

cies in both streams and a macrohabitat generalist. *Orconectes ozarkae* used all macrohabitats, but showed affinity for pools, backwaters and vegetation patches. *Orconectes punctimanus* was the least common species and was largely restricted to vegetation patches and backwaters. We documented ontogenetic shifts in macrohabitat use between age classes in at least two species. Although there were interspecific differences, YOY crayfish generally were concentrated in macrohabitats along shallow margins of streams. Several macrohabitat association patterns showed consistency across temporal and spatial bounds. Study results have implications for lotic crayfish management and conservation.

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*ponicus* (Crustacea, Decapoda) including a hypothesis on the evolution of maternal care in the Astacida. *Acta Zoologica* 83: 203-212.

# Crayfish NEWS

Vol.24 No.3 June 2002

The official newsletter of the International Association of Astacology



Joe Fitzpatrick with Aloyzas Burba at the 1993 International Senckenberg Conference on Crustacea Decapoda. Photo courtesy Dr Michael Türkay, Senckenberg-Museum.

## Farewell to a special IAA friend

Distinguished Astacologist Joe Fitzpatrick, Jr passed away on 11 July 2002 in Mobile, USA. Joe made an outstanding contribution to crayfish science and had many friends within IAA.

The following eulogy was delivered by David H. Nelson, a colleague of Joe Fitzpatrick, Jr, at his memorial service on 16 July 2002.

We are here to celebrate the life, and to honor the memory, of Joseph Ferris Fitzpatrick, Jr: husband, father, professor, educator, scholar, researcher, literarian, lover of crawfish, and a man of deep faith.

For 25 years I knew Joe as a friend, colleague, fellow biologist, collector, kindred spirit of sorts, naturalist, and skilled artisan of the English language. He was a man of integrity: bright, curious and always intellectually honest.

Although he enjoyed a good laugh, he wasn't always a good teller of jokes ...but he always gave it a try. Because of his great ver-

(Continued on page 3)





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

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Statements and opinions expressed in *Crayfish News* are not necessarily those of the International Association of Astacology

### President's Corner

Our next symposium is only two weeks away in Querétaro, Mexico. **Pedro Joaquin Gutiérrez-Yurruta** has provided an update on page 5 and an abbreviated programme follows. Note that there is a high chance of rain while we are there, although when I visited Querétaro this time last year I was really knocked by the heat (and I'm Australian!). A reminder that the bus to Querétaro is very easy to find, right out the front of the airport. Tickets are available at a counter in front of where the buses park and money exchange is straight-forward inside the airport. All buses go to a central depot on arrival in Querétaro, so you will need some pesos for a taxi fare to your hotel.

Joe Fitzpatrick, Jr passed away on 11 July in Mobile, USA. Joe was one of only three Distinguished Astacologists named by the IAA and had many friends within our organisation. Our condolences to Joe's family, IAA will miss him. A eulogy from Joe's memorial service appears in this issue.

*Freshwater Crayfish 13* has finally been printed and I will bring the first copies to Mexico. *FC 13* is a hard cover book of 627 pages, including 56 peer-reviewed articles and 44 short communications from 180 authors. Given the budget deficit from IAA 13, we will be applying voluntary page charges, probably \$US5 per page. Authors very much appreciated receiving a final proof of their contribution, a number of errors were corrected through this process. I am presently working on the CD-ROM version and am hopeful of having this ready for IAA 14.

All members should have received ballots for the next round of IAA elections. Please take the time to return your slips prior to IAA 14, unless you are attending, in which case, return them to Jay Huner at the conference.

Glen Whisson  
IAA President

based system on trade, countries have adopted virtually zero risk policies when dealing with some products or with some countries, and accepted a very high level of risk when dealing with other products and/or from closely allied countries. Import risk analysis, in the context of WTO membership, is part of a rules-based system which ensures that members decide on an acceptable level of risk when importing products. Moreover, this rules-based system provides a mechanism to resolve grievances about unjustified or measures which are a disguised restriction on trade. Importantly, it is disadvantageous for the importing country to accept higher risks on certain products from certain countries because other members will argue for that same level of risk to be accepted across all products. Moreover, domestic stakeholders, including biologists, conservations, industry members and the general public, can point to discrepancies in measures and lobby for these to be rectified.

In conclusion, risk analysis is not a perfect process – there are considerable scientific and practical difficulties. Nonetheless, advancement in scientific knowledge and risk analysis methodology have improved, and will continue to improve, the effectiveness of import risk analysis. Importantly, WTO members are restricted from accepting higher risks in importing some products from some countries because members will quickly leverage against this to have other products accepted for importation. The effect is a more rational and equitable process on deciding what risks (in this case product types) are acceptable when importing products. This is a significant advancement for the protection of the environment and of industries from exotic disease and species introduction.

