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# Crayfish NEWS

Vol.19 No.4

September 1997

The official newsletter of the International Association of Astacology



The Louisiana Crawfish Farmers Association is the world's largest crayfish aquaculture association.

## LOUISIANA CASHES IN ON CRAWFISH

Crawfish farming is the largest freshwater crustacean aquaculture industry in the United States. The nation's leading crawfish producer is the State of Louisiana, responsible for more than 90% of the domestic crop.

More than 1600 farmers produce crawfish in 111,000 acres of earthen ponds. More than 800 commercial

fishermen harvest crawfish from natural wetlands, primarily the Atchafalaya Basin. The combined annual yield ranges from 75 million to 105 million pounds.

Louisiana has more than 30 different crayfish species. The two commercially significant species are the red swamp crayfish (*Procambarus clarkii*) and

the white river crayfish (*Procambarus zonangulus*).

Louisiana crawfish have been introduced throughout the United States and overseas. Some 4 million to 5 million pounds are exported to Sweden each year.

Source: Louisiana Crawfish Brochure, Louisiana State University Agricultural Center, June 1996



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

Some time ago now, IAA moved into the Internet Age. Pioneering as the Web Page creator and first editor was Dr. David Bechler, Valdosta, USA. He initiated the process by offering to set up and edit a Web Page for IAA. As IAA officers we were more than glad to accept his offer.

The IAA Web Page has inspired people to contact IAA officers with questions concerning the organisation and crayfish in general. This shows that the Web Page is working in the best possible way. It promotes IAA's work and spreads information on crayfish to Web surfers around the world.

Now, however, David Bechler has expressed his desire to retire from the editor's post due to increased demands at work. As President I would like to extend the gratitude of all our members to David Bechler for his effort in developing IAA and to wish him the best of success in his work as department head.

I have invited researcher Ari Mannonen to be the new Web Page editor. His own home page is already well known among many of our members and Ari (better known as Lemu) is an active user of Internet and WWW himself. I wish to welcome Ari aboard the IAA organisation as the new editor and ask that all interested members contact him with their ideas concerning the IAA home page. Everyone's suggestions are very valuable in developing the page so that it will serve our members and spread information in the most effective way. When the new IAA home page is finished and working, the old page will be replaced with a link to the new one. So just keep on checking the old IAA page occasionally.

Another ambitious development project is also on the way. IAA Board Member Martin Moore is working on a durable and easily portable poster that will become the newest medium in making our organisation more widely known. The poster will soon be seen at conferences and symposia around the world.

Despite these great new mediums and effort, the main responsibility for informing the public and recruiting new members still remains on the trustworthy shoulders of our country correspondents and other active members. IAA now has 337 members. I believe this number could be significantly increased, taking into account the current interest in freshwater crayfish culture, consumption, research and protection around the globe. Every other year IAA Symposia gather anywhere from 1/4 - 1/3 of our members together which shows how active we are. The next Symposium in Augsburg, Germany, is less than a year away and until then I wish everyone a productive season.

Paula Henttonen, IAA President

### RED CLAW CRAYFISH CULTURE INFORMATION - USA

Member David Rouse (Department of Fisheries & Allied Aquacultures, Auburn University, Alabama 36849 USA. E-mail: DROUSE@AG.AUBURN.EDU) has done much red claw (*Cherax quadricarinatus*) culture research in the USA. An information package available from his office includes the following titles for those interested in culturing red claw crayfish in the USA.

Rouse, D.B. 1991. Australian crayfish promising for Alabama aquaculture. Highlights of Agricultural Research 38(2).

Nelson, R.G., D.B. Rouse, L.U. Hatch, P.B. Medley, and G.F. Pinto. 1992. Economics of producing Australian crayfish in Alabama ponds. Highlights of Agricultural Research 39(4).

Jensen, J. and M. Masser. 1996. Sources of Australian crayfish. Timely Information, Agriculture and Natural Resources, Fisheries System, Alabama Cooperative Extension System, Auburn University, Alabama USA.

Masser, M.P. and D.B. Rouse. 1993. Production of Australian Red Claw crayfish. Circular ANR-769, Alabama Cooperative Extension Service, Auburn University, Alabama USA.

### THE AUSTRALIAN CRAYFISH GENUS *EUASTACUS*: ADVANCES IN RESEARCH

by John R. Merrick

Different countries have different calendar systems. China has its Year of the Rat or Year of the Pig, and Australia is working up to 2000, Year of the Olympics; but in astacological terms 1997 is shaping up as the Year of the *Euastacus*.

