soderhall. 1989. A peptide containing the cell adhesion sequence RGD can mediate degranulation and cell adhesion of crayfish granular haemocytes in vitro. Insect Biochem. 19:573-579.

xx. Jonsson, A. 1989. Predation by dragonfly larvae (*Aeshna*

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TITLES FROM RECENT ISSUES OF CRAWFISH TALES--

Titles from the table of contents of the two most recent issues of Crawfish Tales, the Official Publication of the Louisiana Crawfish Farmers' Association follow. Vol. 8, No. 3, July 1989: Crawfish Forages-1989 Update; Growing Crawfish During Off-Season Months; Grading Crawfish; A Partial Explanation for Decreased Crawfish Prices in the Crawfish Industry; Automated Crawfish Harvesting Machines: A Status Report; Rumors in the Crawfish Industry; Views of Soft Crawfish Production in Louisiana; Household Crawfish Patterns for Crawfish in the U.S.; and Use of Formulated Feeds in Crawfish Culture. Vol. 8, No. 4, October 1989: Pondfish Culture (Circa 1937); Review of the 1988-89 Season; Crawfish Price Summary for the 1988 and 1989 Season; Crawfish Promotion Board Awards Contracts; Pond Crawfish Acreage May Show Slight Decline; Observations on the Scandinavian Crawfish Market; Results of the 1989 Swedish Market Sales; Field Test Confirms Electric Motor Efficiency; Making a Profit in the Crawfish Industry; Crawfish Baits and Feed Products Available; and Insights Into Crawfish Markets. Annual membership in LCFA is \$30 including a subscription to Crawfish Tales. Single subscriptions to Crawfish Tales are: \$15 for USA or \$30 (airmail) outside of USA. Contact: Louisiana Crawfish Farmers' Association, P.O. Box 9656, New Iberia, Louisiana 70652 USA.

NEW MEMBERS/ADDRESS CHANGES--

NEW MEMBERS:

Adao, Helena, Universidade de Evora, Apartado 94, 7001 Evora Codex, Portugal.

British Museum (Natural History), Dept. of Library Services, Cromwell Road, London SW7 5BD, Great Britain.

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Eversole, Arnold, Dept. of Aquaculture, Fisheries & Wildlife, Clemson University, Clemson, South Carolina 29635-0362 USA.

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Zaugg, Blaise G., Chemin de Pratz 17 A, CH-2017 Boudry, Switzerland.

NEW ADDRESSES:

Brown, Paul E., Dept. of Forestry & Natural Resources, Purdue University, West Lafayette, Indiana 47907 USA.

Natural Resources Research Institute Library, University of Minnesota--Duluth, 5013 Miller Trunk Highway, Duluth, Minnesota 55811 USA.

Svendsen, Geir, Bentsebrugt 23 - 3, N-0469 Oslo 4, Norway.

Taugbol, Trond, County Environmental Administration, Statsetatenes Hus, N-2600 Lillehammer, Norway.

FRESHWATER CRAYFISH, A JOURNAL OF ASTACOLOGY--Volumes IV, V, VI, and VII are available. Sources and costs are: IV, P. J. Laurent, Avonnes a Marin, F-74200 Thonon les Bains Cedex, France, 63 Swiss Francs; V, Van Nostrand Reinhold, 115 Fifth Avenue, New York, New York 10003 USA, approximately \$35 US, check for price; VI, Per Brinck, Ecology Building, University of Lund, S-223 62 Lund, Sweden, \$35 US; and VII, Pierre Goeldin de Tiefenau, Musee Zoologique Cantonal, Case postale 448, CH-1000 Lausanne 17, Switzerland, 63 Swiss Francs.

MEMBERSHIP INFORMATION--Membership in the International Association of Astacology is open to anyone interested in the study of freshwater crayfishes or their exploitation. Membership categories are: regular, \$25.00 US; student, \$12.50 US; and business, \$50.00 US. Members receive the quarterly IAA Newsletter and Directories of Astacologists as they are published. Current dues cover the period August 1987-April 1990. To apply for membership, send checks (US banks) or international money orders (US dollars drawn on a US bank) made out to IAA to:

International Association of Astacology
P.O. Box 44650
University of Southwestern Louisiana
Lafayette, Louisiana 70504 USA
Phone: (318) 231-5239 FAX: (318) 231-5395