### STUDY ON MISSOURI OZARKS STREAM CRAYFISH HABITAT USE

In keeping with Missouri Department of Conservation Fisheries Research Section's newly established procedures for com-

municating results (i.e. "they" are making me do this), this message is to inform you of the availability of a newly released final report. The title of the report is "Macrohabitat partitioning among three crayfish species in two Missouri Ozarks streams". It is one of several final reports generated from the federally-funded, long term Crayfish Management Project. The abstract appears below. For those that wish to avoid the technical jargon, a "popularized" summary of this report will be posted on the Department's intranet in the very near future. Report copies are available from me at the Conservation Research Center.

### Bob DiStefano

Fisheries Research Biologist  
Missouri Department of Conservation

### Abstract

Crayfish are a major prey item for many sport fishes and add significantly to the biodiversity of warmwater streams. Stream fisheries management could benefit from management of prey species, but there has been little quantitative work done to assess habitat use patterns of lotic crayfish populations. We examined diurnal macrohabitat association patterns among three crayfishes and two age classes within each species during two seasons in two Missouri Ozarks streams. Fall quadrat samples were obtained during three years at Jacks Fork River and two years at Big Piney River; summer samples were taken for five years at both rivers.

Samples were partitioned among five macrohabitat types (riffles, runs, pools, backwaters, and emergent vegetation patches). *Orconectes luteus*, *O. ozarkae*, and *O. punctimanus* were separated into young of year (YOY) and adults based on carapace length-frequency analysis. Relative use of macrohabitats by crayfish species and age classes was compared using analysis of variance and least squares means probability difference analysis. *Orconectes luteus* was the predominant spe-

ed that discussion paper at the European IAA meeting held in Poitiers, France, in September 2001. The 14<sup>th</sup> meeting is now only a month away and this topic is likely to be discussed again. To enable informed debate, following is a very brief summary of my presentation at Poitiers.

### Import Risk Analysis

When implementing measures (restrictions) that affect international trade for the purpose of protecting the life and health of humans, animal and plants or their territory against damage from pests, the 144 member states of the World Trade Organization are obliged only to implement measures (i.e. restrictions) which are in accordance with the principals stated in the Agreement on the Application of Sanitary and Phytosanitary Measures (commonly known as SPS Agreement). Briefly, these principles are to ensure that decisions are not discriminatory; are formed on the basis of science, are least trade restrictive, are developed transparently and that risk is managed consistently. As such, importing countries are encouraged, when practicable, to implement international standards for controlling risks. However, members have the right to implement a measure or a more stringent measure (eg. affording a greater level of biosecurity) when there is no international standard or when it deems that the protection provided by the international standard would provide less protection than its general policy for risk acceptance (known as the Appropriate Level of Protection -ALOP). In such cases, the member must assess the risks and decide on appropriate measures by risk assessment, often known by the name of import risk analysis (IRA). The Office International des Epizooties (OIE or the world organisation of animal health) is the international organisation charged with developing international standards for animal health and zoonoses (including guidelines for IRA).

OIE guidelines on IRA involve the assessment of risks of introducing diseases to wild and domestic populations in the importing

country with trade. Typically, there will also be an assessment of the "pestiness" (ecological effects arising from the establishment of the species including competitive effects on native species) of an imported viable organism (such as a live freshwater crayfish). However, in practice, some countries assess these risks separately to the quarantine import risk analysis, and often the assessment is done by a different Government agency. The WTO administers a dispute resolution process which allows a member to argue against another member that has introduced measures on the basis that they are not in accordance with WTO rights and obligations including that the measure is not scientifically justified or it is inconsistent with other measures applied by that member. In the history of the WTO, which was established in 1995, there has not been a dispute related to measures against a 'pest'. Nonetheless, it is technically possible for a WTO member to challenge another member's measure to protect against the damage that would be caused by the introduction of a pest.

There can be considerable scientific and practical deficiencies in an import risk analysis. Scientifically there is the important issue of a very considerable lack of knowledge about the disease status of freshwater crayfish populations – how can risks be assessed if little is known about pathogens carried by crayfish in the exporting country, or pathogens already present in the importing country? Also, it is essentially impossible to predict the consequences of exposing a host to a pathogen which it has not previously been exposed. Laboratory trials and extrapolation from similar circumstances may be useful in such cases, but, again, the confidence in the predictions made, such as the consequences of disease introduction in real ecosystems, must be limited.

On the other hand, trade history shows that decisions on importation of products into countries often involve highly political undercurrents, both domestically and internationally. Consequently, without a rules-

*(Continued from page 1)*

bal skills, occasionally he could come up with a devastating pun.

Joe was a gruff, intensely focused person who had a definite opinion on most issues. Usually, it wasn't difficult to determine what that opinion was. Few people would not have an opinion about Joe... but he was always kind, fair, consistent and straight forward in dealing with other people.

Joe was a man of stern and passionate convictions. After his family, his love was crawfishes which he collected, described, drew, catalogued and admired. He devoted much of his life to their study. Joe was well recognized in his field; he was our very own accomplished, resident "astacologist". Joe was a good keeper of scientific records. As a demanding professor he was utterly committed to graduate and undergraduate education. He believed that things should be done the "right" way; and he was willing to take the time to do it properly. As our departmental graduate coordinator for several years, Joe gave careful oversight to individual graduate student records.