Many members will be familiar with the Australian yabby, red claw or marron; these commercial species (all in the genus *Cherax*) are now cultured in a number of countries. But the largest single generic grouping in the family Parastacidae (native to the Southern Hemisphere)

### Editorial

It's hard to believe the Aussie summer is just around the corner once again. With it will come our crayfish growing season and hopefully a bountiful crop.

Using e-mail for newsletter contributions is by far the most convenient - just send plain text or attach a file. I am still finding it very hard to get crayfish-related photographs from other parts of the world. Photos, diagrams, sketches and even cartoons really add to the newsletter. If you have anything suitable please post it to me at the address below:

Glen Whisson, IAA Secretary  
29 Pine Terrace, Darlington  
Western Australia 6070, Australia  
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Glen Whisson, editor

is *Euastacus*. The genus has an extensive range in eastern Australia where it is largely restricted to highlands, or areas adjacent to highlands, and includes some of the largest parastacid species.

As a result of recent revisions (Morgan, 1986, 1988, 1997) over 40 species have been identified and described, some with very small distributions. Otherwise very little is known about most of them. Although the group is widespread and crucial in the ecology of small highland systems, *Euastacus* do not have commercial potential; growth and maturity is slow and fecundity is low (Merrick, 1995).

Fortunately, several recent events have combined to result in the release of a substantial number of new papers on various aspects of the relationships and biology of a range of *Euastacus* species.

Following the publication (in March) of the final taxonomic revision by Morgan another series of six papers on reproduction, population structure, feeding, growth and management of *Euastacus spinifer* (by Turvey and Merrick) was released (in July) in Vol. 118 of the *Proceedings of the Linnean Society of New South Wales*, one of Australia's oldest scientific journals. Details of these papers are listed at the end of this

newsletter. Another eight papers on the taxonomy, early development, growth and ectoparasites of Victorian and Queensland species are to be included in Vol. 119 of the *Proc. Linn. Soc.* - to be released at the end of the year.

It is exciting and satisfying to be part of the initiatives that have led to this 'great leap forward' in knowledge about *Euastacus*. The new papers include the latest findings of DNA analyses, or records of parasites, as well as the first publication of results of long-term biological and ecological programs. It is to be hoped that this output will heighten awareness of the importance of the group and stimulate interest to increase basic research for conservation and management.

Although the papers mentioned are part of the contents of regular volumes of *Proc. Linn. Soc. NSW*, it will be of interest to IAA members that the Linnean Society has agreed to produce (under a separate cover) a Special Issue of reprints of the crayfish papers from Volumes 118 and 119. Copies of this special issue will be available early in 1998. For further information look up the Linnoc Home Page on the Internet: <http://bioscience.babs.unsw.edu.au/linnoc/welcome.htm>

#### References:

Merrick, J.R. 1995. Diversity, distribution and conservation of freshwater crayfishes in the eastern highlands of New South Wales. *Proceedings of the Linnean Society of New South Wales* 115, 247-258.

Morgan, G.J. 1986. Freshwater crayfish of the genus *Euastacus* (Decapoda, Parastacidae) from Victoria. *Memoirs of the Museum of Victoria* 47, 1-57.

Morgan, G.J. 1988. Freshwater crayfish of the genus *Euastacus* Clark (Decapoda, Parastacidae) from Queensland. *Memoirs of the Museum of Victoria* 49, 1-49.

Morgan, G.J. 1997. Freshwater crayfish of the genus *Euastacus* Clark (Decapoda: Parastacidae) from New South Wales, with a key to all species of the genus. *Records of the Australian Museum, Supplement* (23), 1-110.

## NEWS FROM THE RICE RESEARCH STATION LOUISIANA USA

Member Ray McClain (Rice Research Station, P.O. Box 1429, Crowley, Louisiana 70527 USA) has recently published results of his crayfish culture research - *Procambarus* spp. - for 1995-1996. Entitled "Crawfish Research Project - Annual Summary and reports 1995-1996", it includes the following titles:

- Annual Summary of Environmental Conditions and Crawfish Production (McClain, Taylor and Sonnier);
- Effect of Density Reduction on the Production of Large Red Swamp Crawfish (McClain, Romaine, Taylor and Sonnier);
- Evaluation of a Non-Traditional Pond Management Approach: Headstarting Crawfish in Nursery Sections (McClain, Taylor and Sonnier);
- Effects of Previous Field Use on Subsequent Crawfish Production (McClain, Taylor and Sonnier);
- Effects of Supplemental Feeds on Crawfish Growth in Microcosms (McClain, Taylor and Sonnier);
- Determination of the Non-Nutritive value of Vertical Substrate on Crawfish Growth (McClain, Taylor and Sonnier).

