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Summary

I thank the Inspector General of Biosecurity for the opportunity to make a submission to this review. My comments on the effectiveness of biosecurity controls and their implementation for managing the biosecurity risks of importation of uncooked prawns and prawn meat into Australia centred on the demonstrable failure of the previous arrangements for preventing introduction of known exotic disease agents into the retail sector and the environment. I also noted the inadequacies of testing procedures in general to mitigate risks posed by new or emerging diseases for which no reliable tests are currently available, and highlighted how choice of sanitary measures must take into account the comparative lack of information and dynamic nature of emergence of new diseases in prawns and other seafood commodities.

My comments relating to post-entry surveillance measures and 'end use' import conditions for uncooked prawns and prawn meat into Australia highlighted the previous arrangements were ineffective. Firstly, there is no scientific evidence that marinating and breadcrumbing inactivate diseases of concern or dissuade consumers from using prawn products as bait or burley. I also pointed out that if testing is the primary sanitary method being relied upon to reduce risks to within the ALOP, even if the testing process is not corrupted, as new diseases emerge and trade volumes increase, resources required for testing must also increase, dramatically increasing costs over time, or errors will be made and risks of incursions skyrocket, like we have seen with Operation Cattai. The root of the problem is that Federal biosecurity authorities not only underestimated risk and failed to deliver effective testing programs for these products, they also have no control over end use once these risky products clear quarantine and/or are sold at the retail store. Consumers assume that whatever is sold in supermarkets is safe to eat and use however they see fit. It makes no sense to try to apply risk mitigation after the retail sale is made, and to rely on people being educated and "doing the right thing". After the point of sale the routes of entry to high risk pathways are too numerous and widely dispersed, making enforcement impossible. And without adequate enforcement, there is no incentive for people to "do the right thing". The correct way to control risk along a supply chain is to apply appropriate risk mitigation at appropriate critical control points. Clearly the only proper way to control risk in the imported seafood supply chain is either pre border, or at the border. Once these products clear quarantine, and enter the retail chain, all control of the end use is lost.

My comments relating to the areas for improvement in the biosecurity risk management framework and its implementation for future trade in prawns and related seafood centred on the need for a more consistent ALOP across both terrestrial and seafood commodities and replacement of the current “static approach” to IRAs with a more dynamic approach that recognises uncertainties and selects more appropriate sanitary measures for mitigating risks that are constantly changing in todays free trade climate If more appropriate sanitary measures are employed (i.e. all imported prawns are cooked), costs associated with compliance testing are much reduced, as is the need for constant updating of import risk assessments. Selecting cooking as the primary sanitary measure for imported prawns would provide more effective biosecurity for known and unknown diseases, a more consistent ALOP, and a significant reduction in ongoing costs involved with protection at the border, costs which pale in comparison to trying to control impacts post-border if/when things go wrong.

Submission

a. *Comments relating to the effectiveness of biosecurity controls and their implementation for managing the biosecurity risks of importation of uncooked prawns and prawn meat into Australia.*

The general framework for import risk analysis for aquatic animals and their products is laid out in the World Organization for Animal Health's (OIE) Aquatic Animal Health Code (OIE 2016a). Australia, as a member of both the OIE and the WTO, is obligated to follow OIE and WTO procedures (WTO 1994). The 2009 prawn import risk analysis (Biosecurity Australia 2009) went through a process of identifying risks to Australia via imported prawn commodities in a manner consistent with WTO and OIE regulations. The IRA was mostly fit for purpose at the time it was published, although in my professional opinion the risk profiles for the pathways involving diversion of prawns and other imported seafood products to bait and burley were underestimated at that time, resulting in failure to rule out some inappropriate sanitary measures that have been shown to fail to adequately mitigate the risks involved. Indeed, these risks were incorrectly misrepresented as negligible by the Interim Inspector General of Biosecurity during investigation of subsequent incidents (Dunn 2010), based on the fact that the much more comprehensive 2009 prawn IRA did not arrive at a "negligible" risk for scenarios involving large quantities of WSSV infected prawns entering the retail supply chain (Biosecurity Australia 2009).