He called himself the Biology Departmental "Curmudgeon" (which means "cantankerous person"). But he was truly a dedicated scholar, researcher, and literarian.

As a disciplined man, he was logical, analytical and perceptive. Joe passionately believed in the benefits of a "liberal" education. Unlike so many of today's educators who favor specialization, Joe felt that the arts and humanities (as well as the sciences) were essential to the successful individual. This often led to his intolerance of grammatical or historical errors in the essay exams of his students, who would wonder why a noun and verb would need to agree on an anatomy and physiology final.

Joe was a rigorous, thorough, demanding professor. My best students (and my own

daughter) liked and respected him as a person and professional. He was a "non-nonsense" individual. You have heard the expression: "Cleanliness is next to Godliness." On the corner of the blackboard of his Anatomy and Physiology laboratory, he would always write the statement: "In this laboratory, cleanliness is better than godliness." He wasn't being sacrilegious but was making a point that needed to be made. Now, Joe would admit when he was wrong (although he really didn't like to).

Joe had a genuine sense of humor. He had several witty sayings that he would frequently recite at an appropriate time:

1. "No good deed ever goes unpunished."
2. "Illegitime non carborundum," and
3. "If someone says something nice about me, you know that they are lying."

Joe was a very private individual with a deep, abiding faith in God. A few weeks ago he shared with me the feeling that most people probably didn't know that he was a man of faith. He related that perhaps he should have been more verbal in expressing his convictions. But some people are not overt about their personal beliefs. Joe was a scientist, and as such he would always strive for objectivity.

For the past few weeks I have visited Joe regularly and we had the opportunity to share some valuable time together: memories, scriptures and prayers. In one instance we were discussing the mystery of God's love and grace. Joe made an observation that struck me as insightful and profound. He said: "What is most wondrous is that God actually wants us at all."

On more than one occasion, Joe admitted that he was not afraid of death. Indeed his spirit was buoyant even when he was dying. Although he had cancer in his body, Joe died a healed, entire, complete man.

Now he is at home, at peace and utterly fulfilled. Indeed he is in the presence of The



Almighty, now and forever more. Certainly, Joe will be missed, but he will never be forgotten by those who were privileged to know him. If he could, he would probably admonish each of us to live our lives fully and in the knowledge of the Lord.

### CRAYFISH BURROWS

During a survey of a white-clawed crayfish, *Austropotamobius pallipes*, population in a river in Eastern England a large number of burrows, both above and below the water line, were found in the clay banks (see Figs 1, 2). In one case a live individual was found sitting in the entrance to a burrow and in another case an individual that had died from thelohaniasis was found at the entrance. The burrow entrances are oval in shape and are too small to have been made by mammals such as water voles. The burrows are similar (Peter Sibley, pers. comm.) to those made by the signal crayfish, *Pacifastacus leniusculus*, but this crayfish is not known from the river in question. Many of the burrows have been distorted and eroded by strong water ac-

tion when the river is in spate, and it has been suggested (Stephanie Peay, pers. comm.) that the crayfish may make the burrows to avoid this water action. The fact that some burrows are above the water line probably indicates activity when the river was at a higher level for long periods in the winter.

I should be interested to know if anybody else has observed this phenomenon in *A. pallipes*? There is no mention of burrowing by this species in any literature I have seen with the exception of Huxley's (1881) book 'The Crayfish', and Calman's (1902) book 'The Naturalist on the Thames.' On pages 8-9 Huxley mentions that crayfish dig burrows themselves from a few inches (about 10 cm) to a yard (about one metre) in depth, but if the soil is peaty then they work their way into it in all directions, sometimes a considerable distance from the bank. He also mentions that in favourable conditions they sit at the entrance to their burrows and capture passing animals, including water voles! On page 52 Calman mentions that the banks of the River Thames for



Figure 1. Showing a row of burrows above the water line.

missed collecting any of them myself although I had visited South America many years before. The same comments apply to New Zealand. I hunted unsuccessfully in South Africa, observing that what appeared to be favourable niches were occupied by the numerous freshwater crabs. The crabs occupy an insignificant niche in the Australian fauna.

Although I still fly-fish I merely observe the presence of crayfishes in the stream, or observe their burrows in the soaks along the alpine paths or their chimneys in the drying beds of the inland streams.

The common yabby (*Cherax destructor*) and the northern red-claw (*Cherax quadricarinatus*) are commercially available in the east and to some extent the marron (*Cherax tenuimanus*) of Western Australia in that state but rarely in the east. A great pity that the marron is not more readily available for it is certainly the best crustacean flesh I have ever eaten.

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### ANALYSING THE RISKS ASSOCIATED WITH TRANSLOCATION OF CRAYFISH

IAA member **Brett Edgerton** has prepared the following paper, as a basis for continuing discussion at IAA 14.