Ray has also published a new bulletin dealing with the "relaying" of small, stunted *Procambarus clarkii* to unstocked ricefields for growth to larger sizes. This is a very informative bulletin that will be of significant value to any individual who cultures or manages natural crayfish populations regardless of species. The reference is:

McClain, W.R., P.K. Bollich, and J.M. Gillespie. 1997. Relaying: An Intercropping Approach to the Co-Culture of Crawfish and Rice. Louisiana State University Agricultural Center Bulletin No. 862, Baton Rouge, Louisiana USA.

## CRAYFISH GILL-CLEANING MECHANISMS STUDIED

Dr Ray Bauer (Biology Department, University of Southwestern Louisiana, Lafayette, Louisiana 70504 USA) recently presented a paper entitled "Experimental Testing of Gill Cleaning Mechanisms in the Crawfish, *Procambarus clarkii*" at a meeting dealing with introductions of exotic species into North America.

Dr Bauer's work is concerned with the potential problems associated with gill fouling by zebra mussels. According to the abstract "...In crayfish, groups of setae attached to papillae (setobranchs) intertwine among the arthrobranchs and medial side of podobranch gills. The effectiveness of these presumed gill cleaning structures has never been tested. In experiments with the red swamp crawfish, *P. clarkii*, setobranch setae were removed from one branchial chamber ("experimental") but not the other ("control").

Treated crayfish were exposed to fouling for 3-7 weeks in commercial pond and natural swamp habitats. Setobranch setae were relatively effective in preventing sediment fouling in control gills while experimental gills were heavily fouled. However, epizooic fouling was not prevented by gill cleaning setae. Setobranchs are not as efficient in gill cleaning as the cheliped brushing method of some carideans and anomurans. These results support the view that setobranchs are primitive while cheliped brushing is derived or advanced in the Decapoda.

### WHERE IS PROCAMBARUS CLARKII?

President Paula Henttonen and Past-President Jay Huser have prepared a manuscript about crayfish introductions in Europe for presentation at the workshop in Florence, Italy. "The Introduction of Alien Species of Crayfish in Europe - How to make the best of a bad situation?", held 24-27 September 1997. In doing so, they have prepared a listing of *Procambarus clarkii* introductions. Members are asked to review the following material and provide input (refer table on page 8).



Japo Jussila conducting research on *Cherax tenuimanus* in an Intensive Crayfish Culture System (ICCS) in Perth, Western Australia.

### CRAYFISH PHD THESIS

"Physiological responses of Astacid and Parastacid crayfishes to conditions of intensive culture"

This is the title of the PhD thesis by IAA member Japo Jussila, Department of Applied Zoology & Veterinary Medicine, University of Kuopio.

#### ABSTRACT

Three freshwater crayfish species, noble crayfish (*Astacus astacus*), signal crayfish (*Pacifastacus leniusculus*) and marron (*Cherax tenuimanus*), were studied to assess their physiological responses to an intensive crayfish culture system (ICCS) and to describe the environmental characteristics of the system. The measures of physiological responses were growth rates, hepatopancreatic indices, exoskeleton





mineralisation, immune system competence, and changes in total hemocyte numbers. Both indoor and outdoor ICCS facilities and several different modifications were used in these studies. The ICCS was an environmentally controlled, high density rearing system (15 - 30 crayfish per m<sup>3</sup>), where crayfish were held in individual compartments, water recirculated and crayfish obtained up to 90% of their nutrition from pelleted diets. Marron showed, at their best, similar growth rates in the ICCS as in semi-intensive farm ponds and experimental tanks (SGRs from 0.4 to 0.7). Nordic species, noble crayfish and signal crayfish, grew slowly (SGRs from 0.1 to 0.2), which together with relatively high mortality, resulted in low production in the ICCS.

Highest growth rates and production were obtained in a system where marron were fed with both pelleted commercial diet and food items produced in the ICCS. For the other physiological responses, carapace mineralisation showed lower or similar concentrations in both calcium and magnesium for all three species compared to the wildstocks or semi-intensively reared co-species.

In marron, hepatosomatic indices were lower in the ICCS reared animals compared to the semi-intensively farmed ones and higher than in wildstocks, while hepatopancreas moisture content was higher in the ICCS reared animals compared to semi-intensively farmed ones and lower than in wild marron. Noble crayfish and signal crayfish had lower hepatosomatic indices and higher or similar hepatopancreas moisture concentration compared to the wild co-species.

