Bloemfontein, Republic of South Africa

Address changes

Crandall, Keith A. - Department of Zoology, University of Texas, Austin, Texas 78712-1064 USA.

Delong, Michael D. - Department of Biology, Winona State University, Winona, Minnesota 55987 USA.

Gaude', Albert P., III. - 206 Interlacken, New Iberia, Louisiana 70560-1218 USA.

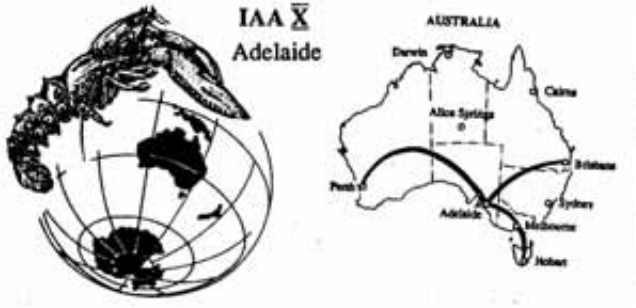
Levett, Sandy J. - Biology Department, Georgia State University, Atlanta, Georgia 30307-4010 USA.
von Hippel, E. - 62 Kings Hedges Road, Cambridge CB4 2PA, England.

New address for the Institute of Freshwater Research in Drottningholm

The postal code for the Institute of Freshwater Research in Drottningholm, Sweden has been changed from "S-170 11 Drottningholm" to "S-178 93 Drottningholm." This affects Swedish Members: M. Appelberg, L. Edsman, A. Fjälling, M. Fürst, A. Jonsson, and T. Odelström.

Material for Crayfish News

The editors, Jay Huner and Jostein Skurdal will like to thank all our contributors in 1993. We feel that our members are active and appreciate the service the newsletter represents. Of course we could do better and we try all the time. However our budget is limited and we can not provide our members with more information than the members provide to us. Please write to us when you have information which have interest for other astacologists and also we appreciate recieving drawings and so forth for illustration. We are very grateful to our national correspondents who have produced a lot of material from their countries, please continue with this work in 1994.



See you all in Adelaide for the tenth symposium for the International Association of Astacology 10-15 April 1994.

Crayfish NEWS

IAA Newsletter

Volume 15 Number 4 January/February 1994

IAA

The International Association of Astacology (IAA), founded in Hintertal, Austria in 1972, is dedicated to the study, conservation, and wise utilization of freshwater crayfish. Any individual or firm interested in furthering the study of astacology is eligible for membership. Service to members include a quarterly newsletter, membership directory, bi-annual international symposia and publication of the journal Freshwater Crayfish.

Secretariat

The International Association of Astacology have a permanent secretariat. The Secretariat is managed by Jay Huner and the address is IAA Secretariat, P.O. Box 44 650, Univ. of Southwestern Louisiana, Lafayette, Louisiana 70504, USA; phone (318) 231-5239 / fax (318) 231-5395.

Officers:

•Jay Huner, President, Crawfish Center, Univ. Southwestern Louisiana, Lafayette, Louisiana 70504, USA.

•Jostein Skurdal, President-Elect, Eastern Norway Research Inst., P.O Box 1066 Skurva, N-2601 Lillehammar, Norway.

•Paula Henttonen, Sec./Treas., Dept. Appl. Zoology, Univ. Kuopio, P.O. Box 1627, SF-70211 Kuopio, Finland.

•David Holdich, Past - President, Dept. of Life Science., Univ. of Nottingham, Nottingham NG7 2RD, England.

Jostein Skurdal and Jay V. Huner, Editors

IAA business

1. Election - Ballots have been mailed by first class mail to all members in good standing. Candidates are: President - Jostein Skurdal & Write in; President-Elect - Paula Henttonen & Write in; and Secretary/Treasurer - Jeffrey Gunderson and Michele Wheatly. Please take the time to vote. If you have not received a ballot, contact the Secretariat.

2. IAA X Adelaide 94 Update - Organizer and Board Member Mike Geddes sends the following information (Dept. Zoology, Univ. of Adelaide, Adelaide, South Australia 5005, Australia):

The registrations for IAA X Adelaide are coming along strongly. I have about 100 registrations although only about 60 have paid up! The post conference tours have been quite popular with about 30 registrations for the Adelaide-Melbourne trip, 20 for the Tasmanian tour and a few for Queenlands.

There have been a large number of papers submitted for oral presentation and as posters. Sixty papers are being considered for acceptance within the oral programme. There will be sessions on Evolution and Systematics, Ecology and Conservation (probably on Monday, 11 April), Physiology and Anatomy (on Tuesday, 12 April), Immunology and Disease Organisms (on Wednesday, 13 April) and Crayfish Culture (on Thursday, 14 April). In addition, there will be up to 40 poster presentations.

If you have not registered for IAA X Adelaide, it is still not too late. I will continue to accept registrations and abstracts until early March. After then there may be some limitation because of the size of the conference room. If you are still considering coming to IAA X, please make your decision soon and send me your registration and payment. I certainly encourage you to come down under and contribute to what I am sure will be a highly successful tenth IAA Symposium.

3. The IAA's Crayfish and Physiological Adaptation symposium at the American Society of Zoologist's meeting - Los Angeles, California, 28 December 1993 - was a

big success - see information later in newsletter. IAA wishes to acknowledge the support of THE CRUSTACEAN SOCIETY, a major co-sponsor, which provided a donation of $500 toward the speakers' expenses. Member Steve Shimizu - Pacific Crayfish Company - also graciously provided "Louisiana" crayfish meat for a post-symposium get together.

