



INTERNATIONAL ASSOCIATION
OF ASTACOLOGY
I.A.A.

NEWSLETTER OF THE INTERNATIONAL ASSOCIATION OF ASTACOLOGY

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Jay V. Huner, Editor, P.O. Box 44650, University of
Southwestern Louisiana, Lafayette, Louisiana 70504 USA

James F. Payne, President
Dept. of Biology
Memphis State University
Memphis, Tennessee 38152 USA

David Holdich, Pres. Elect
Dept. of Zoology
University of Nottingham
Nottingham NG7 2RD, England

Jay V. Huner, Sec./Treas.
Crawfish Center
Univ. Southwestern Louisiana
Lafayette, Louisiana 70504 USA

Pierre J. Laurent, Past Pres.
I.N.R.A.
75, Av. de Corzent
F-74203 Thonon, France

EIGHTH SYMPOSIUM OF ASTACOLOGY--Detailed information has been carried in past newsletters and has been mailed separately to the membership. Last minute inquiries for this event that will be held 22-26 April 1990 at the Hilton Hotel in Baton Rouge, Louisiana USA should be directed to:

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

NINTH SYMPOSIUM OF ASTACOLOGY--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 it is available.

IAA ELECTION--Ballots have been transmitted to the membership. Candidates for various offices are:

President - David Holdich (currently President-Elect)

President Elect - Jay Huner (currently Secretary/Treasurer)

Secretary/Treasurer - Jostein Skurdal

Write-in options have been provided for each position. Dr. Skurdal is employed by the County Environmental Protection Department in Lillehammer, Norway. He currently is a member of the IAA Board. His research involves ecology, population dynamics, management and culture of crayfishes. Dr. Skurdal has many publications dealing primarily with the native Norwegian species, Astacus astacus.

MEMBERSHIP DUES--DUES FOR THE PERIOD APRIL 1990-APRIL 1992 ARE DUE 26 APRIL 1990. A MEMBERSHIP FORM IS ENCLOSED FOR YOUR CONVENIENCE. PLEASE ENSURE THAT YOU FILL OUT THE DIRECTORY INFORMATION SO THAT OUR NEW DIRECTORY CAN BE PUBLISHED BY LATE 1990 OR EARLY 1991.

SYNONYMY IN THE GENUS FALLICAMBARUS--Honorary Life Member Dr. Horton H. Hobbs, Jr. (Department of Invertebrate Zoology, Smithsonian Institution, Washington, DC 20560 USA) has presented, with H. W. Robison, data for placing Fallicambarus (Cresserinus) uhleri (Faxon) and F. (C.) hedgpethi (Hobbs) in the synonymy of F. (C.) fodiens (Cottle). The species ranges from southeastern Texas northward to southern Ontario through the Mississippi River Valley and from Maryland into South Carolina with a conspicuous gap in its presence across the Appalachian Mountains. Refer to: Hobbs, H. H., Jr. and H. W. Robison. 1989. On the crayfish genus Fallicambarus (Decapoda: Cambaridae) in Arkansas, with notes on the fodiens complex and descriptions of two new species. Proc. Biol. Soc. Wash. 102(3):651-697.

CRAYFISH CULTURE IN SPANISH RICE FIELDS, THE LEGAL SITUATION AND THE STATUS OF THE FISHERY AROUND SEVILLE--Board Member Andreas Habsburgo-Lorena (Fuentemilanos 2, E-28025 Madrid, Spain) sends the following information about crayfish culture in Spanish rice fields.

"...Referring to your question: 'Can a man who owns a rice field in Spain cultivate crayfish?' Yes, he can spend his money in cultivating aquatic species BUT anyone can fish on his land. So, in practice, any continental water species are cultivated in ponds or rice fields.

"The legal interpretation of continental waters stored in rice fields is: 'public waters in privately owned land.'

so there is, until laws change, no possibility of cultivating

crayfish...."

"...Regarding the crayfish-year 1989, I inform you that in Sevilla only some 8,000 ha out of 36,000 ha of paddyfields could be flooded this summer due to drought. So the transformation [processing]-plants in the Seville area had little to produce. Only 25% of the captured crayfish reached the commercial length of 8 centimeters and only this size can be exported.

