

Report to NSW Aquaculture Association Inc.

The Risk to Australia from the Proliferation of Exotic Mexican Dwarf Crayfish in Australia

The NSW Perspective

2nd November 2016

Prepared by
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AUSTRALIAN CRAYFISH PROJECT
"Conservation & Research"

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Brief

Provide a brief document to the NSWAA on the current situation and risk to Australia and specifically NSW from illegally smuggled exotic Mexican Dwarf crayfish and their offspring being sold in Australia.

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Executive Summary

Illegal exotic Dwarf Mexican Freshwater Crayfish (genus *Cambarellus*) are currently being bred and sold in the aquarium pet trade in Australia. Worldwide, the pet trade of freshwater crayfish has led to the establishment of non-indigenous crayfish populations to the detriment of those countries.

All exotic crayfish species have the potential to bring crayfish plague to Australia and all exotic crayfish species are prohibited from Australia. Crayfish plague is an exotic disease and is listed in Australia's National List of Reportable Diseases of Aquatic Animals. It is a serious disease of freshwater crayfish, and Australian crayfish are highly susceptible. Crayfish plague has the potential to destroy the Australian Crayfish Aquaculture Industries in all States. Redclaw, Marron and Yabbies are all highly susceptible as are all other native Australian freshwater crayfish. Freshwater crayfish are keystone species, their removal from the creeks, rivers and lakes of Australia would detrimentally alter the ecology of Australia.

Many European countries have had their crayfish stocks destroyed by "crayfish plague", caused by the fungus *Aphanomyces astaci*. It originated in the United States and spread to Europe with introduced crayfish. This fungus is not present in Australia and we are the only continent "plague free", but tests have shown that if it were to reach Australia it would destroy many of our crayfish stocks. To stop this fungus destroying our unique crayfish fauna, the import of freshwater crayfish into Australia has been prohibited. Although prohibited, exotic crayfish are here and unscrupulous, irresponsible people are currently breeding them up and selling their offspring for quick profit. Australia is the only continent Crayfish Plague free and it is essential that it remains so.

Additionally, there are significant risks associated with the movement of aquatic species and water by human agency. Currently, exotic Mexican Crayfish are being traded in the home aquarium pet market. Aquarium crayfish make great pets, but if they are released into the wild they can pose a serious threat to Australia's aquatic biodiversity. Crayfish are a popular aquarium species due to their hardiness, established pet keeping knowledge and their ability to proliferate in captivity. Their ready breeding and increase in population numbers ultimately leads to people stocking ponds, dams and creeks with the hundreds of juveniles produced. Exotic crayfish also pose a greater risk to the ecology of Australia than exotic fish due to their ability to climb from tanks, travel overland and survive long periods out of water.

Background

The blackmarket aquarium pet trade is a lucrative business for unscrupulous people seeking quick profits. Exotic crayfish have been illegally smuggled into Australia and they and their offspring are currently being sold across Australia.

All species of freshwater crayfish are prohibited imports into Australia due to the potential to carry crayfish plague. Crayfish plague, *Aphanomyces astaci*, is a water mold that infects freshwater crayfish and crabs and has devastated many European native populations of freshwater crayfish. When experimentally tested, species from Australia, New Guinea and Japan were also found to be highly susceptible to the infection.

Historically, North American crayfish were first introduced into Europe in the mid to late 1800s for culture and fishery purposes. They carried crayfish plague with them. After its original introduction in Italy in 1860, it spread quickly through Europe and was discovered in Sweden in 1907, in Spain in 1972, in Norway in 1971, in Great Britain in 1981, in Turkey in 1984, and in Ireland in 1987.

Back in 1959, to bolster dwindling stocks of native crayfish, the signal crayfish was introduced to Sweden. The signal crayfish was known to be resistant, and it was not recognised at that time that it was a carrier of the disease. After 150 years of contact, no resistance has been discovered in native European crayfish.