**Background:** At the 7<sup>th</sup> IAA meeting in Lausanne, Switzerland, members present adopted a resolution which was printed in "Freshwater Crayfish 7". The resolution stated the observations and concerns of the meeting, and put forward several recommendations to Governments relating to the importation of live freshwater crayfish. At the 12<sup>th</sup> IAA meeting in Augsburg, Germany, the issue of renewing or revising the resolution was raised. It was decided at this meeting to conduct an inter-symposium debate on the issue and to address it again at the 13<sup>th</sup> meeting in Perth, Australia.

At the 12<sup>th</sup> and 13<sup>th</sup> meetings, I spoke about recent developments in the international environment relating to assessing risks associated with the importation of animals and/or their products. I voiced the opinion that, for the IAA to achieve the aim of positively affecting Governments to ensure the conservation of freshwater crayfish and the protection of aquaculture industries, that any resolution from the Association should be drafted within the international framework in which biosecurity policy is developed. At the 13<sup>th</sup> meeting I was asked to write a discussion paper on addressing risks associated with importing freshwater crayfish. I present-



er live crayfishes to restrict their movements until they could be dealt with back at base.

After preservation, with injection with either alcohol or formalin, the specimens were shaken vigorously to dislodge commensals. The sediment that collected in the bottom of the container was decanted off and preserved separately, usually in formalin or Bouin's fluid. The crayfishes were usually preserved in 70% alcohol.

There is a wide range of commensals and parasites on crayfishes- temnocephalids, ostracods, Stratioidrilus and nematodes occur in the gill cavity, different temnocephalids and an annelid on the outer surface and a parasitic mite on the inner surface of the branchiostegite. The annelid prefers the base area around the eyes and antennae where at times they occur in such numbers that they must inhibit normal movements of these structures.

On my first encounter with one of the smaller temnocephalids I mistook them for an unusually large *Hydra*- they too have a terminal sucker and five oral retractile tentacles.

*Euastacus claytoni* is somewhat unusual. I regularly fly-fished the basalt stream, the McLaughlin River, where it occurs. However, I have never actually seen a specimen in the stream. The only specimens I have collected had to be dug out from above water along the stream margin. The presence of burrows is indicated very obviously by a wide bare patch surrounding the entrance where the crayfish has cropped (eaten) the vegetation (grass). When the burrow is dug out one observes that there is an opening into the stream below normal water level.

On only one occasion have I collected (or observed) an albino crayfish- not a recently moulted specimen but one with fully hardened cuticle. This was a specimen of

*Euastacus claytoni* dug from its burrow.

Field collection of the large *Euastacus* has made one aware that the museum specimens are mainly the larger gerontic individuals in which many of the diagnostic characters are obscured by 'weathering' because such individuals rarely moult. A series of different sizes will show the progression in the development of the spines and bosses that give a quite different appreciation of the species. There is also a change in the colour pattern with age.

There are now restrictions on harvesting the large *Euastacus* in Australia and similar *Astacopsis* in Tasmania so the weekends camping with friends and fishing with set dip-nets in the larger rivers and then cooking and feasting on them are now only fond memories.

My first contact with a species of *Engaeus*, the so-called land crayfishes, was in an alpine forest after heavy rain, while looking for the rather unique japygid insects. This forest is called the Picadilly Circus in the Brindabella Ranges to the east of Canberra. This inch long crayfish was wandering in the forest not far from the chimney leading to an underground chamber with its permanent pool of 'sweet' water. Depending upon the time of year, there can be three-year groups of individuals in the one communal chamber all retreating into side burrows of appropriate size, possibly as a protective measure. Gut contents have not been examined but I believe that they feed in part on plant roots penetrating to the burrows.

My official studies of Australian insects and especially my interest in the fossil insects led to studying the relationship between the Gwondana components of Pangaea. This naturally included the crayfishes.

I had the opportunity to study the South American crayfish collection in the U.S. National Museum with Horton Hobbs but



Figure 2. Burrows with oval-shaped entrances marked by a square with 50 cm sides.

hundreds of miles were perforated by crayfish burrows about three feet (one metre) deep and usually about 18 inches (45 cm) below the water line. In the winter fresh burrows were dug higher up and these were deserted in the summer when the water level decreased.

**David Holdich**  
david.holdich@ntlworld.com

#### CRAYFISH BOOK TO BE PUBLISHED

IAA member **Chris Lukhaup** wishes to inform members that his book *Freshwater Crayfish of the World* will soon be published. It contains information on all crayfish and has photographs of more than 350 different species. Chris also reports that in April, along with colleagues Reinhard Pekny and Werner Köstenberger from Austria, he visited the USA to collect crayfish with Chris Taylor, Dan Jones and Günther Schuster. The group was joined by Roger Thoma, James Fetzner Jr and Whitney Stocker (photos are available on Chris' Crayfishworld homepage).

**ON TO MEXICO FOR IAA 14**  
Conference organiser **Pedro Joaquin Gutiérrez-Yurrita** sends the following update

on preparations for the symposium.

