IAA XV

Crayfish experts from all over the world will gather at the fifteenth symposium of the International Association of Astacology

29th March – 2nd April 2004

LONDON

Monday 29 March	Welcome, reception & registration
Tuesday 30 March	Lectures & posters, Zoological Society, Regents Park.
Wednesday 31 March	Lectures at Zoological Society and see London Zoo with professional staff guides to the aquaria and biodiversity exhibits.
Thursday 1 April	Lectures at Zoological Society plus astacologists dinner in the evening.
Friday 2 April	Meeting finalises in the historic Darwin Room, Linnean Society, Piccadilly.

Plus a Field trip
Saturday 3rd April - Monday 5th April
Visit crayfish projects & sites in England and Wales, short explanations and opportunity for informal discussions.

This is a chance to hear research and opinions from astacologists worldwide and to present your research and views.

The symposium is open to all, further details and registration at www.crayfish15.org

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Crayfish NEWS

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The official newsletter of the International Association of Astacology

CRAYNET MEETING IN NORWAY

Catching crayfish from a population re-established after crayfish plague in Halden, Norway

The second thematic meeting of CRAYNET entitled "European native crayfish with a focus on *Astacus astacus*: linking socioeconomics and conservation" was held in Halden, Norway from 1 to 4 September 2003. Organisers were **Trond Taugbøl** (Norwegian Institute of Nature Research, Norway), **Lennart Edsman** (National Board of Fisheries, Sweden), Ralf Schulz and Holger Schulz (Technical University of Braunschweig, Germany) and **Przemyslaw Smietana** (University of Szczecin, Poland).

The CRAYNET meetings aim at bringing together not only the core scientists but also other crayfish researchers and managers, to identify necessary research for a common approach to management techniques, and to develop recommend-ations for optimal management strategies at a European scale. The special objective of the Halden meeting was to focus on the cultural and socioeconomic significance of the noble crayfish, *Astacus astacus*, and the important link between conservation and use.

(Continued on page 3)

NEWSFLASH: The IAA 15 Organising Committee have extended the early registration deadline to 16 December 2003. A Registration Form is included in this newsletter. Please e-mail **Liz Watson** (m.watson@ntlworld.com) to advise of your attendance. Members, please spread this news to colleagues who are considering attending what promises to be an excellent event. Details at **www.crayfish15.org**.

The International Association of Astacology (IAA), founded in Hintertal, Austria in 1972, is dedicated to the study, conservation, and wise utilisation 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 has a permanent secretariat managed by Bill Daniels. Address: IAA Secretariat, Room 123, Swingle Hall, Department of Fisheries and Allied Aquacultures, Auburn University, AL 36849-5419, USA.

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President's Corner

It is my pleasure to again write to you as I near the end of my term as President of IAA. Our summer meeting is fast approaching (next March!). Indeed, I recently checked some flight prices from the US to London and happily found some very reasonable fares ($600) available at the moment. So I would like to encourage all of you to book your flights to London from wherever you are so that you can partake of the most enjoyable aspect of our association – the biannual meeting. The meeting is being organized by **David Rogers**, who has established a web site for meeting registration and associated information. Please set your internet browser to http://www.crayfish15.org to find further meeting information and register for this exciting event. I hope to see you all there!

As I discussed during my last letter, we have welcomed on board a group from Germany, the Forum Flusskrebse, who share membership in IAA and their local organization in Germany. As a result IAA has grown significantly and we look forward to this continued partnership. We are now working on a similar arrangement with astacologists from France. Our hope is that these local groups will encourage more interest and involvement in IAA. We especially hope to see all of these new colleagues from Europe join us in London for IAA 15.

Finally, I would like to announce that through great effort by member **Jim Fetzner**, IAA has a new and updated website at :
http://crayfish.byu.edu/IAA/index.htm.
Because this site is new, we anticipate that there will be many things missing and perhaps some link problems. We would encourage all of our members to surf this new site and give us your ideas on how to make it better serve the membership. We look forward to your feedback.

Let me conclude by again encouraging you all to make plans for our upcoming meeting in London (IAA 15: March 29 – April 2, 2004).

