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Crayfish NEWS

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Inside this issue:

Dangadi at Ngambaa

Euastacus dangadi from the Ngambaa Nature Reserve, NSW, Australia.

Ngambaa Nature Reserve is approximately 10 kilometres north west of Kempsey, New South Wales, Australia. I went there freshwater crayfishing with international crayfish photographer **Chris Lukhaup** from Germany to see if we could find and photograph the elusive *Euastacus dangadi* crayfish.

Euastacus dangadi are small spiny crayfish that inhabit coastal streams in a relatively small part of coastal NSW. They are a beautiful species with large red/crimson claws with orange highlights and white highlights on the tail spines. They don't get very large in size, around 60 grams (48 OCL) is an average-sized adult crayfish, with the largest one recorded being about 80 grams.

These crayfish live in a crystal clear mountain stream which meanders quietly through the Ngambaa Nature Reserve. Ngambaa reserve is in the coastal foothills and is an old growth forest of predominantly grey gum and spotted gums. It's a wildlife haven in which threatened species such as the Powerful Owl, which is Australia's largest owl, and the Yellow Bellied Gliders can take sanc-

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Catherine Souty-Grosset, IAA President *(France)*

President's Corner

Dear IAA members:

It is my third President's Corner: Spring is again upon us and is a very busy time for field investigations, the beginning of congresses, and also within the IAA it is time to remember that you are warmly invited to participate in *Freshwater Crayfish* (FC) 16 by submitting your articles for publication. **James Furse** will be considering crayfish related papers presented at the symposium in Australia and, in addition, will also consider *any* crayfish paper that is submitted by the membership (or non-members), so a general call for papers has been proposed and should go out in the near future. Please pass along this announcement to your colleagues who might be looking for and outlet to publish their crayfish papers.

This month, **Jim Fetzner** and James were very actively preparing for FC 16 by discussing Instructions to Authors, an electronic submission website, and procedures for reviewing FC 16. Moreover, James proposed the following... "One thought I have had, is that in addition to a standardized set of instructions to authors, perhaps it might be a good idea to consider having a standardized format/layout/template for future volumes of *Freshwater Crayfish*. I think that this would be a good opportunity to ensure, or try to ensure, that all future volumes are presented in a professional looking fashion" ... "As someone that is faced with producing a FC volume, it would be useful if I had a standard IAA-agreed upon template/example/set of guidelines to consult and follow, in fact I do have an example that I am using - *Freshwater Crayfish* 13".

Jim is working on a version of an online IAA Manuscript Submission and Tracking System (http://iz.carnegiemnh.org/FCEditor/) where authors, reviewers, and editors can login, submit and download electronic

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

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

This issue edited by James W. Fetzner Jr.

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documents for publications of *Freshwater Crayfish*.

Now about the future. **Paula Henttonen** has confirmed with me that they are right on schedule regarding the preparations for the IAA17 conference which will be held in Kuopio, Finland in August 2008. The structure of the meeting has now been sorted out. Furthermore, they have already planned some of the social events including the IAA17 banquet at Kuopio University. Accommodation will be organized close to Kuopio University with functional public transport to the venue itself. Paula and Japo feel that they are on the right track, heading steadily to the successful meeting.

Our association seems very healthy these days because I regularly receive new IAA membership applications. I hope that these new members enjoy the website with all it's various links to information, *Crayfish News*, *Freshwater Crayfish,* etc. It seems that the e-version of *Crayfish News* is well appreciated and it is an excellent way for the IAA to save on postage costs. It is very important that the IAA continue to recruit new members, so please don't hesitate to mention the website and link to it from your own laboratory's website. I again encourage you to submit papers to *Freshwater Crayfish* 16. H

My best craywishes,

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Editor's Note

If the font in your copy of *Crayfish News* looks a bit funny, try downloading the font files used to create the issue from the IAA website (Crayfish News download page), or by clicking this link:

http://iz.carnegiemnh.org/crayfish/IAA/members/cn/Docs/Calibri_fonts.zip

After installing the font on your computer, the file should display properly. For some reason it was not embedding properly. Sorry about the inconvenience.

Freshwater Crayfish 16
First Official Call For Papers

All papers presented at IAA16 will be considered for publication in *Freshwater Crayfish* 16. We will also consider any other crayfish related manuscripts that were not presented at the IAA16 symposium.

— The final deadline for submission of manuscripts — is the 18th of May 2007

IMPORTANT NOTES FOR AUTHORS

There have been some minor (**but important**) changes to the "Instructions to Authors" section that was printed in the IAA16 Abstract Proceedings. We ask all authors to familiarize themselves with these new instructions, and to ensure that your manuscripts adhere to the updated instructions. Following the updated instructions will save everyone a considerable amount of time. The updated instructions are available via the following link: http://iz.carnegiemnh.org/FCEditor/

All manuscripts will need to be submitted electronically using the new on-line IAA Manuscript Submission & Tracking system. To submit your manuscript to this new system, follow the link listed above. Many thanks to **Jim Fetzner** for kindly taking the time to develop and prepare this exciting new web-based system.

The updated instructions to authors, and the on-line IAA Manuscript Submission & Tracking system have been implemented to streamline the submission-review-publication process, and to ensure future volumes of *Freshwater Crayfish* are of the very highest quality.

Thank you to those people who have kindly offered to act as reviewers for *Freshwater Crayfish* 16. We will be approaching other IAA members in the near future, seeking assistance with the reviewing of manuscripts. To ensure that *Freshwater Crayfish* 16 is a high quality publication, all manuscripts will be sent to no less than two reviewers, so if you are able to assist with the review process we are gladly accepting offers!

We are still seeking funding for the actual publication of *Freshwater Crayfish* 16, but we are confident that we will secure the necessary funds. If you require futher information please contact **James Furse** by e-mail at j.furse@griffith.edu.au H

Best Regards from down-under,
James and the Freshwater Crayfish 16 Team

IAA Related News

Three Past Volumes of *Freshwater Crayfish Are* Now Available Online

Just a quick note to let you know that several of the older issues of *Freshwater Crayfish* (volumes 1, 2, and 3) are now available online in the members-only portion of the IAA website. You can also view article abstracts (for the volumes in this group that have abstracts) and download low resolution PDF files of all the articles. Low resolution versions were made available so that they can easily be transferred across the internet. On the general access portion of the website, visitors can also view the full abstracts for these three volumes.