Aphanomyces astaci, is a parasitic fungus specialized in living in the cuticle of freshwater Crayfish. Traditionally, no natural host other than crayfish is known (Unestam, 1969 a, b) but now freshwater crabs are also known to carry the plague. European, Japanese and Australian freshwater crayfish species have been found to be highly susceptible to the crayfish plague fungus (Unestam, 1969 a). Mortalities occur in percentages of 100 % for all these highly susceptible species after fungal attack (Unestam, 1969 a; Alderman & Polglase, 1988).

Above and beyond the danger from crayfish plague is the ecological danger these exotic crayfish pose, these are a highly prolific pest species that breed easily and repeatedly, once released into the wild they would compete with our native species. Many of our NSW Native crayfish species are already under threat from competition by other Australian crayfish species that have been translocated (Coughran and Leckie, 2007; Coughran,etal, 2009; McCormack, 2013; McCormack, 2014).

Due to the obvious ecological importance of crayfish, they are considered keystone and flagship species as well as ecosystem engineers in freshwater ecosystems (Hart 1992; Lodge et al., 2000; Reynolds et al., 2013; Souty-Grosset et al., 2006; Twardochleb et al., 2013;) with a disproportionately large effect on the whole catchment relative to their abundance. They often play a critical role in maintaining the structure of the whole ecological community, their prosperity and abundance affecting many other organisms in the ecosystem and helping to determine the types and numbers of these other species in the catchment (McCormack 2015).

McCormack (2008) documents 32 described species of freshwater crayfish occurring in NSW. Since then two new species of *Euastacus* have been described, *Euastacus morgani* (Coughran & McCormack 2011) and *Euastacus augustus* (Coughran & Dawkins 2013). One

species of *Gramastacus* crayfish has also been described *Gramastacus lacus* (McCormack 2014). Many more new species are currently under investigation, with one new *Euastacus* (McCormack and Ahyong) in press and one new *Cherax* species (McCormack and Raadik) in preparation.

Most New South Wales freshwater crayfish species have highly restricted distributions requiring specific environmental conditions that restrict them to distinct habitat areas. This makes many NSW species highly vulnerable to competition from alien species or new diseases.

Crayfish plague transmission, spread, identification and control

Aphanomyces astaci spreads by means of motile zoospores released from mature filaments in infected crayfish. The zoospores are attracted to crayfish cuticle, and the filaments penetrate immediately. Zoospores can remain motile for up to 3 days and cysts can survive for 2 weeks (in distilled water). Zoospores can re-encyst three times if they do not encounter a host. The current recommendation is to wait 3 months before attempting to re-stock waters in which crayfish have been killed by crayfish plague, this will allow all zoospores to die out. Crayfish plague is also spread via contaminated fishing equipment or zoospores in water (EADB).

Freshwater crabs are also susceptible to crayfish plague and may act as reservoirs and transporter for the pathogen. Australia has very rich and diverse freshwater crab fauna (EADB).

Crayfish and crabs themselves and the water carried in their gill cavity and water used for transport and all equipment can all spread and transport the plague.

Often the first sign of infection is massive stock losses. Clinical signs in infected animals may be non-existent or difficult to detect, but are more easily discernible in the terminal stages of the infection. These include gross appearance such as whitening of the musculature beneath the soft cuticle of the abdomen, and areas of brownish-red melanisation where haemocytes have encapsulated the hyphae. Areas of infection are the connective tissue of the abdomen, limb joints, gills, the telson near the anus and occasionally the eyes. Animals in the terminal stages of infection show signs of neurotoxicity such as being seen in daylight hours, loss of limb coordination, a 'walking on stilts' phenomenon, and lack of tail flip response. Loss of limbs or eye stalks can occur. Crayfish may even have tufts of hyphae growing out of the soft areas of the cuticle (Buller, 2008).

The Department of Agriculture and Water Resources, 2005 created AQUAVETPLAN - Disease Strategy Manual - Crayfish Plague. This disease strategy manual is an integral part of the Australian Aquatic Veterinary Emergency Plan (AQUAVETPLAN).

The manual sets out the disease control principles for use in response to a suspected or confirmed incursion of crayfish plague in Australia.