In any case, since 2009 there is evidence that the risks of introduction and establishment of many known diseases of prawns have increased with increasing volumes of trade of these commodities (Figure 1). Indeed, the number of passengers, shipping and containerised cargo arrivals into Australia continue to increase and are forecast to nearly double by 2025 (DIRD 2014), representing a significant increase in risk of introduction of aquatic pests and diseases. Furthermore, since the 2009 IRA, several new diseases have emerged (Table 1), and new sanitary information is now available on risks related to WSSV and many other emerging (post-2009) diseases in imported prawn commodities (see papers by Overstreet et al. 2009, Ma et al. 2009, Stentiford et al. 2009, Oidtmann and Stentiford 2011, Reddy et al. 2011a, 2011b, Bateman et al. 2012, Stentiford et al. 2012, Stentiford 2012, Jones 2012, Shields 2012, Behringer 2012, Lightner et al. 2012, Tran et al. 2013a, 2013b, Reddy et al. 2013, Nunan et al. 2014, De La Pena et al. 2015, Cowley et al. 2015, Li et al. 2016, Thitamadee et al. 2016, Bateman and Stentiford 2017, amongst many others). However, because of the current static approach to hazard identification, the new sanitary information on risks related to WSSV and these other diseases were not incorporated into the IRA, which not being a living document quickly became outdated. Because of this, a comprehensive review of these new hazards and full updates of the risk assessments for prawns and other crustacean products are needed.

Certainly the current risk reduction methods used for imported green prawns such as freezing and processing to removing the head, shell and alimentary canal decrease the risks of introduction of some prawn diseases (YHV1, AHPND, NHP, *Enterocytozoon hepatopenaei*), but some of these processes may actually increase the risk of establishment of other diseases infecting prawn muscle such as WSSV, TSV or IMN, given that removal of the shell may allow potential hosts (e.g. prawns,

Table 1. List of some of the diseases of prawns that were not included in, or have emerged since the 2009 Import Risk Assessment (data collated only from Thitamadee et al. 2016, Li et al. 2016, Bateman and Stentiford 2017 and is not an exhaustive list).

Disease name	Date emerged	Disease agent	Mitigated by existing sanitary measures?
AHPND	2009 (China)	Bacterium w. toxic plasmid	Yes*
Secret Death Disease	?	Possibly AHPND or mixed aetiology	?
Empty Stomach Disease	?	?	?
Aggregated transformed microvilli (ATM)	2009 (China)	Vermiform gregarine-like bodies	?
Covert Mortality Disease (CMD)	2009 (China)	Nodavirus	?
Hepatopancreatic microsporidiosis	2009 (Thailand)	Microsporidian (*Enterocytozoon hepatopenaei*)	?
Hepatopancreatic haplosporidosis	2009 (Indonesia)	Unnamed haplosporidian	?
New strains of YHD	2013 (China)	*Okavirus*	?
Pandalus montagui bacilliform virus	2007 (North Sea)	*Nudivirus*	?

* Existing sanitary measures may prevent direct transmission of AHPND, but may not prevent release and establishment of the plasmids and genes responsible for toxin formation.