4. Freshwater Crayfish Index and Bibliography- Past President David Holdich (Dept. of Life Sciences, Univ. of Nottingham, Nottingham NG7 2RD, England) has completed a draft of "A Bibliography by Volume and Page Number of Freshwater Crayfish: A Journal of Astacology I-VII & IX." IAA is optimistic that this can be updated with FC VIII so that the bibliography can be complete and in sequence. Duplication - hard copy and/or disk copy - is anticipated following the Adelaide meeting. Details of duplication and dissemination (gratis and/or charges) have yet to be worked out.

Bird depredation symposium proceedings

The proceedings from the jointly sponsored National Aquaculture Association/National Audubon Society entitled, Management of Fish-[and crayfish] Eating Birds on Fish Farms have just been published. The symposium was held in New Orleans, Louisiana January 5-6, 1993 for the purpose of nurturing constructive interaction among the various stakeholders on this sensitive issue. These unique proceedings provide a descriptive common ground and areas of mutual concern with a discussion on solutions and recommendations. Edited by Dr. Jay V. Huner, University of Southwestern Louisiana, Lafayette, the 51 page publication contains papers, abstracts, a transcribed panel discussion and lists of presenters and attendees. The publication is available from the National Aquaculture Association (P.O. Drawer 1569, Shepherdstown, West Virginia 25443 USA) at $USD 5 for NAA members and $USD 7.50 for non-members including postage & handling.

Crayfish as ancient pest control system

According to "Introduction to Integrated Pest Management. 1981. M. L. Fling & R van den Bosch - Plenum Press - New York & London" a Roman agricultural text of 50 A. D. (De re Rustica) recommends two methods for controlling caterpillars in gardens: 'a woman ungirded and with flying hair must run barefoot around the garden, or a crayfish must be nailed up in different places in the garden."

Lousiana Crawfish Field Day

The Louisiana State University Agricultural Center co-hosted a "Crawfish Field Day" with the Louisiana Crawfish Farmers' Association in Crowley, Louisiana USA on 10 December 1983. The day featured crawfish/rice field research at the LSU Crowley Rice Research Station (led by IAA Member W. Ray McClain) and Educational and Vendor Booths. Several presentations later in the day included: "Marketing Crawfish Today" - Randy Motegut, Bon Creole Seafood - IAA Member; "You Can Impact Today's Market Place" - Ken Roberts, LSUAC; "Research with Real Application" - Robert Romaire, LSUAC - IAA Member; and "Growing Crawfish Food - W. R. McClain. More information about the meeting can be obtained from Dwight Landreneau, LSUCES, P.O. Box 497, Crowley, Louisiana 70527 USA.

Crayfish and Zebra mussel

Member Walter Momot (Dept. of Biology, Lakehead University, Thunder Bay, Ontario, Canada P7B 5E1) sent an abstract from ASLO/SWS 1993 - MacIsaac, Hugh J. [Dept. Biol. Sci., Univ. of Windsor, Windsor, Ontario, Canada N9B 3P4] Dietary Utilization of a Recent Great Lakes Invader (*Dresissena polymorpha*) by Native Crayfish (*Orconectes virilis*). According to the abstract, crayfish were offered mussels in 3-5, 8-10, and 12-14 mm shell length categories. Female crayfish readily consumed all size classes while males preferred small and mid-sized mussels. Members may recall reference to the zebra mussel as being fouling organisms on *Orconectes* sp. in the Great Lakes Region. However, MacIssac suggests, to the contrary, that the crayfish may affect local densities and size distributions of the mussels.

News from the People´s Republic of China

Member Shu Xinya (Hubei Fisheries Science Institute, No. 18 Dong Hu Road, Wuhan, People's Republic of China) sends a summary of information about production of crayfish products in the PRC. Total exports exceed 204 tons. There are three processing factories and smaller units where tail meat is produced in Hubei, Jiangsu, Jiangxi, Shanghai, and Zhejiang Provinces. Crayfish, *Procambarus clarkii*, are becoming more and more popular each year in local markets. There is increasing interest in crayfish production on farms and in private culture sysems. However, the government has not yet shown special interest in crayfish production.

The Australian Red Cla[illegible]rayfish, *Cherax quadricarinatus*, has been introduced into 8 provinces in China and has been well accepted by farmers. It is now a part of the developing Chinese crayfish industry.

Eystalk ablation report

A report about a new method to increase soft-shell crayfish production is now available from the University of Southwestern Louisiana's Crawfish Research Center. The method, called "destalking" increases production efficiency by a factor of three. The method involves removal (amputation) of the two eyestalks from each crayfish. The eyestalks contain the nervous tissue that produces a molt inhibiting hormone. As a result, the crayfish shed their exoskeletons in about 10 days. This compares favorably to untreated crayfish which take 40-50 days to shed their exoskeletons.

The report is entitled: Practical Application of Bilateral Eyestalk Ablation for Production of Soft-Shell Red Swamp Crawfish and White River Crawfish." Authors include Jay Huner and Christopher Wiggins of the University of Southwestern Louisiana and their Louisiana State University cooperators, Shulin Chen and Ronald Malone. It was published in the Proceedings of the 1993 Louisiana Aquaculture Conference. The research was funded by a grant from the Louisiana Sea Grant College Program. It may be obtained from the Crawfish Research Center, University of Southwestern Louisiana, Lafayette, Louisiana 70504-4650 USA.

Book of Abstracts on Aquaculture

The World Aquaculture Society held its annual meeting January 14-18, 1994 in New Orleans, Louisiana USA. A book of abstracts was published with most "abstracts" being full page summaries. Authors, titles, and page citations for crayfish papers follow. Contact WAS, 143 Parker Coliseum, Louisiana State University, Baton Rouge, Louisiana 70803 USA, to obtain copies of the abstract books.