Sincerely
Keith A. Crandall, Ph.D.
IAA President

LITERATURE OF INTEREST TO ASTACOLOGISTS

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2. Holdich D. M. 2003. Ecology of the White-clawed Crayfish, *Austropotamobius pallipes*. Conserving Natura 2000 Rivers. Ecology Series No. 1. English Nature, Peterborough. This can be downloaded from www.riverlife.org.uk
3. Kawai, T., Arai, K. and Ohtaka, A. 2003. Local name of the Japanese crayfish, *Cambaroides japonicus* and its specimens from Yamagata Prefecture. Cancer 12:31-35 (in Japanese).
4. Kawai, T. and Mitamura, T. 2003. Taxonomy of introduced crayfish in Fukushima Prefecture, Japan. Cancer 12:29-30 (in Japanese).
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6. López, M., Mejíe, L. M. & Alvarez, F. (2003). *Procambarus* (*Villalobosus*) *achilli* (Decapoda, Cambaridae): a new species of crayfish from Mexico. Crustaceana, 76(5), 523-531.
7. Nakata, K., Hamano, T., Hayashi, K-I. & Kawai, T. 2002. Lethal limits of high temperature for two crayfishes, the native species *Cambaroides japonicus* and the alien species *Pacifastacus leniusculus* in Japan. Fisheries Science, 68, 763-767.
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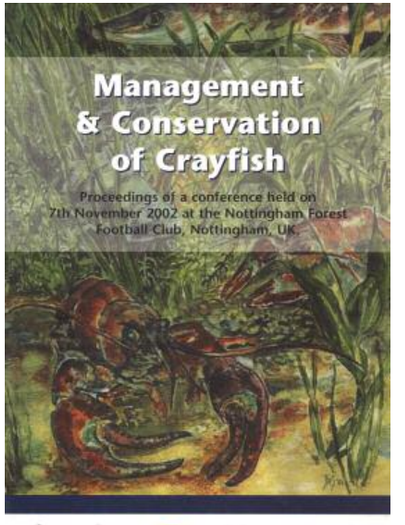

MANAGEMENT & CONSERVATION OF CRAYFISH

The proceedings of the conference on *Management & Conservation of Crayfish* (Holdich & Sibley, 2003) can now be obtained via the Environment Agency website:
http://www.environment-agency.gov.uk

Go into the website and to the 'Choose a Section'. Choose 'Science & Research' and the details are highlighted in red. An e-mail address is given where you can ask for a copy.

My study will investigate the impact of *Cherax quadricarinatus* in Jamaican river systems by examining key biological and ecological factors of *Cherax quadricarinatus* in both rivers; mainly distribution, diet, population density, microhabitat and reproduction. The interactions of *C. quadricarinatus* with the native benthic macro-invertebrates mainly shrimps and gastropods as well as with the invasive snails *Thiara granifera* and *Melanoides tuberculata* (family Thiaridae) will be investigated. The economic effects of the introduction of *Cherax quadricarinatus* will also be determined.

Sacha-Renee Todd and Michela D'Andrea conduct crayfish distribution surveys in a tributary of the Black River

Several crayfish species have been introduced beyond their natural ranges worldwide, either accidentally or intentionally for aquaculture (Gherardi & Holdich, 1999). Typically, these animals had adverse effects on the existing crayfish fauna, including the elimination of native species (Vorburger & Ribi, 1999). No crayfish are native to Jamaican rivers and streams (E. Hyslop, pers. comm.); however, there are 14 indigenous freshwater shrimp species (Hunte, 1978). Of this number, nine occur in the Black River and Rio Cobre systems collectively. Williams *et al.* (2001) warned that the introduced crayfish *Cherax quadricarinatus* possibly constitutes a great threat to indigenous shrimp.

Preliminary results indicate, contrary to reports that *C. quadricarinatus* does not dig burrows in Australia (Wingfield, 2000), that individuals in Jamaican rivers are generally found occupying u-shaped burrows which they construct in the banks of the rivers, each containing a single crayfish. It is possible that *Cherax quadricarinatus* will cause deterioration of riverbanks and consequently alter the habitat.

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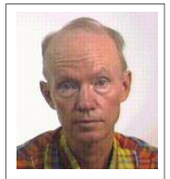
CHANGE OF IAA SECRETARIAT

Dear Astacolleagues,



Jay Huner
IAA legend

I first became associated with IAA in 1972 when I resumed my studies after spending several years in the service. **Jim Avault**, my major professor, asked me to assist him with collecting information about the status of crayfish in the USA. Jim had been invited to make a presentation on the topic in Hinterthal, Austria. There was no IAA at that time; however, when Jim returned, the International Association of Astacology had been established at that meeting with the second meeting scheduled for Baton Rouge, Louisiana in 1974.

The rest, as some say, is history. We now approach our 15th meeting of IAA in London, 32 years later. It has been a pleasure to have served IAA in various capacities over the years, most recently as the general manager of the permanent home office and correspondent to our newsletter. I have enjoyed the opportunity to travel to many interesting venues because of my association with IAA and meet all sorts of wonderful people.

I now realize that it is time to step back and pass the responsibilities associated with the permanent home office to a highly motivated, competent person. I am pleased that **Bill Daniels** has agreed to accept those responsibilities and I look forward to the enthusiasm he will bring to IAA.

Thank you for your past support and good wishes.

Best Regards
Jay Huner

NEW IAA CONTACT INFORMATION:

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PLANNING CLAWS

Plans for a 1200-unit housing estate at Pontypool, South Wales (UK), were scrapped after the discovery of a colony of white-clawed crayfish, *Austropotamobius pallipes*, a protected species, on the site!

***********IAA ELECTIONS***********

It's election time again. If you know of a colleague who could make a contribution to IAA as an Executive Officer, please forward a nomination to the current IAA Secretary, **Catherine Souty-Grosset**:
E-mail: catherine.souty@univ-poitiers.fr

Ballots will then be prepared and sent out in the near future.

EDITORIAL

Thank-you to everyone who contributed to this issue of the newsletter. We've had positive feedback about the last issue, and this time it's a bumper 20 pages!