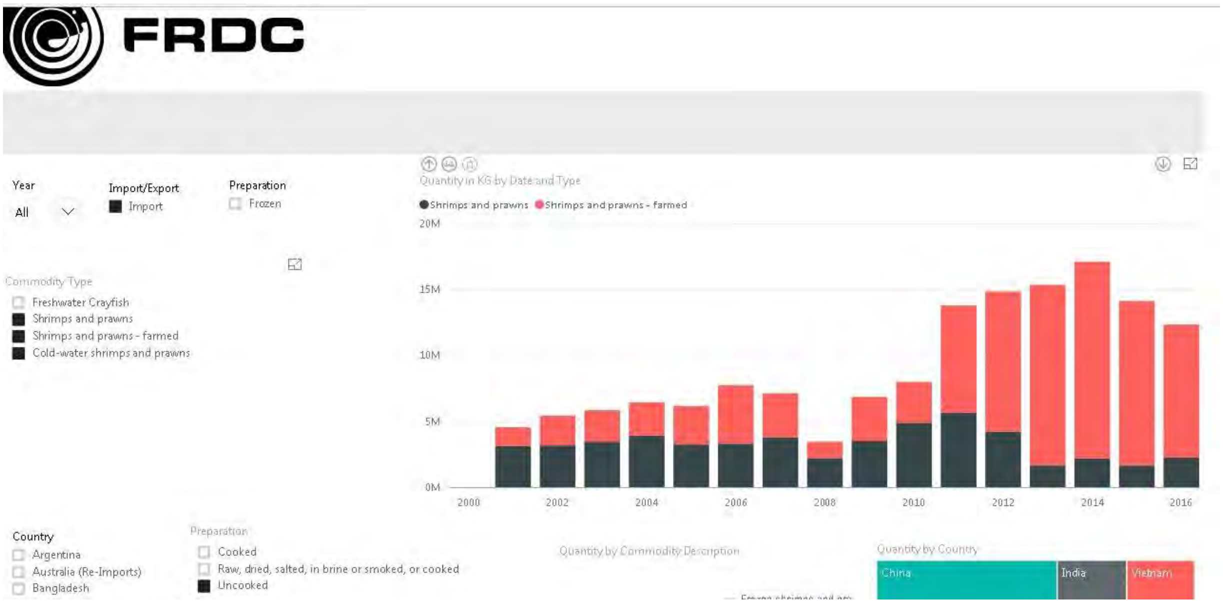

Figure 1. Quantities of uncooked prawns imported between 2001 and 2016. The quantity of farmed uncooked prawns more than tripled between 2009 and 2013-16. Data from FRDC (2017).

shrimp, crabs) to eat a larger ration of muscle tissue if they encountered an imported prawn used as bait or burley. Recent data from Europe suggest that a ration of less than 50 mg of muscle tissue of supermarket prawns is sufficient to establish WSSV infection or disease in susceptible hosts (Bateman et al. 2012, Tables 2a, 2b), and removing the shell may allow that host to eat more of the prawn that it otherwise would, potentially increasing the overall dose of virions via the *per os* route and increasing chances of infection (Oidtmann and Stentiford 2011, Bateman et al. 2012). Furthermore, there is no scientific evidence that marinating and breadcrumbing inactivate diseases of concern or dissuade consumers from using prawn products as bait or burley, hence description of these as "processing steps" that negated the need for disease testing was misleading and probably heightened risks instead of reducing them, by providing a loophole for importers to avoid testing.

Given that these “processing” measures may not provide any real risk mitigation for some diseases (e.g. WSSV) in imported uncooked prawns, the Federal Government effectively became reliant almost entirely on an at- border testing program for risk mitigation. In a perfect world, even assuming a significant increase in resources was granted to allow disease testing of each consignment of prawns to a highly rigorous standard (ie: random sampling to detect disease at 2 or 1% prevalence), the chance of human error would remain, and tests are not always 100% reliable. Furthermore, as mentioned above, new prawn diseases continue to emerge for which there are no tests available, sometimes for many years, and it is well known that many important diseases of prawns were spread widely before their cause was identified and tests became available (Lightner 1999, Jones 2012). So, if disease testing programs are chosen to mitigate risks, to keep those risks within the Appropriate Level of Protection (ALOP), the risk assessments underpinning the testing programs need to be living documents updated very regularly, probably every year given the high rate of emergence of new disease syndromes in cultured prawns (Table 1).

Under such dynamic circumstances, when a new disease emerges, unless we are very lucky, it may become established in Australia before the IRA is updated and a reliable test becomes available. Due to the “static approach” to hazard identification, risk analysis and risk mitigation, the reason why Australia has not yet got some of these new diseases may be pure luck. For example, the toxin related components of the bacterium that causes Acute Hepatopancreatic Necrosis Disease (AHPND) appear to be inactivated by freezing, which is fortunate otherwise Australia could be included in the estimated $5 billion US annual global losses experienced by overseas prawn producers due to AHPND (Tran et al. 2013a, 2013b, Chamberlain 2013, Thitamadee et al. 2016). Unfortunately, while freezing may stop transmission of AHPND, it may not prevent release of the genes responsible for toxin formation. In either case, as trade volumes increase, propagule pressure increases and without increased funding for more rigorous inspection and testing procedures and more frequent reviews of IRAs, biosecurity breaches become inevitable, which is unacceptable to many Australians including Australia's fishing and aquaculture industries.