Higher resolution PDFs and a completely searchable version of FC1 has been available on CD for over a year. The cost of the CD is US $10.00 for members and US$15.00 for non-members, for those that might be interested in such a thing. I expect to have similar CD versions available for FC2 and FC3 by the end of this year. In addition, I hope to make additional FC volumes available online this year as well. Check the website and *Crayfish News* for progress updates. H

James W. Fetzner Jr.
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Biology of Freshwater Crayfish

The book *Biology of Freshwater Crayfish* edited by **David Holdich** (2002) has been out of print for a while but is now back in the Blackwell's 2007/2008 catalogue. Suppliers can be found in most countries - see www.blackwellfish.com. H

Cheers, **David Holdich**
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Short Articles

Chinese mitten crab in Hungary

Fisherman Csaba Halász from near Budapest, Hungary holding a specimen of Chinese mitten crab.

A specimen of Chinese mitten crab (*Eriocheir sinensis*) was caught by an angler, Csaba Halász, in the Danube near Budapest at Ráckeve, Csepel Island. (The name of the angler is a "*nomen est omen*" as "halász" means fisher in Hungarian). The pictured specimen was caught in late November 2006. The crab reached a considerable size. Its carapace length was 70mm with a width of 70mm and a weight of 156 g. Chinese mitten crabs are exotic freshwater crabs now found in large European rivers. Its introduction dates to the early decades of the 20th century. Carried by vessels from China, they survived the journey in ship ballast water. Although this species lives almost entirely in freshwater, during its reproductive phase it returns to the sea, where it spawns, lays eggs, and the young hatch out in brackish waters. This new generation then spends the first larval stages here and then begin to migrate upstream to populate freshwater rivers and streams.

The Chinese mitten crab has two troubling characteristics: First, it has a very strong burrowing habit which causes serious damage to embankments and drainage systems, and second, it can migrate large distances, up to 1500 km upstream in certain rivers in China.

Hungary is a landlocked country surrounded by the Carpathian Mountains in central Europe. The main river is the Danube, which begins in Germany, flows through Austria, Hungary, Romania, Bulgaria and the Ukraine before entering the Black Sea.

Hungary is very far from the habitats where Chinese mitten crab has previously been detected. So the crab Mr. Halász caught in the Danube near Budapest is probably the world record holder of its kin for long distance migration. This Chinese immigrant is the third recorded specimen from Hungary. H

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When Conservation Means Business – Eat2Beat !

Background

Many rivers and lakes in the UK are infested with huge numbers of the North American signal crayfish, *Pacifastacus leniusculus*. They are well known as having an adverse impact on such ecosystems, including burrowing extensively into banks (Holdich, 1999; Holdich *et al*., 2004; Souty-Grosset *et al*. 2006).

In the UK, signal crayfish are out-competing the native white-clawed crayfish, *Austropotamobius pallipes*, as they are:

- More aggressive (with much larger claws)
- Faster growing
- More fertile with females producing between 100 and 300 eggs per year
- Mating with native crayfish females who then produce sterile offspring, further reducing the number of natives
- Eating the native crayfish
- Carrying crayfish plague, which kills white-clawed crayfish

Competing with native crayfish for resources

The UK has the most stringent legislation relating to alien crayfish in Europe, but this has failed to stop them spreading (Holdich and Pöckl, 2005). Many attempts have been made to try and eradicate and control nuisance populations but with little success. In *Crayfish News* 28(4) **Stephanie Peay** describes work in progress in Scotland to try and eradicate some signal crayfish populations using natural biocides. However, whilst such a method might be OK in an enclosed system it is much more difficult to apply to rivers and streams, where manual removable and trapping might be the only option. A case in point is the River Lark in the Brecks region of East Anglia (eastern England), where a removal programme was initiated by the Lark Angling and Preservation Society (LAPS) in 2004.

The author of this article became involved in this programme in her role as Community and Biodiversity Project Officer with the Brecks Partnership. This partnership is a Countryside Management Project and a Sustainable Tourism Project based in Thetford in the Norfolk and Suffolk Brecks region (www.brecks.org for further information). A trapping and research feasibility study has been set up with the aim of increasing trapping effort and hopefully to prove that a little effort by many may add up. LAPS had been catching 6,000+ signal crayfish annually and it was found that this was only the tip of the iceberg. Through local and national PR (many articles have appeared in the national and local press – see below) a trap designer ('Trappy Pete') was found and using his 'D' traps and a lot of effort, over 100,000 signal crayfish of all shapes and sizes have been removed from a 2 mile stretch of the River Lark in just 2 months! Serious trapping effort is obviously going to be needed to make a dent in this rapidly expanding alien crayfish population.

Examples of media coverage

- Crayfish are the catch of the day.
  Thetford and Brandon Times (08 Sept 2004)

A male signal crayfish in a typical aggressive posture

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- Crayfish in the Brecks.
  Brecks Newsletter (Winter 2004)
- Traps set for alien invader.
  Guardian Unlimited (web) (05 May 2005)
- Alien crayfish threaten leisure site with floods.
  Newmarket Weekly News (12 May 2005)
- The Aliens are coming.
  Eastern Daily Press (20 Aug 2005)
- Close Encounters...of the crayfish kind.
  East Anglian Daily Times (24 Aug 2005)
- Here's to our delicious guest.
  East Anglian Daily Times (27 Aug 2005)
- The Today Programme. *Radio 4* (15 Nov 2005)
- Claws: the tasty alien terrorising our wildlife.
  The Observer (13 Nov 2005)
- The Crays: New gang is ruling the underwater world. *The Sun* (14 Nov 2005)
- Aliens coming to a garden near you.
  Country Life (24 Nov 2005)
- Crayfish invader usurping rivals.
  East Anglian Daily Times (25 Nov 2005)
- Tastes of Anglia brochure.
  Local Food and Drink (2006/2007)
- When conservation means business.
  Ranger magazine (Winter 2007)

Following on from our initial large scale trapping we now benefit from the efforts of many other interested parties. More traps, bigger traps and more effort have significantly increased the number of crayfish that we are able to remove during the main season (April to September), whilst improvements in trap design and methodology will allow us to further target smaller individuals and females (especially berried females) in the future.