"Crayfish are captured in many waterbodies all over the country as more and more people are dispersing the species P. clarkii thanks to its fast growth and - when newly installed in a waterbody - good size."

PROCAMBARUS CLARKII EXTENDS ITS RANGE IN FRANCE--P. clarkii is now reported in the area of South Charente in France according to a French language news item sent by Past President Pierre Laurent. The author, one Didier Pigeneau, expresses grave concern about possible danger to irrigation systems and native crayfishes. He indicates that the species is of poor table quality. He speculates about the use of a selective pesticide to eliminate the species and cautions against its transfer to other regions.

THESES DEALING WITH ORCONECTES NAIS IN KANSAS USA--Member Harold Klaassen (Division of Biology, Ackert Hall, Kansas State University, Manhattan, Kansas 66506) has sent a list of theses that he has directed over the past several years.

1. Ingelin, M. E. 1984. Growth and distribution of the crayfish, Orconectes nais in Kansas ponds. Masters Thesis. Kansas State University, Manhattan, Kansas USA. 89 pages.
2. Kichler, C. E. 1987. Evaluating survival of the crayfish Orconectes nais exposed to hypoxic winter conditions. Masters Thesis. Kansas State University, Manhattan, Kansas USA. 44 pages.
3. Money, J. H. 1988. Aspects of reproduction of the crayfish Orconectes nais. Masters Thesis. Kansas State University, Manhattan, Kansas USA, 56 pages.

PROCAMBARUS CLARKII IN ZIMBABWE--Member Don Watson (Box 48, Guruve, Zimbabwe) sent the following comments to member C. J. Grubb (Box 60287, Livingstone, Zambia) about P. clarkii in Zimbabwe: "...Firstly as regards the query from Jay Huner. I don't know where he got his information from that crayfish were being widely cultivated in farm dams in Zimbabwe because

it is completely untrue. At the moment National Parks have only given permission for myself and Nick O'Conner a neighbour and friend of mine to cultivate crayfish in protected ponds or dams only draining into one river system and this being the extreme northern area of Zimbabwe. Should the crayfish get into this river system...National Parks will poison them. Nick O'Conner has only just started with my help and breeding stock. I am marketing in a very small way to 2 restaurants in Harare. However we are expanding area building more ponds which are being closely monitored by National Parks. It is however true that 2 years ago P. clarkii were being sold in pet shops in Zimbabwe. National Parks put a stop to this and confiscated the fish in the shops but some must still be at large in peoples' aquariums..." Mr. Watson also reported that 15 of 25 Pacifastacus leniusculus obtained from England in July 1988 have grown well but not mated.

PROCAMBARUS CLARKII AND OTHER CRAYFISHES AS PETS IN WEST GERMANY--Member Theodore Zollmann (Rommerstrainer Muhle, 6414 Hilders, West Germany) sent a long letter. Some highlights about crayfishes as pets in his country follow:

"...Yes, the aquarium shops provide P. clarkii in Germany. When I recently asked in one shop I was told that the crayfish had come in via Holland. Even in the remote border area where we live, clarkiis were sold when available. The owner of a pet shop told me (3 years ago) that the crayfish had propagated so successfully in the aquariums of one of his customers that they had to be put in an outside pond, where they didn't like it and began wandering all over the place.

"The widespread sale of crayfish as pets is a recent phenomenon: In the gardens of all residential areas all over Germany (and other countries), tiny plastic-lined 'garden ponds' are being built. (A booming business). 'Garden centers' supply the ponds and anything that people could conceivably be persuaded to put into their 'ponds'. I think far more crayfish are supplied through the 'garden centers' than through aquarium shops. I have seen P. clarkii and all the 'native' species being sold, with Orconectes limosus predominating. It is well known that some fishes supplied through the aquarium trade wind up in public waters. It is reasonable to assume that this is also true for crayfishes...." [Note: Mr. Zollman later speculates that P. clarkii could not thrive in nature in Germany.]