<http://www.agriculture.gov.au/animal/aquatic/aquavetplan/crayfish-plague>

Susceptibility of Australian crayfish species

Australian crayfish are known to be highly susceptible to crayfish plague (Unestam, 1969 a; Alderman & Polglase, 1988). Eight species of four genera (including yabbies, *Cherax destructor*) of Australian crayfish were experimentally exposed to zoospores of *A. astaci*. They showed limited or little effective host response to invading filaments. The usual response of crayfish to infection is encapsulation and melanisation of invading filaments (EADB).

Redclaw crayfish and marron have been introduced into many countries for farming purposes. In September 2013, crayfish plague was detected in farmed redclaw crayfish in Taiwan (OIE 2014). It was detected in five widely spread locations, four of which experienced 100% mortality, while one experienced 5% mortality and 20% morbidity.

Mass Mortality of *Cherax* reared in Sicily (Italy) caused by Crayfish Plague being introduced in an Intensive Farming operation. The outbreak of crayfish plague in *C. quadricarinatus*, is described, confirming the susceptibility of the species to the pathogen *A. astaci*. In 2010, some redclaw crayfish broodstock, *C. quadricarinatus*, were imported from Australia for farming purposes. They were acclimatized and reared in a recirculating system that consisted of 15 large (8 m² each) and 40 small (1.2 m²) PVC tanks sharing the same mechanical-biological filtration and supplied by tap water. In August 2011, red swamp crayfish (*P. clarkii*), collected from ditches in Latina province (Central Italy), were introduced at the facility and kept in separate tanks that were connected to the main filtration system. After one month, a few redclaw crayfish started to show melanised lesions and abnormal behaviour, and in fifteen days, a progressive increase in redclaw crayfish mortality occurred while tanks holding *P. clarkii* specimens did not sustain any losses. When the first clinical signs of the infection appeared, the stocking density of redclaw crayfish in the tanks was fairly high (25 specimens m⁻² with average size of 60 – 80 g) and water temperature ranged between 20 – 24°C (Marino, 2014)

Legislation

National environment law is covered by the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). This legislation covers the import of all live animals.

For the imports of live plants and animals the legislation: establishes a list of specimens suitable for live import. Only fish listed on the list of specimens taken to be suitable for live import (the live import list) can be imported into Australia. You should be aware that species not listed on the live import list are prohibited imports.

<https://www.environment.gov.au/biodiversity/wildlife-trade/exotics/exotic-fish-trade>

No freshwater crayfish are on the list so all freshwater crayfish are prohibited from Australia.

The EPBC Act refers to illegal imports.

<https://www.environment.gov.au/biodiversity/wildlife-trade/exotics>

On the website it states: Some of the exotic animals available in Australia have been imported illegally despite Australia's strict import laws. Possessing illegally imported animals (**or their offspring**) is an offence under national environment law. The penalty for illegal possession under national environment law is gaol of up to five years and/or a fine of up to \$110,000.

There is current Legislation to solve this problem and discourage further black market profiteering from illegal exotic crayfish. Unfortunately, efforts with the Minister for Agriculture and Water Resources the Hon Barnaby Joyce, have been unsuccessful and the Minister has approved the proliferation of this exotic species in Australia. Those who were previously dealing clandestinely on Facebook and requesting all buyers delete their trails are now marketing openly on Gumtree touting they have the approval of the Department of Agriculture and Water Resources to sell their exotic crayfish. (See Ministerial Response attached)

There are a thousand species of exotic freshwater crayfish. All are prohibited from Australia but none are specifically listed as noxious species in NSW. This is a priority issue and we need this Mexican Dwarf Crayfish that is currently being distributed throughout the community listed at a state level as noxious.