Currently used trap designs are often hugely ineffective. The Swedish 'trappy' allows many crayfish to escape. This may be an intentional feature for the sustainable Swedish crayfishery but is not helpful here! Minnow traps with slightly enlarged openings are good for all sizes of crayfish, especially when you add vegetation to provide hiding places for small crayfish. It is clear that new designs to target smaller crayfish and berried females are needed and bankside traps may be the answer.

We are currently working with a multi-disciplinary team of civil engineers, erosion control specialists and trap designers to develop equipment that will protect banks from erosion whilst mimicking habitat that crayfish like to burrow into. These designs will incorporate a trap and will assist in our aim to catch year round, all size, male and female crayfish.

Under UK law it is illegal to put alien crayfish back into the environment once caught. Therefore in order to remove the number of crayfish necessary a means of disposing of them is needed. A lively interest in marketing alien crayfish exists and is, at the moment, being serviced by mostly unlicensed and unregulated individuals. Many trappers are exporting crayfish to mainland Europe whilst other supply locally or sell their 'wildcatch' to fishmarkets. At the same time UK food suppliers and distributors buy crayfish in from European countries and China.

However, there are drawbacks in trying to stimulate the marketing of alien crayfish. The issue here lies with some trappers approach to their 'product'. In order to ensure a continued supply of their product the regulations regarding 'not returning alien crayfish to the water once caught' may be ignored and small ones may be put back. Even more damaging is the 'seeding' of new areas with alien crayfish. A bad situation may rapidly get worse.

Possible answers

However, there is hope. Presenting **'eat2beat',** a Social Enterprise based on the premise that if you eat it you can beat it!

We have just completed our first year's trial of this business with great success. Funds from the enterprise have supported the expenses of a team of International MBA students based at Lancaster University who have written the business plan for this endeavour.

The aim is to provide high quality, ethically harvested food items. Starting with crayfish and moving swiftly onto muntjac, Canada geese etc... the possibilities are endless in the UK with its numerous introduced species. (The author has heard that you can even eat Japanese knotweed – which is a bit like rhubarb!)

But back to our first quarry ... alien crayfish. Crayfish are high in protein, low in fat and very tasty. In line with our ever increasing interest in healthy eating and putting people in touch with nature there seems to be a good link here, not only for the individual but in order to make the link with finding 'community solu-

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tions to environmental problems' as the funding briefs say!

This is a call for those of us who have rivers, lakes and ponds in our remit to take action and allow the community to get actively involved:

In the words of Taugbøl and Skurdal (1999):

> *'No method has been developed for eradication of unwanted crayfish populations without causing harmful effects to other biota. That means that the alien species have to be accepted as part of the European fauna. Accepting this does not mean giving up on the native species. A more balanced view with minds open for different solutions in different areas is a more fruitful approach. If those who are advocates for the native species also accept the existence and exploitation of alien species outside the "Native Crayfish Areas", this may perhaps, in return, lead to more understanding for the necessary native crayfish conservation actions.'*

Over 87% of UK river catchments contain alien crayfish and it is possible that our native crayfish has less than 30 years left before becoming extinct (Holdich et al., 2004).

Using the methods outlined above we are recording:

- Reduced numbers of crayfish being caught in heavily trapped areas
- The overall size of the individuals is decreasing (these individuals will be more vulnerable to predation and we are improving trap designs and techniques constantly to increase the capture of smaller crayfish)

In intensively trapped areas fish fry have been seen for the first time in years. So overall biodiversity is improving in heavily trapped areas

Once an initiative to regulate the 'crayfish industry' has been established (such as **eat2beat**) and numbers are below what is seen to be commercially trappable we will need the best efforts of our local communities to continue to keep the pressure on. At present a licence is required to trap alien crayfish at specific sites, however in some Environment Agency Regions such licences may not be granted.

If we are to control populations once commercial trapping has had its effect then local effort will be the key. If we can keep up our large-scale trapping efforts on the River Lark we estimate that community trapping will need to take up the gauntlet in 3-5 years time — will they be ready for the challenge? H

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The Brecks Partnership is funded by the Norfolk and Suffolk County Councils, Breckland Council, Forest Heath District Council, Borough Council of King's Lynn and West Norfolk and St. Edmundsbury Borough Council. Project work is funded by partner organisations. Thanks are due to all these organisations and to David Holdich for his help in preparing this article.

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A simple protocol for the preparation of crayfish chromosomes from gill cells applicable to field studies, teaching, and banding

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Abstract

Due to the great gap and lack of information about karyotype protocols in crayfish species from México belonging to the genera *Procambarus* and *Cambarellus*, it was important to establish a standardized protocol to arrest metaphase chromosomes of these genera. This was necessary in order to make cytogenetic comparisons among species and genera. The relevance of karyotypic studies arises from the fact that chromosome number, shape and heterologous sex chromosomes may provide insights, together with molecular, morphometric and biogeographic analysis, into the evolution and diversification of the cambarids. In addition, they may help conservation biologists localize zones of hybridization when an invading, or introduced species, hybridizes with a native one. After a careful review of the available works about cytogenetic protocols that have been used for other organisms, like fish, shrimps, and flies, the Denton (1973) protocol, as modified by Hernández and Gutierrez-Yurrita (1990), turned out to be the best option.

Introduction

The naturally occurring cambarids in México are a highly diverse group of more than 50 species, commonly called '*acociles*' (Nahuatl word) or camarones de río (Spanish) (Gutiérrez-Yurrita 2004). These species represent a significant proportion of the macroinvertebrate benthic fauna in the rivers and lakes of the Mexican territory. In addition, most of the species belonging to the genus *Procambarus* and *Cambarellus* play a keystone role in the functioning of the ecosystems they inhabit. At the current time, only a limited number of cambarid species have been karyotyped. This is largely due to 1) the difficulties in obtaining high quality metaphase chromosome preparations, and 2) the fact that in stark contrast with other animal groups, mainly terrestrial vertebrates, crayfish usually have a large number of very small chromosomes.