NEW SOVIET MEMBER SEEKS MORE CONTACT WITH ASTACOLOGISTS--Dr. Valery P. Fedotov (c/o Thomosto-Smith AB, S Strandvagen 5 B, S-114 51, Stockholm, Sweden) writes that his specialty is

human and animal physiology having graduated from Leningrad University in 1972. His studies have been published in Evolutionary Biochemistry and Physiology. His current work involves the biotechnology of breeding of crayfishes and is very interested in aspects of adaptation and growth-promoting factors in crayfishes.

CRAYFISH PLAGUE EFFECTS IN TURKEY--Past president and board member Ossi Lindqvist (Dept. of Applied Zoology, University of Kuopio, SF-70211 Kuopio 21, Finland) moderated a session on crustacean culture at the European aquaculture conference, Bordeaux, France in October 1989. A contribution about crayfish plague in Turkey by I. K. Oray (School of Aquatic Products, SU Urunleri Yuksekokulu, 81650 Beykoz-Istanbul, Turkey) arrived to late for the conference. Professor Lindqvist sent it to the IAA Newsletter and it is included below because of the timely nature of the subject.

A Short-Report on the Turkish Crayfish, Astacus leptodactylus Esch. Fishery in 1989 in Turkey by I. K. Oray.

Due to the outbreak of the crayfish plague the maximum catch of crayfish in Turkish waters which was 7936 tons in 1984 dropped to 950 tons in 1986. In 1987 and 1988 the yield was around 200 tons. In the 1988/89 season fishing for crayfish was prohibited in the following lakes: Civril, Egirdir, Isikli, Hoyran, Beysehir, Kovada, Sucullu, Sapanca, Terkos, Hirfanli, Kesikkopru, Ulubat, Hotamis, Cavuscu and Manyas. This prohibition is remaining in effect for the current 1989/90 crayfish season.

Currently, fishing for crayfish is permitted in Lakes Aksehir, Iznik, and Apolyont as well as in Lakes Aksehir and Iznik and in the lakes on the central Black Sea coast. The crayfish season for both 1988/89 and 1989/90 was/is 1 July - 1 December. The Lakes of Aksehir and Iznik have unusually high electrolyte concentrations. Both lakes exhibit inverted Ca:Mg ratios with high absolute Mg+2 values. The estimated yields for these two lakes was about 200 tons. The lakes on the central Black Sea coast yielded about 130 tons in 1988 and have not been affected by the crayfish plague. The lakes around Terme yield barely 15 tons in 1989. The Bafra Balik golleri lakes were opened quite late in 1989 - September - and did not yield the 50-60 tons that would have been expected had they been opened earlier.

Infestation of crayfish by the crayfish fungus plague has been determined as follows: Lake Egirdir - 40 %, Lake Civril - 21 %, and Lake Beysehir - 16 %. Declines in catch are seen in

the following table for the period 1983-1987.

Lake	Area (km ²)	1983	1984	1985	1986	1987
Sapanca	50	58	52	40	5	0
Ulubat	150	400	310	250	20	4
Manyas	150	n.i.	200	57	2.5	0
Iznik	300	80	164	126	190	50
Buyuk Akgol	3	n.i.	5	5	0	0
Poyraziar	6.5	n.i.	5	5	5	0
Golmarmara	35	-	10	135	200	2
Civril	40	400	80	1	0	0
Egirdir	470	n.i.	n.i.	2500	20	0
Beysehir	600	95	95	100	180	8.5
Aksehir	350	180	250	270	270	80

*n.i. - no information

NEWS ABOUT CRAYFISH IN PORTUGAL--Member Alexandra Marcal (Museu E Laboratorio Zoologico E Antropologico, Rsua Escola Politecnica, 1200 Lisbon, Portugal) sends information about Procambarus clarkii in Portugal. There is nothing published about the biology of the species in the country. It is currently considered to be a "plague" with respect to agriculture. The species is available commercially in some local markets and the price is \$4-5 US per kg.