The NSW Department of Primary Industry states: *Many European countries have had their crayfish stocks destroyed by the so-called "crayfish plague", caused by fungus Aphanomyces astaci. It originated in the United States and spread to Europe with introduced crayfish. This fungus is not present in Australia, but tests have shown that if it were to reach Australia it would destroy many of our crayfish stocks. To stop this fungus destroying our unique crayfish fauna, the import of crayfish into Australia has been prohibited.*

<http://www.dpi.nsw.gov.au/fishing/aquaculture/publications/species-freshwater/freshwater-crayfish-aquaculture-prospects>

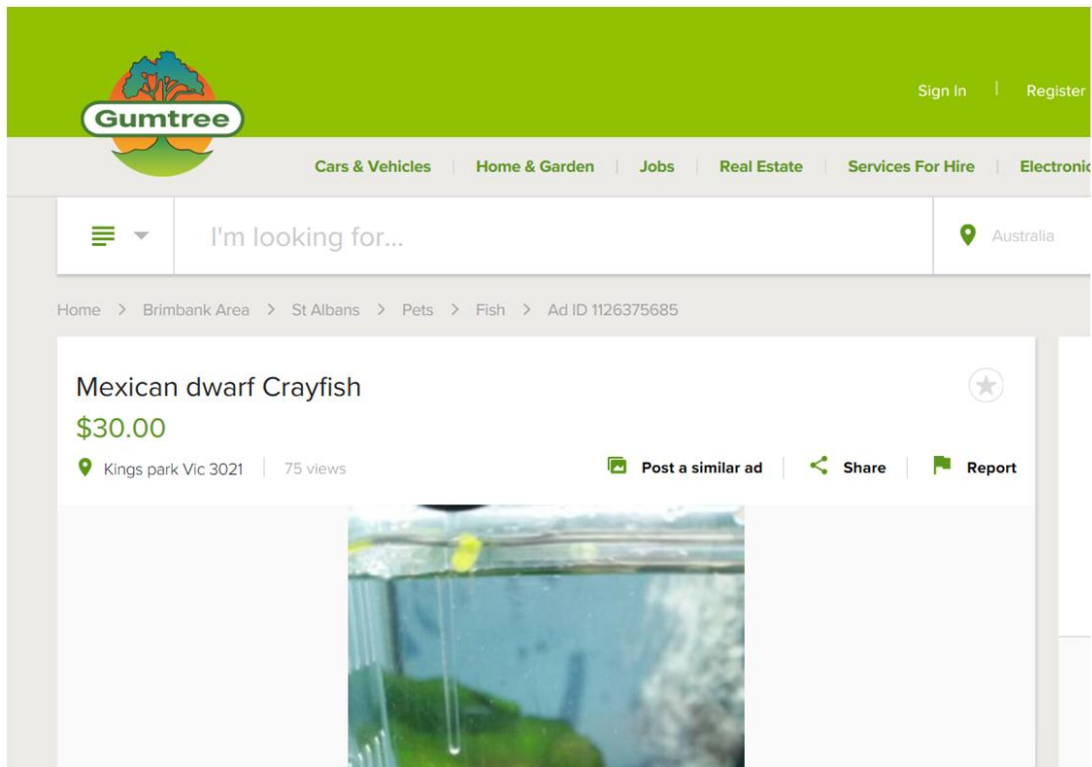
The Current Situation

Currently, the exotic Mexican crayfish are being sold for \$30-\$100 each. Previously these were being sold clandestinely only on Facebook. After investigation by the Federal Department of Agriculture and Water Resources (DAWR) and their conclusion that it's all too hard and nothing can be done the sale of these illegal crayfish has moved into mainstream media and are being openly sold on Gumtree, with those selling now claiming they have the approval of the DAWR. More and more of these dangerous crayfish are being distributed throughout the community.

This response from a breeder/seller of Dwarf Mexican Crayfish

I asked around and got this response from a breeder

"Hi Megan, dept of agriculture thinks that it might carry disease to threat out native yabbies (it comes from Mex) . But luckily the test came out with good result with no disease.. i had to sacrifice one my crayfish. So now i can trade or sell"



<http://www.gumtree.com.au/s-ad/st-albans/fish/mexican-dwarf-crayfish/1126375685>