Noble crayfish, reared in the ICCS, were infected with several gram-negative bacteria and the infection prevalence increased throughout the experiment. Total hemocyte counts (THCs) were lower in the ICCS reared marron compared to the semi-intensively reared marron. The growth of marron in the ICCS was strongly affected by type and amount of feeds, compartment size (density), total water volume, total ammonia and diurnal temperature variation. Dissolved oxygen level and water temperature had a moderate significant effect on marron growth in the system.

Based on these results it can be concluded that

the ICCS, as used in these experiments, showed low commercial potential and the intensively reared crayfish possibly experienced severe stress causing loss of condition. The main reasons for the suboptimal rearing conditions were poor quality of artificial diets, temperature stress and system limitations due to poor infrastructure design.

#### Conclusions

The general conclusion in the present studies on the freshwater crayfishes physiological responses to intensive rearing was that the particular modification of the ICCS (O'Sullivan 1990) used provided suboptimal conditions for marron (*C. tenuimanus*), noble crayfish (*A. astacus*) and signal crayfish (*P. lenisculatus*). The studies indicated that the growth was slower, exoskeleton mineralisation similar or poorer, and crayfish condition worse than in wild or semi-intensively reared co-species. The THCs and hemolymph bacteria also indicated poorer condition in intensively reared crayfish. The age at sexual maturation indicated that the ICCS provided adequate resources for the process and it was comparable to that in the wild populations. All studied crayfish species showed low commercial potential under intensive rearing.

The nutrition seemed to cause severe inhibition in growth of all the studied species. Increased density inhibited marron growth, which has also been shown previously (Morrissey 1992, Morrissey *et al.* 1995), but the slow growing strain of marron (runts) used in these studies partially masked both of these effects. The density effect in noble crayfish or signal crayfish was not studied.

#### Growth and molting

Growth of marron (*C. tenuimanus*) was slower in the ICCS than expected in a commercial system. The growth rate was inversely related to total water volume in the ICCS. The nutrition provided in the commercial marron pellets was suboptimal, while pellet water stability resulted in increased growth rate. The ICCS also proved to be susceptible to air temperature fluctuations resulting in high water temperature and low dissolved oxygen levels.

Noble crayfish and signal crayfish grew slower than marron, as could be expected of the Scandinavian species. Noble crayfish from stunted populations did not show significantly faster growth in the ICCS compared to wild populations of the same origin.

The weight gain at molt was lower in both marron and noble crayfish compared to results obtained previously in semi-intensive or intensive rearing systems. Also the intermolt period was longer than previously reported for all of the three studied species.

The production was relatively high in marron in the ICCS, but the slow growth rates negated the commercial potential. The production of noble crayfish and signal crayfish in the present studies was negligible.

#### Sexual maturation

Marron reached sexual maturity at an age (1+ y.o.) similar to but at a smaller size (17 g) than wild or semi-intensively reared marron. This indicates that the ICCS offers enough resources for both growth and sexual maturation, even though the environment partly inhibits marron growth.

#### Exoskeleton mineralisation and pigmentation

Low carapace mineralisation in noble crayfish and signal crayfish showed that the ICCS could not provide an adequate environment to complete the mineralisation. Since the levels of calcium and magnesium were only slightly lower than in wild co-species, it can be argued that the nutrition in the system was suboptimal for mineralisation.

Marron showed intermediate, or slightly low carapace mineralisation compared to the wild or semi-intensively farmed co-species. Exoskeleton mineralisation was better in marron than in the Scandinavian species compared to their wild co-species.

Marron showed changes in exoskeleton pigmentation, a pearly blue color, as a result of a prolonged rearing in the ICCS on commercial marron pellets. This indicated that the marron

were experiencing carotenoid deficiency, which also could have inhibited their growth.

#### Crayfish condition

Intensively reared marron were in slightly poorer condition than semi-intensively reared marron but in better condition than their wild co-species.

The larger water volume in the ICCS improved marron condition compared to marron reared in the small water volume. Furthermore, the condition of marron reared in the dirty ICCS was slightly better than that of marron reared in the clean system.

Hepatopancreatic indices showed that both noble crayfish and signal crayfish were reared on nutritionally insufficient diets. The poorer condition in noble crayfish was more evident than in signal crayfish compared to wild co-species.

The hepatopancreatic indices showed a potential for predicting the growth rates of marron and signal crayfish. The relationships between hepatopancreatic indices and SGR were reverse in marron compared to signal crayfish.