Picture 1. Landscape of the type locality of *Procambarus* sp. A.

Studies of crayfish chromosomal variation are rare. There are only seven crayfish karyotypes reported where the number of metaphase chromosomes was calculated. Karyotypes include three from the family Astacidae and four from the family Cambaridae. The diploid number of crayfish metaphase chromosomes were found to vary from 116 to 376 in these seven species. However, within the cambarids the variation in chromosomal number appears to be much less pronounced, ranging from 192 to 200 (Fetzner & Crandall 2002). In the cambarid group, Niiyama (1941) produced the first karyogram for a crayfish from *Procambarus clarkii*. At present, there are no reliable hypotheses concerning the evolutionary processes that produced the great number of crayfish metaphase chromosomes (Niiyama 1962). According to Crandall (1997), additional work on crayfish karyotypes would aid in explaining the origin of this large number of chromosomes and possibly the evolutionary history of the group, but no additional data were reported. Genetic variation is a fundamental basis for the study of the systematic characteristics of species and their taxonomic relationships.

Karyotype analysis has allowed us to detect possible hybrid zones between multiple native crayfish species or between native and introduced species (Perry *et al*. 2001). These hybrid zones tend to occur in many protected natural areas where introductions are illegal and, thus, generally go undocumented.

At the present time, there are a lot of protocols for calculating genetic divergence via molecular analysis of mtDNA or allozymes, or through phenetic analysis of morphometric data. However, only a few protocols

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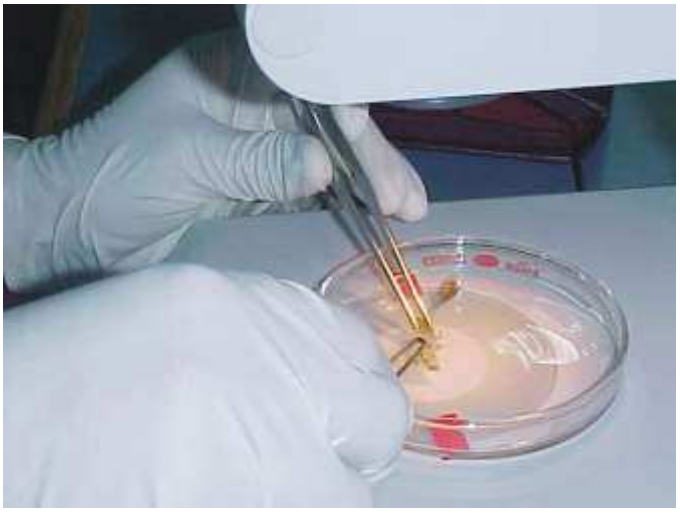
Picture 2. Measuring the total length of *Cambarellus montezumae*. Individual is inside a special Petri dish used to measure crayfish.

have been developed, and subsequently improved upon, to make use of cytogenetic studies, such as an analysis of chromosomal variation (Crandall 1997).

Karyotype research on cambarids has developed slowly due to the lack of adequate protocols (Salemaa 1985). It is very important to improve and standardize the protocols so that researchers can easily obtain metaphase chromosome spreads of these organisms and make detailed comparisons. The lack of any specific protocols for Mexican crayfish species made us search and review different karyotype methods applied to other animals, like fish (Denton 1973, Rivlin *et al*. 1986, and more recently Harvey *et al*. 2002), flies (Sullivan *et al*. 2001), and other decapods like shrimps (Campos-Ramos 1997), or other species of *Procambarus* (Niiyama 1941, Diupotex-Chong *et al*. 1997). The main objective of the present work was to establish and improve karyotype protocols that would apply to any crayfish species of the genera *Procambarus* and *Cambarellus*.



Picture 3. Gill dissection of *C. montezumae* under a stereoscopic microscope.

Materials and Methods

Crayfish were sampled with hand nets (shallow water ponds, less than 2 m depth), by skin diving (ponds between 2 and 5 m depth; and rivers), and electro fishing (slow streams and springs) (Picture 1). The specimens of the genus *Procambarus* that we used were collected in Molango, Hidalgo (*Procambarus acutus cuevachicae*); Puente de Palictla, San Luis Potosi (*Procambarus toltecae*) and Arroyo Plátanos, Querétaro (*Procambarus* sp. A – a new species to science; its official description by Gutiérrez-Yurrita is in progress). *Cambarellus montezumae* individuals were collected from El Vegil Dam, Querétaro. The crayfish analyzed in the study were from populations known to be of pure stock, as confirmed by molecular analysis by López-Romero (in press).

Because of the small size of *C. montezumae* individuals (2.5 cm carapace length) (Picture 2), and in order to standardize a protocol for both genera occurring in México, all crayfish metaphase chromosome spreads were prepared from gill cells isolated from centrifuged whole tissue (Picture 3). These preparations were then incubated for 24h at 30°C in the karyotyping medium described by Diupotex-Chong *et al*. (1997). After a detailed review of the available protocols for obtaining metaphase chromosomes, and after conducting a pilot experiment trying each one, we decided to follow the protocol of Denton (1973), as modified by Hernández and Gutierrez-Yurrita (1990):

- *The incubation time with colchicine were adjusted from 4 to 8, 12 and 24 h.*
- *The incubation time with potassium chloride from 30 to 35, 45 and 50 minutes.*
- *Centrifugation velocity from 12,000xg to 1,000xg.*
- *The incubation time with methanol – acetic acid from 4 to 24 h.*
- *The incubation with Giemsa stains from 15 seconds to 1 minute.*

Results

Metaphase chromosome batches were prepared from gill cells suspensions according to the protocol of Diupotex-Chong *et al.* (1997). First, gill cells were immersed in 0.5 M $CaCl_2$ to promote mitotic activity. After approximately 24 hours, cell suspensions were extracted and placed in 0.05% colchicine (w/v) for an-