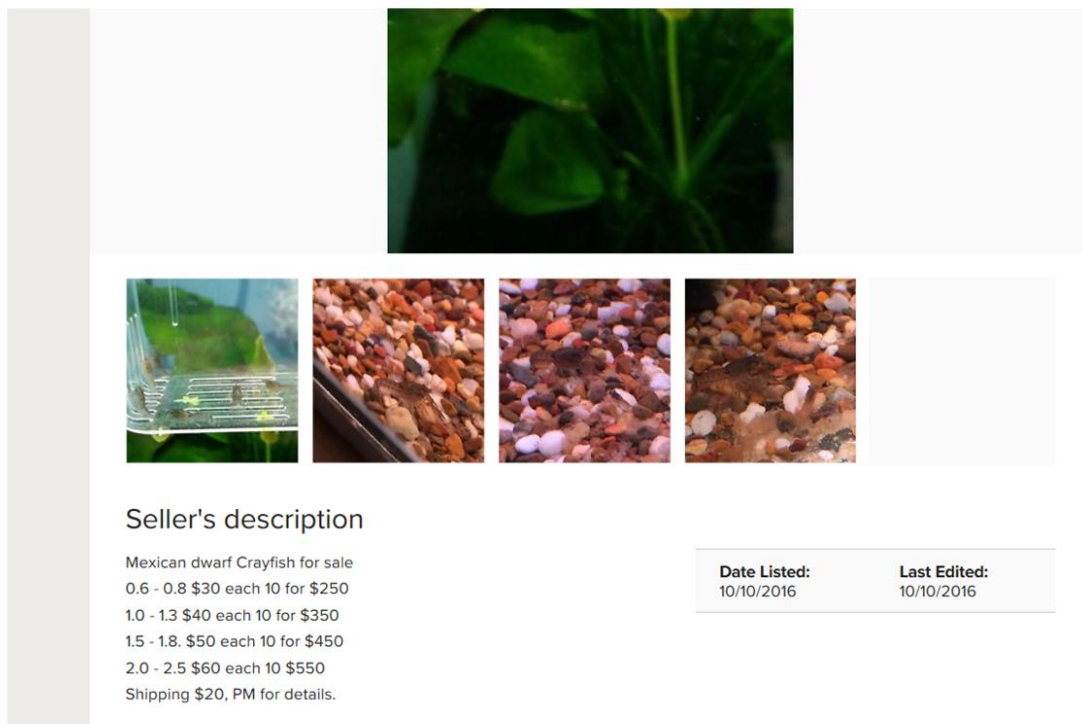


Figure 1 Screen Shot from Gumtree

Distinguishing between a crayfish illegally imported or ones supposedly breed from illegal imports into Australia is impossible. All exotic crayfish should be prohibited from Australia. Offspring from illegally imported species should also be illegal, it is unacceptable that the Australian Government considers them legal. Those now propagating offspring of those

illegal crayfish are profiting from a crime with the full support of the Deputy Prime Minister, the Hon Barnaby Joyce.

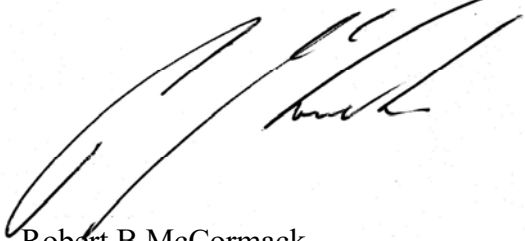
There are many other varieties/species of Mexican Dwarf Crayfish. For example the orange dwarf Mexican crayfish (*Cambarellus patzcuarensis*) may sell for over \$2000/crayfish when it is illegally imported into Australia. Make NO Mistake the aquarium crayfish industry is huge with hundreds of species traded worldwide. For example in America the aquarium pet crayfish industry trades \$100 million USD/year.

The incentive and demand for unique crayfish species is huge. The huge sums of money to be made from the illegally importing of more exotic crayfish species into Australia and the condoning of the sale of the progeny from this blackmarket trade by the Department of Agriculture and Water Resources is placing the ecology of Australia at extreme risk. Lack of action on this first illegal import gives the GREEN LIGHT for further illegal imports of exotic freshwater crayfish.