However, there are other options. Implementation of more appropriate sanitary measures (e.g. cooking of prawns and crabs) would reduce risks of introduction of not only WSSV, YHV and TSV, but also the many new diseases that continue to emerge in crustaceans farmed overseas (Table 1). Cooking is a simple, cheap and effective sanitary process that inactivates most pathogens that threaten animal and human health and/or the environment (Torgersen and Hastein 1995, Tacon

2017). Indeed, cooking eliminates the risk of introduction of WSSV (Maeda et al. 1998, Nakano et al. 1998, Chang et al. 1998, Biosecurity Australia 2009) especially if the cooked prawns are subsequently frozen (Reddy et al. 2011a, 2011b 2013).

While the original source of the WSSV in the current Logan River and Moreton Bay incursions may never be known with absolute 100% certainty, the available evidence suggests there is a strong possibility that these disease incursions were caused by use of imported uncooked prawns diverted to use as bait or burley by recreational anglers, because of the following:

- The apparent absence of WSSV in crustaceans sampled from the Brisbane River to date, despite intensive sampling (DAF QLD 2017) suggesting that the pathway of entry into the Logan River and/or Moreton Bay was not likely to be via introduction by ballast water discharge or biofouling of shipping at the Port of Brisbane.

- The extremely low likelihood that the virus was introduced into affected prawn farms via infected broodstock prawns/post larvae or aquaculture feed (Diggles 2017).

- The fact that WSD has never been reported in prawn farms on the Logan River prior to November 2016 suggests that WSSV was not present in the Logan River prior to when the last prawns of the 2015/16 season were harvested, which was sometime around April 2016. This suggests that sometime between April 2016 and November 2016, WSSV was introduced into the Logan River system.

- In the absence of prawn farming elsewhere in Moreton Bay (and its associated intensive active disease surveillance), it is impossible to determine the timing of introduction of WSSV into other parts of northern Moreton Bay (e.g. Redcliffe, Deception Bay). However such a patchy distribution of WSSV could be explained by separate introductions of the virus at multiple locations via the bait and burley pathway.

- It appears between 50% and 80+% of supermarket prawns sold in the lead up to Christmas/New Year 2016/17 were positive for WSSV (Diggles 2017, Senate Estimates 2017, Future Fisheries Veterinary Service 2017), and surveys by Biosecurity QLD field officers in December 2016 allegedly found 6 groups of recreational anglers fishing with imported green prawns near the affected prawn farms on the Logan River. Two of the 6 bait samples (33%) were allegedly tested as "strongly positive" for WSSV.

- Viable WSSV has been recovered from crustacean tissues (including commodity prawns) frozen at both -20 and -70°C after months to several years storage and used to successfully infect susceptible crustaceans (Wang et al. 1998, Durand et al. 2000, McColl et al. 2004, Hasson et al. 2006, Biosecurity Australia 2009, Bateman et al. 2012, RM Overstreet, personal communication, Nov 2009).

- Viral loads of between 10^8-10^{10} viral copy units/g tissue typically occur in infected imported green prawns (Oidtmann and Stentiford 2011). This level of virus has been proven to be more than sufficient to infect or even kill naïve hosts after consumption of less than 50 milligrams (mg) of infected tissue (Bateman et al. 2012, Tables 2a, 2b).