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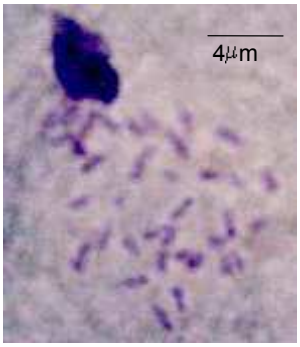

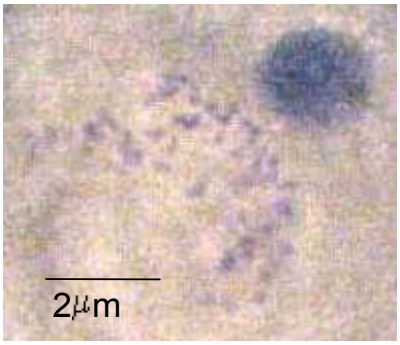

Pictures 4 & 5. Metaphase chromosome spread of *Cambarellus montezumae*.

other 24 hours. After the colchicine treatment, cell suspensions were incubated in hypotonic 75 mM KCl for 50 minutes. Incubation time was very important to arrest metaphase chromosomes in the appropriate way to be observed under a microscope. Afterwards, samples were centrifuged at 1,000xg for 10 minutes, and then the supernatant was discarded. One milliliter of a methanol-acetic acid (3:1 v/v) was added as a fixer and then samples were centrifuged again to 1000xg for 10 minutes. Supernatants were again discarded and the fixer was changed one more time. Samples were then kept at 4°C for 24 hours. After this, samples were centrifuged under the same conditions again, and the supernatant of each was again discarded. More fix solution was then added to each sample. Finally, "splash" preparations from these suspensions were made as suggested by Session (1996). It is noteworthy to mention that at least 10 preparations from each sample were examined under a light microscope.

After "splashing", preparations were fixed by passing them through a Bunsen burner flame. Preparations were then stained with 10 % Giemsa (v/v) in 10 mM phosphate buffer solution (PBS), pH 6.8, for 10 to 15 minutes and rinsed with water. The preparations were air dried at room temperature (25°C). Finally they were observed under a light microscope (1,200X). Some were mounted with entellan and photographed.

As depicted in pictures 4 and 5, we observed that crayfish chromosomes are too small to be properly separated; and because of their great number (we counted more than 130 chromosomes in other spreads) it is not possible to quantify them by using a conventional microscope. However, the tested protocol did prove to be adequate to obtain metaphase chromosome spreads. H

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Revision of the Endemic Tasmanian Crayfish Genus *Parastacoides*

Tasmania's count of endemic crayfish genera moves from two to three with a recently published revision of the genus *Parastacoides*. The wet western half of Tasmania is dominated by acidic peat soils, which support a mosaic of sedgelands, heaths and scrub forest, all of which provide habitat for large numbers of burrowing crayfish. They are probably important ecological engineers in these systems, aerating and draining the soil, and providing habitat for quite a diverse associated fauna.

The first specimens of these animals were collected in the late 1800s, but they were only recognised in their own genus in 1936 when Ellen Clark established the genus *Parastacoides*, with a single species, *P. tasmanicus*. She later added two more species, and Edgar Riek described a further four, one of which he later synonymised with *P. tasmanicus*. So the count of *Parastacoides* species stood at six when Colin Sumner revised the genus using a numerical taxonomic approach in 1978 and reduced it to a single species, *P. tasmanicus*, with three sub-species: *P. t. tasmanicus*. *P. t. inermis* and *P. t. insignis*.

Extensive distributional and ecological studies in the 70s and 80s did not support these sub-species, as they were often found living very close together with fine-scale habitat partitioning, and a preliminary allozyme study showed that there were high levels of fixed differences between sympatric populations of the sub-species. There things stopped until 1997 when Brita Hansen started a PhD program to examine the taxonomy, phylogeny and biogeography of the group. After a long and winding road, Brita's revision of the genus was published just before Christmas 2006 in *Invertebrate Systematics,* Vol. 20.

Figure 2. *Ombrastacoides leptomerus*. Photo: Ron Mawbey.

Figure 1. Orange Valley, south west Tasmania. Habitat of *Ombrastacoides* and *Spinastacoides* species from valley floor to mountain top. Photo: Alastair Richardson.

This is one of those revisions that has to change a familiar (well, to some of us, anyway) name. The generic name *Parastacoides* will disappear since it turns out that the type specimen of *P. tasmanicus*, which is in turn the type species of the genus, is actually a specimen of *Geocharax gracilis*! The confusion arose because this specimen was long thought to have been lost, but it was safe in the Museum für Naturkunde of the Humboldt University in Berlin all the time. Our review describes 14 species, 10 of which are new. They are placed in two genera, *Ombrastacoides* (11 species) and *Spinastacoides* (3 species). Although identification of some of the species using morphological characters is quite difficult, the two genera are easily separated since all *Spinastacoides* species have terminal spines on their uropods, a rare character in freshwater crayfish (and indeed in astacuran decapods in general).

Much of the geographical ranges of these two genera lies within the Western Tasmania World Heritage Area and its associated national parks, but some species have very restricted ranges, and one at least is likely to be listed as Vulnerable under the Tasmanian Threatened Species Protection Act. *Ombrastacoides denisoni* occupies little more than 10 km^2 on current information, and all of its range is within forest used for timber production. Another species, *O. parvicaudatus* may already be extinct as a result of a hydro-electric development. H

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News Items From Around the World

Alabama Undisputed Crawfish King

Last month, according to the Mobile Register, nationally recognized crawfish scientists identified the state of Alabama as the "most biologically diverse" in the number of crawfish species in the country. Here are some of the findings:

- Alabama has 83 species of crawfish, six (6) more than Tennessee, the next most diverse state.
- Some creeks in Alabama have more than twice as many species of crawfish as are known in all of Europe.
- 2/3 of the world's species of crawfish are found in the U.S. and 95% of those are in the Southeast.
- Alabama has 46 more species of crawfish than mudbug farming Louisiana.

