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Inside this issue:

First Threatened Species Listing of Crayfish in Queensland, Australia

Figure 1. *Euastacus bindal* Morgan (Photo by: Diana Angeliqué Virkki).

On the 28th of August 2015, the first ever freshwater crayfish species were listed as Threatened under the Queensland Nature Conservation Act 1992 (NCA).

Euastacus bindal Morgan (Figure 1) was listed as Vulnerable and *Tenuibranchiurus glypticus* Riek (Figure 2), was listed as Endangered. In Queensland, the Endangered and Vulnerable categories are roughly equivalent to the Critically Endangered and Endangered categories of the IUCN Red List, respectively.

Tenuibranchiurus glypticus is Australia's smallest species of freshwater crayfish (~30 mm total length) and typically inhabits the coastal (and acidic) *Melaleuca* swamps of central-eastern Australia (see Dawkins et al. 2010). The species is listed as Endangered on the IUCN Red List (Coughran et al. 2010). The species' distribution is highly fragmented, and the species is threatened by habitat destruction and development, pollution and industrial accidents (e.g., oil or chemical spills) (Coughran et al. 2010). *Tenuibranchiurus glypticus* provides a good example of how endangered species of freshwater crayfish can be found in our backyards: *T. glypticus* populations occupy all the *Melaleuca* habitats on the Gold Coast campus of Griffith University (including the Frog Lane habitat, Carkpark I swamp, and the Smith Street land), and also habitat associated with the proposed Stage-2 extension of the Gold Coast's light rail system.

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INTERNATIONAL ASSOCIATION OF ASTACOLOGY

Susan Adams, Ph.D.
IAA President *(USA)*

President's Corner

Dear IAA Members,

In the southeastern USA, we are happily bidding adieu to another very hot summer, and welcoming lovely autumn weather (except where it's flooding) and changing forest colors. Unfortunately, we also have more somber farewells to make as the crustacean scientific community has lost three exemplary members. I did not have the good fortune to know either of the European men, but clearly both lived rich lives and made many friends in addition to making exceptional professional contributions. They will be dearly missed by colleagues around the world, as well as by family and friends.

Pierre Laurent died in France in August at the age of 90. The IAA is indebted to Pierre for his many contributions to the society, including being a charter member and former president (see In Memoriam on pg 12 in this issue for more details). Professor **Michael Tuerkay** (see pg 14) passed away in September in Frankfurt, Germany. He was a global leader in crustacean science and collaborated with a number of IAA members. **John Cooper**, of the USA, also died in August (see pg 16). He contributed greatly to the taxonomy and conservation of southeastern US crayfishes over a long career that included collaborations with many IAA members. Condolences to the family, friends, and colleagues of all three men. Please see additional remembrances of all three in this issue.

Many of us have begun anticipating in earnest our travels to Madrid, Spain for IAA21. The meeting will be held 5-9 September 2016. Our meeting host, **Javier Dieguez Uribeondo**, provides more information in this issue (pg 11). Speaking of meetings, now is also the time for members to think about preparing bids for IAA22 to be held in 2018. Bids will be presented and voted on during IAA21. Contact me if you have questions about the bid process.

Understandably unable to wait until summer 2016 for their next crayfish meeting, IAA members around the world have been participating in regional meetings over the past few months, including the first two officially sanctioned IAA Regional Symposia in the US and Australia. Four meetings are summarized in this issue, one each in the US and Australia and two in Europe. A fifth meeting is being held as I write; the International Symposium on Conservation of

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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 institution interested in furthering the study of astacology is eligible for membership. Service to members includes a quarterly newsletter (*Crayfish News*), a membership directory, biennial international symposia and publication of the journal *Freshwater Crayfish*.

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Native European Freshwater Crayfish is being held in Olot, Girona, Spain (Sept 23-25th 2015).

IAA members have also been busy writing. This issue contains crayfish articles from four continents, which is fantastic! Many thanks to the crayfish meeting organizers for sharing summaries of their regional meetings. I know it's hard to find time to write those, but they are instrumental to maintaining our international networks. The next issue of *Freshwater Crayfish* will include more than 20 papers, most of which came out of the IAA symposium held in Savannah, Georgia, USA, in January 2015. *Freshwater Crayfish* editor, **Jim Fetzner**, plans to have the issue out in December. Also, two new crayfish books packed with information sit on my desk, guarded closely by my rubber crayfish, until I find time to read them. They are Freshwater Crayfish, A Global Overview by IAA Secretary/ IAA20 host, **Tadashi Kawai**, et al. and Crayfish Biology and Culture by IAA Board Member, **Pavel Kozák**, et al.; congratulations to these gentlemen and all coauthors on these important contributions to astacology literature!

All of this activity brings me to the mundane matters of membership and money. The chief benefit of IAA membership to members is the creation of a scientific, as well as social, community that brings astacologists together via the written word and meetings. Memberships are the main revenue source for IAA to facilitate these things. With annual publication of our journal, memberships are more important than ever! We currently have 152 regular (i.e., not Forum Flusskrebse) members. Certainly many more than 152 people have attended crayfish meetings this year. I encourage each of you to invite at least one colleague to join IAA and thereby support publication of *Freshwater Crayfish*, hosting of regional and international meetings, and funding of student travel scholarships. And remember that student membership is now FREE for the first year.

Thanks to all who contributed to this great issue of *Crayfish News* and to our hardworking editor, Jim Fetzner!

I hope that each of you has a happy and productive autumn (or spring). H

Sincerely,

Susie Adams
IAA President

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Figure 2. *Tenuibranchiurus glypticus* Riek. A sense of scale is given by the sand grains that the specimen is standing on (Photo by: Furse and Dawkins).

Euastacus bindal is one of the smaller (i.e., <0.5 m in length) and poorly spinose species of *Euastacus*. The species is known from a single site, a small area of tropical rainforested stream habitat ~830 to 1100 m above sea level, near the peak of Mt Elliot in North Queensland (Extent of Occurrence 1.06 km^2, see Furse et al. 2012). Despite Mount Elliot being wholly within Bowling Green Bay National Park (to the southeast of Townsville), the species faces numerous threats including: illegal collecting, exotic species, altered rainfall patterns and increasing environmental temperatures. The species is listed as Critically Endangered on the IUCN Red List (Furse and Coughran 2010).

These NCA listings are somewhat of a watershed in the assessment and listing of Endangered species of freshwater crayfish in Queensland, and both are notable in that *T. glypticus* is one of only six invertebrate species listed as Endangered, and *E. bindal* is one of only seven invertebrate species listed as Vulnerable in Queensland. H

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Short Articles

Searching for Canada's Rarest Crayfish

On a sunny August 24th 2015 morning, we set out to search for the white form of the Northern Clearwater Crayfish (*Orconectes propinquus*) in Lake Simcoe, about one hour north of Canada's largest city, Toronto, in the province of Ontario The white morph was first described by D. W. Dunham, Stephen Jordan and Mihkel Niglas from the University of Toronto in 1978. Their research found that the white form shared the lake with two other colour variants of *O. propinquus* as well as *O. virilis*, another common Ontario resident (Jordan and Dunham 1980). The original surveys showed that the white morph was found in the south–western portions of the lake only (from Kempenfelt Bay to Sibbalds Point), while a brown morph inhabited the north shore, and the chestnut morph was found on eastern shores near Mara. In all localities, all morphs of *O. propinquus* were found to be sympatric with *O. virilis*. (Figure 1 in Jordan and Dunham, 1980). The white morph can be described as having white chela, walking legs and tail fan while the carapace is beige-pink. The abdomen is white with a very dark median stripe (Figure 1). The underside is white. Dunham and Jordan's subsequent, small scale, morphometric studies showed that the white morph was not significantly different from brown form(s) and furthermore, the stylets and seminal receptacles also did not appear to differ from those of the more common brown form (Dunham et al. 1978, 1979).