At present we have 103 communications (including 48 oral presentations), with authors from: México (68); USA (29); Italy (16); Australia (16); Cuba (7); Portugal (6); Finland (6); UK (6); France (4); Russia (4); Chile (3); Germany (3); Poland (2); Israel (2); Spain (2); Uruguay (1); Ghana (1); Brazil (1); and Colombia (1).

Many people have enquired about getting Mexican pesos. I think the best way is to exchange money at any of the 24-hour bank outlets (> 20) at the airport in Mexico City. Furthermore, this way of getting pesos usually gives the best rates.

Right now we have a small tropical storm in Querétaro—so the temperature is between 15 and 25 C (but it's raining every night). Participants should bring raincoats, however, if the rain subsides, the temperature could increase to 35 C.

**IAA 14**  
**Querétaro, Mexico**



## Instructions for presenters and chairpersons

Duration for special lectures should be 45 minutes. Sture Abrahamsson Memorial Lecture and Host Country Lecture will be in the Auditorium Fernando Díaz, University of Querétaro. In this room will be instantaneous translation from English into Spanish and from Spanish into English depending of the language of the lecture.

Duration for oral communications should be 20 minutes including discussion. Slide, overhead and PowerPoint projectors will be available. Video System is NTSC and DVD is multiregion channel. Venue for oral communications will be the Sala Corregidores, Fiesta Inn Hotel.

Chairpersons are requested to meet the presenters in their session in the presentation room 15 minutes prior to the start each session. Slides should be loaded at this time. There will be technical assistance on hand. If you require PowerPoint projection, please contact the technical assistant the day before your presentation to avoid any data loading problems. A PowerPoint and a slide projectors will be available in a separate room for presenters to preview their presentation and slides.

Poster authors are kindly asked to mount their posters on Sunday or early on Monday on the allocated board in the Foyer del Salón Corregidores, Fiesta Inn Hotel. The posters should be on display until the end of the conference. During the poster sessions authors should be present at their poster. Poster size should be 90 x 120cm (width x length).

## IAA Symposium Programme

### Monday, 5 August Registration

#### Opening ceremony

Pedro J. Gutiérrez, IAA 14 Organising committee  
Alejandro Lozano, Director of the CONCYTEQ  
Glen Whisson, IAA President  
Jay Huner, IAA General Manager

#### Host country lecture

Dr. Alberto Huberman, Instituto Nacional de Nutrición, México

Oral session: **Ecology and Biology** (Chairman: Brenton Knott)  
Responses by *Orconectes virilis* to alarm odors in different habitats and possible source of the alarm substances. Patrizia Acquistapace, Brian A. Hazlett, Dan Rittschof, Francesca Gherardi

El cultivo de *Samastacus spinifrons* en Chile: Situación actual y perspectivas. Alberto Augsburger Bachmann, Dino Saltarini Cruz, Erich Rudolph Latorre

The influence of light on the onset of first maturity and egg laying in the crayfish *Procambarus (Austrocambarus) llamasii* (Villalobos, 1955). Claudia Carmona-Osalde, Miguel Rodríguez-Serna, Miguel Olvera-Novoa

Seasonal availability of *Procambarus clarkii* in the Tejo river basin, Portugal. Alexandra Marçal Correia, Nuno Bandeira

Microhabitat influences on distributions of three crayfishes in Ozarks streams, Missouri, U.S.A. R. J. Distefano, M. G. McManus

Growth, survival and condition indices of marron (*Cherax tenuimanus*) fed germinated grains. Ravi Fotedar

Oral session: **Physiology and Ecophysiology** (José Latournerié, Méx.)  
Effects of binders and increasing amounts of water before drying on nutrient leaching and pellet hardness in crayfish diets. Edu D'Agaro, Domenico Lanari

The effect of broodstock diet on egg and hatchling production of the eastern white river crayfish, *Pro-*

*hering* to the swimmerets under the female abdomen by hooks on the hind legs.

During my university teaching, because of a restricted budget, it was necessary to collect crayfish for dissection by students. This was easy in some of the local rocky streams. The largest specimens were preserved for student use and the smaller ones cooked and eaten.

For preservation of the internal organs, I found it best to inject preservative into the body cavity using a hypodermic syringe, initially at the base of an eye but more conveniently at the intersegmental membrane between carapace and abdomen. Also, by this method the large chelae were never shed.

My Master's thesis was based on the invertebrate freshwater fauna of Queensland so I travelled widely and extended my crayfish knowledge to include the species of *Euastacus* (and subdivided genera).

My first contact with these spiny crayfishes was while hunting for small (red) land nemertean, with their fascinating long retractile proboscis, in the tropical rain-forest on the Lamington Plateau of south-eastern Queensland. (Most nemerteans are long fragile marine organisms.) I was disturbed by a loud hissing noise resembling the stridulating of a large scarab beetle. On looking, I was surprised to see a large *Euastacus sulcatus* with outspread raised large white chelae in the defensive posture. I believe that the stridulating is made by rubbing the bases of the large chelae across the rough sides of the carapace. This specimen was at least 400 metres from permanent water and about one hundred metres above the level of the stream. This was not the only occasion that I have seen specimens of this species some distance from the stream.

