PE1558/Q

Dear Scottish Parliament Petitions committee,

I believe that the best way forward for this committee is to host a debate involving the relevant parties in the hope that mutual understanding, and a way forward, can be achieved. In the meantime my response to the submission from SEPA/SNH (22nd December 2015) is as follows.

SEPA/ SNH stated:

> "Our aim is to support sustainable economic growth by helping others balance use of resources and economic development with an understanding of the effects on, and risks to, the natural environment. In this instance, we consider that the environmental risks of establishing a fishery for signal crayfish are significant and far outweigh the potential benefits."

ASV questions:

- **What are the alternatives to a local control and management programme for the growing signal crayfish population currently in Loch Ken?**
- **If no action is taken what will be done to monitor the signal crayfish population and how will the effectiveness of the current policy be evidenced?**
- **How will any newly detected populations be dealt with? Will lotic and lentic populations be managed differently?**
- **How will it be demonstrated that people's behaviour is being modified by the current Scottish Policy banning the trapping of non-native signal crayfish?**

SEPA/ SNH stated:

> "Although trapping can, in some circumstances, reduce the abundance of crayfish locally, there is no evidence that it can eradicate or prevent the spread of signal crayfish, or that it is an effective means of long-term control."

There is also no evidence that reducing the abundance of crayfish does not reduce the spread or damage caused by crayfish. Trapping has been widely reported as capable of causing an increase the number of crayfish (size structure perturbation leading to an increased biomass of small crayfish - population regulation theory) but there has been no evidence of ever increasing populations of crayfish as a result of trapping. Signal crayfish populations will undoubtedly increase and spread if left unmanaged. New introductions are being reported with increasing regularity (both here and abroad). If the populations currently being detected are from introductions made 5-10 years ago (lag phase to detection) what will the situation be in the next 5, 10 or 15 years? What evidence is there that the current policy will reverse, or slow, this trend?

SEPA/ SNH stated:

> "The pilot study of intensive crayfish trapping in Loch Ken cost approximately £90,000 over a five-month period. The project was reviewed, on behalf of Scottish Government, by a recognised UK crayfish expert, Dr. Stephanie Peay, who concluded that it was unlikely that the project reduced the ecological impact caused by signal crayfish, or reduced their spread."

The cost of this programme demonstrates the inherent difficulty of funding a control programme (in such a widespread species) where the end product is treated as 'waste'. It is, in my view, morally and ethically wrong to 'destroy' what is considered to be a food product. Also irksome is that this oft referred to report (commissioned to 'review' the research previously commissioned) has not been made publicly available and has not been submitted to this committee for its consideration.

The following sections of EU Regulation 1143/2014 are relevant to this debate (3; 4; 6; 9; 12; 18; 19; 22; 24; 26; 29; 32; 36; Article 3 – Definitions (14, 16, 17); Article 4 (3d); Article 5 (1 b,d,h); Article 8 -Permits (2, 3); Article 10 – Authorisations (1); Article 19 – Management measures (1,2), Article 21 – Costs recovery; Article 26 –Public participation). **I have included below two pertinent paragraphs.**

Article 19 – Management measures

1. Within 18 months of an invasive alien species being included on the Union list, Member States shall have in place effective management measures for those invasive alien species of Union concern which the Member States have found to be widely spread on their territory, so that their impact on biodiversity, the related ecosystem services, and, where applicable, on human health or the economy are minimised.

Those management measures shall be proportionate to the impact on the environment and appropriate to the specific circumstances of the Member States, be based on an analysis of costs and benefits and also include, as far as is feasible, the restoration measures referred to in Article 20. They shall be prioritised based on the risk evaluation and their cost effectiveness.

2. The management measures shall consist of lethal or non-lethal physical, chemical or biological actions aimed at the eradication, population control or containment of a population of an invasive alien species. Where appropriate, management measures shall include actions applied to the receiving ecosystem aimed at increasing its resilience to current and future invasions. The commercial use of already established invasive alien species may be temporarily allowed as part of the management measures aimed at their eradication, population control or containment, under strict justification and provided that all appropriate controls are in place to avoid any further spread.

CHAPTER V HORIZONTAL PROVISIONS

Article 21 **Costs recovery**

In accordance with the polluter pays principle and without prejudice to Directive 2004/35/EC of the European Parliament and of the Council ([23]), Member States shall aim to recover the costs of the measures needed to prevent, minimise or mitigate the adverse impact of invasive alien species, including environmental and resources costs as well as the restoration cost.

Article 21 points to the interesting prospect of potentially charging the Ministry of Agriculture Food and Fisheries (MAFF) (whose functions are now discharged by other bodies) in relation to the introduction of signal crayfish into waters mainly in the south of the country in the 1970s and 1980's.