- Removal of the head section does not reduce WSSV viral load on a per weight basis, as WSSV viral load in prawns is similar in either heads (49% of total virus) or tails (51% of total virus) (Durand et al. 2003). The viral load of the peeled shell represents c. 55% of the total viral load remaining in the tail (Durand et al. 2003). Hence full processing of green prawns as specified in the 2009 prawn import risk analysis (Biosecurity Australia 2009) only reduces viral load by around half, which is not sufficient to prevent establishment of infections in susceptible species (Bateman et al. 2012, Tables 2a, 2b), and

- The evidence that the number of recreational anglers fishing with imported green prawns purchased as seafood from supermarkets was increasing in the early 2000s (Kewagama Research 2002, 2007, Table 3) and has continued to increase to become "routine practice" as imports of green prawns have increased in volume (Fishraider.com.au 2013, Fishing Victoria 2016, Figure 1). Recent phone surveys conducted by Biosecurity QLD suggest that the prevalence of anglers using supermarket purchased imported prawns as bait may now exceed 50% (Biosecurity QLD 2017 - unpublished data).

Taking these factors into consideration, the strong possibility that this disease incursion was caused by use of imported prawns as bait or burley signals an urgent need to revise the 2009 prawn IRA and reassess this and other potential pathways of aquatic animal disease introduction into Australia. The IRA has now not only failed, it is simply out of date. The risk profiles for diversion of prawns and other imported seafood products to bait and burley have either changed or were not properly identified in the first place, and they were certainly never “extremely low” or "negligible" as suggested by the Interim Inspector General of Biosecurity (Dunn 2010).

While a risk analysis has been done to assess the risk of domestic bait translocation (Diggles 2011), it did not consider risks associated with use of imported fish or shellfish products as bait or burley. These risks were supposed to be considered and mitigated in the appropriate IRAs for the imported commodities. It appears when that is not done properly, these risks "fall through the cracks" and Australia is left vulnerable to aquatic disease incursions. Given the scale of the biosecurity breaches that have been recently revealed at the international border in Operation Cattai, and the potentially severe consequences of introduction of exotic diseases to Australia’s environment, fisheries and aquaculture industries and food security, it is clear that the biosecurity controls imposed on the importation of uncooked prawns and prawn meat into Australia have been, to put it politely, ineffective. For these commodities in recent times it seems Australia has basically been relying on luck, and in November 2016 we found that our luck had run out.

Clearly, relying on luck is simply not good enough. Only a comprehensive review and full update of the IRAs for prawns and other seafood products (and the resulting biosecurity protocols implemented at the international border) is acceptable, so that Australia’s environment, seafood industries, and food security for future generations are given the full consideration and attention the people of Australia deserve and demand.

Table 2a. WSSV minimum infective doses based on data from the EU (Oidtmann and Stentiford 2011, Bateman et al. 2012).

	Carrier state viral load in commodity prawns	Typical viral load in infected prawns	Emergency harvest viral load in muscle	Minimum dose to initiate infection (*per os*)	Minimum lethal dose	LD50% dose
P. vannamei	4.6×10^{1} to 5×10^{2} viral copies/ng DNA[a]= 4.6×10^{7} to 5×10^{8} viral copies/g tissue*	1×10^{9} to 7×10^{10} viral copies/g tissue[b]	3.65×10^{5} viral copies/ng DNA[a] = 3.65×10^{11} viral copies/g tissue*	c. 100 viral copies[b]		
P. monodon		1×10^{9} to 1×10^{10} viral copies/g tissue[b]	1.5×10^{9} viral copies/g tissue[b]			
P. stylirostris			5.7×10^{11} viral copies/g tissue[b]			
European Lobster[a]				$<2\times10^{6}$ viral copies[a]	c. $>1\times10^{8}$ viral copies ?[a]	1.82×10^{10} viral copies[a]
	Equivalent commodity prawn dose – carrier state			4 – 43.5 mg	0.2 – 2.2 g	36.4 – 395 g
	Equivalent commodity prawn dose – typical infection			0.028 – 2 mg	0.0014 – 0.1 g	0.26 -18.2 g
	Equivalent commodity prawn dose – emergency harvest			0.003- 0.13 mg	0.17 – 66.7 mg	0.03 -12.1 g

* Assumes that virus copy numbers reported per g of tissue are roughly 1000·x the number of virus copies reported per µg of DNA[b]

[a] Bateman KS, Munro J, Uglow B, Small HJ, Stentiford GD (2012). Susceptibility of juvenile European lobster *Homarus gammarus* to shrimp products infected with high and low doses of white spot syndrome virus. *Diseases of Aquatic Organisms* 100: 169-184.