The e-version of *Crayfish News* is received by 90% of our membership, however, only 13% choose to receive the e-version only. We will continue to make the e-version more attractive in an effort to boost this percentage, which will result in significant savings on postage for IAA.

Glen Whisson
David Holdich

(Continued from page 1)

The meeting gathered 58 participants from 17 countries. The program comprised plenary talks, poster presentations and roundtable discussions from Tuesday morning to Wednesday lunch. A total of 14 plenary talks addressed socio-cultural and socioeconomic aspects, conservation and restocking, trade regulations, genetic variation, survey methods, and perspectives on the past, present and future of crayfish pathology in Europe.

Among the many good and interesting presentations I would like to emphasize the talk given by Prof. Jan-Öjvind Swahn from the Dept. of European Ethnology of the Lund University in Sweden. He presented the cultural history of crayfish and the important role the crayfish has played in the eating habits in Europe, habits that in many countries have become extinct. In the Scandinavian countries the present ritual and ceremonial form of social intercourse, called the "The Crayfish Party", developed during the second half of the 19th C and has been an extremely popular late-summer tradition ever since. The socio-cultural aspect is very important to have in mind when discussing and implementing management and conservation strategies. The poster sessions included 17 posters covering a wide range of topics and crayfish species. For a downloadable version of the abstract booklet from the meeting, see: http://labo.univ-poitiers.fr/craynet/index.htm

The roundtable discussions included four parallel sessions on the following topics:

- Threats to native crayfish populations - crayfish on a landscape level (chaired by Holger Schultz & Ralf Schultz),
- Exploitation, conservation and legislation (chaired by **Lennart Edman** & **Przemyslaw Smietana**),
- Reintroduction of native crayfish, habitat restoration and monitoring (chaired by **Trond Taugbøl** & **Stephanie Peay**)
- Crayfish diseases (chaired by **Brett Edgerton** & **Japo Jussila**).

Delegates of the Halden CRAYNET meeting

FENNO-HUNGARIAN SEMINAR AND WORKSHOP ON SUSTAINABLE DEVELOPMENT OF FISHING TOURISM, BALATONFÜRED, HUNGARY, 2003

A joint Finnish-Hungarian Seminar was held at Balatonfüred, HUNGARY from 14-16 May 2003.

In addition to fishing, crayfishing has got a considerable role in Finnish free-time activities. Lectures about crayfish farming, crayfish diseases and crayfish-tourism were presented.

Ari Mannonen's talk dealt with crayfish aquaculture in Finland and gave a broad picture of crayfish farming in Finland. Pietary Paasonen talked about the most frequent crayfish diseases, and **Japo Jussila** spoke of the developing crayfish tourism that can be an added attraction to those tourists who love to spend their free time by aquatic places. All three work at the Päijänne Institute, HÄME Region, Finland.

The Finnish scientists took part in a crayfishing tour at a pond in Bakony Range, Pannonia, Hungary. They managed to catch several king-size noble crayfish in a relatively short time, so they could contribute to the gastronomic value of their dinner table with a big dish of brilliant red cooked *Astacus astacus*.

The main goal of the seminar was to create a project of co-operation in different fields of fishing tourism. Crayfish tourism can be one branch of fishing tourism. Crayfish grows faster and reach a bigger size in Hungary, so some small scale Finnish crayfish tourism can be developed especially if crayfishing is combined with other Hungarian attractions as gastronomy, wine-routes, landscape, climate and culture.

It was suggested that a crayfish farm should be established in Hungary to serve restocking natural waters and produce crayfish for the table.

The Finns have got the know-how, as there are nearly 100 crayfish farms in Finland, and the Hungarians can offer a suitable place for the First Hungarian Crayfish Farm. Co-financing seems to be possible and some EU resources can be involved into the realisation.

Pál Kiszely
Bartok Bela u 3, H_8230 Balatonfüred, Hungary (Seminar organizer).

ALIEN CRAYFISH INVASION OF JAMAICAN RIVERS

Sacha-Renee Todd and Michela D'Andrea conduct crayfish distribution surveys in a tributary of the Black River

The redclaw crayfish *Cherax quadricarinatus* has been a popular choice for aquaculture since the late 1980s. Brood stock of this Australian native was introduced in 1993 to farms in Jamaica, but owing to improper management, populations have since become established in two of the largest river systems in Jamaica: Black River in the parish of St. Elizabeth, and Rio Cobre in St. Catherine. The first known established specimen was collected from the South Elim River (a tributary of the Black River), in 1999. The large quantities in which this crayfish is now caught and sold by fishermen is an indication of its local abundance.

(continued on page 14)

CRAYFISH ON CARIBBEAN ISLANDS

This is a query about the presence of freshwater crayfish on islands in the Caribbean from **David Holdich** (david.holdich@ntlworld.com)? Last year an article appeared in the British press from a person who said they had eaten freshwater crayfish from the upland rivers in St Lucia. This year a colleague reported having heard that there were four different kinds of freshwater crayfish on Grenada.

According to the literature the only island where native crayfish occur in the Caribbean is Cuba. Does anybody know if crayfish really occur on any of the other islands?