Although this crayfish is arguably the most interesting and rare in Canada, it has not been sampled since the original studies. Our goal was, therefore, to ascertain whether the white morph still occurs in the lake and whether it is now threatened by the spread of the introduced Rusty crayfish (*Orconectes rusticus*) which had been found in the lake since 2005 (Bowles 2009).

The Ohio native has replaced the native *O. propinquus* in numerous watersheds across Ontario (Hamr 2010) following its introduction in the 1960s. Since we were aware of the recent occurrence of the white form on Big Bay Point on the western shore of Lake Simcoe (personal communication by R. O'Shea, one of our students), we targeted our search on that locality (Figure 2).

Figure 1. White morph of *O. propinquus* from Big Bay Point, Lake Simcoe. Canada's rarest crayfish.

Figure 2. August 24, 2015, Lake Simcoe sampling area (red square).

Our surveys showed that the white morph indeed still occurs in that area, however, we found it only at one locality between Big Bay road in the north and Innisfil Beach in the south (Figure 3).

The locality at Glenhaven Beach yielded only 3 white *O. propinquus* crayfish despite a significant 2 man sampling

Table 1. Sample locations August 24th 2015

Location	Coordinates
10 Big Bay Point Rd.	44.400172, -79.514153
Lakeside Dr. (Kempenfelt)	44.402857, -79.519238
318 13th Line (Glenhaven)	44.384087, -79.526125
438 Mapleview Dr. East	44.369424, -79.535271
497 Lockhart Rd	44.357357, -79.532219

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Figure 3. August 24, 2015 Sample locations (red dots).

effort. The individuals included 2 Form I males (CPLs 24 and 26 mm) and one female (CPL 24 mm, with some glair and white eggs in her ovary). We also captured 2 large mature female *O. virilis* at this site (CPL 46 and 36 mm). The densities of the two native species appear to be rather low on the point and the only other location yielding crayfish was the boat launch at the end of Big Bay Point road, where a single mature *O. virilis* female (CPL 38 mm) was collected.

Interestingly, some of the *O. virilis* specimens also exhibited unusually bright and vivid colouration for this species (Figure 4). We did not find any Rusty crayfish in our surveys and this suggests that they have not yet spread from the high density areas reported in 2009 in the north of Lake Simcoe and the adjoining Lake Couchiching (Bowles, 2009).

We plan on conducting more follow-up surveys in the spring of 2016 to establish whether any of the other historical localities still hold populations of the white crayfish. In addition, we hope to collect some females bearing broods in order to establish captive lab populations in conjunction with a conservation facility, such as the Metro Toronto ZOO or the Aquarium of Canada in Toronto. DNA comparisons with other *O. propinquus* populations would also shed more light on the uniqueness of the Simcoe population. It is likely that in the

Figure 4. *O. virilis* from Big Bay Point, Lake Simcoe. Unusually bright and vivid coloration for *O. virilis*.

near future, the Rusty crayfish will spread in the Lake Simcoe watershed and eventually replace the native crayfish populations. Since *O. propinquus* has been shown to be lost due to hybridization and niche overlap, it is therefore, at the greatest risk of extirpation (Hamr 2010). It would be a great pity to loose the white morph, as it appears to be a unique type of crayfish in not only the Great Lakes, but also in all of North America. H

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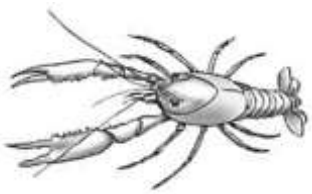

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Some Initial Investigations of the Invasion of Cessy Pond, Pays de Gex, Eastcentral France, by the Signal Crayfish, *Pacifastacus leniusculus*

INTRODUCTION

In a previous article (Baldry, 2015) a short account was given of an invasion of Cessy Pond by Signal crayfish ("signals") which had left the River Oudar and migrated up the Ruisseau du Marais (RDM; the rivulet which carries water from the pond to the River Oudar), and thereby gained access to the pond.

There must be other instances when such events have been noted, and when it may have been difficult, if not impossible, to identify the "whys" and "wherefores" that enable precise interpretations to be made of such happenings. Be that as it may, it is deemed important to attempt to arrive at plausible explanations, not only for our own sakes, but also for the benefit of colleagues, collaborators, and other interested parties.

Thus, attempts are being made at Cessy to provide answers to such questions as, what were the circumstances that stimulated "signals" to leave the River Oudar?, how did they overcome obstacles in their path?, would they become entrenched in the pond?, what impact might they have on the flora and fauna of the pond?, and, how will they relate to the established population of *Orconectes limosus*?. Some of the progress that has recently been made to answer those questions is summarized below.

COULD RECENT CHANGES IN WATER QUALITY AND/OR TEMPERATURE HAVE ENCOURAGED "SIGNALS" TO LEAVE THE RIVER OUDAR AND ADVANCE TOWARDS CESSY POND?

Since the late 1960s, there has been a dramatic increase in the population of Cessy Commune (Table 1). The numbers of inhabitants in 1999 and in January 2015 were, respectively, 2287 and 4486 (Source: www.mairie-cessy.fr).

Associated with population increase, there has been intensified urbanization; mainly in Les Marguerons, a locality in the upper Oudar valley (Figure 1). Those trends could be considered to have resulted in a reduction of the quality of the River Oudar. However, that may not have been the case.

Table 1. Cessy population percentage increases. Source: Cessy Population Bulletin (2001).

	1968-99	1990-99
Cessy	+ 348	+ 29.5
Gex Division	+ 154	+ 13.7
Ain Dept	+ 53	+ 9.4
France	+ 19	+ 4.6

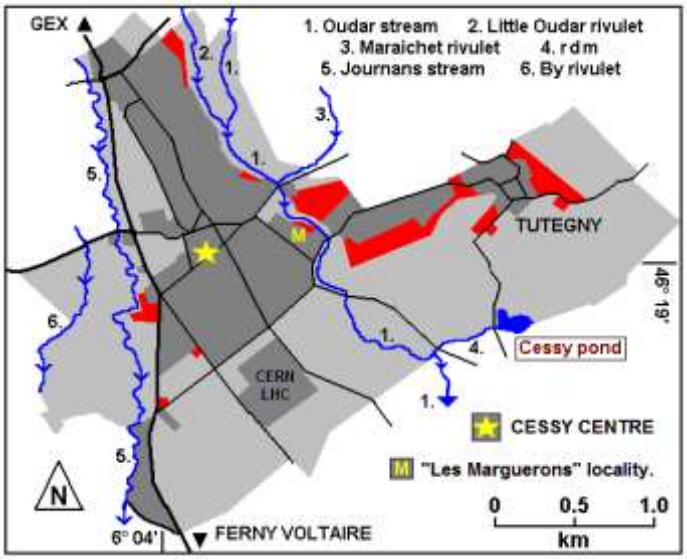

Figure 1. Map of Cessy commune showing the main urbanization areas in relation to the River Oudar basin.