1. Miltner, M. R., D. B. Jones, & A. Wilson. 1994. Rotation of raice, (*Oryza sativa*), and a native Florida crawfish, *Procambarus alleni*, as a sustainable aquaculture alternative in the Everglades Agricultural Area. p. 169.
2. Huner, J. V., B. Fluery, R. P. Romaire, & T. Sherry. 1994. Observations on avian predation in southern Louisiana (USA) crawfish culture systems with emphasis on wading birds. p. 191.
3. Liu, H. & J. W. Avault. 1994. Effect of nitrite on growth of red swamp crawfish juvenile, *Procambarus clarkii*. p. 192.
4. McClain, W. R. 1994. Growth of crawfish (*Procambarus clarkii*) as a function of density and food resources. p. 193.
5. Huner, J. V. 1994. Development of low cost supplemental feeds for crawfish, *Procambarus* spp., pond systems. p. 194.
6. Chen, S. & R. F. Malone. 1994. Improving soft-shell crawfish production using eyestalk ablation and temperature control. p. 195.
7. Meade, M. E. & S. A. Watts. 1994. A comparison of the growth of hatchling Australian crayfish, *Cherax quadricarinatus*, fed various formulated and commercial feeds. p. 198.
8. Yeh, H. & D. B Rouse. 1994. Stocking density, sex ratio and water temperature affects on the spawning rate of red claw crayfish, *Cherax quadricarinatus* (Von Martens). p. 199.
9. Medley, P. B. & J. W. Avault, Jr. 1994. Production capabilities and economic potential of an Australian red claw crayfish hatchery inn the United States. p. 201.
10. Henttonen, P., J. V. Huner, & O. V. Lindqvist. 1994. Possible movement of epibionts, parasites and diseases with crayfish introductions. p. 244.
11. Webster, C. D., L. S. Goodgame-Tiu, J. H. Tidwell, & D. B. Rouse. 1994. Evaluation of practical feed formulations with different protein levels for juvenile red claw (*Cherax quadricarinatus*). p. 246.
12. Faulkner, G. & J. V. Huner. 1994. Polyethylene trawl system for harvesting crawfish, *Procambarus* spp., in culture ponds. p. 247.
13. Wiggins, C., J. V. Huner, L. Fall, D. Drennan, & R. Malone. 1994. Practical crustacean holding, purging, and molting systems with restaurant applications. p. 248.
14. Yamamoto, A., R. Pedroza, P. Chavez, H. Ledesma, & M. Janczur. 1994. Extruded feed for crawfish from Spirulina alga. p. 250.
15. Villarreal, H. 1994. Effect of changes in dietary protein content of commercial diets on the growth and biochemical composition of the Australian crayfish *Cherax tenuimanus*. p. 251.

Physiological Adaptations Symposium

This symposium was organized by members Brian McMahon (Dept. Biological Sciences, Univ. of Calgary, Calgary, Alberta Canada T2N 1N4) and Milton Fingerman (Dept. Ecology, Evolution & Organismal Biology, Tulane Univ., New Orleans,

Louisiana 70118 USA). Its principal sponsors were the IAA and The Crustacean Society. Titles and authors follow. The papers will be published as review articles in a unit in The American Zoologist.

B. R. McMahon & M. Fingerman. 1994. Introduction to the Symposium.

B. R. McMahon. 1994. Adaptations of oxygen uptake and transport in burrowing crayfish.

C. N. Reiber. 1994. Physiological adaptations of crayfish to the hypoxic environment.

M. G. Wheatly & A. Gannon. 1994. Ion regulation in crayfish: freshwater adaptation andd the problem of moulting.

J. V. Huner & O. V. Lindqvist. 1994. Physiological adaptation of crayfishes that permit successful aquacultural enterprises.

P. B. Brown. 1994. Physiological adaptations in the gastrointestinal tract of crayfish.

H. Atwood. 1994. Neural adaptations in crayfish.

J. L. Wilkens. 1994. Cardiovascular control metchanisms in crayfish.

E. Frixione. 1994. Pigmen migration in photoreceptors during light/dark adaptations.

K. Söderhäll. 1994. Crustacean immunity: molecular adaptation to disease adaptations.

M. Fingerman. 1994. Endocrine mechanisms in the crayfish with emphasis on reproduction and neurotransmitter regulation of hormonal release.

Catalonia ends *Procambarus* fishing

According to L'Astaciculteur de France (37:1993) "a resolution taken at Barcelona shows that in Catalonia red swamp crayfish is considered as an agricultural plague and can be destroyed by chemical treatments made by the administration. To avoid competition between rice farmers and crayfish fishermen in Andalusia, commercial fishing of crayfish is forbidden."

Procambarus in the Netherlands

Member Professor L. B. Holthuis (National Museum of Natural History, Postbus 9517, 2300 RA Leiden, The Netherlands) sends the following commentary about *P. clarkii* in his country.

As to *Procambarus clarkii* in the Netherlands, it seems to have established itself firmly in the canal system of The Hague. The story started in 1985, when someone from The Hague came to this Musem with a live *Procambarus clarkii*, which he had fished in one of the canals of The Hague and wanted to know the name and what to do with the animal. I advised him to keep it in an aquarium, but not to set it free, which he had suggested. A few days later an account of this finingd appeared in a local newspaper of The Hague. Three days after that, in a letter to the editor of the paper, a keeper of a restaurant mentioned, in connection with an earlier story, that about 6 years earlier he had received on trial a batch (about 10 specimen) of crayfish from Kenya. He found them too small for his purpose, and not wanting to kill them, dumped in the canal in front of his restaurant. He thought that the 1985 crayfish might be one of his 1979 lot which of course is improbable judging by the lapse of 6 years. The 1985 specimen could be of the second generation of the of the 1979 lot; the fact that the latter came from Kenya makes it pretty well certain that it also is *Procambarus clarkii*. The two above canals are in communication with each other and with the canal in which the electricity plant of The Hague empties its used cooling water. This heated cooling water keeps the temperature of the water in these canals rather high. This water is lead to a canal outside The Hague which empties into the sea and is used to get excess water and sewage from the town to the sea. The quantity of water is surprisingly rather high. The outside canal is rather famous because it never freezes over in the winter and lots of ducks, geese and other waterfowl concentrate there in the winter when most other waters are frozen over. As a schoolboy living in The Hague and being an entousiastic birdwatcher, I learned practically all of my duck species there. In this canal system with its heated water *Procambarus clarkii* has established itself. Recently a friend of one of our Museum collaborators collected 235 specimen of *Procambarus* in a canal in The Hague, in one evening. This is the only record of a reproductive population in the Netherlands. In Leiden a few specimen were collected outside and in water with a higher temperature (also near the electricity plant), but these finds, as well as others in the Netherlands, are too incidental to form the basis for definite conclusions.