COMPARATIVE STUDY OF OPERA HOUSE TRAPS AND CYLINDRICAL TRAPS FOR CATCHING *ASTACUS LEPTODACTYLUS* IN THE ARASS WATER RESERVOIR, IRAN

At present the crayfish fishermen in Arass water reservoir use only Cylindrical traps (Fig. 1). This study was conducted in 2002 and was aimed at evaluating the catchability, sex ratio and average length and weight of crayfish caught with Opera House traps (Fig. 2) and Cylindrical traps.

The results revealed no significant differences (ANOVA test) between the average length and weight of the crayfish caught with the two types of trap in different months of the year. The CPUE with Opera House traps was greater than with Cylidrical traps and the number caught in 24 h in one trap of the former type was 2.26 number higher.

The ANOVA test also revealed significant differences in the CPUE between the two types of trap in different months. A greater quantity of male crayfish was caught with Opera House traps, but compared with Cylindrical traps in respect of male crayfish catch, the difference was not significant (ANOVA test). Crayfish of more than 120 mm length (minimum standard size for Arass crayfish) in Opera House traps comprised 87.56% of the catch, while by Cylindrical traps, the figure was 69%.

Considering the present research finding, it is proposed that the crayfish fishermen in Arass be allowed to use Opera House traps, because they are more likely to improve crayfish population sustainability.

(Note: full paper is in Farsi)

Karimpour, M., Taghavi, S.A. and Khanipour, A. Caspian Sea Bony Fishes Research Center, P.O. Box 66, Bandar Anzali, IRAN.

E-mail: mohammad _ karimpour @ yahoo.com

Fig. 1. Cylindrical trap

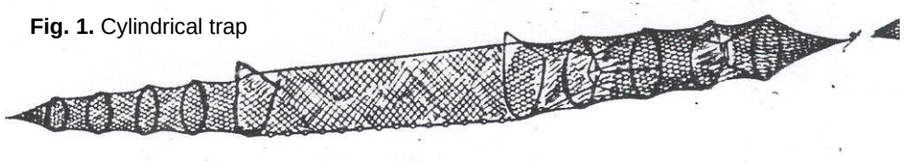

Fig. 2. Opera House trap

The roundtable session finished with a plenary presentation of conclusions and recommendations from the different groups.

Afterwards the core and associated delegates held a meeting to discuss continuing responsibilities within CRAYNET and the way forward to the next Innsbruck-meeting in September 2004.

The conference dinner was held Tuesday night and served as a 18th century dinner in the Kings Halls at the Fredriksten Fortress. In the 18th century, no fork or knife were used! Halden is very close to the Swedish border and the Fredriksten Fortress was ordered to be built by King Fredrik of Denmark in 1660 as defence against the Swedes. At that time Norway was part of Denmark. The last time Fredriksten was of any military importance was in 1905 in connection with the Norwegian-Swedish union dissolution. Since then, the fort has been maintained as an historical monument.

18th century dinner at the Fredriksten Fortress

The last part of Wednesday was assigned to a field trip along the lakes and rivers in the Halden watercourse. Earlier, these were among the best crayfish localities in Norway. The watercourse was hit by the crayfish plague in 1989. Reintroduction of the noble crayfish started in 1995 as a collaborative effort between the environmental authorities and the

The crayfish party is about to start!

landowners. In almost all parts of the watercourse, crayfish recruitment again occurs but crayfish density is still very low and more time is needed for a harvestable population to be developed.

First, delegates went by bus to a place called Strømsfoss where crayfish traps put out the night before were investigated. The catch was rather small, but none the less demonstrated that a crayfish population has been re-established in this plague-affected locality. After the crayfish catching, delegates continued upstream in the watercourse by an old, restored boat, M/S Turisten. The boat trip ended with an exciting lift through the locks at Ørje.

The last part of the field trip and the end of the meeting included a traditional crayfish party, Scandinavian style.

The event took place in idyllic surroundings at the shore of Lake Rødenessjøen. A total of 45 kg of noble crayfish was consumed together with necessary accessories. As usual on crayfish parties, the participants got inspiration for singing and dancing. The aim of the crayfish party was not only social, but also to demonstrate the magic of crayfish eating in a social assembly, and give some impressions of the cultural significance of crayfish in Scandinavia. Delgates returned to their hotel late Wednesday night (early Thursday morning!) for a few hours sleep before check out and departure for the airport on Thursday morning.

The CRAYNET meeting was immediately followed by a national Swedish/Norwegian meeting gathering some 80 participants from both countries focusing on the conservation and sustainable use of crayfish. This meeting was organised by Øystein Toverud and Christian Åberg, project leaders of a Swedish-Norwegian EU-Interreg project on crayfish conservation and use who also attended the CRAYNET meeting, in collaboration with CRAYNET core members Lennart Edsman and Trond Taugbøl. The close link between these meetings was aimed at bridging the gap between the international level/scientific research and local managers and stakeholders.

A special edition of the BFPP-journal will be dedicated for peer-reviewed papers from the meeting as well as reports from the roundtable discussions.