RED CLAW (CHERAX QUADRICARINATUS) IN THE USA--The current issue of Seafood Leader Magazine (Volume 10, No. 2, 1990) includes an article entitled "Australian Freshwater Crayfish (Marron/Red Claw) Cherax spp" (No Author, pages 278-284.) The article deals primarily with the red claw and makes some interesting points. The U.S. Government has granted \$200,000 to a South Carolina company to see if it can farm red claw. Auburn University (Auburn, Alabama) is studying red claw culture. A Missouri firm (presumably Fercom) has developed a sophisticated hatchery with the capacity to produce 250,000 juvenile red claw a month. It aims to grow these in freshwater ponds in the Caribbean with a production goal of 5,000-10,000 tons a year by 1991.

HORTON H. HOBBS, JR. PUBLISHES NEW CRAYFISH BOOK!--Dr. Hobbs (see address above) was kind enough to send a copy of the following reference:

Hobbs, Horton H., Jr. 1989. An Illustrated Checklist of the American Crayfishes (Decapoda: Astacidae, Cambaridae, and Parastacidae). Smithsonian Contributions to Zoology, Number 480: 1-236.

The publication includes an alphabetical list of the names of all of the American crayfishes, including two fossil species, that were described prior to 1 January 1988. Comparable illustrations, arranged in related species groups, are provided for 379 recognized extant species and subspecies. Geographical distribution information is also provided. This book is certainly a valuable contribution to the field of astacology and a tribute to Dr. Hobbs' dedication to his work.

YABBIE TALES--"Yabbie Tales" is the newsletter of the Yabbie Growers Association Inc. (P.O. Box 607, Benalla, Victoria 3673, Australia). Volume 1, Number 4 (1989?) includes the following articles: (1) One step at a time; (2) What's the association all about?; (3) Yabbie farming at Wy-Wurrie Marron; (4) Yabby farming today; (5) Plastic yabbies; (6) Daphnia: what is it?; (7) Yabbie research in South Australia; (8) Wy-Wurrie Marron field days; (9) The crayfish plague fungus; (10) A new book on Australian aquaculture; and (11) Background on the YGA. "Yabbie Tales" is a very interesting and informative publication for those working with Cherax destructor. Its format is certainly far more sophisticated than the IAA Newsletter!

Volume 2, No. 1 has the following topics: A message from the President; Volunteers?; Is a hatchery a necessary part of yabbie farming?; North American crays again!; New members; Freshwater organisms - good guys and bad guys; and Appeal for contributions. There are at least 215 members listed including joint entries - husband/wife or multiple partners. This certainly shows considerable interest in crayfish. Ironically, Louisiana with the world's most important crayfish industry with several thousand farmers does not boast an organization with more members. IAA, in fact, has approximately 275 paid memberships! Concern was expressed about importing of Procambarus clarkii for laboratory studies. Potential problems from crayfish plague were referenced. It should be noted that the same formalin used to preserve crayfish is also the substance used to disinfect gear used to fish for crayfish in Scandinavia.

LOUISIANA AQUACULTURE CONFERENCE FEATURES TWO CRAYFISH ORGANIZATIONS--The Louisiana Aquaculture Conference 1990 was held February 8-9, 1990 in Baton Rouge, Louisiana USA. Meetings of the Louisiana Soft-Shell Crayfish Association and the Louisiana Crayfish Farmers' Association were held during the conference. Presentations and presenters were as follows: Soft-Shell Crayfish - (1) Progress in Development of Hydraulic Soft-Shell Crayfish Separation Unit - Ronald Malone; (2) Impact of Various Management Practices on Crayfish Molting -

Dudley Culley; (4) Methods to Enhance Crayfish Molting - Jay Huner; and Processing and Packaging - Michael Moody. Crayfish Farmers - (1) Aeration in Crayfish Ponds - Thomas Lawson; (2) Crayfish Genetics and Breeding; (3) Crayfish Nutrition and Breeding - Robert Reigh; (4) Crayfish Harvesting - Robert Romaine; and (5) Crayfish Processing - Michael Moody. A conference proceedings will be published shortly. Information about these proceedings may be obtained from the editor, Robert Reigh, School of Forestry, Wildlife and Fisheries, Louisiana State University, Baton Rouge, Louisiana 70803-6200 USA.