There is an extreme risk that these new exotic crayfish will establish as wild pests in Australia. When crayfish escape or are illegally released into a favourable environment, they could start to breed in the wild and spread to new locations. Once they are widespread, eradication becomes virtually impossible. This is a very real risk, even accidental releases, take the Queensland floods where 10,000 homes and 2000 businesses were flooded, typically at least 30% of these homes had aquariums in them and those fish, crayfish and shrimp all ended up in the local river.

Worldwide the clandestine pet trade is the most common introduction pathway for invasive aquatic species into countries waterways. Apart from the threat of disease the threat to local fauna from competition by these exotic species is a major consideration.

The Minister Barnaby Joyce and the Department of Agriculture and Water Resources have completely failed in their duty of care to protect Australia's borders, protect the Australian aquaculture industry and the ecology of Australia. We will continue to demand that the Federal Government acts on this critical issue, in the mean time we request that the NSW State Government list this species as noxious and enforce the prohibition of having in possession, sale and propagation of this exotic species.



Robert B McCormack
Australian Aquatic Biological P/L
2nd November 2016

References

- Alderman D.J., Polglase J.L., 1988. Pathogens, Parasites and Commensals. In HOLDICH D.M., LOWERY R.S. (eds.), *Freshwater Crayfish : Biology, Management and Exploitation*, 167-212, Croom Helm, London.
- Buller, N. 2008. Crayfish Plague, Australia and New Zealand Standard Diagnostic Procedure Sep 08, Animal Health Laboratories, Dept Agriculture & Food WA.
- Coughran, J., and Leckie, S. 2007. Invasion of a New South Wales stream by the Tropical Crayfish, *Cherax quadricarinatus* (von Martens). Pp 40 - 46 in *Pest or Guest: the zoology of overabundance*, edited by Daniel Lunney, Peggy Eby, Pat Hutchings and Shelley Burgin. 2007. Royal Zoological Society of New South Wales, Mosman, NSW, Australia.
- Coughran, J., McCormack, R.B., Daly, G. 2009. Translocation of the Yabby, *Cherax destructor*, into eastern drainages of New South Wales, Australia. *Australian Zoologist*. Vol 35 (1); <http://dx.doi.org/10.7882/AZ.2009.009>
- EADB. Emergency Animal Diseases Bulletin: Crayfish plague | Australian Veterinary Association. Brett Herbert, Australian Government Department of Agriculture.
- Hart, D. D., 1992. Community organization in streams: the importance of species interactions, physical factors, and chance. *Oecologia*, 91: 220–228
- Lodge, D. M., Taylor, C. A., Holdich, D. M., & Skurdal, J., 2000. Nonindigenous Crayfishes Threaten North American Freshwater Biodiversity: Lessons from Europe. *Fisheries*, 25: 7–20
- Marino,F., Preto,T., Tosi,F. Monaco,S., De Stefano,C., Manfrin A. and Quaglio, F. 2014. Mass Mortality of *Cherax quadricarinatus* (Von Martens, 1868) Reared in Sicily (Italy): Crayfish Plague Introduced in an Intensive Farming. *Freshwater Crayfish* 20(1):93–96, 2014 ISSN:2076-4324 (Print), 2076-4332 (Online) doi: <http://dx.doi.org/10.5869/fc.2014.v20-1.9>
- McCormack, R.B. (2014). New records and review of the translocation of the yabby *Cherax destructor* into eastern drainages of New South Wales, Australia. *Australian Zoologist*. Volume 37 (1) 85 – 94. ISSN 0067-2238 (Print). <http://doi.org/10.7882/AZ.2014.006>
- McCormack, R.B. (2015). Conservation of imperiled crayfish, *Euastacus clarkae* Morgan, 1997 (Decapoda: Parastacidae), a highland crayfish from the Gondwana Rainforests of Australia’s World Heritage Area. *Journal of Crustacean Biology*, Volume 35, Issue 2, pp 282 – 291. DOI: 10.1163/1937240X-00002315
- McCormack, R.B. 2008. “The Freshwater Crayfish of NSW Australia” Australian Aquatic Biological Pty Ltd., Karuah, NSW. ISBN 978-0-9805144-1-4
- McCormack, R.B. 2013. Conservation of Imperiled Crayfish, *Euastacus dharawalus* (Decapoda: Astacidea: Parastacidae), from the southern highlands of New South Wales, Australia. *Journal of Crustacean Biology*, 33(3), 432-439, 2013; <http://dx.doi.org/10.1163/1937240X-00002138>