Thanks are due to **Leopold Füreder** who took all the photos

Trond Taugbøl
Norwegian Institute of Nature Research
Lillehamer, Norway

OXYGEN AND FOOD CONSUMPTION OF *ASTACUS ASTACUS* IN SPRING AND AUTUMN PERIODS DURING CULTIVATION

The climatic conditions of NW Russia (severe long winters and a short period of summer vegetation) determine the length of the life-history of the indigenous noble crayfish, *Astacus astacus*, and prolong the time taken for this crayfish to reach a commercial length. In its original waters this takes not less than 4-5 years and it followed by great swarms of crayfish (commercial return of crayfish is 7-10% from eggs of females).

During cultivation of crayfish most attention is paid to intensification of the growth in the summer period and slightly less to optimization of conditions of crayfish maintenance in winter.

The issues of crayfish transition from active growth to the period of winter rest in autumn and reactivation in spring are not practically illustrated in the literature. However, it is mentioned that transitions require readiness of the entire organism and are followed by profound physiological reconstruction that is exhibited in changes

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IAA MEMBERS CONTRIBUTE TO NEW ENCYCLOPEDIA

IAA members contributed to the volume "Biodiversity Conservation and Habitat Management" (Editor **Francesca Gherardi**, co-editors Claudia Corti and Manuela Gualtieri, University of Florence, Italy) for The Encyclopedia of Life Support System (EOLSS), published by Unesco (http://www.eolss.net).

The EOLSS presents a comprehensive, authoritative, and integrated body of knowledge of life support systems. It is a forward-looking publication, designed as a global guide to professional practice, education, and heightened social awareness of critical life support issues. Natural and social sciences, humanities, engineering and technology, and management policies for sustainable development and use of life support systems are emphasised, together with issues of global change and their ecological, economic, social, ethical, cultural, and political dimensions.

The EOLSS is intended to enhance the systematic development of knowledge that is essential for global stability, justice, equity, peace, and security; it presents perspective from worldwide regions and cultures, and is free from geographic, cultural, political, gender, age, or religious bias.

Contributions of IAA members are as follows:

History and Overview of Biodiversity Conservation and Protected Areas (Incorporating a History of The Conservation Movement), by *Naill E. Doran, World Heritage Area - Fauna Section, Nature Conservation Branch, Department of Primary Industries, Water and Environment, Australia &* ***Alastair M.M. Richardson****, School of Zoology, University of Tasmania, Australia*

Conservation Strategies, Species Action Plans and Translocation by ***Catherine Souty-Grosset*** *&* ***Frederic Grandjean****, Genetique et Biologie de Populations de Crustaces UMR 6556, Universite de Poitiers, France*

Progress with Species Action Plans by ***David Rogers****, UK*

Translocation as a Means of Balancing Populations and Impact on Natural Habitats by ***Catherine Souty-Grosset & Frederic Grandjean****, Genetique et Biologie de Populations de Crustaces UMR 6556, Universite de Poitiers, France*

Translocation of Aquatic Organisms in Western Australia: History and Associated Impacts by ***Craig Lawrence****, Western Austrelian Department of Fisheries, Australia &* ***Glen Whisson****, Aquatic Science Research Unit, Curtin University of Technology, Australia*

Eradication and Control of Invasive Species by ***Francesca Gherardi*** *& Claudia Angiolini, Dipartimento di Biologia Animale e Genetica" Leo Pardi", Universita di Firenze, Italy*

(continued from page 13)

species of crayfish, *A. italicus* and *P. clarkii*, inhabiting a lotic and a lentic habitat, respectively. In particular, since the use of multiple sensory channels in animal communication usually provides more reliable information (Rowe 1999), the role of single and combined stimuli (chemical and visual) in mate recognition during the reproductive period was studied in male *A. italicus* and in both male and female *P. clarkii*.

Several differences were found. Male *A. italicus* showed a substantial response only in the presence of the odour produced by a female together with visual cues. *Austropotamobius italicus* lives in lotic systems characterized by turbulent currents that cause chemicals to disperse rapidly and this may result in a poor orientation towards stimuli by animals (Vickers 2000). Visual stimuli may add information on the location of females and may save energy and time in this species, characterized by both a restricted mating period (less than 1 month; Villanelli and Gherardi 1998) and a population whose density is low (Gherardi et al. 1997).

In male *P. clarkii*, chemical stimuli from females were sufficient to elicit a searching behaviour. This species lives in lentic systems where current flows are slow, and is characterized by both a longer mating period (6 months, Gherardi et al. 1999) and a population whose density is high. In this case, visual stimuli are important for a better location of females, but chemical stimuli may be sufficient to trigger a searching behaviour since *P. clarkii* is not strongly influenced by time and female availability. In *P. clarkii*, single visual stimuli elicited a searching behaviour only in females highlighting the different role that these stimuli play in mate recognition in the two sexes.

Females were attracted by visual signals possibly because they give information on the size of the potential mates. Larger males are preferred by female *A. italicus* (Villanelli and Gherardi 1998) and more successful mating attempts between large females and smaller males were recorded in *A. pallipes* (Woodlock and Reynolds 1988). In females, chemical and visual stimuli seem to interact as nonredundant signals within a multimodal communication system (Partan and Marler 1999) and may function independently whether they are perceived simultaneously or not.