In the summer of 2015, while the APEC President, Williame Coosemans, was remapping the River Oudar, the writer was making biological surveys in the Oudar-RDM junction area. What they noted was that there were good, reproductive communities of brown trout (*Salmo t. fario*), of the Miller's Thumb (*Cottus gobio*) and of "signals". The Amphipod shrimp, *Gammarus pulex*, was abundant in all types of sediment formation, while the immature stages of insects were well represented. Mature clumps of Willow Moss (*Fontinalis antipyretica*) were common in places where there were rocks and discarded building materials for them to attach.

Thus, it was cautiously concluded that nothing had suggested that the river was in poor condition. The word "cautiously" is deemed necessary because the writer recalls that in the past, there had been reports of dead trout being found in the river. In addition, in 2011 he had seen a viscous orange fluid draining into the river, adjacent to a building site at the "Les Marguerons" locality (Photo 1).

With regard to water temperature, it is pertinent to mention an article in the Tribune de Genève (www.tdg.ch) of 3-4 January 2015, entitled "Never has it been so hot". Apparently, 2014 was the hottest year that Switzerland had experienced since 1864. At Geneva, the mean air temperature had been 1.2° C above normal. It was claimed that the high temperatures were threatening the trout and grayling of Swiss rivers, and might also be allowing the arrival of new species of animals and plants.

At Cessy, the early part of 2014 was marked by significant numbers of "signals" leaving the River Oudar, and making incursions up the RDM and into the "special studies

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area" below the dam. That was also a period when temperatures in the upper water column of the pond were sometimes higher than those recorded in the previous six years (Figure 2). However, the increases were not that great. In addition, it would be unwise to assume that temperatures in the pond closely reflected those of the River Oudar and the RDM, both of which had different hydrological characteristics.

COULD THERE HAVE BEEN CHANGES IN THE QUANTITY OF WATER IN THE RDM IN EARLY 2014, AT THE TIME WHEN MANY "SIGNALS" APPEARED BELOW THE DAM?

Unfortunately, in the Cessy area, hydrological stations are conspicuous by their absence. Thus, by necessity, "improvisation" had to become an integral component of some of the writer's studies. Fortunately, accurate rainfall data were available from a meteorological station operated by Williame Coosemans (see Fig. 3), and those data permitted the writer to obtain rough estimates of the quantity of water flowing out of the pond, during any given period.

From those data it was concluded that during the January – July periods of the years 2012 to 2014, there had not only been progressive increases in rainfall above the 19-year mean but that, concomitantly, there had evidently been significant increases in the quantity of water flowing out of the pond and down the RDM.

For several years, and parallel to that study, the writer has recorded his visual impressions of the amount of water flowing over the sluice gate (see Note). In order to record his observations, he created a simple flow classification, i.e.: NF – No flow, TR – Trickle, MF – Moderate flow, and GF – Great Flow. On two occasions in early February 2014, GF was accompanied by flooding of the sluice installation.

Ninety records, between 13 January and 30 June 2014 have been used to summarize the morning water-flow situation, shown in Fig. 4. What is inferred is that in 2014 "signals" did not arrive in the pool below the RDM dam in appreciable numbers, until there had been a marked slackening of water flow at the end of April. What happened to the individuals that were not caught and removed from the pool at that time, awaits clarification.

WHAT WERE THE PATHWAYS BY WHICH "SIGNALS" WERE ABLE TO MOVE UPSTREAM FROM THE RDM DAM AND INTO THE POND?

Hydrological studies of the RDM commenced in the summer of 2015, but the unusually early onset of "stagnation" conditions has hampered progress. The first simple study has produced some interesting data, which will be reported later, and in a separate article.

ARE "SIGNALS" ESTABLISHING THEMSELVES IN CESSY POND?

Over the period 9 April to 2 September 2015 a single baited crayfish trap was periodically positioned, for 24 hours,

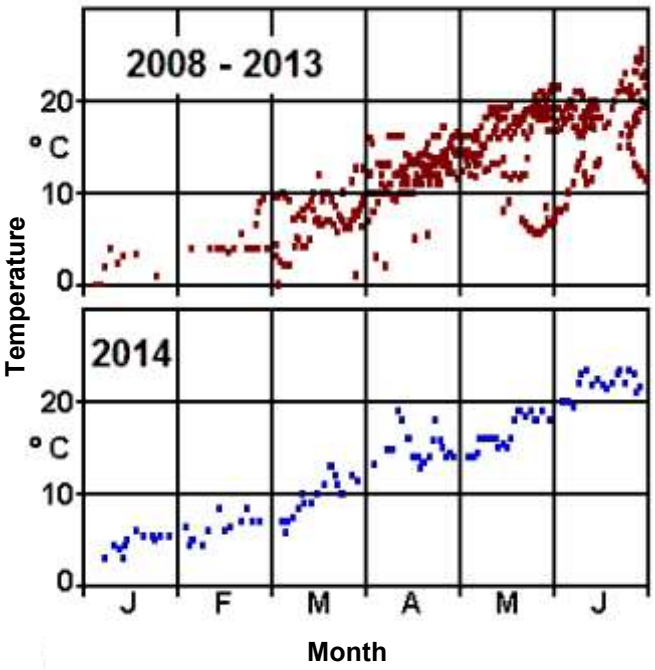

Figure 2. Temperatures in the upper water column of Cessy Pond during the first six months of 2014, and of the previous six years.

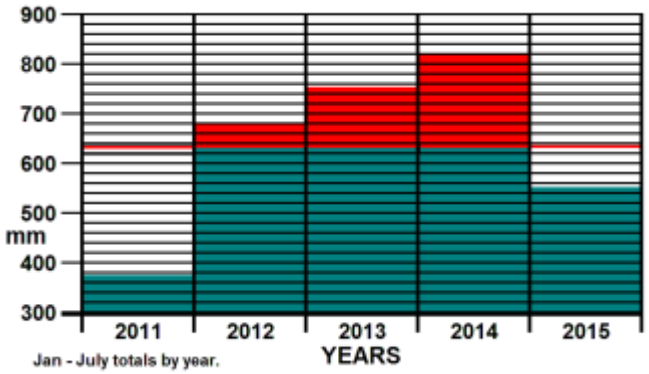

Figure 3. Graphs showing the January–July total rainfall amounts for the years 2011 to 2015 at Cessy Sud. The red areas denote the amount of rain greater than the 19-year means.

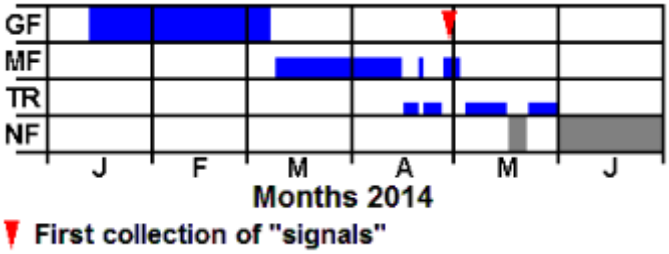

Figure 4. Graphic summary of the water-flow over the RDM sluice gate for the period 13 January – 30 June, 2014. The red arrow denotes the time of the first detection of "signals" below the RDM dam.