Interest in crawfish diversity, especially in Alabama, has grown since 2004 when Press Register reporters captured a thought to be extinct crawfish species called the "rusty gravedigger". Steve Rider, aquatic resources coordinator with the Department of Conservation has also been instrumental for securing funding to do a crawfish survey in the state. According to Rider, there may be an additional 10-12 species of crawfish that have never been identified. H

Bama Environmental News - BEN
http://www.BamaNews.com/
March 23, 2007 #281

Revival of the Gravedigger

Plunging arms shoulder deep into underground burrows carved into the soft and muddy bottoms along Daphne's D'Olive Creek, a team of scientists captured seven rusty gravedigger crawfish Thursday morning, marking just the second time anyone had documented the rare species since the early 1990s.

By the end of the day, the scientists had found additional populations of the diminutive species in wetlands near Fish River and a handful of small streams in south Baldwin County, news that suggests the county's own unique species is not as close to extinction as once feared.

The scientists said the D'Olive Creek population appeared to be healthy, though the species is considered a candidate for the federal endangered species list. Prior to the collection work Thursday, the confirmed range of the rusty gravedigger consisted solely of a small island in the creek, about the size of a tennis court.

Even with the newly discovered populations, scientists still believe the crawfish may merit federal protection. Other species already on the endangered species list, such as California's Shasta crayfish, apparently exist in much larger numbers and are found in tributaries of several river systems in that state.

The fact that the gravedigger was found in new locations suggests both how little is known about the creatures of Alabama's exceptionally rich and diverse waters, and how difficult catching and identifying rusty gravediggers can be. A number of scientific efforts in the 1990s failed to confirm any gravedigger populations outside of D'Olive Creek.

The crawfish were captured by scientists from Eastern Kentucky University, the U.S. Fish & Wildlife Service, the Illinois Natural History Survey and the Alabama State Lands Division.

The scientists are working from a grant funded by the Alabama Department of Conservation & Natural Resources and the U.S. Fish & Wildlife Service. Federal officials will use the scientists' research to determine whether the species deserves federal habitat protection.

The rusty gravedigger, also known by the scientific name *Cambarus miltus*, is a small, brick red crawfish about the length of a wooden matchstick. Delicate lines in a lighter shade of red make an elegant filigree around the edges of its shell. It digs elaborate underground burrows in soft mud banks and wetlands near gently flowing water. Each crawfish usually creates one chimney-like entrance to its burrow, with three or four smaller, more discreet side entrances.

The original scientific paper identifying the gravedigger -- which was discovered in 1978 by the late **Joe Fitzpatrick**, who was a University of South Alabama professor -- estimated the total population at perhaps as few as 25.

Guenter Schuster, a renowned crawfish expert from Eastern Kentucky University, predicted that that the population on D'Olive Creek alone would end up containing hundreds of individuals, perhaps thousands.

He said he suspected that the species would also be found in other Baldwin County streams, even after a brief survey suggested that the next most likely location, Yancey Branch in Daphne, did not appear to contain any species of crawfish. A recent stream-restoration project on Yancey Branch undertaken by the city of Daphne -- a project that some federal officials described as a "disaster" -- resulted in a redirected and dramatically widened streambed, and the alteration of surrounding wetlands where crawfish might live.

Scientists in the field last week said that damage to that creek shows the tenuous grasp of Alabama's wild creatures in the face of bulldozers, burgeoning development and a lack of appreciation of Alabama's natural habitats.

(Continued on page 13)

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Schuster, along with **Christopher Taylor** from the University of Illinois, is doing field work in Alabama in preparation for a scientific book to be titled "The Crayfishes of Alabama." The pair just completed "The Crayfishes of Kentucky."

While Alabama is also home to the common species of crawfish farmed in Louisiana rice paddies for human consumption, its diversity of other crawfish species far exceeds that of Louisiana or any other state.

Schuster and Taylor said they have confirmed 84 species of crawfish in Alabama. In fact, Alabama is home to a quarter of the 350 species found in all of the United States and Canada. The scientists said they are studying four additional species of Alabama crawfish that are so far unidentified, and predicted that after their field work is completed the state will likely be found to be home to 90 or more species.

"Alabama is the richest state in the nation, biologically. If you look at the different groups -- snakes, fish, mussels, clams, snails, insects, crayfish -- Alabama has the highest diversity in the country. It's quite incredible, a very unique state," Schuster said.

Schuster said that about 90 percent of the known species in Alabama were caught in streams. He believes that burrowing species such as the rusty gravedigger, which lives most of its life in underground tunnels that stretch from the surface to the water table, have slipped under the scientific radar, and many may remain to be discovered.

Courtney Graydon, with the Conservation Department's lands division, has been studying two of the unidentified species, both burrowing crawfish. One of them lives in pitcher plant bogs around Grand Bay, near the Mississippi border. That species grows to about 6 inches long and is deep blue in color. The other crawfish lives in the Splinter Hill pitcher plant bogs north of Mobile and is bright purple.

"This is cool. We found them," Graydon said, as the scientists fished the gravediggers out of D'Olive Creek. "We don't know much about a lot of these guys."

Graydon, who often spends weekends chasing mud bugs, said the homes of the crawfish are easy to locate in the pitcher plant bogs, given away by tiny towers of mud erected outside their front doors.

Those distinctive mud chimneys are visible all over south Alabama, rising 3 to 8 inches above the surrounding earth at the mouth of most burrows.

"We had a good morning, really good. We got two females and five males. It's unusual to get so many males, and lucky," said Taylor, the Illinois scientist, as he sorted the captured specimens and placed them into a cooler.

Scientists need adult males, he said, in order to identify certain physical characteristics that distinguish between closely related crawfish species.

Using surgical scissors and tweezers, Taylor cut a hole in the shell of one of the gravediggers and carved out a tiny plug of flesh from its tail. Preserved in a small vial, the sample will be subjected to a DNA analysis and entered into a database that the scientists are compiling. They hope the genetic information will aid in determining whether any of the similar looking crawfish found throughout the South are best classified as unique species or as regional variations of a single species.

"Got one!" cried Carl Couret, chief biologist with Daphne field office of the Fish & Wildlife Service, as he pulled a muddy arm from the oozing swamp muck. As the tiny red prize pinched a finger, Couret remarked on the size and power of its claws.