Procambarus in England

IAA Correspondent John Foster (National Rivers Authority, Chichester Area Office, Oving Road, Chichester, West Sussex PO2O 6AG, England) sends the following personal observations about *P. clarkii*.

A specimen of *Procambarus clarkii* (with a carapace length of 58 mm) caught from the wild at Harrietsham, Kent, S. E. England was, in fact, a fertile berried female with twenty to thirty attached eggs. The quantity of eggs was small for the specimen's size and I am sure that many were lost through disturbance or handling before it reached me. I kept the specimen in a tank at ambient room temperature and, consequently, thirteen of the eggs hatched in the last forthnight of October 1993. The other eggs were either infertile or diseased. I am rearing the hatchling in isolated tanks for interest; their growth rate, as you know, is phenomenal compared to native *A. pallipes*. The two important pertinent facts about the above events are that this is:

(1) the first record of fertile berried *Procambarus clarkii* caught from the wild in the British Isles.

(2) the first record of a successful hatching of eggs from *Procambarus clarkii* caught from the wild in the British Isles.

However, it should be noted that the above two facts are not conclusive proof that *Procambarus clarkii* young can successfully overwinter in the British Isles nor is it conclusive proof that adult *Procambarus clarkii* can breed in the wild. Consequently, I am keeping some *Procambarus clarkii* at ambient environmental temperatures from January until Spring and noting their survival pattern....

News from Finland

IAA correspondent Jorma Kirjavainen, (Finnish Game and Fisheries Research Institute, Evo State Fisheries and Aquaculture Research Station, FIN-16970 Evo, Finland), have send the following information on various matter regarding crayfish.

Finnish crayfish regulations revised

The Finnish Fishing Decree (30.12.1982/1116) concerning crayfish catching has changed on 1.3.1993. Also The Finnish Fishing Act has changed in December 1993, but there were no dramatical changes concerning direct to crayfish or crayfish management. Here is a short view to Finnish crayfish legislation.

The Finnish Fishing Act says in § 34: "The close seasons for fish and crayfish are provided by decree. During the close season for a fish species or crayfish, no such trapping tackles shall be kept in the water which have been made for or are especially suited to its catching". § 35 of the Act says: "The smallest sizes for fish and crayfish caught in natural waters are provided by decree. The delegation for the fishing area may for a certain period and in a determined water area prescribe that the size reffed to in Subsection 1 is to be bigger for a fish species or crayfish than decreed, if specifically necessitated in order to achieve the goals mentioned in § 1". § 1 of the Act says: "When engaging in fishing, efforts shall be made to maintain the maximum permanent productivity of the waters. Special attention should be paid to exploiting the fish stock rationally, with consideration for the aspects of the fishing industry, and to caring for and increasing the fish stock. Consequently, such measures shall be avoided that might harmfully or adversely affect nature or the balance of nature". § 4 of the Act says: "What is prescribed on fishing rights in this Act or according to this Act also concerns, to the extent appropriate, the right to catch crayfish".

In the new Fishing Decree (12.2.1993/179) the old § 20: "Catching crayfish which are less than 10 centimetres long measured from the tip of the frontal spine to the outer edge of the middle carapace of the straightened tail shall not be permitted" is now ceased, i.e. after 1.3.1993 there isn't minimun size for noble crayfish or signal crayfish any more. The closed season is the same as before, but now also the signal crayfish (*Pacifastacus leniusculus*) is named in the legislation and it has the same closed season as noble crayfish (*Astacus astacus*). § 18 says: "Noble crayfish and signal crayfish are protected by law and catching them from the beginning of November to the 21 July noon shall be prohibited". i.e. it is allowed to catch crayfish from 21.7. 12:00 am to 31.10. 12 pm.

Signal crayfish didn't have a closed season or miniumum size in the old legislation, because this new introduced crayfish species was not known in the old legislation. The total catch of signal crayfish is nowadays in Finland still only about 10 000 individuals per year, but the catch is increasing rapidly and therefore it was necessary to set the same closed season for both crayfish species. There are 113 waterbodies where signal crayfish has been introduced at the end of 1992. There are also some lakes where noble and signal crayfish are living together sympatric in the same areas.

To protect crayfish stocks from overfishing water owners have still a possibility to set local restritions (e.g. minimum size, gear restriction or pacification).

The new legislation have probably some positive effects in crayfish management. E.g. stocking possibilities of noble crayfish are now better because water owners do not need a special licence from ministery of agriculture and forestry if they want to catch noble crayfish smaller than 10 cm for stocking purposes. They still need a licence from local fishery authorities for stocking new crayfish species (e.g.

signal crayfish) or for stocking crayfish from one lake to another. § 121 of the Act says: "When a fish or crayfish species is planted into waters where it has not perviously existed, or if fish or crayfish are transplanted to the area, the measure shall receive the permission of the fishing district".