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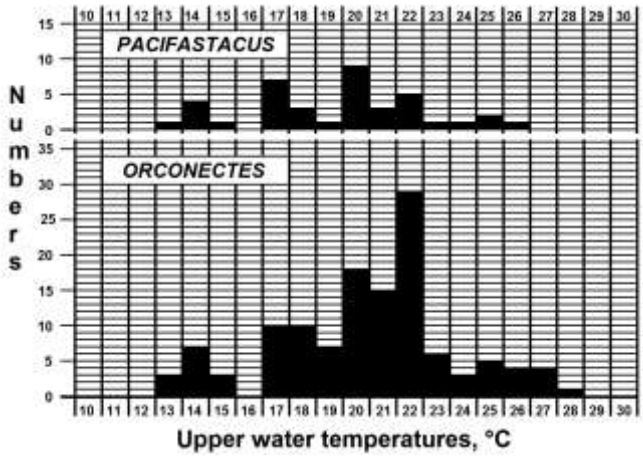

Figure 5. Graphs showing the numbers of "signals" and of *O. limosus* trapped in Cessy Pond, from 09-04 to 02-09-2015, displayed according to upper water column temperatures.

Photo 1. A viscous orange liquid seen trickling into the River Oudar in 2011.

in the south-western corner of Cessy pond. It collected 39 "signals" and 126 *O. limosus*; 23.6% and 76.4% of the total catch, respectively (Figure 5). All the "signals" were adult males and females, of many different sizes.

Most of the two crayfish species that were trapped are now housed together in an artificial garden pond, in order to determine if there is any physical aggression between them. Nothing of note has so far been observed.

It would be premature to draw any definitive conclusions from these data, although it does seem that the "signals" are "making themselves at home".

Some ten years ago, a teenager borrowed his father's automobile and drove to the Cessy Pond car-park to practice skidding. Alas, he lost control of the vehicle and crashed it into the sluice, damaging the sluice to such an extent that it was impossible to adjust the height of the gate. The damage has never been repaired and the gate remains fixed at its lowest level, resting on its basement sill. H

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The History and Status Quo of Ornamental Freshwater Crustaceans in Japan

History of the Problem

Japan has a total of three species of crayfishes: one endangered and native species (*Cambaroides japonicus*), and two alien species from North America (*Pacifastacus leniusculus* and *Procambarus clarkii*). These two alien species are recognized as invasive species that have a strong negative influence on native ecosystems (e.g., Holdich 1999), and they are expanding across Japan.

It is documented by official documents that the signal crayfish *P. leniusculus* was first introduced into Japan from northwestern North America for use as food, in 1928 (Kawai et al., 2002). *Pacifastacus leniusculus* was designated as an "Invasive Alien Species" (IAS) by the Ministry of the Environment of Japan and by the Ministry of Agriculture, Forestry and Fisheries of Japan on 1st February 2006. The IAS Act prohibits the raising, importing, transferring and releasing of IAS in Japan, and control of *P. leniusculus* has been conducted in Hokkaido under the IAS Act (Usio et al. 2007).

According to the literature, the red swamp crayfish *P. clarkii* was introduced into Kamakura Prefecture, Japan in 1927, as food for the bullfrog, *Rana catesbeiana*, from New Orleans, USA. From that single introduction, *P. clarkii* subsequently spread all over the Japanese Archipelago (Kawai and Kobayashi 2006). Japan did not have a history of crayfish consumption, and *P. clarkii* was not then considered as a food resource (Nonaka 2012). However, the crayfish has been commonly used as a teaching device with a specific academic purpose in elementary schools (Goto and Kawai 2012) (Figure 1). Recently, new concerns are rising about their distribution through the ornamental pet trade market.

Since the mid-1970s, crustaceans have been sold in pet shops. However, these have mostly been marine species. In the 1980s, pet shops began selling *Caridina multidentata*, although not as an ornamental species itself, but rather for its role in cleaning the aquarium (eating attached algae). In 1988, Koi traders in the Chiba Prefecture discovered a white body color red swamp crayfish, *P. clarkii*, from their Koi ponds, which became a big topic featured in magazines. The

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individuals were albino, and their body color inheritable on "Mendel's laws" (Nakatani 1999, 2000). These albino individuals were generally weak and their survival rates relatively low compared to wild individuals with the regular, red body color (Begum et al. 2010). However, Japanese aquarists and primary school students easily managed to induce reproduction in a home aquarium or a tank in the classroom. By the early 1990s, other new colors of American crayfish, such as orange and blue, were presented in various colors in magazines, and one after another were introduced for sale in pet shops.

After the mid-1990s, a variety of crayfish of foreign production, such as marron (*Cherax tenuimanus*), koonak (*C. preissii*) and red claw (*C. quadricarinatus*), were imported as ornamentals for sale in Japan, via Europe and Southeast Asia. In the late 1990s, small freshwater shrimp species also began to be circulated. Crayfish and shrimps were featured in home aquarium magazines, and their promotion through the media led to an increase in their circulation at this time.

By 2006, with the exotic *Cherax*, *Pacifastacus* and *Procambarus* species now listed as IAS, the distribution and sales of these species was restricted. It became difficult for aquarists to buy crayfish in a pet shop, and instead crayfish trading mostly took place over the Internet after that time.

By 2008, the distribution of exotic small shrimps had begun in earnest, and imports increased dramatically. It also became easier to cooperate with domestic and overseas traders via the Internet. As well as commercial distribution routes, there were also increases in the shrimps imported via the personal route. By 2011, small freshwater crabs were also being imported. The species imported were mainly those that inhabit the Southeast Asian tropics, which initially were brought via Europe, and then were independently collected in Southeast Asia and brought directly to Japan.

About the Pathways of Introduction and Distribution

The sale and distribution of traditional ornamental crustaceans mainly began after they were featured in magazines. After breeders obtain individuals through a pet shop, they are generally able to begin breeding the animals successfully. The process is facilitated through the distribution of information, including educational activities; let's say that it is a very easy situation.

In response to demand trends and a request from the pet shops, wholesalers raise the individuals to sell. If necessary, crustaceans can also be sourced by asking a specialized hunter to target a species. In Japan, these people are referred to as "captive" suppliers. In addition, if you are farming, you can purchase stock from other farmers. In Japan, this could occur in association with the purchase of species such as koi carp.

The collected individuals are held in stock by a wholesaler, who then informs the pet shops that deal in these animals as to their available stock and inventory, and will ship their stock to order.

Figure 1. *Procambarus clarkii* is bred as an ornamental crustacean in Japan.

Figure 2. Very rare blue color phase of the Japanese endangered species *Cambaroides japonicus* in the wild.

When stocks reach the pet shop, the store can sell each type of crustacean with a charming slogan to drive consumer interest. Animal lovers, based on information they see in magazines, then purchase these individuals. The species held in a pet shop vary greatly depending on factors such as time and trends, and prices are often changed according to the situation. Some kinds are sold all year round, while others are sold only in a particular season. Rare species or forms are traded at very high prices.

One of the problems of this conventional type of distribution of ornamental species is that it is done with only the minimum required compliance to the law. Dealers may comply with respect to what is stipulated by the law, but do not understand the spirit of the law at a higher level, and

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therefore the full intent of the law will not be achieved. For example, crayfish in Japan on the verge of extinction are still routinely distributed today, because keeping them in home aquaria is not specifically prohibited by law. In addition, except for information relevant to their income, distributors display little interest in the issue, and may not think about whether a species is in an endangered state. They are also content to distribute species that cannot be bred in aquaria, and therefore require continued wild harvesting, such as *Caridina multidentata*, which are collected and distributed through the trade in large quantities each year, for their use in cleaning aquaria.