LOUISIANA CRAYFISH SEASON UPDATE - EARLY APRIL 1990--Louisiana has had as many as 54,000 ha of crayfish ponds as recently as last year. The Louisiana Cooperative Extension Service believes that this may have declined by 5-10% in the current season because of poor overall prices received last year. Representatives of the Louisiana Crayfish Farmers Association believe that the decline may have been as much as 33%. It is difficult to document the decline because detailed survey data are not maintained by any governmental or private agencies. Prices as high as \$2.20 per kg were received in the November-December 1989/January 1990 period but have also fallen as low as \$0.88 per kg since late January; however, close attention is being paid to size. Lowest prices are paid for smallest crayfish which are peeled for the abdominal (tail) muscle. Large, choice "export" grade crayfish still command prices of \$2.20+ per kg. Stabilization of prices through development of more out-of-state (& country) markets is an industry wide goal. However, even with declines in pond area, Louisiana will still produce the great majority of the crayfish harvested this year, regardless of source.

THE BIOLOGY AND AQUACULTURE POTENTIAL OF CHERAX

QUADRICARINATUS--This is the title of a draft report sent by member Clive M. Jones (Queensland Department of Primary Industries, Fisheries Branch, Research Station, Walkamin, Queensland 4872, Australia). The 131 page draft report is full of information about the so-called red claw and will be a boon to those desiring to cultivate the species when it is officially released. Sections include: (1) Temperature Experimentation; (2) Salinity Experimentation; (3) Salinity Experimentation; (4) Juvenile Nutrition and Habitat; (5) Development of Hatchery/Nursery Procedures; (6) Growout Trials - Supplemental Feeds; (7) Growout Trials - Commercial Production; (8) Post-Harvest Aspects; (9) General Biology; and (10) Aquaculture Potential. This report has one of the most comprehensive crayfish cultivation reference sections that I have encountered. Mr. Jones has done an excellent job of

obtaining and synthesizing crayfish cultivation literature.

CRIA DEL CANGREJO DE RIO--This is the title of a book about crayfishes in Spain and emphasizes Procambarus clarkii. Author is Julio Coll Morales of the University of Madrid. Published in 1987 by Editorial Hispano Europea, S.A., Barcelona, Spain, the book has only recently come to the attention of your editor. It is liberally illustrated with high quality figures and graphs. The 157 page book, entirely in Spanish, includes the following sections: Introduccion; Construccion de Estanques; Control de Calidad de Agua; Alimentacion; Dinamica de Poblaciones; Comercializacion; Economia; and Extrapolacion a Otras Especies.

L'ECREVISSE ROUGE DES MARAIS--This is the title of a new book written entirely in French about Procambarus clarkii. Published in 1990 by Maisonneuve & Larose, Paris, the book is authored by IAA Members Jacques Arrignon, Jay Huner, and Pierre Laurent. This brief 87 page book is well illustrated and addresses the cosmopolitan distribution of P. clarkii with sections including: Biologie; Exploitation; Nuisances; and Commercialisation. It was written to ensure that French speaking peoples around the world would be able to obtain factual information about P. clarkii in their native language.

UNUSUAL MATING BEHAVIOR OF A JAPANESE CRAYFISH--Member Tadashi Kawai (Fisheries Division, Kuji District Promotion Bureau, T032, Yokamachi-2-156, Kuji City, Iwate Prefecture, Japan) has described the copulatory behavior of Cambaroides japonicus, the native Japanese crayfish. Some highlights (see reference in literature section below) follow. The male seizes the female but turns himself over and positions himself under her. During the copulatory period which lasts an average of 147 minutes, the male does not use his chelae to hold the female.