The annual catch of noble crayfish, 4,8 million individuals (4,2 mill. from lakes and 0,6 mill. from rivers) in 1992, will probably increase at least in the next few years, because we have several stunted populations where almost all the of catch is smaller than 10 cm. Of course the price is lower for small crayfish. In Finland crayfish are traditionally sold by the piece, about 10 FIM (2 US$)/individual, but propably in the future there will be a kiloprice for crayfish. There has not been weakening of price yet, but it will be interesting to follow the results in coming years.

Finnish freshwater crayfish markets

The fresh living noble crayfish in size 10-12 cm in TL is the most wanted in Finnish crayfish trade. There are no markets for crayfish under 9 cm in TL for eating purposes. The signal crayfish is almoust as wanted as noble crayfish but the red swamp crayfish (*Procambarus clarkii*) and the narrow-clawed crayfish (*Astacus leptodactylus*) are not so wanted, but because of lower price of them, people eat several millions individuals of these imported species every year. The markets for crayfish are quite low outside of the traditional crayfish season (from 21. July to 31. October).

The mean price in customsbrokers official statistics was 27,68 FIM/kg (4,82 US $/kg) for frozen imported red swamp crayfish (*P.c.*) and 28,40 FIM/kg (4,95 US $/kg) for frozen imported narrow-clawed crayfish (*A.l.*). Most of the imported freshwater crayfish was frozen. The mean prices for salt dillwater cooked, frozen and vacuumpacked narrow-clawed crayfish for consumers was 6,6 FIM (1,15 US $) and red swamp crayfish 2,4 FIM (0,42 US $) per piece (individuals were 30 g in meanweight and 10 cm in TL), i.e. kiloprices were 34,49 and 12,54 US $ respectively.

The total crustacean-import in Finland in 1992 was 2200 tn and the value was 72 Million FIM (12,54 Million US$). Most of the import (95% of weight and 89 % of value) was prawns (*Pandalus borealis*) from Norway. The value of freshwater crayfish import was 2,3 Million FIM (0,4 Million US$) of which 2,07 Million FIM (0,36 million US $) was frozen and 0,25 Million FIM (0,04 Million US $) fresh. Most of the imported freshwater crayfish was from USA (5[illegible] tn and 1,62 Million FIM (0,28 Million US $); mainly *Procambarus clarkii*) and from Russia (6 tn and 0,23 Million FIM (0,04 million US $) *Astacus leptodactylus*). The import seems to be in 1992 as large as the recent years.

Licence needed to catch crayfish

Every 18 year old person who want to catch crayfish or fish in Finland must in most cases buy two fishing licence. First you have to buy the Finnish State fishing licence in the post office (the price is in 1994 80 FIM + expences 8 mk (13,94 + 1,39 US $)). (If you want to fish in the three norternmost communes (Enontekiö, Inari, Utsjoki) in nortern Lappland, you have to buy another State fishing licence for this area, but in this area there are no dense crayfish populations).

After you have bought the State fishing licence you have to buy also a licence from water owners for crayfish traps or for any other equipments you want to use. § 5 of The Fishing Act says: The right to engage in fishing and stipulate on it belongs to the owner of the waters and the § 2 says: The holder of fishing rights is in first place responcible for organizing fishing and the caretaking of the fish stock in way that duly takes account the goals mentioned in § 1.

The water owners, usually there are several owners in one waterbody (§ 3 of the Fishing Act says: The joint owners of fishing waters belonging jointly to several real estates form a fishing corporation), have different price for different catching equipments and the price is not the same for every waterbody. Most water owners (fishing corporations or private persons) have restrictions in amount of traps and the price for one trap is 5-10 FIM (1-2 US $) on average.

There is also a possibility that fishing corporation sell crayfish licence only for local people and for people who are living in site all the summer. § 9 of The Fishing Act says: "Each inhabitant, temporary residents (person who does not own the residence he uses nor has lived there continuously for at least 4 weeks) excluded, of a village has a right to acquire a licence to fish for domestic needs or recreation in an area situated within village boundaries and designated by the owner of the waters, on condition that the directions of the owner are observed. The holder of such licence is obliged to pay the owner of the waters a reasonable fee". Sometimes it is a little difficult to find a person who is allowed to sell the fishing licences, but usually the local people knows somebody who sell them. Almoust all the money

from licences is spent for [illegible]cking purposes.

Crayfish stockings in Finland

Crayfish stocking activity is increasing all the time in Finland. The economic value of noble crayfish and signal crayfish stockings was about 3 000 000 FIM (522 600 US $) in year 1993. Expecially stockings of signal crayfish have increased very rapidly, because the crayfish plague has reduced noble crayfish populations now 100 years and most of the crayfish waters have not been restored by noble crayfish stockings. Signal crayfish stockings are concentrated to River Kokemäki-waterway in southern Finland and noble crayfish stockings to eastern and central Finland.

This figure is from a brochure for "Die Igeho 93" in Basel. The crayfish is made from various kitchen tools.

Crayfish genetic studies

Member Keith A. Crandall (Dept. of Zoology, Univ. of Texas, Austin, Texas 78712-1064 USA) sends the following information about his recent work in the area of crayfish genetics.

My dissertation, titled "Molecular systematics and evolutionary biology of the crayfish subgenus *Procericambarus* (Decapoda: Cambaridae)," [Washington University, St. Louis, Missouri USA] uses nucleotide sequence data to estimate the phylogenetic relationships of the 24 species within the subgenus and additional species from the genus *Orconectes*. I then show how these phylogenetic relationships are useful in studying a number of evolutionary questions. First, I determine biogeographic relationships within the central highlands region of the United States and relate these findings to the center of origin hypotheses for both the genus and subgenus. I then examine functional morphological relationships with certain ecologies. Finally, I address conservation biologicla issues using the crayfish to rank aquatic habitats for conservation priorities and endangered status for the crayfish species themselves.