One is surprised at the number of individu-

als of these large crayfish present in a rain-forest stream, the Coomera River. On an overcast misty day in spring I have seen this stream simply teeming with moving white objects-one sees the white chelae and upper carapace of the crayfish (*Euastacus sulcatus*).

On another occasion, I walked along the highest alpine stream in Australia (the Snowy River) at night to observe the movements of trout by shining a strong light into the water and was surprised to see the numerous reflections of the eyes of this smaller species of *Euastacus*. During the day while collecting stream insects, there was no sign of the species (although I knew that it occurred in the stream).

During university days, I joined the Field Naturalists' Society (and the Entomological Society) at Caloundra and participated in many pleasant outings. On one occasion, I visited the coastal heaths of south-east Queensland during the spring flowering. Naturally, I combined my interest in the flowers with searching for aquatic crustaceans and insects. The only streams within walking distance of our accommodation were minute trickles issuing from areas of bog-like heath, and flowing only a very short distance before dropping steeply to seep through the ocean beach. This is where I was thrilled to discover the very small *Tenuibranchiurus* (what a terribly long name- my apology) in the only area where I could scoop my 12 cm dip-net. I joined CSIRO in Canberra at the end of 1945 as a biological control scientist. That summer I learnt to fly-fish for trout. This led to an increased interest in freshwater organisms. My field studies in entomology took me to many parts of Australia. And everywhere I went I continued to collect crayfishes (and aquatic insects) though this was not part of my official duties. Naturally, therefore, I carried spirit and other preserving fluids. Also, I usually carried 2-3 cloth soil-sample bags with tie-cords for the larg-



gar Riek collected continentally and published the first comprehensive taxonomic papers on the Australian crayfish, listed below. Dr Riek, a self-confessed epicurean, now produces vintage wines in his vineyard north of Canberra. **Craig Lawrence & Noel Morrissy**

As a country youth I spent many a weekend and after school on long summer afternoons 'yabbing', either by turning stones in the headwaters of small mountain streams or by fishing with a piece of meat on the end of string in some ponds and dams. There we used a small dip-net made with a wire frame and mosquito net to be sure of landing the catch.

Our favourite pond (for my brother and me) was one surrounded by (introduced) willows and margined with patches of sedges. This was a very unusual pond because it harboured two distinct species, of *Cherax*, which even at that time we recognised readily. There were the drab stocky *Cherax punctatus* with strong chelae and the more delicate blue-clawed *C. dispar*, with marked sexual dimorphism. The blue-claw cooked with the better flavour.



Figure 1: Dr Edgar Reik (left) and Dr Noel Morrissy (right) reminisce about freshwater crayfish collecting. Photo by Dr Craig Lawrence

My family had a property in the foothills and there we collected a slightly different colour form of *C. punctatus* in the small stony stream simply by turning over rocks. We cooked them on the spot on our weekend jaunts to the property.

During my university days, the family had moved to the outskirts of a city (Brisbane) but I was fortunate to be located close to a small unpolluted stream, Moorooka Creek. There was a small colony of *C. punctatus* at the headwaters and lower down in the more permanent weed-infested pools and riffles a larger colony of *C. dispar*. The stream was less than a mile long before it merged with the tidal zone of a small tributary, Norman Creek, south of the Brisbane river.

By this time, I was curious as to the age of the very few very large specimens in the population. So, one year I sampled the lower section with a fine-meshed scoop-net on two occasions six months apart. I graphed carapace lengths and although there was considerable over-lap, the males appeared to reach sexual maturity at two years and most of the females a year later. The largest specimens appeared to be at least 10 years old.

The other surprise was that it appeared that these oldest specimens did not moult regularly for the empty egg-shells of the ecto-commensal *Temnacephala* of what appeared to be several generations remained attached to the crayfish exoskeleton.

At this time, I had been studying regeneration of lost appendages and found that such specimens moulted more or less regularly each month. And it seemed that juveniles (without any lost appendages) did much the same. (Replication was limited by the facilities in my study.)

I also hatched eggs from berried females to follow the embryonic development and then knew that the first two instars remained ad-

*cambarus acutus acutus*. [Grant S. Blank](#), William H. Daniels, Joseph H. Soares Jr.