ADDENDA:

BURROWING OF VERY YOUNG PROCAMBARUS CLARKII--Member Stephen Hasiotis (Dept. of Geology, Univ. of Buffalo, Buffalo, New York 14260 USA) has been studying the burrowing of P. clarkii to better understand fossil burrows (see last newsletter and references section of this newsletter). The diagrams on the back cover were sent by Mr. Hasiotis. Comments about his observations follow:

"...The juveniles I have been working with range in size from approximately 10mm to 70mm. The burrow architecture is very interesting. I have seen this communal living you mentioned, but in my aquariums, it appears as though only a few juveniles burrow and the others will intrude upon the dwelling. As they get older, at approximately 20mm, each individual becomes very aggressive and tends to its own burrow. From my observations, the number of juvenile crayfish that survive from a particular brood are those that hatched first, burrow in the nest, and feed off the other hatchlings. They tend to leave the burrow first and reburrow near their birth place. It is incredible to see how the number of hatchlings drop drastically due to cannibalism.

"Just a note, in my collections of fossil burrows from the Triassic, I have found a burrow approximately 5mm in diameter and 100mm in length. I have identified this as a juvenile crayfish burrow from the burrow morphology...."

WEST GERMAN CRAYFISH REGULATIONS--The following information was just received from member Erik Bohl (Demollstrasse 31, D-8121 Wielenbach, West Germany).

"...Catch and stocking: Crayfish is regarded like a fish in legislation and thus is the object of the fishery law. Fishery is ruled federatively by a county's own fishery law. Fishery law discerns between natural waters ('non-closed waters') and artificial waters like fish-ponds ('closed waters'), further law identifies native species and alien species. Catching native crayfish species in non-closed waters is ruled by legal size and closed season.

"In the county of Bavaria for example: Astacus astacus - legal size 12 cm (both sexes); Austropotamobius torrentium - legal size 10 cm (both sexes). Closed season: Oct. 1 to Jun. 30 for females of both species. Legal sizes and closed seasons don't differ much in other parts of the republic.

"For Pacifastacus leniusculus, Orconectes limosus and also Astacus leptodactylus no restrictions are fixed in most counties. Only native species Astacus astacus and Austropotamobius torrentium are allowed to be stocked in natural

waters. (In Bavaria even A. torrentium needs a special permission.) Other species may be kept in artificial ponds under the condition that any escape can be excluded (which can hardly be warranted in reality).

"Trade. Crayfish is considered in the German species preservation decree which as a part of nature preservation legislation concerns the whole territory of the Republic. The new edition of this decree from Aug. 1989 contains some regulations of great importance for crayfish management. To protect natural stocks from overfishing, crayfish of native species originating from natural stocks are not allowed to be traded without special permission. Private use is free. All marketable species of freshwater crayfish are excluded from importation to Germany as live specimens for any purpose. This injunction was added to the decree to prevent further spreading of the plague and includes European species as well as American ones, and stocking material as well as food. Crayfish for human consumption can be imported frozen, cooked or canned. Live imports for scientific purposes might be granted special cases...."

HYBRID CRAYFISH IN WEST GERMAN??--Member Theodore Zollman (Rommersrainer Muhle, D-6414 Hilders, West Germany) sends the following information about a "hybrid" crayfish from his homeland.

"...HYBRID CRAYFISH ORCONECTES AFFINIS CLARKII FORMA GERMANICA DEMONSTRATES SUPERIOR PERFORMANCE. An exhibit at Dusseldorf's new 'AQUA ZOO' purports to show a native crayfish species of American extraction. An information board explains that the crayfish Cambarus affinis is regarded as a member of the native fauna, although it was introduced into Germany only a while ago from North America. Near the board is an aquarium with several beautiful crayfish that outwardly appear to be identical with the ubiquitous Procambarus clarkii. They could easily be mistaken for the Red Swamp Crayfish, if it weren't for the information sign for this aquarium that informs the visitor that he is looking at 'Amerikanischer Flusskrebs' (American River Crayfish) Orconectes limosus, having been naturalized (eingeburgert) in 1890, and that these crayfish displace the remaining populations of Noble Crayfish, because they reproduce faster, grow faster, and are less demanding in regard to water quality...."

ADDRESS CHANGE--Sommer, Ted - 626 Georgetown Place, Davis, California 95616 USA.