"The gravedigger is a candidate species, a species of concern, and we'd like to keep tabs on them," said Couret. "If the population drops below a certain point, we need to know that. There's a lot we need to know about these guys, so its great we're able to get out here and look at how they're doing." H

By BEN RAINES
Staff Reporter, Press-Register, Mobile, AL
Monday, March 19, 2007

No Change in Panama City Crayfish Designation

Florida's Fish and Wildlife Conservation Commission took no action Wednesday on the proposed designation of the Panama City crayfish as a threatened species.

Nor did it scale back protection of manatees - a more closely watched issue - giving its staff another year to study how the state treats dwindling species. The inaction allows manatees to keep their endangered classification for another year in spite of claims by some that the sea cow population has rebounded and is no longer in danger of extinction. However, it keeps a Panama City crayfish management plan from going into effect.

The management plan consists of a summary of available biological information; an assessment of the threats facing the species; a statement of the conservation goal and objective; a listing of the conservation strategies to achieve that goal and objective; an implementation and monitoring strategy; and areas for future research.

Commissioners opted not to take action Wednesday after they became entangled in a discussion about how to decide

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whether a species is endangered, threatened or of special concern.

"Anytime we're this confused, the system we use is broken," said Commissioner John Rood. "The public also thinks it is broken. We need to do what's right." Henry Cabbage, a spokesman for the commission, said the issue is whether Florida should align itself with federal rules or the International Union of Conservation of Nature criteria, which uses a statistical analysis to determine protection levels.

"Commissioners decided we really need to iron out criteria before making any changes," Cabbage said.

The Panama City crayfish, also referred to as the Econfina crayfish, grows to about 2 inches. It's brown overall with a light brown and a black stripe extending from head to tail along each side.

The crayfish has been listed as a species of special concern since 1989. But a comprehensive assessment prompted by an August 2001 petition to the FWC found that the crayfish meets the criteria for listing as a threatened species, according to the management plan.

The plan says major threats to the crayfish are habitat loss and degradation from human development, human-caused mortality from property maintenance activities, and vulnerability to extirpation from fragmentation and isolation effects.

The species only occurs in Bay County in and around Panama City and is restricted to 26 known sites, none of which occur on public conservation lands. H

NEWSHERALD.com
AP Associated Press

By Kevin Porter
News Herald Writer
Thursday, November 20, 2003
The Associate Press contributed to the story
(*Story shortened to include only crayfish related text*)

Yabbies Have a Sixth Sense

They may have tiny brains but yabbies possess a sophisticated sixth sense which alerts them to prey and predators, Australian researchers have discovered.

The freshwater Australian crayfish has an ability to listen to electrical signals from other creatures in the water - in the same way as a great white shark uses "electroreception" to hunt prey - five years of study have revealed.

A University of Melbourne zoology research team

The Australian yabby.

made the discovery after playing some electrical signals through electrodes in water near a yabby.

Research team leader Blair Patullo said: "We've found evidence that these yabbies have a sixth sense and it's one that this animal is particularly lucky to have because it has got a brain the size of a pea."

Daily Telegraph The findings have been published in the prestigious journal Current Biology. H

The Daily Telegraph
February 21, 2007 12:00

Literature Cited:

Patullo BW and Macmillan DL (2007). Crayfish respond to electrical fields. Current Biology, 17(3): R83-R84.

Tweed Salmon in Danger From Killer Crayfish

FEARS are growing about the future of salmon fishing on the Tweed following the discovery of an alien predator in one of its tributaries.

Dismayed salmon experts have found a killer crayfish in the Till and are now "very concerned" about the effect it will have. "We are very worried about it," said Tweed Foundation director Nick Yonge this week.

"We've been concerned about them getting in there as the Till has soft banks where they can burrow in so we were very disappointed to find they were there already."

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The Signal Crayfish, a native of north America, was first brought over to England as a possible fish farming crop.

However, there was no market and many have since escaped into British rivers and are working their way north.

Biologists have been watching anxiously for signs of them in the Tweed as they believe they could have a serious effect on the salmon. The crayfish eat young salmon and trout as well as compete with them for food and space so the discovery of them in a tributary of one of the country's premier salmon rivers is a major blow.

"It is a very dominating creature which can fundamentally change the ecology of a river," said the Tweed Foundation's assistant biologist James Hunt. "A female can carry 400-600 eggs so they breed and spread very quickly."

"We are not going to say it is the end of salmon but we do consider it to be very serious and is another potential problem for a salmon river.

"It could be a serious threat to salmon fishing. We just don't know yet how much damage they will cause."

To make matters worse there is no fail proof way of removing them from a river, according to the scientists. "In a pond it may be possible to poison them but not in a river," said Mr. Hunt.

"People think you can trap them and then get rid of them but that is just not the case. All we can do is monitor them as there is no way of getting rid of them."

So far 24 of the crayfish have been trapped at the Till. It was seen as a danger point because of the soft banks where they can dig in and cause erosion although there is no evidence of any erosion yet.

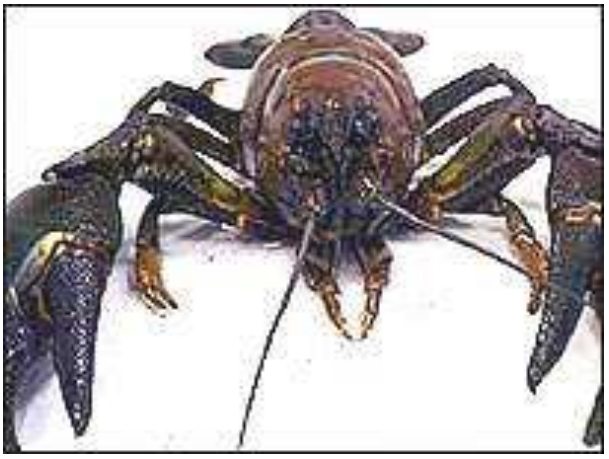
"The problem is that adults eat their young so if you trap them it tends to be the adults that you catch so you end up with even more young," explained Mr. Hunt.

"They are obviously well established and I would say they have been there for some time."

The crayfish grow up to 10cm long and carry a disease which is lethal to the native English crayfish. There are no native crayfish in Scottish freshwater and the first sighting of the alien was in Dumfries and Galloway around 15 years ago.