RECOMMENDATIONS FOR INTRODUCTIONS OF CRAYFISHES INTO PENINSULAR FLORIDA FOR AQUACULTURE PURPOSES--Member Michael Miltner (Florida Game and Fresh Water Fish Commission, 3900 Drane Field Road, Lakeland, Florida 33811 USA) has sent the executive summary for a paper that he wrote entitled, "A Review of the Proposed Introduction of the Red Swamp Crayfish into Peninsular Florida for Aquaculture Purposes." The three recommendations follow: (1) The red swamp crayfish, Procambarus clarkii, should be designated a "restricted" species east of the Apalachicola River basin for the next five years, effectively prohibiting the transplanted of this species for pond aquaculture, ornamental purposes, or as bait. Cases for possession for research, or intensive indoor culture



INTERNATIONAL ASSOCIATION
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I.A.A.

P.O. Box 44650
University of Southwestern Louisiana
Lafayette, Louisiana 70504 USA

MEMBERSHIP RENEWAL FORM

DIRECTORY FORM

Membership dues for the period April 1990 - April 1992 are as follows:

Regular Membership - \$25.00 US	_____	MUST BE PAID IN US DOLLARS - Check in
Student Membership - \$12.50 US	_____	USA or International Money Order or Draft
Business Membership - \$50.00 US **	_____ **	DRAWN ON AN AMERICAN BANK.

Name: _____ Phone: _____

Address: _____ FAX: _____

TELEX: _____

Additional Directory Information

Species Studied _____

Subjects of Interest _____

Mail 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

**Business memberships are acknowledged in the first newsletter published after they are received. Business members are asked to send a 150-200 word commentary about their interests in astacology, products, etc. for inclusion in both the Newsletter and the Directory of Astacologists. Business memberships help to fund newsletters sent to astacologists in countries where even IAA's nominal dues cannot be paid.

with zero discharge may be reviewed on an individual basis. Live red swamp crayfish may be imported for sale in retail outlets for human consumption provided a permit is obtained. (2) During this five year period, commitment to and funding for a thorough evaluation of native species, including P. paeninsulanus, P. alleni, and possibly, P. fallax, should be expanded. Specific research areas should include life history, reproductive biology, growth, economic characteristics, environmental requirements, and appropriate culture methods/systems for these species. Species and culture methods appropriate for the Everglades Agricultural Area should be a target priority. (3) The status of the red swamp crayfish should be reviewed again in five years, and permission for possession and culture of this species in peninsular Florida should be re-evaluated pending the outcome of native species research.

MEXICAN ASTACOLOGIST SEEKS ASSISTANCE--Hugo Paul Hrdz. Montano (Aquaculture Technician, Rancho Guadalupe No. 34, Col. Capestre Coyoacan, C.P. 04890, Mexico 22, D.F.) is seeking information about Procambarus mexicanus and Cambarellus montezumae. He is studying the reproductive and feeding habits of the species and both internal and external morphology. He is interested in cultivation of these species in Mexico.

HORTON HOBBS, JR. SEEKS SPECIMEN OF PROCAMBARUS ACUTUS ACUTUS FROM SOUTHERN LOUISIANA--Dr. Hobbs, an honorary life member of IAA, and his son Horton, III, an IAA member, have been reviewing all available specimens of what has been identified as P. a. acutus in southeastern Texas/southwestern Louisiana. They believe that several species have been confused. They have prepared a preliminary description of a form that occurs in Jefferson, Hardin, and Orange counties Texas. However, few specimens are available from southern Louisiana and the two astacologists have requested assistance in securing specimens. Dr. Hobbs may be contacted at the National Museum of Natural History, Smithsonian Institution, NHE Stop 163, Washington, DC 20560 USA.

PRODUCTION RATES AND COMPETITIVE INTERACTIONS OF RED SWAMP AND WHITE RIVER CRAWFISH UNDER DELAWARE CONDITIONS--This is the title of a final project report to the Alternative Crops and Marketing Program, Delaware Department of Agriculture (November 15, 1989) by Bernard R. Petrosky (IAA Member) and Donald E. Wujtewicz, Department of Agriculture and Natural Resources, Delaware State College, Dover, Delaware 19901 USA. Work was done in pools and large tanks with earthen bottoms. Results of the first year of a two year study included:

(1) Reproduction was more protracted in white river crayfish (*Procambarus acutus acutus*) than in red swamp crayfish (*P. clarkii*). Whites produced young through the summer while reds did so at the end of the summer. (2) Whites were more productive over a short period. (3) With adequate food and good water quality, standing stocks of 225 g/sq. m. were achieved. (4) The white river crayfish shows promise of being at least as good a species for Delaware aquaculture as the red swamp crayfish.