With the completion of my doctoral thesis, I have an Alfred P. Sloan and NSF postdoctoral fellowship at the University of Texas at Austin to study the generic relationships within the Cambaridae while addressing questions in molecular evolution using nucleotide sequencing.

Louisiana Crayfish situation

The extensive flooding and high waters of the Mississippi River System and Chinese crayfish production have greatly influenced the Louisiana crayfish situation. Mississippi River flooding in the central USA had no direct effect on Louisiana - no damage; however, it kept water in the Atchafalaya Basin high throughout the summer and into the autumn. There was no real low water there and fishermen produced crayfish continuously from November 1992 into November/December 1993 - the first time on record that there was no real break in production. Total Basin production was approximately 70 million pounds compared to 51 million pounds from the state's crawfish ponds. This saturated live markets and huge quantities of inexpensive crawfish meat were stored. Needless to say, this depressed prices paid farmers and fishermen during the season and has carried over into the current farm season.

Around 925,000 pounds of frozen Chinese crawfish meat was imported into the USA in the last 6 months of 1993. This further depressed prices paid for crawfish meat and live crawfish.

At this writing, late January 1994, cold weather and lower water in the Atchafalaya Basin have combined to reduce the availability of live crayfish. This has caused prices to rise from around $1.00 per kg before Christmas to around $1.75 per kg now. It is impossible to say how long this will last. Warm weather will begin in late February-early March and pond crayfish will become abundant then. Prices will probably decline then again. Many farmers may opt to drain their ponds then and plant rice to reduce losses. If, however, it appears that there will not be a good "Basin" season, they may continue to harvest.

So, persons interested in the status of the Louisiana crayfish season will have to follow it almost week to week to determine what supplies and prices will be like. Remember, it is impossible to predict the water regime in the Mississippi River System which, ultimately, controls the availability of wild crayfish.

The figure above is from an application form for crayfish aquaculture in Sweden illustrating the relationship between crayfish and official laws.

Bombastus - the giant crayfish?

The Danish magazine "Ferskvandsfiskeribladet 12, 1993) presented an article on Bombastus a giant crayfish caught outside the isle Bornholm. Bambastus was claimed to be an *Astacus astacus* measuring 240 mm total length compared to previous records of only 160 - 170 mm TL. The article had few specific data and member Henrik Jörgensen (Skov- og Naturstyrelsen, Haraldsgd 53, DK-2100 Köbenhavn Ø, Denmark) was asked to comment on the issue. The observation is from 1985, and the crayfish was caught in the sea outside Bornholm. The sea has a salt content of 7‰. Where the crayfish actually come from no one knows but there are some speculations about crayfish parties on boats and so forth. The crayfish was caught and then released after having being measured to 240 mm TL, which means we have no more information on Bombastus. Based on the photos featuring the article we feel that the size of the crayfish is overestimated, if on the other hand the hand holding the crayfish do not belong to another giant. Henrik Jørgensen claims that the size of the claws should have been close to 260 mm on a 240 mm TL male crayfish based on the relationship established for the size of chelipeds and body size on Danish crayfish.

Information on Louisiana crayfish season

The most reliable sources of information about the Louisiana crayfish season are the Louisiana Cooperative Extension Service - Knapp Hall, Louisiana State University, Baton Rouge, Louisiana 70803 USA [504-388-4141] and the Louisiana Dept of Agriculture and Forestry, P.O. Box 3334, Baton Rouge, Louisiana 70821 USA [504-922-1280].

Crayfish Book and harvest news from Russia

Member V. P. Fedotov (Timurowskaya Str. 22/1-147, Saint Petersburg, 195297, Russia) has published a Russian language crayfish book - "Breeding of the Crayfish" - which may be ordered from the referenced address. Cost is $USD25. The book is well illustrated and an English summary explains the contents of the 10 chapters which are oriented toward the commercial exploitation of crayfish resources in Russia.

Dr. Fedotov serves as Chairman of the Crayfish Section for the Russian Council of Invertebrate Animals and Water Plants - Basin Directorate. According to a 1992-93 survey the following information on Russian crayfish stocks is provided: Karelia, 2 million *Astacus astacus* and 3 million *Astacus leptodactylus*; lower Volga River Basin, 140 tons *A. leptodactylus*; Cuban River Basin, 300 tons *A. leptodactylus*; north-west region of Russia including Leningrad, Novgorod, Pskov, Volgodsekaja Provinces, 27 tons *A. astacus*. Information about other areas is lacking.

Bioswyaz solicits aquaculture business in Russia

Member V. P. Fedotov's firm "Bioswyaz" is involved in the organization of crayfish farms in Russia. He explains that there is a need for water quality monitoring devices, general aquaculture equipment, etc. in Russia. Persons interested in trade contacts should contact Mr. Fedotov at Bioswyaz, Box 152, Saint Petersburg, 195176 Russia - Fax 812 227-47-91.

Protocols for crayfish pathogen methodology

This Nordic course is planned to take place in Jyväskylä, Finland 9 - 18 August 1994. The preliminary program includes comparative immunology, presentation of known pathogenic organisms on crayfish, health control situation in the Nordic countries, identification methods and a lot of practical demonstration and laboratory work. The aim is to evolve a common protocol for diagnosis of parasites for comparative studies.

For more information contact member Jari Rantamäki, University of Jyväskylä, Dept of Biology, POBox 35, FIN-40351 Jyväskylä, Finland.

News from Louisiana Crawfish Resarch Center

The following new fact sheets are available from the University of Southwestern Louisiana's Crawfish Research Center (P.O. Box 44650, Lafayette, Louisiana 70504 USA).