The Melrose-based Tweed Foundation, a charitable trust set up to promote the development of salmon and trout, believes that action should have been taken at that point to stop the crayfish's spread but says nothing was done.

Signs that the crayfish were moving east were found recently when they were discovered in the Ettrick Water, near



North American signal crayfish, *Pacifastacus leniusculus*.

Selkirk. "This is a problem for the whole of Scotland," said Mr. Hunt. "We have been campaigning for something to be done but none of the government agencies are taking responsiblity.

"We feel Scottish Natural Heritage or SEPA should be publicising the effects of the crayfish and funding research to try and get rid of them.

"When they were discovered in Dumfries and Galloway that was when something should have been done to prevent the spread.

"You need a license to have them but people still get them, put them in their ponds then forget about them.

"They always escape as they can crawl across land or just follow the water course exiting from the pond," said Mr. Hunt.

A spokesman for SEPA said: "The Scottish Environment Protection Agency (SEPA) supports appropriate eradication measures taken by those responsible for addressing this issue and has participated fully in efforts to control its spread made by organizations concerned with the Tweed .

"Our remit is quite restricted but in practical terms we offer help with monitoring the spread and provide advice on control, policy, use of biocides and the law and disposal of corpses.

"We will also use new water regulations wherever possible to avoid the spread of crayfish with river gravel and will continue to offer as much support as we can to organizations tasked with its control." H

Berwickshire Today
22 February 2007

Office of the Minister
Environment and Heritage

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20 DEC 2006

Dear Dr Souty-Grosset

Thank you for your letter of 31 August 2006 to Senator the Hon Ian Campbell, Minister for the Environment and Heritage, concerning the Giant Freshwater Lobster (*Astacopsis gouldi*) Recovery Plan. The Minister has asked me to thank you for your letter and to reply on his behalf. I regret the time it has taken to reply.

The Australian Government is committed to protecting and recovering all our threatened species and ecological communities. You will be pleased to learn that, based on independent scientific advice, the Minister has recently adopted a national recovery plan for the Giant Freshwater Lobster under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The recovery plan addresses the major threats to the Giant Freshwater Lobster, including the past and current (illegal) fishing pressure and large-scale habitat disturbance from agricultural, urban and forestry land use.

The Australian Government has contributed more than $200,000 since 1991 on direct actions to protect and recover the Giant Freshwater Lobster and over $80,000 on projects that have broader biodiversity benefits to the Lobster. Project funding has been directed towards a range of activities such as the development of a recovery plan, community awareness, habitat protection, management and habitat restoration.

Having a recovery plan in place is just the beginning. The Australian Government Department of the Environment and Heritage and the Tasmanian Department of Primary Industries and Water have begun discussions on which priority implementation actions are required as a matter of urgency to protect and recover this iconic species.

The recovery plan can be accessed from the Department of the Environment and Heritage website at: www.deh.gov.au/ biodiversity/ threatened/publications/a-gouldi.html

Thank you for taking the trouble to write.

Yours sincerely

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Multimedia

The state of Oklahoma has recently released a poster of the crayfishes of the state. The "Crayfish of Oklahoma" is the 3rd poster in a series depicting the variety of plants and animals found in Oklahoma. This poster features all but one species of crayfish found in the borders of Oklahoma (the uncommon *Procambarus curdi*, Red River burrowing crayfish, is the only Oklahoma species not represented). Photographs for the poster were taken by IAA member **Chris Lukhaup**.

All three posters in the series are available free of charge. Copies of the poster can be obtained by contacting Priscilla Crawford at prill@ou.edu. If you would like more than 10 posters to distribute to large groups, such as entire classes or conference attendees, please contact their office by phone (1-405-325-7658) or email okregistry@ou.edu.

For more information on the Oklahoma Biological Survey posters visit their website at http://www.biosurvey.ou.edu/OBSposters.html

(Continued from page 1)

Chris and Rob at Stockyard Creek.

tuary. The area is full of small wallabies and Red Necked Pademelons that create a hazard as you drive through the area, but Chris and I avoided any collisions and went to Cedar Park picnic area located within the Nature Reserve. We wandered down to Stockyard Creek, which meanders through the park, and started looking for the little known *Euastacus dangadi* crayfish. This creek has crystal clear water and was flowing steadily towards the Macleay River and the sea at South West Rocks. It has a sand and gravel bottom with a mass of leaves from the overhead forest canopy that float on the water's surface or litter the bottom of the creek.

The creek consists of various 'ponds' and pools that contain sections with gravel or sand beds. The creek flows through these different beds which then filter and clean the water, thus ensuring that the water is crystal clear in the open pools.

The edges of these ponds were full of crayfish burrows, so we knew we were in the right area. After a quick search of a few pools to see if we could spot any crayfish just out for an afternoon stroll through the pond, we started to turn over some rocks. Rock turning is always a good method to find crayfish as they love to make their burrows under rocks and boulders. It did not take long to get results and soon small crayfish were darting out all over the place. Chris, being keen and energetic, got his shoes off and hopped into the pond to get the big ones hiding under rocks out in the deeper water. Gently turning a rock so as not to disturb any sediments usually will reveal a crayfish just sitting there. They do not stay still for long and you need to be quick. If you are not, they will rapidly disappear down into their burrows, which often continue further down into the bottom of the pond.

A close-up of *Euastacus dandagi*.

Chris and I captured our crayfish in rapid succession. Though we caught full grown animals around 60 grams in size, the big monster ones eluded us. Chris nearly had one, but it managed to get away at the last second. The real big ones are just too smart and that's why they have made it to such a large size (about 30% larger than any we caught). I can't show you a photo, as it was too fast for me to capture a shot. However, you can see that the average-sized adults have claws that are red in color. The big old man cray we saw this day had white claws! That's a real badge of honor as white claws in this species are very very rare. There is not much known about this species of crayfish, but some of the other large spiny crayfish are known to live for over 50 years, so we can only surmise that the huge old male we saw with white claws was over 50 years old. Well, I know where he lives so I will be back to try and get his photo in the future. H

Chris holding a captured *Euastacus dandagi*.

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(Continued from page 20)

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