However, this conventional system of trade and distribution does have some advantages. Because those involved are wanting to receive a permanent source of revenue, they will be encouraged to take some care for the resource. For example, in the case of fishermen, they will try to prevent the depletion of crustacean resources at their fishing location. They do not capture more than the necessary amount, and it is in their interest to prevent the extinction of individuals at that location. Also, because any death of animals during distribution means a reduction in profits, they will invest considerable expense in building and maintaining a management facility for the stock. Although there is a necessary minimum to comply with the law, this is nonetheless a positive aspect of the conventional industry.

With the development of the Internet, however, the pet industry and the style of distribution began to change significantly. Among these changes was the appearance in the trade of the "semi-professional" dealer. Using the Internet, animals can now be sold directly to a customer, rather than through the traditional route via a pet shop. This provides more incentive for a semi-professional to capture their own animals in the wild as a fisherman, since the animals caught are now easier to sell, and more profitable. Even if the semi-professional is employed in another occupation, they are able to engage in this wild harvest of crustaceans in their spare time. This aspect of the trade has become a major threat to wild stocks of ornamental species, and the activity is increasing. An example is the online auction of the rare blue form of the native Japanese crayfish (*Cambaroides japonicus*) (Figure 2), which sell for a very high price; all of the animals sold in this market have been wild-caught from their natural habitat.

Because this type of dealer can operate only as a sideline, they are more likely to consider only the profits that can be made at that particular time, rather than a sustainable, permanent revenue. Therefore, when a habitat supporting animals of value is discovered, there will be a tendency to exploit the habitat heavily, and this may cause catastrophic damage to the population. This phenomenon has happened in Japan to species such as the Japanese native crayfish (*Cambaroides japonicus*), Itasenpara bitterling (*Acheilognathus longipinnis*) and giant water bug (*Lethocerus deyrollei*), and many other creatures. Habitats that had not been heavily exploited when only professional activities were occurring, have been over-exploited with the advent of semi-professional collecting, to the point of causing local extinctions. This is a very serious problem.

In addition to semi-professional operators, “amateurs” have also now entered into the distribution cycle of these animals, in terms of both exports and imports. It is now easy for a person to make contact with other people abroad over the Internet, and these personal networks may have informally allowed the flow of ornamental crustaceans to continue into Japan. Since 2006, new imports of crayfish have been banned. However, crayfish species that were not sold in Japan prior to 2006 have been sold on the Internet in recent years - this suggests that these species have been smuggled into Japan. The suppliers of these species are not professionals, and may not have knowledge of, or regard for compliance with, the law. For personal imports, it is also difficult to enforce the regulations contained in the law.

The Internet is very useful, and has helped to remove a lot of obstacles and barriers in a global era. But that has included some barriers that should not have been removed. Removing restrictions on professional, semi-professional and amateur traders of ornamental species has caused a new problem, a borderless phenomenon in the bad sense. Traditionally, information about the activities of dissemination and awareness about the trade in ornamental species was confined to the conventional pet industry. Now, the problem will have to be considered from a different perspective, and from alternative distribution routes. H

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Meeting Announcements

XXI Symposium of the International Association of Astacology

Real Jardín Botánico CSIC, Madrid, Spain
September 5-9, 2016

Dear Colleagues and Friends,

On behalf of the Organizing and Scientific Committee, it is our pleasure to invite you to attend the "XXI Symposium of the International Association of Astacology" that will be held at the Royal Botanical Garden CSIC in Madrid (Spain), September 5 – 9th, 2016 (http://www.rjb.csic.es/jardinbotanico/jardin/). The symposium will include invited lectures, contributed oral and poster presentations, and exhibitions. Opportunities to visit crayfish farms, crayfish populations, crayfish production sites, and places of local interest during the symposium will also be arranged.

In Memoriam

Honouring Pierre-Jacques LAURENT (1925-2015)

France's Pierre-Jacques Laurent died on 8th August 2015 at the age of 90.

Many astacologists were personally saddened to hear of the death of Pierre Laurent. Pierre was formerly Director of the Station d'Hydrobiologie Lacustre at Thonon-les-Bains, France, a facility run by the French Institute for Agronomical research (INRA).

He was one of the pioneering scientists assisting in the birth of the International Association of Astacology. He was present at the first IAA meeting in Austria in 1972 and attended the first IAA meeting in Scandinavia at the University of Kuopio (Finland) in 1976. Convinced of the importance of the Association, he organized the 4th symposium at Thonon-les-Bains (France) in 1978 and edited *Freshwater Crayfish* 4 in 1979, finally becoming IAA President from 1984 to 1987. Since 1990, he was an Honorary IAA Member. He was presented with a Charter Member's medal in 1996, as one of the members who had attended the first IAA meeting in 1972. At the 7th IAA symposium in Lausanne (1987) he put forward a 'Resolution on Transplantations' to the delegates, which was accepted - see Holdich and Whisson (2004): 'The First 30 years. A history of the International Association of Astacology)'. Following the IAA European meeting 'Knowledge-based management of European native crayfishes' (Poitiers, France, 2001), he co-authored two papers with **Francesca Gherardi** and **Lars Cerenius** (see bibliography).

For many years Pierre was the chief contributor, editor and producer of 'L'Astaciculteur de France', the trimestrial Bulletin (published under ISSN 1244-457X), of the Association of the Astacicultivators of France, for which association Pierre also served as Secretary-Treasurer. The articles in this A4 Bulletin usually included English summaries, mostly translated by Pierre, and featured many contributions by him, still relevant today, such as 'White-clawed crayfish restocking, OK, but how to obtain the necessary living material?' (Bull. 86, 2006), and "In Savoie, an anglers' society [re]populates a catchment with white-clawed crayfish" (Bull. 82, 2005). Other issues featured historical notes, dreadful puns, and even recipes! Pierre was very concerned about the introduction of non-indigenous crayfish in Africa (Baldry and Laurent 2008). He was a very keen 'amateur' entomologist, with special interests (and collections) in Lepidoptera and Coleoptera.

Photo 1. Pierre (82 years old) in his laboratory in Thonon-les-Bains in 2007. Photo by David Baldry

Photo 2. Pierre (Right) discussing the taxonomy of Bavarian crayfish with Max Keller (Left) in 1994. This was during a dry run for the 12th IAA Symposium in Augsburg planned for 1998.

Photo 3. Pierre (Center) leading a field excursion during the 4th IAA Symposium in France in 1978.

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On 20 May 2011 the French newspaper 'Le Messager' published an article entitled "Pierre-Jacques Laurent: more than half a century of passion for crayfish". Pierre –Jacques Laurent emphasized how he was involved in editing the quarterly bulletin of L'Astaciculteur de France: 'That involves a lot of work for me, but then, there is always something that has to be said. I am in contact with people throughout the whole world, who contribute to the chronicle every quarter!'