The total hemocyte counts (THCs), obtained in marron reared in the ICCS or semi-intensively, indicated that the ICCS provided insufficient nutrition and resulted in lower THCs than in semi-intensively reared marron. The THCs, on the other hand, correlated significantly with marron growth and hepatopancreatic indices, which suggests that the THCs could be used as condition indices.

Noble crayfish, reared in the indoor system, were infected with a range of gram-negative bacteria. This might be indicating decreased immune system activity and thus a poorer condition of the crayfish. The bacterial infections have traditionally been indicating suboptimal rearing conditions and could severely affect production in an aquatic system. On the other hand, it has been demonstrated previously, that pond reared crayfish can be infected with bacteria and be otherwise healthy.

**Global introductions of *Procambarus clarkii***

Region	Country	Approximate Date	Status
North America	Western USA	early 1900s	Well Established-little used
	Eastern USA	1970s/1980s	Established-Limited Aquaculture
	North-Central USA	1950s/1960s	Established-Limited Aquaculture
	Lower Mexico	early-mid-1900s	Well Established-Artisanal Use
Central America	Belize	1960s	Established
	Costa Rica	1960s	Established-Artisanal Use
	Nicaragua	1960s	Unknown
South America	Argentina	1990s	Unknown
	Brazil	Unknown	Established
	Columbia	Unknown	Established
	Ecuador	1970s	Well Established-Artisanal Use
	Guyana	1990s	Unknown
	Venezuela	Unknown	Established
Carribbean	Dominican Republic	1970s	Established-Artisanal Use
Atlantic Islands	Azores	1990s	Established
Europe	Belgium	1970s	unknown
	Cyprus	1980s	Established
	England	1990s	Established
	France	1970s	Established-Artisanal Use
	Germany	1980s	Established
	Italy	1980s	Established
	Majorca	1980s	Established
	Netherlands	1970s	Established
	Portugal	1970s	Well Established-Limited Commerce
	Spain	1970s	Well Established- Major commerce
	Sweden	1980s	Unknown
	Switzerland	1990s	Established
	Africa	Egypt	1980s
Kenya		1970s	Well Established-Limited Commerce
Republic of South Africa		1990s	Established
Sudan		1970s	Unknown
Zambia		1970s	Established-Limited Commerce
Zimbabwe		1980s	Unknown
Asia	Hong Kong	Unknown	Established
	Malaysia	Unknown	Unknown
	People's Republic of China	1930s	Well Established-Major Commerce
	Singapore	Unknown	Unknown
	Taiwan	Unknown	Established
Pacific	Hawaii	early 1900s	Well Established-Artisanal Use
	Japan	1920s	Well Established-Artisanal Use
	Philippines	1990s	Established



**RANDOL'S ON THE MOVE**

Randol's is a major seafood/ cajun music restaurant operating in Louisiana, United States.

The company caters for "crayfish boils" and uses the trailer (above) to haul equipment and advertise.

The trays (below) are full of red swamp crawfish being purged prior to steaming for patrons.



### The factors affecting growth in the ICCS

The basic factors affecting growth in the ICCS were similar to those functioning in semi-intensive pond conditions: level of dissolved oxygen, temperature and its diurnal fluctuation, food quantity and quality, and density of the crayfish (expressed as compartment size or total water volume). The intermolt period was normally affected by these factors while the weight gain at molt was affected only by diurnal temperature variations.

#### References:

Morrissey, N. 1992. Density-dependent pond grow-out of single year class cohorts of a freshwater crayfish *Cherax tenuimanus* (Smith) to two years of age. *Journal of the World Aquaculture Society* 23(2):154-168.

Morrissey, N., Bird, C. and Cassella, G. 1995. Density-dependent growth of cultured marron, *Cherax tenuimanus* (Smith 1912). *Freshwater Crayfish* 10:560-568.

### JUST HOW IMPORTANT IS DETRITUS AS CRAYFISH FOOD?

Jay V. Huner - USL Box 44650, Lafayette, Louisiana 70504 USA

For many years, I read learned paper after learned paper telling me that microbially enriched plant detritus was the principal crayfish food. During that period I was impressed by the ability of crayfish with such short, simple digestive systems to successfully process detritus so efficiently. I slowly, however, began to change my opinion about crayfish trophic dynamics thanks to numerous discussions with Walter Momot and my own observations of crayfish feeding habits including a number of feeding studies.