Annexe – 05/02/16 – blog posts and additional information documents

THE SCOTTISH PETITION - NOVEMBER 8, 2015

Non-native crayfish in the UK: The debate around the consumption of *Pacifastacus leniusculus* (signal crayfish)

There is currently a public petition going through the Scottish Parliament (PE1558:www.scottish.parliament.uk/GettingInvolved/Petitions/americansignalcrayfish) asking the Scottish Government to lift the ban on trapping non-native crayfish for Loch Ken, Scotland. This is a large waterbody with a substantial population of red signal crayfish which are doing considerable damage to both the loch and its local inhabitant's livelihoods. I am trying to write my general observations on the multifarious issues that underpin this 'debate' as a series of posts to delight and *maybe* inform the debate…

NB: I will refer to the North American signal crayfish (*Pacifastacus leniusculus*, Dana 1852) as the red signal crayfish as adults have very red undersides to their claws distinguishing them from our ONLY UK NATIVE CRAYFISH the white-clawed crayfish (*Austropotamobius pallipes*, Lereboullet, 1848) which has pinky-white undersides to its claws. This is helpful if we are keen on communicating key messages about identifying native and non-native crayfish in the UK. There are a number of species of non-native crayfish in the UK but we should always assume native crayfish are present as the default position.

‘THE GIVENS’ - NOVEMBER 8, 2015

In my view some of the key tenants of the long running debate in the UK on the control of non-native crayfish populations in our freshwater lakes, can be best grappled with by first acknowledging a series of ‘givens’, in brief:Non-native crayfish, in particular the red signal crayfish (our most ubiquitous non-native crayfish in the UK) are very damaging

- They carry crayfish plague which kills our native white-clawed crayfish (which is rare and endangered and protected by law)
- Red signal crayfish have excellent climbing abilities and can survive on land for weeks at a time in damp conditions
- Red signal crayfish are currently present in c. 87% of UK river catchments
- There are more red signal crayfish populations in the south of the country as this is where the government introductions (for food, that’s another story) mostly took place but they are spreading ever northwards

NB: I refer to the North American signal crayfish (*Pacifastacus leniusculus*, Dana 1852) as the red signal crayfish as adults have very red undersides to their claws distinguishing them from our ONLY UK NATIVE CRAYFISH the white-clawed crayfish (*Austropotamobius pallipes*, Lereboullet, 1848) which has pinky-white undersides to its claws.

NATIVE CRAYFISH (INDIGENOUS CRAYFISH SPECIES: ICS) AND CRAYFISH PLAGUE - DECEMBER 26, 2015

Austropotamobius pallipes (Lereboullet, 1858) (**white-clawed crayfish**) is the only native crayfish species found in the UK though it is recorded in a total of 18 countries across Europe alongside other native crayfish species. In England, Ireland and Wales historical introductions may account for its presence (Holdich et al., 1995; Pöckl et al., 2006), with introductions in the 1940’s into Scotland (Gladman et al., 2009). Globally native crayfish are subject to overfishing, poaching, predation, habitat alteration and pollution, together with threats from crayfish plague and the deliberate or accidental introduction of non – indigenous crayfish species (NICS) (Lodge et al., 2000).

In the UK white-clawed crayfish population declines were noted prior to the government sponsored *Pacifastacus leniusculus* (red signal crayfish) introductions (for human consumption) in the 1970s and ‘80s (Shardlow et al., 2002). However, the introduction of NICS has certainly exacerbated the decline of *A. pallipes* which is

increasingly imperilled (Sibley et al., 2011) with extinction predicted by 2033 (Holdich et al., 2004). *P. leniusculus,* and other introduced North American crayfish species, are carriers of *Aphanomyces astaci* (Schikora, 1903) (fungal crayfish plague) which extirpates native crayfish populations. As well as carrying crayfish plague NICS reduce the abundance and diversity of other aquatic biota, damage ecosystems via burrowing and habitat perturbation and out-compete native crayfish species (Holdich et al., 2009).

INVASIVE SIGNAL CRAYFISH COME TO THE UK - DECEMBER 26, 2015

A bit of crayfish history

From 1907 Swedish *A. astacus* populations (the native noble crayfish) were negatively affected by outbreaks of crayfish plague (Souty-Grosset et al., 2006), with concomitant disruption to commercial fisheries and national traditions. A successful campaign to bolster stocks of crayfish in Sweden was fought with 'plague-resistant' non-indigenous crayfish species (NICS) such as *P. leniusculus* (the signal crayfish originally from North America) promoted as an 'ecological and gastronomic homologue' of the native *A. astacus* (Abrahamsson and Goldman, 1970).
The UK had only a limited tradition of local native crayfish consumption yet the Ministry of Agriculture, Fisheries and Food (MAFF) yet decided to copy Sweden and commenced the introduction of *P. leniusculus* (for subsequent sale as a human foodstuff) against scientific advice (Bowler, 1979; Holdich and Whisson, 2004). In the UK crayfish "farm-diversification" enterprises were incentivised via generous subsidies (Alderman et al., 1990), with marketing and distribution support offered via the newly formed British Crayfish Marketing Association (BCMA; Reynolds and Gherardi, 2012).