Visual signals may provide information on both the location of individuals and the size of potential mates, while chemical signals may inform of the sex and possibly of the hierarchical rank of the partner, as demonstrated in the American lobster by Bushmann and Atema (2000).

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of oxygen exchange and food consumption – the main components of power exchange.

There are results of experimental works on Narvsky fish factory with young crayfish (0+) that were developed in trays and basins and with crayfish of different age that were caught in original waters. Also there is material on breeding of crayfish in various conditions of cultivation on base FSGCR “Ropsha”.

Intensity of metabolism was determined by speed of oxygen consumption (bottle method); food consumption was calculated as the difference between food mass and uneaten food.

Table 1 shows the results of determination of oxygen consumption by *Astacus astacus* females. Two critical points can be seen – with a decrease of water temperature from 12°C to 10°C, and lower than 5°C on the background, there is an almost linear decrease of respiration intensity. In the first case, the deviation of the temperature coefficient from that calculated is apparently connected with generative changes. In the second case, with the temperature decrease lower than 5°C, the value of indices of respiration intensity show the transition of the organism into another quantitative condition, close to the diapause of insects.

It should be noticed that in the spring and autumn periods crayfish require more oxygen than was calculated by using the coefficient for determining oxygen exchange in the summer period, and oxygen consumption drops lower than calculated data only after the temperature decreases lower than 4°C.

In Table 2 the food consumption by crayfish under different temperature in spring and autumn periods is shown. The ration decreases considerably with a fall in temperature. Moreover, with the same water temperatures in autumn crayfish consume more food than in spring: their ration is higher almost by 30%.

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Table 1. Dynamics of oxygen exchange indices of *Astacus astacus* depending on water temperature.

t, °C	W, g	Findings		Calculated data (on Cukerzis*)	
		Q, mgO_2/ind.h.	Q/W, mgO_2/ g.h.	Q Q=0,178W0.876	Q/W
2.8	33.40	0.37	0.011	0.59	0.018
4.8	34.37	0.86	0.025	0.76	0.022
7.0	35.13	1.29	0.037	1.01	0.029
10.0	35.83	1.97	0.055	1.53	0.043
12.0	30.15	2.08	0.069	1.63	0.054
15.0	33.10	2.48	0.075	2.43	0.073
18.0	32.65	3.36	0.103	3.14	0.096
20.0	36.08	4.08	0.113	4.12	0.114

*Cukerzis, J. M. 1989. Freshwater Crayfish. Vilnius. (In Russian).

Table 2. Food consumption of *Astacus astacus* females depending on temperature and season.

t, °C	Season	W, g	Food consumption, g/ind. day	Ration g/ind. day·100
8.0	Spring	25.22	0.013	0.05
	Autumn	28.80	0.020	0.07
15.0	Spring	25.10	0.230	0.92
	Autumn	28.38	0.350	1.22

During the cultivation of *A. astacus* the following conditions should be maintained:

- in the autumn period the ration should be increased and the calorific value should be increased;
- in the spring period there should be increased oxygen supply with a rise of temperature higher than 5°C;
- during the whole winter resting period any decrease in oxygen should not be allowed and the temperature should not be higher than 4-5°C.

Article based on a poster presented at the International Symposium "Cool water Aquaculture", September 1-8, 2003, St Petersburg, Russia.

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NEW CRAYFISH BOOK

A new hardback book on the world's crayfish has been produced by **Chris Lukhaup**. The book is in German but includes hundreds of colour photographs. An English version is planned. This book will be of great use to amateurs and naturalists, as well as being of use to specialists for a quick determination of the world's crayfish species.

It is available through the German Amazon.com for a price of Euro 32.50 + handling charges, but it is not available from other Amazon.com's, e.g. American, French, English or Japanese.

LUKHAUP, Chris. (2003).
Suesswasserkrebse aus aller Welt.
Daehne Verlag GmbH, Ettlingen. 247 pp.
[ISBN 3-935175-14-0]
Publisher: Daehne Verlag GmbH, Postfach 250, D-76256 Ettlingen, Germany.

inhibit later learning that would occur normally from the pairing of predator cues and successful predation.

Experiments conducted on a native (*Orconectes virilis*) and an invasive crayfish (*O. rusticus*) have shown that both are affected by this phenomenon, since none of them treated the goldfish (*C. auratus*) as a predator when exposed for three days to fish odour only before being exposed to fish and conspecific alarm cues simultaneously. Alien species were not more capable of recognizing unsuccessful predators than native ones. It would be of interest to test whether an increased predator investment in capture would change the latent inhibition effect on both the native and the invasive species.