Huner, J. V. 1993. Methods to Reduce Wading Bird Numbers in Crawfish Ponds. 2 pp.

Huner, J. V. 1993. Notes on Identification and Habits of Wading Birds. 2 pp.

Huner, J. V. 1993. The Crawfish Pond - Louisiana's Autumn Oasis for Waterfowl. 2 pp.

Huner, J. V. 1993. Theoretical Importance of Levees for Burrow Spaces in Crawfish Ponds. 1 p.

Huner, J. V. & L. Burras. 1993. Some Observations about Crawfish Burrows and Their Significance in Crawfish Culture in Louisiana. 1 p.

Huner, J. V. 1993. Crawfish in Louisiana. 2 pp.

Huner, J. V. 1993. L'ecrevisse en Louisiane. [Translated by Pierre J. Laurent]. 2 pp.

Crustaceana

Past - President David Holdich has become part of the editorial board of Crustaceana. We congratulate and feel that this will enhanche astacological studies in the future.

Recent publications of interest to astacologists

Adao, H. & J.C. Marques. 1993. Population biology of the red swamp crawfish *Procambarus clarkii* (Girard, 1852) in Southern Portugal. Crustaceana 65 (3):336-345.

Andrews, L.S. & R.M. Grodner. 1993. Gamma-irradiation of *Listria monocytogenes* in crayfish (*Procambarus clarkii*) tail meat. Seventeenth Annual Tropical and Subtropical Fisheries Technology Conference of the Americas, pp 118-122.

Baldridge, Terry & D. Huffman. 1993. Crawfish production and harvesting economics in Louisiana. Department of Agricultural Economics Research Report No. 695, Louisiana State University Agricultural Center, Baton Rouge, Louisiana USA.

Burba, A. 1993. Nouvelles de l'ecrevisse en Lithuanie - Facts about the crayfish in Lithuania. L'Astaciculteur de France 36:2-6.

Cassan, Y. 1993. Programme experimental en faveur de l'astaciculture en Charente, Compte rendu d'etape au 15 Octobre 1993. Chambre d'Agriculture de la Charente, B. P. 1364, F-16 016 Angouleme, France. 20 pp.

Daubie, G., P. J. Laurent, & L. Paris. 1993. Une methode pour surveller les populations d'ecrevisses: les briques creuse - Hollow bricks, as survey method for crayfish populations. L'Astaciculteur de France 37:2-5.

Delmastro, G. B. 1992. Sull'acclimatazione del gambero della Louisiana *Procambarus clarkii* (Girard, 1852) nelle acque dolci italiane (Crustacea: Decapoda: Cambaridae). Pianura, supplemento di Provincia nuova No. 4:5-10. Italian, English Summary.

Didonato, G.T. & D.M. Lodge. 1993. Species replacement among *Orconectec crayfishes* in Wisconsin lakes- the role of pedation by fish. Can J Fish Aquat Sci 50(7):1484-1488.

Diéguez-Uribeondo, J. & K. Söderhäll. 1993. *Procambarus clarkii* Girard as a vector for the crayfish plague fungus, Aphanomyces astacis Schikora. Aquacult Fish Management 24:761-765.

Dorsa, W.J., D.L. Marshall & M. Semien. 1993. Effect of potassium sorbate and citric acid sprays on growth of *Listeria monocytogenes* on cooked crawfish (*Procambarus clarkii*) tail meat at 4C. Food Sci Technol-Lebensm Wiss 26(5):480-482.

Douglass, J.K., L. Wilkens, E. Pantazelou & F. Moss. 1993. Noise enhancement of information transfer in crayfish mechanoreceptors by stochastic resonance. Nature 365 (6444):337-339.

Fleury, Bruce. 1993. Crisis in the crawfish ponds. Living Bird. Winter 1994:28-34.

Garciacarreno, F.L. & N.F. Hard. 1993. Characterization of protein classes in langostilla (*Pleurncodes planipes*) and crayfish (*Pacifastacus astacus*) extracts. J. Food Biochem 17(2):97-114.

Henry, J. M., Y. Goux, & J. F. Suat. 1993. Elever des ecrevisses pied rouges dans les Mille-Etans. Parc Naturel Regional des Ballons de Vosges, 1, cour de l'Abbaye, B. P. 11, F-68 140 Munster, France. 16 pp.

Hobbs, H.H. & D.J. Peters. 1993. New records of entocytherid ostracods infesting burrowing and cave-dwelling crayfishes, with descriptions of 2 new species. Proc Biol Soc Washington 106(3):455-466.

Holdich, D. M. 1993. A review of astaciculture: freshwater crayfish farming. Aquatic Living Resources 6:307-317.

Huner, J. V. 1993. The economics of crawfish, rice and birds in Louisiana fields. First Annual Agro Ecology Conference, Dept. of Renewable Res, College of Applied Life Sciences, Univ. SW Louisiana, Lafayette, Louisiana 70504 USA, 4pp.

Ilheu, M. & J. M. Bernardo. 1993. Aspects of trophic ecology of red swamp crayfish (*Procambarus clarkii* Girard) in Alentejo, South of Portugal. Atas VI Congreso Espanol de Limnologia Granada, Mayo de 1993:417-423.

Jezerinac, R.F. 1993. A new subgenus and species of crayfish (Decapoda, Cambaridae) of the genus Cambarus, with an amended description of the subgenus Lacunicambarus. Proc Biol Soc Washington 106(3):532-544.

Johansson, M.W. & K. Söderhäll. 1993. Intracellular singlanig in arthropod blood cells: Involvement of protein kinase C and protein tyrosine phosphorylation in the response of the 76-kDa protein or the b-1,3-glucan-binding protein in crayfish. Develop and Comparative Immunology 17(6):495-500.