Studies on the nutrition freshwater crayfish *Cherax quadricarinatus* (von Martens): effect of the dietary protein level on growth of juvenile and pre-adult. [E. Cortés-Jacinto](#), H. Villarreal-Colmenares, R. Civera-Cerecedo

Effect of temperature and diets on the physiological energetics of *Cherax quadricarinatus* (von Martens). Gisela Escalante, [Fernando Díaz](#), Elizabeth Sierra, Ana Denise Re

Description of the embryonic development of *Cherax quadricarinatus* von Martens, 1868 (Decapoda, Parastacidae), based in the staging method. [Marcelo García-Guerrero](#), Michel E. Hendrickx, Humberto Villarreal

Effect of the temperature on lipids, proteins and carbohydrates variation during the embryonic development of *Cherax quadricarinatus*. [Marcelo García-Guerrero](#), Humberto Villarreal, Ilie S. Racotta

#### Poster session

Querétaro sight-seeing tour

#### Tuesday 10 August

Oral session: **Conservation and Management** (David Rogers, UK)

Introducción a Colombia de los Astacoideos, *Procambarus clarkii* (Decapoda: Cambaridae) y *Cherax quadricarinatus* (Decapoda: Parastacidae): Estado de su conocimiento y perspectivas de su aprovechamiento. [Ricardo Álvarez-León](#)

The effect of broodstock stocking density on hatchling production of the eastern white river crayfish, *Procambarus acutus acutus*. [William H. Daniels](#), Grant S. Blank

Oral session: **Aquaculture and Biotechnology**

Distribution of white river crayfish, *Procambarus acutus acutus* in a culture pond [Arnold G. Eversole](#), Rebecca L. Pylpink, Yavuz Mazlum, Shawn Young

Effect of trap inner funnel diameter on crawfish catch. [Jay V. Huner](#), Jorge Espinoza

Increased crayfish aquaculture productivity through genetic selection. [Clive M. Jones](#)

Effect of aeration levels on the growth, survival and biomass of *Cherax quadricarinatus* (redclaw) juveniles reared in ponds. [José Naranjo](#), Humberto Villarreal

Oral session: **Physiology and Ecophysiology** (Humberto Villarreal, Méx.)

Influencia de la modificación de los tonos serotoninérgico y octopaminérgico de *Procambarus clarkii* sobre su comportamiento agonista. Elizabeth Guarneros, René Arzuffi, Eduardo Ramírez-San Juan

Salinity tolerance of juvenile *Cherax tenuimanus*. [P. Lindhjem](#), B. Knott

Efecto del nivel de proteína en el alimento sobre la actividad enzimática digestiva del digestiva del hepatopáncreas de juveniles de langosta de agua dulce *Cherax quadricarinatus* (von Martens, 1868) [Silverio López-López](#), Héctor Nolasco, Humberto Villarreal-Colmenares, Roberto Civera-Cerecedo

Characterization of the circadian rhythm of electrical activity in the brain of crayfish (*Procambarus clarkii*) induced by monochromatic light. [K. Maldonado-León](#), B. Fuentes-Pardo

*Cambarellus montezumae* source of macronutrients for human nutrition. [Virginia Melo](#), Ana Maria Amaya, Cristina Sánchez, José Salas, Norma Noguera

Oral session: **Review of crayfish studies** (Chris Taylor, USA)

A review of ten year studies on the ecophysiology and growth experiments of *Cambarellus montezumae* (Saussure). [J. R. Latournerié Cervera](#), A. R. Estrada Ortega

Oral session: **Genetics, Systematics and Biogeography**

Analysis of the genetic variability in populations of the genera *Procambarus* and *Cambarellus* from central México using RAPD. [José Luis Blasco](#), Aránzazu López Romero, Pedro J. Gutiérrez-Yurrita

Comparison between genetic and population density estimates to understand the genetic differentiation in recently fragmented populations of *Austropotamobius pallipes*. [Nicolas Gouin](#), Catherine Souty-



Grosset, Anne Ropiquet, Frédéric Grandjean

Phylogenetic investigations of subgeneric structure in the genus *Cambarus* (Astacidea: Cambaridae)  
Megan L. Porter, Jen Flygare, Liz Sinclair, James W. Fetzner Jr., Keith A. Crandall

Poster session

IAA Board meeting

### Wednesday 7 August

•Conference field trip to Teotihuacán •Visit to the Pyramids •Conference Photograph  
•Crayfish ancient uses forum •Risk management in aquaculture - a case study from Western Australia, Glen Whisson •Visit to crayfish places

### Thursday 8 August

**Sture Abrahamsson Memorial Lecture.** Dr. Catherine Souty-Grosset

Oral session: **Ecology and Biology** (Glen Whisson, Au.)

Laboratory moult increment, frequency, and growth in *Euastacus sulcatus*, the Lamington spiny crayfish. James M. Furse, Clyde H. Wild

In-stream and terrestrial movements of *Euastacus sulcatus* in the Gold Coast hinterland: developing and testing a method of accessing freshwater crayfish movements. James M. Furse, Neville N. Villamar, Clyde H. Wild

Individual and status recognition in *Procambarus acutus acutus* dominance. Francesca Gherardi, William H. Daniels

Social control of growth in the Australian freshwater crayfish *Cherax quadricarinatus*. Ilan Karplus, Asaf Barki

Speculations on the ecological consequences of the spread of yabbies, *Cherax destructor*, (Decapoda: Parastacidae) in Western Australia. Patience Lindhiem, Jess Lynas, Andrew Storey, Brenton Knott

Oral session: **Physiology and Ecophysiology** (Fernando Díaz, Méx.)