A preliminary study on the characteristics of alarm cues demonstrated the presence of these molecules in the hemolymph of two species of crayfish, *O. virilis* and *P. clarkii*. Molecules less than 5 kDa elicited a strong alarm reaction in *P. clarkii* and were degraded with time through enzymatic activity. Alarm molecules were found in the hemolymph of the hermit crab *Clibanarius vittatus* and they are peptides less than 1 kDa that may be involved in the complementary cascade of the hemolymph (Rittschof et al. 1992). The only result that may direct hypotheses towards a peptidic origin of alarm cues in crayfish is the fact that frozen hemolymph had no biological activity when tested 24 h after its extraction. Freezing alters the tertiary structure of proteins, thus reducing or eliminating their bioactivity. These chemicals are subject to enzymatic degradation and may be involved directly or indirectly in the blood clotting process since clotted hemolymph seemed not to elicit an alarm response in crayfish (personal observation). Further studies are necessary to determine the nature of alarm cues and to understand whether any link exists between them and blood coagulation.

A further objective of this study was to analyze some aspects related to chemical communication during the reproductive period of two

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Entropy in Ecology and Ethology

IAA member **Radu Cornel Guiasu** recently released "Entropy in Ecology and Ethology", a book he co-authored with Silviu Guiasu. It was published by Nova Science Publishers, New York in September 2003. Radu wrote the book with Silviu Guiasu, his father, who is a Professor in the Department of Mathematics at York University (Toronto). This resulted in a unique combination of experts in biology and mathematics. While the book is not directly about crayfish, it contains several detailed crayfish examples and analyses several crayfish data sets. The authors also published a related paper: "Conditional and weighted measures of ecological diversity" 2003. by R.C. Guiasu and S. Guiasu. International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems. Volume 11: 283-300. This paper analyses biodiversity indices, and proposes a new one, while using an example dealing with crayfish species diversity in many Central Ontario lakes. While the book and paper mentioned above are not directly about crayfish, they may be of interest to IAA members, because there are detailed crayfish examples given. Furthermore, ecologists and ethologists, as well as biologists interested in classification, evolution and biodiversity, may be interested simply because these are some of the major topics covered in the book.

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Experiments have shown that both a native (*Austropotamobius italicus*) and an alien species (*P. clarkii*) were able to recognize new predators after an association of only two hours to both conspecific alarm cues and the new potential predator odour (goldfish, *Carassius auratus*). When trained with a 24-h association to both conspecific and goldfish odours, the invasive species still responded with an alarm reaction to the fish odour when tested three weeks after training. Individuals of the native *A. italicus*, whether trained for short or longer periods, forgot the association after three weeks. A longer memory of learned association in the non-indigenous species again demonstrates how greater behavioural plasticity may help these species to cope with environments where new predators may be encountered.

When predators are unsuccessful, potential prey are inhibited in learning predator-related cues. This can be related to the latent inhibition phenomenon, where prior exposure to a stimulus (unsuccessful predator) without any obvious reinforcement at the time of the exposure results in a reduction of the strength of a learned association that could be formed later (Ferguson et al. 2001). Thus, the presence of stimuli from a predator without associated stimuli indicating predation (damaged/crushed conspecifics) should

Take that you alien!

A coot attacking an American signal crayfish, a population of which has recently been found in a nature reserve in Nottingham (UK). (Photo: J. Black).

CRAYFISH FISHING IN FRANCE: SEASON 2003

Like every summer, the native crayfish fishing was open in France. My fishing area is in Departments of Ardèche and Drôme (Rhône-Alpes Region), but this year was not usual one. Because of the severe drought, crayfish fishing was not open in the Department of Ardèche. My friends I therefore could fish only in Department of Drôme for the three days of 26-28 July, 2003. We fished for white-clawed crayfish (*Austropotamobius pallipes*). The legal size for catching is 9 cm (rostrum-telson) and the bag limit is 50 crayfish per person per day. The only method allowed for the fishing is the crayfish lift-net (Krebsteller, balance à écrevisses), and six lift-nets per person.

In our "secret fishing rivers", we caught 158 crayfish. They were kept alive in an aquarium till the cooking day, 29 July 2003, when our family and we fishermen ate them with nice wines (see photo). During the meal we talked about all funny happenings occurred during this fishing. Crayfish fishing was a tradition in all parts of France, but now it occurs only in southern France locally.

The crayfish is decreasing in France and so does the crayfish tradition. Since about ten years I'm fishing and studying crayfish. I saw many crayfish waters disappear since and continue to disappear. Although the fishing regulation becomes tighter and tighter (some "ecologists" even propose a total ban of the crayfish fishing), the crayfish continue to decrease. Because the habitats continue to be destroyed and/or polluted, often legally.

The non-welcome introduction of signal crayfish (*Pacifastacus leniusculus*) is an additional problem. Recently this crayfish seems to be extending its presence in the Department of Ardèche alarmingly (I have not verified this yet). I cannot say that the recent extinction of native crayfish from some of our fishing rivers in the Department of Ardèche is related to the signal crayfish, but I cannot exclude it either. Last year and this year I observed the rivers in order to find the reason(s) of the extinction. The waters have become more eutrophic. These are located in agricultural areas. Also, signal crayfish are present in waters not so far away (at Lamastre and Fay-sur-Lignon). So I expect pollution(s), pesticide(s), and/or crayfish plague (transmitted by contaminated gears) to be responsible for the decline in the native crayfish. Indeed one river showed a mass mortality of crayfish in 2002 (or 2001?) according to local information near Alboussière (not verified yet). *(continued on page 10)*

Crayfish spoils from French rivers—enjoyed with nice wine!