In the UK over 300 'implants' of juvenile *P. leniusculus* had taken place by 1992 (Rogers and Watson, 2011), with 110 new crayfish farms registered (David Rogers Associates, 2012). However, new "crayfish farmers" reported slow growth and low yields and the dissolution of the BCMA followed in 1990, with ponds abandoned and stock left to grow-on unchecked. Meanwhile in Sweden it became apparent that North American crayfish species were carriers of crayfish plague (Alderman et al., 1990), further exacerbating the decline of Swedish *A. astacus* stocks.
P. leniusculus now occurs in 24 European countries making it the most widely distributed NICS in Europe with population growth, movement and accidental & deliberate introductions contributing to its increasing distribution in the UK and elsewhere.

THE SIGNAL CRAYFISH: A SUCCESSFUL INVADER – DECEMBER 26, 2015

The signal crayfish (*P. leniusculus*) is a non-indigenous crayfish species (NICS) in the UK. It is highly adaptable, large, long-lived, fecund, aggressive and polytrophic (eats plant and animal matter), cannibalistic crustacean with wide-ranging environmental tolerances and is a tenacious and dominant invader. Signal crayfish can breed successfully in brackish waters (Holdich et al., 1997), fluctuating thermal conditions (Rutledge and Pritchard, 1981; Firkins and Holdich, 1993), varying water qualities and significant heavy metal concentrations (Ant ón et al., 2000). Signal crayfish can survive on land for up to three months in damp conditions and can travel overland (as well as through watercourses), their excellent climbing abilities allowing them to circumnavigate weirs and other obstacles (Holdich, 1991). It is not known how far a crayfish can walk over land (Holdich et al., 2004), though spread through rivers has been estimated at 2.4 km yr^{-1}downstream (Bubb et al., 2005).

An additional threat is present in the form of movement of juvenile or adult crayfish by predators including *Mustela vison* (mink), *Lutra lutra* (European otter), *Ardea cinerea*, (grey heron) and *Anas platrhynchos* (mallard) in the UK (Holdich et al., 2004; Banha and Anastácio, 2011; Capinha et al., 2013). NICS movement by predators could result in false recording of presence data generated from NICS remains or even the spread of live individuals between catchments. Ill-advised movement of NICS species by humans is also a major concern widely used as an argument against allowing the exploitation of 'wild' NICS in the UK. It is considered that any control or management attempts that involve trapping and consumption may inadvertently promote these damaging crustaceans as a revenue source leading to more illegal introductions. However, little is being done by Government agencies to control or manage non-native crayfish populations with trapping left to small business owners operating without assistance or national framework. Whilst making a living is a vital part of running a small business the trappers forming the National Institute of Crayfish Trappers (www.nict.moonfruit.com) are also concerned with freshwater conservation and invasive population control.

EXPLOITATION AS MANAGEMENT - DECEMBER 26, 2015

Humans have a well-established history of natural resource exploitation leading to population declines and extinctions. Fisheries for marine prawns, crabs and lobsters are regulated in the hope of providing a 'sustainable' harvest (Barnes, 1987), though fisheries management practices are fraught with uncertainty. *Homarus*

americanus (American lobster) populations off the coasts of New England and Canada are considered heavily overfished (Barnes, 1987; Ingle, 1997), with efforts being made to rear *H. gammarus* (European lobster) juveniles in captivity (Anon., 1995). In Australia, consumption of the crayfish *Astacopsis gouldii* (Giant Tasmanian lobster; Taylor, 2002), locally valued for its meat, has contributed to extinctions and declines throughout its range. Similarly, the range reduction of three species of *Euastacus* in Australia is attributed to fishing mortality (Horwitz, 1990). Globally, and in a European context, native and non-native crayfish are harvested for food, so trapped populations are substantial (or trapping would not be considered worthwhile), rendering population studies inconclusive. Density dependence and/ or trapping may both prompt stunting when both are present. As natural mortality is high amongst juveniles, and signal crayfish have a long life span (up to 16 years; Belchier et al., 1998), reduction of the reproductively active population is key. If the impact of trapping is being examined then quantification of trapping effort is vital. Commercial/ professional harvest will always exceed that of recreational/ scientific endeavours (Darimont et al., 2009), though the two are rarely examined in tandem. Niche availability is considered the only potential limiting factor for wild NICS populations (Hill et al., 1993; Söderbäck, 1993). Crayfish movement/ migration may therefore be motivated by a desire to locate vacant niches (Moorhouse and Macdonald, 2010; 2011), with the potential movement of a growing crayfish population in a river perhaps depicted as a 'travelling wave' (Williamson, 1996). Signal crayfish easily spread through rivers, with movement potentially prompted as the population increases. It is therefore not only the presence of NICS, but also their abundance, that is of importance. The famed tolerances and climbing abilities of signal crayfish mean that abundance increases can affect both the immediate area and any nearby waterbodies.

Available via email from abby.stancliffe-vaughan@anglia.ac.uk : Adapting to Invasions in a Changing World: Invasive Species as an Economic Resource by Matthew A. Barnes, Andrew M. Deines, Rachel M. Gentile and Laura E. Grieneisen. From: Invasive Species and Global Climate Change, 2014 (eds. L.H. Ziska and J.S. Dukes), published by CABI; & Peay, 2010 – A review of the trapping project on Loch Ken. Both are available from me via email abby.stancliffe-vaughan@anglia.ac.uk