Effect of photoperiod and irradiance of 24 h cycles on the heart rate and ventilation of the crayfish *Procambarus clarkii*. J. Prieto-Sagredo, A. Farca-Luna, M. L. Fanjul-Moles

Effect of dietary protein and lipid level on the gonad development of the freshwater crayfish *Cherax quadricarinatus* (von Martens). Hervey Rodríguez, Humberto Villarreal, Hector Nolasco, Manuel García-Ulloa

Ecophysiological comparisons between two populations of dwarf crayfish *Cambarellus montezumae* from Querétaro during one hydrologic cycle. Carlos F. Rojas Flores, Pedro J. Gutiérrez-Yurrita

Characterization of yolk proteins during ovary and egg development of mature female freshwater crayfish (*Cherax quadricarinatus*). Vania Serrano-Pinto, Celia Vazquez-Boucard, Humberto Villarreal-Colmenares

Courtship and mating behaviour of the signal crayfish *P. leniusculus*. Paul Douglas Stebbing

Pigment dispersing hormone entrains circadian rhythms in crayfish. M. A. Verde, A de la O-Martínez, B. Fuentes-Pardo

Poster session

**Symposium banquet** Revolución mexicana style banquet

### Friday 9 August

Oral session: **Parasitology and diseases** (Jay Huner, USA)

Pathology of redclaw, *Cherax quadricarinatus* (von Martens). Brett F. Edgerton

Susceptibility of the native European crayfish *Austropotamobius pallipes* to white spot syndrome virus: information for assessment of the likely consequences if the virus were introduced into central Euro-

pean freshwaters. Brett F. Edgerton

The relationship between *Euastacus sulcatus* and *Temnocephala* spp. (Platyhelminthes) in the Gold Coast hinterland. James M. Furse, Clyde H. Wild, Aron M. Joseph

Branchial epibionts and commensal organisms of freshwater crayfishes - management implications  
Paula Henttonen, Jay V. Huner, Ossi V. Lindqvist

Susceptibility of *Cherax quadricarinatus* to white spot syndrome virus, using *Litopenaeus vannamei* as a reference species. Marco Linné Unzueta-Bustamante, Raquel Silveira-Cofficny, Adela A. Prieto, Gabriel Aguirre-Guzmán, Marco A. Porchas-Cornejo, Ricardo Vázquez-Juárez, Luis R. Martínez-Córdova, Marcial L. Lizárraga-Partida

Oral session: **Ecology and Biology** (Francesca Gherardi, It.)

Effects of simulated drought on crayfish survival and reproduction in artificial burrows: a preliminary study. W. Ray McClain, Robert P. Romaine

Visual adaptations to cave life of two stygobite crayfishes compared with an epigeal species from Oaxaca, México. Luis M. Mejía-Ortiz, Richard G. Hartnoll, Saul Cortés S., José A. Viccon-Pale

Comparative population dynamics of three sympatric *Orconectes* species. Charles F. Rabeni, Robert DiStefano

Estudio del sistema sexual del parastácido de Chile *Virilastacus araucanus* (Faxon, 1914) (Decapoda, Parastacidae): primeros resultados. Erich Rudolph, Alexandre Almeida

Sexuality in the burrowing crayfish *Parastacus pilimanus* (Von Martens). Erich Rudolph, Ana Verdi

•Presentation for the next IAA Symposium •General Assembly •Poster session •Poster removal

### Saturday 10 August (40 participants required)

Post-Conference field trip and sight-seeing

### Happy 30th Anniversary, IAA!

### REMINISCENCES OF A PIONEERING AUSTRALIAN CRAYFISH TAXONOMIST

**Dr Edgar F. Riek OAM DSc 1920- .**

*The large Australian freshwater crayfish fauna was described piecemeal by various early 'explorers': e.g. Gray, Hess, Erichson, von Martens, McCulloch and Smith. However, Ed-*

### CORRECTIONS TO FC VIII PAPER

IAA member **Magnus Fürst** requests members to take note of errors in the published version of his paper: "On the recovery of *Astacus astacus* L. populations after an epizootic of the crayfish plague (*Aphanomyces astaci*)", pp. 565-576, FC VIII, 1995.

In six cases *A. leptodactylus* has been changed to *P. leniusculus*: p. 569 (last paragraph on the second line); p. 570 (5<sup>th</sup> and 10<sup>th</sup> lines); p. 573 (5<sup>th</sup> paragraph in two cases); and p. 574 (last paragraph).

Magnus reports that, although retired, he still manages to do some work with crayfish—like following an unexploited population of *Asta-*

*cus astacus* in Montenegro following commencement of a commercial fishery.

### CRAYFISH PRINTS STILL AVAILABLE

A small number of silk screen prints are still available (at time of printing) from a limited edition of "Cherax", the collage of a marron by famous Australian artist Robert Juniper. This is the picture that appears on the cover of *Freshwater Crayfish 13*. For more information contact Glen Whisson: g.whisson@curtin.edu.au