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In the Department of Drôme the native crayfish situation seemed no worse than last year and a scientific curiosity was found. One river showed strange crayfish. They all belong to *A. pallipes*, but the rostral cresta median "seemed" to be slightly stronger than that of our native population. I imagined the Italian white-clawed crayfish *A. pallipes italicus* at the beginning, so I quickly took morphological data before cooking (see Table 1). Unfortunately as I did not carry a binocular microscope with me and as they were alive then, I could not observe morphology of the third maxilliped (for the number of spines).

There were nine specimens caught from this river. I also compared them with specimens from another population. Looked at in detail, the rostral cresta median cannot be distinguished from other native crayfish. Also, the ratio of acumen length to rostral length and the number of spines behind the cervical groove fail to be distinct from the French white-clawed crayfish *A. pallipes pallipes*, but the shape of male's pleopod 1 is not of the French crayfish. Generally the pleopod 1 is symmetrical in the French ones in the majority of cases. Absence of the symmetric pleopod 1 may indicate the population could have been stocked from Italy, or perhaps a hybrid between the French one and the Italian one has occurred? Two specimens from this river are conserved in ethanol for genetic analyses later.

Spanish white-clawed crayfish as well as the Italian ones were introduced into several French waters. As far as I know, at least the following French departments were involved: Hérault, Isère, Puy-de-Dôme, Pyrénées-Orientales, Savoie, and Vaucluse. The future genetic analyses may add Drôme to this group. As I'm also doing genetic analyses of *Austropotamobius* spp., the Drôme crayfish may reveal a new vision on the systematics and biogeography of white-clawed crayfish.

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Table 1. Morphological features of APP caught in Department of Drôme, 28 July 2003

Sex	Ratio Acumen/Rostrum	Number of spines behind the cervical groove		Shape of pleopod I
		left	right	
M	0.154	2	2	assymetric
M	0.203	2	3	assymetric
M	0.215	3	2	assymetric
M	0.175	3	3	assymetric
F	0.224	3	5	
M	0.219	2	2	assymetric
M	0.218	2	3	assymetric
M	Rostrum broken	2	2	assymetric
M	0.172	3	4	assymetric

Eco-ethology of chemical signals among freshwater crayfish: a comparative analysis

IAA member **Patrizia Acquistapace** sends the following report on studies that resulted in a successful PhD thesis.

Chemical signals involved in both predator-prey interactions and communication during the reproductive period were analyzed in several species of crayfish belonging to three families (Astacidae, Cambaridae and Parastacidae). The general purpose of this study was to obtain a broader vision of how differences in both the biology and the habitat occupied by these species may influence their response to chemicals.

The first experiments were conducted on both indigenous and non-indigenous species and showed differences in behavioural plasticity in response to predator detection. This could explain why alien species are successful invaders of new habitats.

In predator-prey interactions, the detection of chemical alarm cues is critical to the survival of animals since alarm odours may signal the presence of a nearby predator. Appropriate behavioural responses to the detection of alarm cues are important for an efficient defence against predators. Studies on several non-indigenous crayfish collected from natural habitats showed that they respond to a wider array of alarm cues (emitted by conspecifics and heterospecifics) than native species (released by conspecifics only) (Hazlett 2000; Hazlett et al. unpublished data). This hypothesized greater behavioural plasticity in response to alarm cues was studied in indigenous and non-indigenous species that were reared in farm ponds. Aquaculture systems seem to alter the response to alarm cues in at least the alien species. In the Australian species analyzed, the indigenous crayfish *Cherax tenuimanus* showed a weak alarm reaction only to conspecific alarm odours and the non-indigenous *C. albidus* was alarmed neither by the con- or the heterospecific cues. Further experiments were conducted on two American species using a different experimental protocol. The native species (*Procambarus acutus acutus*) responded with an alarm reaction in the presence of conspecific cues, while the non-indigenous crayfish (*P. clarkii*) did not display an alarm response but showed an increased feeding activity when both conspecific and heterospecific cues were added.

Crayfish are cannibalistic species and juveniles can learn the association between alarm odours and a danger event caused by a conspecific (recently-hatched individuals are the most prone to cannibalism, Abrahamsson 1966). In the absence of predators, adult alien species (that are less prone to cannibalism) may both unlearn the association between alarm cues and a danger situation and learn to associate alarm odours to the presence of food as a consequence of cannibalistic events. This demonstrates that alien species make faster and more appropriate use of information than those species that are known not to be invasive.

From these experiments, no definitive conclusions can be drawn on the innate or acquired recognition of alarm cues as signals of danger in crayfish. It would be of interest, however, to further study this issue since the recognition of alarm cues as danger signals has been demonstrated to be either innate (fishes, Pfeiffer 1963; Waldman 1982) or acquired after experience with a danger event (a species of salamander, Wildy and Blaustein 2001).

In predator-prey interactions, alarm odours released during a predator event are responsible for mediating learned recognition of predators (Göz 1941).