To say that crayfish do not eat detritus is foolish. Detritus comprises the bulk of crayfish stomach and gut contents. To say, however, that crayfish prefer detritus to other foods is equally as foolish in light of the data that have accumulated over the past decade. Crayfish can subsist on detritus.

Crayfish cannot, however, thrive on a diet of detritus and can never achieve maximal growth potential where their diets are largely restricted to detritus.

Anyone reading my earlier papers, books, etc. will see that I accepted that detritus was the most significant crayfish food. I was wrong. I present this short note in the hope that its readers will review the literature, especially the recent reviews and papers by Walter Momot and Charles Rabeni, and realize that animal and plant seed materials are critical dietary components for all crayfish species.

Offer your favorite pet crayfish a decomposing plant or a juicy piece of crayfish flesh. Most times it will choose the flesh. The same is true if you offer a dry bean or kernel of corn in place of the crayfish flesh. Bait your crayfish traps with either a handful of rotten leaves or a fresh piece of common carp. You will probably catch no more crayfish in the trap baited with leaves than unbaited control traps.

Crayfish are wonderful organisms. Understanding their position in the food web requires that astacologists recognize that it is time to stop trying to pound a square peg into a round hole!

### TENNESSEE AQUARIUM SEEKS EXOTIC CRAYFISH

IAA member Jeff Campbell (senior aquarist, Tennessee Aquarium, Chattanooga, Tennessee, USA) sends the following:

The Tennessee Aquarium is a premier, world-class, public aquarium and educational facility. Our primary focus is on North American freshwater habitats, with additional exhibits displaying fish, reptiles and amphibians from Africa, Asia, South America and Eurasia. Tennessee is widely recognized as a focal area as regards speciation and diversity of freshwater crayfish. Our state hosts some 76 species and sub-species of these intriguing crustaceans. I am

of the opinion that we have an opportunity and more importantly, an obligation to educate our visitors about crayfish, and show them a world-class exhibit of live specimens. In addition to our local, regional and North American species, I would like to display a selection of colorful and/or unusual specimens from other areas of the world- Europe, Asia, Latin America, and Australia.

Any assistance that members could provide as per obtaining the exotic animals would be greatly appreciated. My e-mail... GJC@TENNIS.ORG

### LENGTH-LENGTH AND LENGTH- WEIGHT RELATIONSHIPS OF *ASTACUS LEPTODACTYLUS* FROM IRANIAN COASTS OF THE CASPIAN SEA

Baradara Noveiri, S.

(Gilan Fisheries Research Center, P.O. Box 66, Ghazian Bandar Anzali, Iran)

Many studies have been carried out on different aspects of the Caspian Sea crayfish *Astacus leptodactylus* in neighboring countries around the Caspian Sea. There are no data for this species along the Iranian coasts. Sampling was carried out from August 1991 until August 1993 along Bandar Anzali coasts in northern Iran. This was done from 30 m to 75 m depth with folding galvanized iron frame traps with 20 mm mesh (knot to knot) and 5.5-6.5 cm funnel entrance diameter, baited with salted Clupeidae.

One thousand males and 201 females were caught. Total length (TL), carapace length (CL), and post orbital carapace length (OCL) and weights were measured. The average weight of females (35.3 +/- 12.3 g) was significantly less than the average weight of males (42.2 +/- 14.8 g) and total length of females (110.2 +/- 12.9 mm) was significantly more than the males (106.6 +/- 10.8 mm). The males were heavier because of their enlarged chelipeds. The relationships between TL, OCL and weight have been calculated.

The egg carrying females were observed during early May until the end of August at water temperatures of 8.6-8.8 °C. Catchability of males was 4.33 times greater than that of females although the ratio differs from 1:1 in summer to 42:1 in spring. Some 63.7% of the males and 72.1% of the females were equal to or larger than 102 mm TL.

### STATUS OF FRESHWATER CRAYFISH II AND PAGE CHARGES

According to Editor Walter Momot, the copy for *Freshwater Crayfish II* is to be sent to the Secretariat in Louisiana in September 1997. The books should be printed by the end of October and sent to participants of the Thunder Bay Symposium by the end of November.

It is not possible to estimate the cost for individual books and postal charges until the books are actually printed. It is anticipated that the books will be around 550 pages long and cost \$US 25-30 for members. Postal charges will probably be similar to those for Volumes 8 and 10.

IAA is asking authors to pay nominal page charges to offset printing costs and hold the actual costs of each book down. Authors will be invoiced in September and are asked to pay at least some of the charges. These page charges will be VERY MODEST COMPARED to the charges that other journals make.