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David Baldry (U.K.),
David M. Holdich (U.K.),
Julian D. Reynolds (Ireland), and
Catherine Souty-Grosset (France)

IAA Friend: Professor Dr. Michael Türkay (1948-2015)

One of the most popular scholars, Professor Dr. Michael Türkay (Tuerkay) of the Senckenberg Forschungsinstitut und Naturmuseum Frankfurt (Senckenberg Research Institute and Natural History Museum Frankfurt) (Figure 1) contributed to our understanding of many crustaceans, but he especially had an interest in freshwater crayfish. In August 2014, at the largest scientific meeting for crustaceans, the 8th International Crustacean Congress, was held in Frankfurt, Germany, and was hosted by Michael. During this meeting, I was invited by him to visit the library and collections of the museum after the meeting. During this time, he happily gave me a tour of the library and specimen collection. All issues of *Freshwater Crayfish* were present in the library at the museum. His personal website also had links to the official IAA website, showing his significant interest in both astacology and the IAA.

The museum collection contained preserved specimens of the alien crayfish *Procambarus clarkii* that were collected from Germany. These specimens verified the year of invasion and the original locality of these exotic crayfish in Germany and Europe. He was concerned about the negative impact that invasive crayfish can have, so he collected specimens of non-native species for use as basic information for conservation efforts. The former curator of the Natural History Museum Frankfurt, Professor Dr. Richard Bott, established the presence of the genus *Pacifastacus* based on specimens housed in the Crustacean Collection at the museum (Bott 1950) (Figure 2), and the collection also contains specimens of the extinct species, *Pacifastacus nigrescens* (Figure 2). It is widely known that the Pacific slope drainages of western North America are home to the genus *Pacifastacus*, particularly *P. leniusculus* (Larson and Williams 2015), and that this species negatively impacts the native ecosystems in Europe and Asia. Biological information is important for both conservation and systematic efforts, and specimens are the most important material for taxonomic investigations. In addition, specimens of the extinct *P. nigrescens* are really rare, even in North American museum collections. European Astacids (genera *Astacus* and *Austropotamobius*) have many endangered species and are a problematic group taxonomically (Füreder 2015). As such, they are in need of taxonomic revision in order to aid conservation efforts of these native European crayfish. When I visited Frankfurt, Professor Michael Tuerkay and I talked about the possibility of utilizing the specimens in the Natural

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Figure 1. Professor Dr. Michael Türkay (Right) with Tadashi Kawai (Left), Goethe University, Frankfurt am Main, Germany, August 2014, 8th International Crustacean Congress.

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History Museum Frankfurt, and he stated that the museum holds many specimens of European and American Astacids in excellent condition. These specimens are an "available academic heritage", and are ready to contribute to taxonomic works by Astacologists. These specimens can add knowledge that helps conservationists all around the world. I thought he was a dedicated astacologist and Michael was a good friend and advocate fir the IAA.

Michael was also "Cosmopolitan" and he visited Japan several times and indeed had a Japanese name "鶴飼美蛙", where the family name 鶴飼 means crane raiser, and the given name 美蛙 means beautiful frog. He had a great sense of humor. Again, I sincerely thank him for his contributions to astacology and pray that his soul may rest in peace. H

Tadashi Kawai
IAA secretary
Sapporo, Japan

Figure 2. Specimens in Natural History Museum Frankfurt. *Pacifastacus leniusculus* (upper) and *P. nigrescens* (lower).

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John Edward Cooper

November 17, 1929 — August 28, 2015

John Edward Cooper (1929-2015) (Photo 1) was born in Baltimore, Maryland on November 17, 1929. He died at his home in Knightdale, North Carolina on August 28, 2015 at the age of 85 while recovering from a stroke that occurred earlier this year (April).

In his early years, John worked briefly as an assistant on the Rodent Ecology Project at John Hopkins University, was employed for several years at the Baltimore Zoo, and served on active duty with the U.S. Marine Corps (1951-1953). He attended Johns Hopkins University from 1953 to 1957, receiving his B.A. in Biological Sciences. From 1957 through 1966 he taught biology in Baltimore secondary schools and was part of the evening faculty at Baltimore Junior College for part of that time. In 1966, he enrolled as a graduate student in the Department of Zoology at the University of Kentucky. He was elected a full member of Sigma Xi in 1967 and received his M.S. in Biology in 1968. In 1970, he joined the faculty of the Community College of Baltimore as an Assistant Professor, resigning in 1974. Later that same year, he became the Director of Research and Collections at the North Carolina State Museum of Natural History and retired just recently from what is now the North Carolina Museum of Natural Sciences with over 25 years of service. He received his Ph.D. in 1975 from the University of Kentucky with his dissertation research on decapod crustaceans from Shelta Cave.

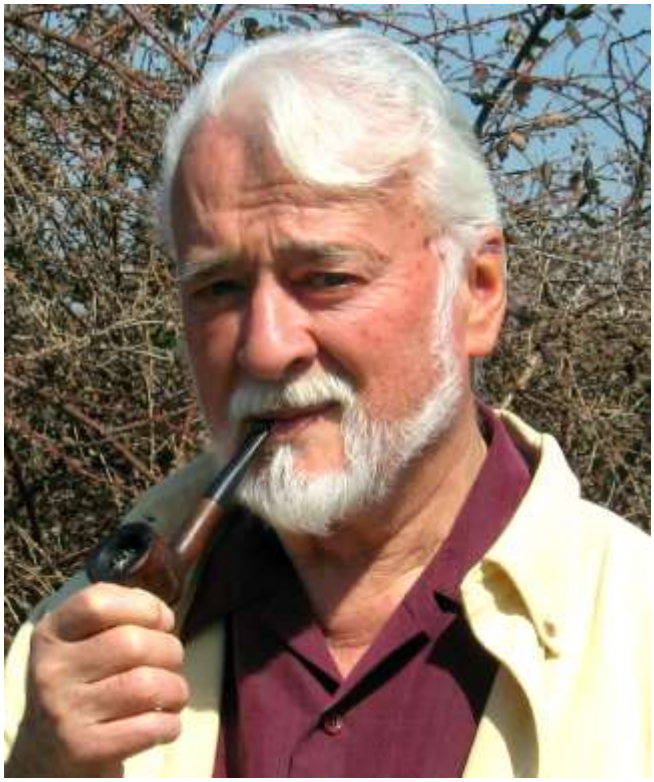

Photo 1. John Edward Cooper (1929-2015).

John held a number of positions in the National Speleological Society and was a member of many other professional organizations, including the International Association of Astacology, Ecological Society of America, Association of Southeastern Biologists, and several others.

John has had a major impact on both the fields of Astacology and Speleology, which is quite evident from his over 130 publications in these areas of research. John was instrumental in helping to understand the crayfish fauna of the southeastern US, and North Carolina in particular. Between 1980 and 2010 he descried 16 species of freshwater crayfish from three genera, including 10 *Cambarus*, 5 *Orconectes* and 1 *Procambarus*.

John was a consummate gentleman and a knowledgeable scholar and he will be sorely missed by his astacological colleagues. Our thoughts and condolences go out to his family. A more detailed "In Memoriam" article about John will appear in the upcoming issue of *Freshwater Crayfish*. H

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Photo 2. John Cooper working on crayfish in his office.