Jones, T.C. & R.G.J. Lester. 1993. Aspects of the biology and pathogenicity of *Diceratocephala boschmai* (Plathyhelminthes:Temnocephalida), an ectosymbiont on the redclaw, *Cherax quadricarinatus*. Aus J Mar Freshwater Res 44(6):927-

Kopacek, P., L. Grubhoffer, & K. Söderhäll. 1993. Isolation and characterization of a hemagglutinin with affinity for lipopolysaccharides from plasma of teh crayfish *Pacifastacus leniusculus*. Develop and Comparative Immunology 17:407-418.

Lanz, H., V. Tsutsumi, & H. Arechiga. 1993. Morphological and biochemical characterization of *Procambarus clarkii* blood cells. Develomental Comparative Immunology 17(5):389-398.

Lanz, H., S. Hernandez, E. Garridoguerrero, V. Tsutsumi & H. Arechiga. Prophenoloxidase system activation in the crayfish *Procambarus clarkii*. Develop Comparative Immunology 17(5):499-407-.

Louisiana Sea Grant. 1993. Crawfish: Louisiana's Gift - Sea Facts. Louisiana Sea Grant Program, Louisiana State Univ, Baton Rouge, Louisiana USA.

Love, J. & Savino, J.F. 1993. Crayfish (*Orconectes virilis*) predation on zebra mussels (*Dreissena polymorpha*) J Freshwater Ecology 8(3):253-260.

Loya-Javellana, G. N., D. R. Fielder & M. J. Thorne. 1993. Food choice by free-living stages of the tripical freshwater crayfish, *C. quadricarinatus* (Parastacidae: Decapoda). Aquacult 118:299-308.

McClain, W. R., P. K. Bollich, & D. C. Huffman. 1992. Relaying: a new way to grow crawfish in rice fields. Louisiana Agriculture 35(4):3-4.

Momot, W. T. 1992. Further range extensions of the crayfish *Orconectes rusticus* in the Lake Superior Basin of northwestern Ontario. Canadian Field-Naturalist 106:397-399.

Moore, D. & J.L. Larimer. 1993. Cyclic postural behavior in the crayfish, *Procambarus clarkii*: Properties of the pattern-initiating network. J Exp Zool 267(4):404-415.

Naqvi, S. M. & C. Vaishnavi. 1993. Bioaccumulative potential and toxicity of endosulfan insecticide to non-target animals. Comp. Biochem. Physiol. 105C:347-361.

O'Brien, B. 1993. Marron reproduction. Marron Growers Association Bulletin 15(2):6-7.

The Danish Crayfish Growers Association send this Merry Christmas drawing to their members which also includes an address change. The Danish Crayfish Grower Assoc, Rørkærvejen 3, DK-5771 Stenstrup, Denmark.

Reynolds, J. D., J. D. Celada, J. M. Carral, & M. A. Matthews. 1992. Reproduction of astacid crayfish in captivity - current development and implication for culture, with special reference to Ireland and Spain. Invertebrate Reprod and Develop 22:253-266.

Sarojini, R., P.S. Reddy, R. Nagabhushanam & M. Fingerman. 1993. Naphtalene-induced cytotoxicity on the hepatopancreatic cells of red swamp crayfish, *Procambarus clarkii*. Bull Environ Contamination & Toxicology 51(5):689-695.

Stone, E.L. 1993. Soil burrowing and mixing by a crayfish. Soil Sci Soc Amer J 57(4):1096-1099.

Söderhäll, K., J. Rantamaki, & O. Constantinescu. 1993. Isolation of *Trichonsporon beigelii* from the freshwater crayfish *A. astacus*. Aquacult 116:25-31.

Somers, K. M. & R. H. Green. 1993. Seasonal patterns in trap catches of the crayfish *Cambarus bartoni* and *Orconectes virilis* in six south-central Ontario lakes. Canadian J. Zool. 71:1136-1145.

Stone, Earl L.1993. Soil burrowing and mixing by a crayfish. J. Soil Science 57:1096-1099.

Thornqvist, P.O. & K. Söderhäll. 1993. *Psorosper-mium haeckeli* and its interaction with the crayfish defense system. Aquaculture 117(3-4):205-214.

Ushio, H. & S. Watabe. 1993. Ultrastructural and biochemical analysis of the saproplasmic reticulum from crayfish fast and slow striated muscles. J Exp Zool 267(1):9-18.

Whisson, G. 1993. Growing fish and marron together. Marron Growers Association Bulletin 15(2):8-9.

Member has a new post

Member Michael D. "Cowboy" Delong has a new post at the Biology Department at Winona State University in Winona, Minnesota USA. Mike says that he plans to continue the work that he initiated in Louisville (Kentucky) dealing with *Orconectes putnami* in the Ohio River. However, much of his work is oriented toward amphipods and ecosystems.

Lost members

Knudsen, Hans Christian - Kaigaten 9, N-5016 Bergen, Norway.

New members

Blair, A. F. "Bob" - 309 Plater Drive, Thibodaux, Louisiana 70301-5611 USA. Tel. (504) 446-5543. Species - *Procambarus clarkii*. This is a Business Membership.

Lawrence, Craig - Western Australian Marine Research Laboratories, Box 20, North Beach, Western Australia 6020, Australia.

Moore, Warren - P.O. Box 855, Cloverdale, Western Australia 6105, Australia.

Novoseltsev, G. - Laboratory of Hydrobiology and Aquaculture Leader, SevRibNIIRH, 185650, Petrozavodsk, Varcaus 3, Karelia, Russia.

Reinach, H. A. Dr., P. O. Box 22224, Exton Road 9313, Bloemfontein, Republic of South Africa.

Reinach, N., P. O. Box 22224, Exton Road,