PUBLICATIONS OF INTEREST TO ASTACOLOGISTS--

- x. BANKSTON, D. J., F. E. Baker, T. Lawson, and J. Roux. 1989. Demonstration of paddlewheel aerators in crayfish ponds. American Society of Agricultural Engineers/Canadian Society of Agricultural Engineering. ASAE/CSAE Meeting Presentation Paper No. 897012. [Quebec, PQ, Canada, June 25-28, 1989].
- x. BRINCK, P. 1988. The restoration of the crayfish production in a plague stricken country. *SU Urun. Derg/J. Aquat. Prod.* 2(1):53-60.
- x. BRUNSON, M. 1989. Crayfish forages 1989 update. *Crayfish Tales* 8(3):10-13.
- x. CROWL, T. A., and A. P. Covich. 1990. Predator-induced life-history shifts in a freshwater snail. *Science* 247:949-951.
- x. CULLEY, D. D. 1989. Views of soft crayfish production in Louisiana. *Crayfish Tales* 8(3):23-26.
- x. DE LA BRETONNE, JR., L. W. 1989. Making a profit in the crayfish industry. *Crayfish Tales* 8(4): 22-23.
- x. DE LA BRETONNE, JR., L. W. and R. P. Romaine. 1989. Growing crayfish during off-season months. *Crayfish Tales* 8(3):14-16.
- x. DIXON, D. and H. L. Atwood. 1989. Phosphatidylinositol system's role in serotonin-induced facilitation at the crayfish neuromuscular junction. *J. Neurophysiol.* 62:239-246.
- x. EDWARDS, R. and R. Howell. 1989. Welsh rivers and reservoirs: management for wildlife conservation. *Regulated Rivers: Research & Management.* 4:213-223. [Discusses problems associated with *Pacifastacus leniusculus* and *Austropotamobius pallipes*.]
- x. FINERTY, M. W., J. D. Madden, S. E. Feagley, and R. M. Grodner. 1990. Effect of environs and seasonality on metal residues in tissues of wild and pond-raised crayfish in southern Louisiana. *Arch. Environ. Contam. toxicol.* 19:94-100.
- x. FREID, M. R. 1990. The tale of Louisiana's crayfish industry grows bigger every year. *Crayfish Tales* 9(1):10-11.
- x. FUENTES-PARDO, B., and E. Moreon-Saenz. 1988. Action of deuterium oxide upon the ERG circadian rhythm in crayfish, *Procambarus bouvieri*. *Comp. Biochem. Physiol.* 90A:435-440.
- x. HALDER, M. and W. Ahne. 1988. Freshwater crayfish *Astacus astacus* - a vector for infectious pancreatic necrosis virus (IPNV). *Diseases of Aquatic Organisms* 4:205-209.
- x. HOBBS, H. H., JR. and D. J. Peters. 1989. New records of entocytherid ostracods infesting burrowing crayfishes, with the description of a new species, *Ascetocythere stockeri*. *Proc. Biol. Soc. Wash.* 102: 324-330.
- x. HUNER, J. V. 1989. Observations on the Scandinavian crayfish situation: Finland and Sweden. *Crayfish Tales.* 8(4): 16-17.
- x. HUNER, J. V. 1989. Culture of white river (*Procambarus acutus acutus*) and red swamp (*Procambarus clarkii*) crayfishes: An update. *Marron Growers Association Bulletin.* Volume 11.
- x. HUNER, J. V. and V. A. Pfister. 1990. Feasibility of stocking juvenile crayfish in small ponds. *Crayfish Tales* 9(1):13-14.
- x. HUNER, J. V. 1990. Use of seines and harvesting machines in soft-shell crayfish industry. *Crayfish Tales.* 9(1):16.
- x. HUNER, J. V. 1990. Are fire ants a problem in crayfish management? *Crayfish Tales* 9(1):19.
- x. HUNER, J. V. 1990. Wading birds in crayfish, a new problem? *Crayfish Tales* 9(1):20.
- x. KAWAI, T. 1989. The crayfish *Cambaroides japonicus* in the southern limit of the distribution. *Freshwater Fish Protection* 2:116-117.
- x. KAWAI, T. 1989. Copulatory behavior of *Cambaroides japonicus* (Decapoda: Astacidae). *Nankiseibutu: The Nanki Biological Society* 31(2):99-100.