### SPECIAL ISSUE OF L'ASTACICULTEUR DE FRANCE PUBLISHED

L'Astaciculteur de France Bulletin No. 51 (June 1997) summarizes five years of crayfish studies in France - Programme National Ecrevisses. Papers include:

- Elevage de *Pacifastacus leniusculus* (Dana) en graviers [*Pacifastacus leniusculus*]



production in gravel pits] by J. Arrignon, pp. 3-11;

- Production extensive d'*Astacus leptodactylus* dans les étangs de la Charente [Extensive production of *Astacus leptodactylus* in ponds of the Charente] by Y. Cassam, pp. 12-28;
- Les pieds rouge en nord France-Comte [Noble crayfish in nord Franche-Comte] by J.-F. Suat, pp. 29-33;
- Les repeuplements en *Astacus astacus* L. Synthèse des essais réalisés en Lorraine et en Morvan, enseignements à en tirer [Noble crayfish restocking, synthesis of the experiments in Lorraine and Morvan, lessons to learn] by P. J. Laurent, J. Nicolas, and L. Paris, pp. 34-58;
- Etude de la population d'écrevisse à patte blanches (*Austropotamobius pallipes* Lereboullet) en cours d'eau, soumises à une pêche de loisir [White clawed crayfish (*Austropotamobius pallipes* Lereboullet) population studies in brooks exploited by sport fishermen] by L. Roqueplo;
- Comparaison de la croissance des différentes espèces d'écrevisses présentes en France en Région Bretagne [Comparison of the growth of different crayfish species in the Bretagne region of France] by A. Neveu, pp. 71-80.

Editor is Honorary Life Member and Past President **Pierre J. Laurent** (Avonnes a Marin, F-74200 Thonon, France). Each paper includes an extended English summary.

#### TARIFF ON IMPORTED CHINESE CRAYFISH MEAT ESTABLISHED IN THE USA AND RELATED ISSUES

The US International Trade Commission (ITC) has established final tariffs on imported Chinese crayfish meat (temporary tariffs were established

in March 1997). According to news accounts in Louisiana newspapers (August 30, 1997) and information from the Louisiana Crawfish Promotion and Research Board (PO Box 3334, Baton Rouge, Louisiana 70821 USA) the tariff will average approximately 90% and will be in effect for three years when the issue will expire unless the injured US parties initiate a review. However, importers can request a review after a one year period. As a result of this action, wholesale prices of Chinese product will almost double from the \$US 2-3.00 per pound (454 g) range to the \$US 5-6.00 per pound range.

A related issue involves the establishment of dummy corporations "to try to beat the federally imposed dumping duty on Chinese crayfish..." (*The Aquaculture News*, July 1997, p. 6). Some importing companies simply go out of business to avoid paying duties. Federal and State (Louisiana) officials are monitoring this situation closely.

The American crayfish producers are, of course, pleased with the ITC ruling. However, they continue to be concerned about the unrestricted importation of whole cooked, frozen crayfish from China. This product has made serious inroads into the industries' live sale markets. As a result, they are watching the issue carefully.

#### HYBRIDS CONSUMMATE SPECIES INVASIONS

This is the title of a report by Wade Roush in the 18 July 1997 issue of *Science* (Vol. 227:316-317). Research done by IAA members **David Lodge** and **William Perry** (University of Notre Dame, Notre Dame, Indiana USA) with Jeff Feder has shown that rusty crayfish, *Orconectes rusticus*, and blue crayfish, *Orconectes propinquus*, hybrids are fertile and the hybrids are outcompeting both native *O. propinquus* and the invading *O. rusticus* in north-central USA and south-central Canada.

According to the article "...From laboratory observations, Lodge and his colleagues had thought that most of the interspecies matches

would be between the large, aggressive rusty males and the blue females. But when Perry examined the hybrids' mitochondrial DNA - which is inherited only from the mother - he found, to his surprise, that 89% were offspring of the opposite match, between rusty females and native blue males..."

#### REMOVAL OF WHOLE FROZEN, BOILED CHINESE CRAWFISH FROM FINNISH MARKETS

**Jay Huner**, (USL Crawfish Research Center) sends the following summary of a news article which appeared in the July 31, 1997 issue of the *Helisiki Sanomat* newspaper.

All whole frozen, boiled Chinese crayfish were removed from Finnish markets effective July 31, 1997. Some 15,000 one kilogram packages were involved. The product came into Finland from Denmark. Although there were no human health hazards involved, product quality control was very poor.