Crayfish Meeting Summaries

IAA Crayfish Symposium Hosted at the Southern Division of the American Fisheries Society Meeting in Savannah, GA

Over 50 students, agency biologists, and astacologists from across the central and southeastern United States descended on Savannah Georgia January 29 – February 1st, 2015 to attend the IAA Southeastern United States Crayfish Conservation Symposium held in association with the Southern Division of the American Fisheries Society meeting. The symposium kickoff event was a poster session held Friday night in conjunction with the SDAFS poster session. The following day, over 20 oral presentations on crayfish research from across the southeastern and central United States were presented by the symposium attendees. Broad topics covered by the oral presentations included crayfish natural history, conservation initiatives, status survey results, conservation physiology, and current trends in crayfish molecular phylogenetics. A future product of the symposium is a dedicated issue of *Freshwater Crayfish*, where many of the oral presentations will be formally published and presented to our growing crayfish research community. Saturday evening, all participants enjoyed IAA sponsored dinner and drinks at Moon River Brewing Company in downtown Savannah. Many a collaboration was formed during the evening events. Sunday morning, the Southeastern Crayfish Working Group held a round-table where conservation strategies specific to the southeastern United States crayfish fauna were discussed, as well as potential joint collaborations and funding streams. Plans are underway to make symposia on crayfish at this meeting an annual event. There will be a crayfish symposium at the 2016 SDAFS meeting, which will be held at Oglebay Park in Wheeling, West Virginia, so if you study crayfish in the Southeastern United States, set aside the first weekend in February to attend the meeting! H

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Crayfish Conference: Conservation and Invasion Across the British Isles, Giggleswick School, North Yorkshire 17-19 August 2015

Since the last national crayfish conference, held in Bristol in 2009, the indigenous white-clawed crayfish (*Austropotamobius pallipes*) has continued to suffer substantial population declines and local extinctions across much of its former range. In 2010, the species was reclassified as "endangered" on the IUCN's Red List. Unfortunately, area-based designations have largely failed to halt the decline; a little over a decade since most UK Special Areas of Conservation (SACs) were confirmed, white-clawed crayfish are now either extinct, or on the verge of local extinction at almost all SACs that have the species as a listed interest feature. By 2015, only two UK SACs retained populations of white-clawed crayfish in relatively favourable condition. Ireland supports perhaps Europe's strongest surviving white-clawed crayfish populations, but tragically, an outbreak of 'crayfish plague' (*Aphanomyces astaci*) was confirmed there in August 2015.

Whilst our indigenous crayfish continue to decline, the range of American signal crayfish (*Pacifastacus leniusculus*) consolidates and continues to extend further across the UK. Since Bristol 2009, there is now further evidence of deliberate illegal introductions of signal crayfish to new areas, including parts of Scotland; well beyond the historic range of white-clawed crayfish. Misguided 'wild foodies' have certainly played a part; and such actions are both damaging and, at the moment, irreversible. Without an evidence-based response to this problem, the human-assisted spread of signal crayfish will certainly continue, and prime salmon fishing rivers of Scotland and Ireland might soon become infested. Also, additional, even more problematic non-native crayfish species might be similarly introduced to UK waters: the problem of invasive non-native crayfish certainly threatens the naturalness of a large proportion of our freshwater aquatic systems.

It was within this context that over 100 delegates from across Britain and Europe gathered for this two-day conference at Giggleswick School – an imposing 500-year-old

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seat of learning on the edge of the Yorkshire Dales. Organised jointly by the Environment Agency and the Applied Ecology Trust, the conference brought together a broad range of researchers, practitioners, regulators, conservationists, and crayfish trappers. The overall aim was simply to help inform a more evidence-based approach to issues around indigenous and invasive non-native crayfish species across the British Isles.

David Holdich commenced proceedings with an authoritative review of the distribution of indigenous and non-indigenous crayfish species in Europe. Historically, Europe had only five indigenous crayfish species. The first non-indigenous crayfish species to be introduced was spiny-cheek crayfish (*Orconectes limosus*) in 1890, followed by red swamp crayfish (*Procambarus clarkii*) and signal crayfish (*Pacifastacus leniusculus*) in the 1970s. These three species were deliberately introduced from North America for aquacultural and restocking purposes, following the arrival of 'crayfish plague' in ships' ballast, also from North America. Since the 1980s, seven new non-indigenous crayfish species have appeared in European waters – five from North America and two from Australia, often as escapees and deliberate releases from the aquarium and aquaculture trades.

Almost uniquely in Europe, Ireland currently remains free of invasive non-native crayfish species. Julian Reynolds provided a fascinating account of a situation that also pertained across England and Wales until as recently as the 1970s. White-clawed crayfish currently remain widespread in parts of Ireland, and the island of Ireland is currently free of signal crayfish. However, the high level of trapping activity in England at the moment, is perceived to increase the risk of introducing signal crayfish to Ireland.

Jen Nightingale summarised the achievements of the South West Crayfish Partnership. This project spearheaded a communication strategy that has successfully engaged key audiences in efforts to conserve white-clawed crayfish, and helping to prevent further illegal introductions of signal

crayfish in the region. Joanne Backshall then summarised eight years of crayfish monitoring and public engagement work in the Eden catchment of Cumbria. Together, these two initiatives provide many lessons and resources for other regions to now adapt and apply.

Some say the future of white-clawed crayfish may be restricted to isolated stillwater sites. Paul Bradley presented the results of long-term monitoring; indicating that stillwater populations may be vulnerable to catchment nutrient inputs. Paul suggested that physically isolated headwater stream populations may warrant additional conservation priority. Graham Hill reported that in the Wyre Forest, surviving populations of white-clawed crayfish are found above barrier features. Graham also observed that certain barriers in the Wyre Forest may be inhibiting the upstream spread of signal crayfish to headwaters.

A choice of four engaging field-excursions on the first afternoon, included: (i) dewatering of a signal crayfish infested headwater stream; (ii) the site of a recent illegal crayfish introduction; (iii) a successful white-clawed crayfish translocation; and, (iv) an isolated extant 'ark site' white-clawed crayfish population.

Attention then switched to invasive non-native crayfish. Trevor Reynolds summarised EA's INNS lead in this regard. The new EU Regulation on invasive alien species entered into force on 1 January 2015, and foresees three types of interventions: (i) prevention; (ii) early warning and rapid

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response; and, (iii) management. A list of invasive alien species of Union concern is being drawn up, and an updated edition of the GB Invasive Non-native Species Strategy was issued August 2015. Paul Stebbings then presented interim results of signal crayfish control trials being undertaken by Cefas. Recent work at Cefas has included development of a poison bait that is intended to be specific to the target species. Rupert Houghton presented his related research, and suggested that control attempts should focus on recently introduced signal crayfish populations, and must be able to target the younger cohorts as well as mature crayfish. Stephanie Peay showed how the environmental cost of invasion by signal crayfish could be estimated and used this to set out the financial case for the eradication of small isolated populations of signal crayfish.

Lennart Edsman reported that intensive trapping activity in Sweden has only served to further proliferate the spread of signal crayfish and 'crayfish plague'. Lennart's assertion that opening up of sites for signal crayfish fishing is "very very bad" has been much re-tweeted since the conference. The UK might have lessons to learn from Sweden in this regard. Stephen Rice then presented ongoing research on the geomorphological impacts of signal crayfish. Stephen asserted that seasonal and diurnal patterns of increased sediment mobilisation are yet another negative consequence of signal crayfish, and a further mechanism by which infested waters might fail to meet WFD objectives.