- x. KIVIVUORI, L., S. Lehti, and K. Y. H. Lagerstedt. 1989. Effect of temperature acclimation on thermal dependence and hysteresis of the resting membrane potential of the stretch receptor neurone in crayfish [Astacus astacus (L.)]. *Journal Thermal Biol.* 15: 9-14.
- x. LAURENT, P. J., H. Lelorin, and A. Neveu. 1990. Remarques sur quelques stations a Procambarus clarkii (Decapoda, Cambaridae). *Bull. Soc. Linneenne de Lyon*. IN PRESS.
- x. MADDEN, J. D., M.W. Finerty, and R. M. Grodner. 1989. Suvey of persistent pesticide residues in the edible tissues of wild and pond-raised Louisiana crayfish and their habitat. *Bull. Environ. Contam. Toxicol.* 43: 779-784.
- x. MILTNER, M. R. 1989. Aquaculture in south Florida: native crayfish culture in the Everglades Agricultural Area (EAA). *Florida Aquaculture Association Newsletter* (Winter 1989).
- x. MORENO-SAENZ, E., J. Hernandez-Falcon, and B. Fuentes-Pardo. 1987. Role of the sinus gland in crayfish circadian rhythmicity -- 2. ERG circadian rhythm. *Comp. Biochem. Physiol.* 87A:119-125.
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NEW MEMBERS--

ANDRES, Jose Manuel Diez, Department of Biochemistry,

University of Valladolid, 47005 - Valladolid, Spain.

- BUCHANAN, James V., Department of Biological Sciences, University of South Alabama, LSB 124, Mobile, Alabama 36688 USA.

- CATES, Don, Apotu Road, Kauri, R.D. 1 Kamo, Whangarei, New Zealand.

- CULLEY, Dudley D., School of Forestry, Wildlife and Fisheries, Louisiana State University, Baton Rouge, Louisiana 70803 USA.

- FEDOTOV, Valery P., c/o Thomasto-Smith AB, S Trandvagen 5 B, S-114 51, Stockholm, Sweden.

- GREENFIELD, Dave, 3515 Jamaica Drive, Augusta, Georgia 30909 USA.

- LARIMORE, R. Weldon, Illinois Natural History Survey, 607 E. Peabody Drive, Champaign, Illinois 61820 USA.

- REITZ, Ronald R., Department of Biochemistry, University of Nevada, Reno, Reno, Nevada 89557 USA.

- HOLLMAR, Dick, 109 Walnut Avenue, North Hampton, New Hampshire 03862 USA.

NEW ADDRESS--

- DEFUR, Peter L., Staff Scientist, Environmental Defense Fund, 1108 East Main Street, Suite 800, Richmond, Virginia 23219 USA.

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The International Association of Astacology
P.O. Box 44650
University of Southwestern Louisiana
Lafayette, Louisiana 70504 USA
Tel. (504) 231-5239/Fax. (504) 231-5395

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Addenda:

Publications of Interest to Astacologists:

- x. Ackefors, H., R. Gydemo, and L. Westin. 1989. Growth and survival of juvenile crayfish, Astacus astacus in relation to food and density. Aquaculture. A Biotechnology in Progress. N. DePauw, E. Jaspers, H. Ackefors, N. Wilkins (eds.). European Aquaculture Society, Bredene, Belgium. pp. 365-373.
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