Because the product was processed in seafood plants where there was no European Union inspection, Finnish authorities were permitted to pull the product from markets. The newspaper account states that Finnish consumers have ample supplies of USA (=Louisiana) and Spanish crayfish to meet their needs at the same price as the banned Chinese product. (Note: Russian and Turkish narrow-clawed crayfish product was also removed from the market.)

The action by Finnish authorities has no direct influence on any other government. However, adverse publicity about Chinese crayfish products is sure to influence consumers in other countries. Furthermore, if Chinese processing plants are properly inspected in the future by European Union officials, Finnish authorities will be unable to interfere with imports.

#### MARRON FARMING GURU RETIRES

IAA member **Dr Noel Morrissy** from the Fisheries Department of Western Australia retired on 10 July

1997 after 30 years of service. Noel finished off his career as the Research Supervisor, Aquaculture and Environment.

Noel has researched a wide range of fisheries and aquaculture species including the marron recreational fishery, trout recreational fishery, barramundi fishery, Lake Argyle catfish fishery, Southwest native fish, marron farming, yabby farming/harvesting, trout farming and barramundi farming.

He also assisted private companies and other research institutes on mahi mahi, *Macrobrachium*, silver perch and dhufish. His efforts have contributed more to the scientific literature and knowledge in this field than anyone else in Australia. He has written over a hundred peer-reviewed scientific papers, and numerous popular articles and information brochures for the lay person.

The high calibre of Noel's work led to invitations to travel to many parts of the world to advise on freshwater fisheries and aquaculture. These visits have included Japan, China, Finland, Chile, New Zealand and the USA. It has also allowed him to be able to encourage other leaders in the aquaculture field to visit WA and impart their valuable knowledge - Professor Walter Momot from Canada and two visits by Professor Claude Boyd from the USA. In addition Noel has also been asked to supervise PhD students and collaborate in many projects from around the world.

The major thrust of Noel's endeavours has been the development of a viable and profitable marron farming industry. This has been achieved despite limited facilities at the Pemberton Fish Hatchery, and low funding. His research has culminated in the ability to accurately computer model a marron pond and predict harvest quantities and size composition. This has gained Noel world wide recognition from other scientists with the system being adapted internationally for other crayfish species.

Noel retires with this pioneering work gaining wider acceptance by the Western Australian

marron farming industry. Noel's work has placed the industry in an enviable position in which to proceed into the next century.

Noel would like to thank the industry members who have assisted in his research and to wish all those in the aquaculture industry well in their future development.

Source: *ACIFA News*, Vol. 18:10.

## THE INTRODUCTION OF ALIEN SPECIES OF CRAYFISH IN EUROPE: How to make the best of a bad situation?

An International Workshop  
Florence, Italy, September 24-27, 1997

A lot of valuable papers and information were presented at the workshop. These will be presented in another forum. I will only report from the roundtable contributions about the present situation in Europe. The speakers discussed the occurrence of native and alien crayfish species in various countries and the role of legislation, conservation and action plans to restore the native species in various countries.

Questions were raised regarding knowledge of the present situation in countries and how to monitor the development. It was obvious that in some countries the knowledge of scientists and authorities was good but not so in other countries. Some members of the roundtable discussions gave valuable information about their action plans. The importance of educating the general public was stressed. In some countries people are not aware of the situation due to lack of knowledge on how to distinguish between various species of crayfish.

Some speakers told us about the accidental introductions of alien species, which have been imported as pet animals and sold in shops, and other speakers about deliberate introductions due to economic reasons.

Methods to eradicate crayfish species were also discussed. This is usually not possible if the

species are widely dispersed. The conservation of native species is also very much related to management plans for the environment and conservation genetics. Water quality and crayfish requirements were other topics discussed. The need for more research in various disciplines of crayfish biology, ecology and physiology was stressed.

Hans Ackefors

## ALGAE DELAYS CRAYFISH SEASON IN NORWAY

Past President Jostein Skurdal provided the following information about blue green algae in Lake Steinsfjorden, Norway.

Toxin-producing blue-green algae have been registered in Lake Steinsfjorden this summer, mainly in deeper layers. There has been some controversy regarding the possibility for the toxin to enter crayfish. At present some researchers are investigating these possibilities by examining crayfish from the lake. They do not have a set-up to study the toxin directly in the crayfish meat and have to study the stomach contents and do toxicity tests on mice.

The crayfish season was delayed by two days due to the tests. No effect or mortality on the mice was detected in spite of very high concentrations fed to the mice. The conclusions from the experts were that there was no risk in eating crayfish meat from Lake Steinsfjorden and the fishery was opened on August 8.

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