OIE. 2014. Event summary: crayfish plague (*Aphanomyces astaci*), Chinese Taipei. 2014. http://www.oie.int/wahis_2/public/wahid.php/Reviewreport/Review/viewsummary?reportid=14784

Reynolds, J., Souty-Grosset, C., Richardson, A. 2013. Ecological Roles of Crayfish in Freshwater and Terrestrial Habitats. *Freshwater Crayfish*, 2013, 9 (2), pp.197-218.
Souty-Grosset C, Holdich DM, Noël PY, Reynolds J, Haffner P. 2006. Atlas of Crayfish in Europe. Collection Patrimoines Naturels, Muséum National d'Histoire Naturelle, Paris, Vol. 64, 187 p.

Twardochleb LA, Olden JD, Larson ER. 2013. A global meta-analysis of the ecological impacts of nonnative crayfish. *Freshw Sci* 32: 1367–1382.

Unestam, T., 1969 a. On the adaptation of *Aphanomyces astaci* as a parasite. *Physiol. Plant*, 22, 221-235.

Unestam, T., 1969 b. Resistance to the crayfish plague fungus in some American, Japanese and European crayfish. *Rep. Inst. Freshw. Res. Drottningholm*, 49, 202-209.

Appendices

Ministerial Response



The Hon. Barnaby Joyce MP

Deputy Prime Minister
Minister for Agriculture and Water Resources
Leader of The Nationals
Federal Member for New England

Ref: MC16-008198

Mr Rob McCormack
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13 OCT 2016

Dear Mr McCormack

Thank you for your correspondence of 5 September 2016 and 1 October 2016 regarding the possible sale of Mexican crayfish in Australia. The government takes any breach of Australia's biosecurity system seriously and works with industry and the public to safeguard Australia from the introduction of new pests and diseases.

I understand that officers from the Department of Agriculture and Water Resources have contacted you in relation to this matter. The investigation has concluded with my department unable to find any evidence to substantiate a breach of portfolio legislation, including the *Biosecurity Act 2015*. I am advised that limited testing has not provided evidence of infection with 'crayfish plague' (*Aphanomyces astaci*).

The jurisdiction of the *Biosecurity Act 2015* applies to goods (which includes animals) that have been imported into Australia. While the Act prohibits receiving or possessing prohibited goods, the legislation does not provide an offence if the goods are the progeny of those legally brought into Australia. Information obtained during the investigation indicates that Mexican crayfish sold through numerous online sites and social media were bred from an established population in Australia.

During the course of the investigation, inquiries were conducted with a number of state authorities who advised that these crayfish were not listed as 'Noxious Aquatic Species' (in Victoria) or its equivalent in other states.

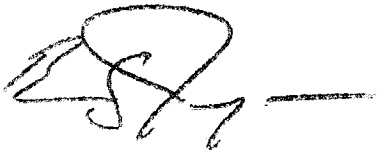
I have asked my department to refer this issue for consideration by the committees on Aquatic Animal Health and Invasive Plants and Animals. These national committees include membership from State and Territory Governments and the Commonwealth.

Ongoing issues regarding the sale of the established Mexican crayfish population should still be referred to the relevant state bodies for consideration. The department values the contribution made by industry and the public in providing information that identifies potential non-compliance with biosecurity laws and requirements.

Any information that attributes Mexican crayfish to an illegal importation should be provided to the departments 'Redline' service on the following number 1800 900 090.

Thank you again for bringing your concerns to my attention.

Yours sincerely

A handwritten signature in black ink, appearing to be 'Barnaby Joyce', followed by a horizontal line.

Barnaby Joyce MP