Edward Willis-Jones presented the results of mesocosm and field manipulation experiments used to assess the effect of bioturbation by three invasive crayfish species on a variety of ecosystem properties across seasons. Kate Mathers then presented an investigation of the long-term macroinvertebrate community response to signal crayfish. Kate has found that following crayfish invasion, macroinvertebrate communities displayed clear changes compared to pre-invasion and control rivers, with these differences persisting for over 10 years. Alterations to community composition were found to be driven primarily by a reduction in Hirudinea and Gastropoda/Bivalvia species, although regional differences in the taxon affected were also evident. Nathan Edmonds presented the results of a Cefas mesocosm investigation that has shed new light on the proclivity of signal crayfish to predate upon the intra-gravel and emerging embryo life-history stages of Atlantic salmon *Salmo salar*. Further field-based evidence of fish impacts was presented by Dan Chadwick and Lawrence Eagle, who are currently investigating the impact of signal crayfish on headwater stream fish communities.

Jonathan Grey presented a fascinating account of using stable isotope analysis, a natural chemical tracer technique, to complement other more traditional approaches. Jonathan presented evidence that chub and barbel consume crayfish, some individuals especially so, and that their growth may be enhanced because of it. The study also demonstrated niche differentiation and dissimilar functional effects cascading to ecosystem processes for the different invaders, suggesting that they may co-exist and even amplify each other's effects.

These are just some of the highlights of what was an enjoyable and informative conference. Of course, most of the important business happens outside the formal sessions. Fortunately, most delegates were accommodated on site. The school also provided for communal mealtimes, and on both evening the sixth form common room hosted a bar. Surprisingly, this is the first modern-day conference that has been hosted by Giggleswick School. The venue suited very well indeed; the staff, local suppliers and coach company were all extremely helpful, and Giggleswick is brilliantly located for a diverse range of local excursions.

The success of this conference was very much the result of a team effort. Many thanks go to FBA, CIEEM, Environment Agency, Natural England, Non-native Species Secretariat, Field Studies Council, The Applied Ecology Trust, and to Giggleswick School. The conference organising committee and the submissions review committee began work over a year before the event, and we are so fortunate to have engaged outstanding conference administrator Elizabeth Judson, who made it all happen.

The conference committees will be meeting shortly to discuss next steps. The conference was funded solely by delegate fees, underwritten by PBA, and with a kind £250 donation from Hanson Aggregates. Unfortunately, we have no budget to produce conference proceedings at the moment, and we are investigating whether a journal special edition might be possible.

The next national crayfish conference is provisionally scheduled for July 2018; perhaps with a return to Giggleswick. In the meantime, please use #crayconf15 on twitter to post/follow updates and relevant news. H

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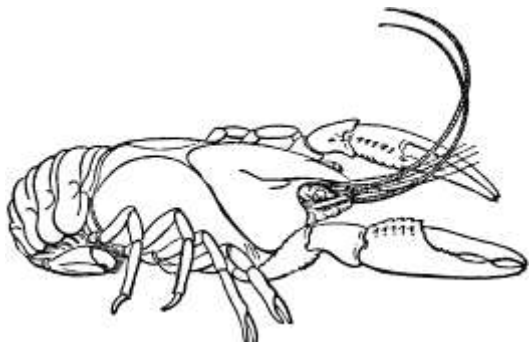

7th International meeting of *Forum Flusskrebse* in Möllbrücke (Austria)

The 7th International meeting of the *forum flusskrebse* took place September 10th until 13th 2015 in Möllbrücke in Carinthia (Austria). About 70 German-speaking researchers, students, crayfish producers, managers and other crayfish maniacs met in the heart of the Alps and exchanged their knowledge and experiences. Twenty speakers presented their newest results and findings in protection of the native crayfish species, restoration of aquatic habitats, ecology of different crayfish species in Europe, detection of crayfish plaque, measures against the further spread of non-native species and the breeding of crayfish for stocking and food.

The local organizer of the meeting, Jürgen Petutschnig and his team, made a great job and presented an interesting program for the participants. But also, the general public had a chance to attend an oral presentation on crayfish in Carinthia. An Aquarium exhibition, with local and exotic crayfish, and posters on display about different projects relating to crayfish protection were also open to the public. This opportunity was used by many local families and interested people.

During two field excursions, populations of all 7 crayfish species in Carinthia were visited. Besides the wonderful Alpine scenery, good talks and friendship, visitors of the meeting could enjoy the delicious local food and wine, as well as the hearty Austrian hospitality. Many thanks to Jürgen Petutschnig and his team for the successful and splendid meeting!

The next international meeting of *forum flusskrebse* is going to be held September 15th until 17th 2017 in Vaduz (Liechtenstein). The central topic of the meeting will be the restoration of crayfish habitats. Excursions in Liechtenstein and to the neighboring countries Switzerland and Austria are planed. IAA members are very welcome to visit us at our bi-annual meeting that takes place always in the year between the IAA meetings. Looking forward to seeing you in Liechtenstein!

Thomas Stucki
President *Forum Flusskrebse*
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Figure 1. The typical Carinthian crayfish *Austropotamobius italicus*.

Figure 2. Reinhard Pekny presents the 100 ways to shipwreck as a crayfish breeder.

Figure 3. Jürgen Petutschnig, local organizer of the meeting.

Figure 4. Weissensee, Carinthia.

TCS / IAA 2015 Summer Meeting in Sydney, Australia

The IAA jointly hosted The Crustacean Society Summer meeting, at the Australian Museum, Sydney, Australia 19-23rd July 2015. At this meeting, Professor Alastair Richardson attended as the invited speaker, and presented a talk entitled "Australian crayfish: how do they shape up?". The Freshwater Crayfish symposium was held on Wednesday the 22nd (chaired by Tadashi Kawai) and 5 papers were presented: Tierney, Wild and Furse: The mineral content of *Cherax quadricarinatus* in Southeast Queensland and Northeastern New South Wales. Ishii H: New ethological method for conservation research of the endangered crayfish, *Cambaroides japonicus*, using a radio telemetry system and contactless tags, in Sapporo, Hokkaido, Japan. McLoughlan, Wild and Furse: The distribution and population characteristics of *Cherax quadricarinatus* in Southeast Queensland and Northeastern New South Wales. Walsh T: Conservation issues facing the giant freshwater lobster (*Astacopsis gouldi*), and Ikeda K: Detecting of Limiting Factor of Appearance of the Endangered Japanese Crayfish, *Cambaroides japonicus*, Japan. In total, seven IAA members attended this meeting, and we welcomed two newly joined members.

Also, the potential for IAA 22 (2018) to be hosted in Australia, and the possibility of forming an Oceania IAA regional chapter were discussed at the IAA business meeting, and over dinner by the seven IAA participants. Possible IAA 22 venues in Australia were discussed and key points of discussion were transport links/accessibility from Asia, Europe, and the Americas, accommodation options, and access to native crayfish habitat. Two potentially suitable venues have been identified and the possibility of preparing a bid is being examined. The possibility of forming an IAA Oceania Regional Chapter is also being considered, and this requires further discussion with the IAA Board and IAA Oceania members.

Tadashi Kawai [1] and James Furse [2]

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Photo 1. Entrance to Symposium. Tadashi Kawai with IAA flyers.

Photo 2. Keynote lecture of Professor Alastair Richardson.

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To view abstracts, etc., click on a reference to be taken to the journal website (some references may not contain links).

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