[b] Oidtmann B, Stentiford GD (2011). White Spot Syndrome Virus (WSSV) concentrations in crustacean tissues – A review of data relevant to assess the risk associated with commodity trade. *Transboundary and Emerging Diseases* 58: 469–482.

Table 2b. Summary of experimental results from Bateman et al. (2012)

Treatment	Commodity shrimp #1	Commodity shrimp #2	Commodity shrimp #3	Positive control
Source of virus	Ecuador	Vietnam	Honduras	Lab – Emergency harvest
Viral load in muscle	4.68×10^{1} viral copies/ng DNA	1×10^{2} viral copies/ng DNA	5.16×10^{2} viral copies/ng DNA	3.65×10^{5} viral copies/ng DNA
Viral load per mg muscle	4.68×10^{4} viral copies/mg	1×10^{5} viral copies/mg	5.16×10^{5} viral copies/mg	3.65×10^{8} viral copies /mg
Viral dose in 50 mg ration	2.34×10^{6} viral copies	5×10^{6} viral copies	2.58×10^{7} viral copies	1.82×10^{10} viral copies
% lobsters infected	30%	45%	70%	94%
% lobster mortality	20%	22%	0%	55% (after 6d. at 22°C)

Table 3. Temporal trends in use of supermarket green prawns as bait by recreational fishers in Australia using WSSV as an example of risk.

	A	B	C	D[+]	E	F	G[++]	H
Date	% of fishers using prawns sold as seafood as bait	Weight of seafood prawns used as bait (tonnes)	% of seafood prawns used as bait that are imported	Quantity of imported prawns used as bait	% increase in weight of imported prawns used as bait	% prevalence of WSSV in retail prawns	Quantity of WSSV +tve prawns used as bait	% increase / decrease in WSSV +tve bait by weight since 2002
2001/2002[1]	6%	50.5 t	4%	2020 kg	-	50% (est)	1010 kg	-
2006[2]	7.9% (+33%)	59.6 t (+18%)	11%	6556 kg	324%	50% (est)	3278 kg	+324%
2012 (est)	10.5% (est)	70.3 t (est)	18% (est)	12654 kg	626%	5%*[4]	632.7 kg	-38%
2017 (est)	14% (est)	82.9 t (est)	25% (est)	20725 kg	1025%	5%*[4]	1036 kg	+2.6%
2017[3] actual	>50%[3]	82.9 t (est)	>50%[5] (est)	>41450 kg	>2051%	50-83.6%[6]	>20725 – 34652 kg	>+2051 to 3430 %

* 5% prevalence based on "as designed" testing program from 2009 IRA (65 prawns per shipment sampled at border assuming 100% test sensitivity /specificity)[4]

[+] Quantity of imported prawns used as bait calculated D = B x (C/100) x 1000 [++] Weight of WSSV+tve prawns used as bait calculated G = D x (F/100)

(est) = 5 year growth estimates for years 2012 and 2017 based on linear extrapolation of % growth trends documented between surveys done in 2001 and 2006. Actual % increase in imported bait use may far exceed this[3] hence actual quantities now used (2017 actual) are likely to be underestimates.

[1] Kewagama Research (2002). National survey of bait and berley use by recreational fishers. Report to Biosecurity Australia, AFFA. December 2002. Kewagama Holdings, Pty. Ltd., Noosaville, Queensland, Australia. 137 pgs.

[2] Kewagama Research (2007). National survey of bait and berley use by recreational fishers: a follow-up survey focussing on prawns/shrimp. Report to: Biosecurity Australia, AFFA.

[3] Biosecurity QLD (2017). Online Survey. (Unpublished).

[4] Biosecurity Australia (2009). Generic Import Risk Analysis Report for Prawns and Prawn Products. Final Report. Biosecurity Australia, Canberra, Australia. 7 October 2009, 292 pgs.

[5] FRDC (2017). Australian Seafood Trade Database. http://frdc.com.au/trade/Pages/Crustacean-Full.aspx

[6] Future Fisheries Veterinary Service (2017). Assessing compliance and efficacy of import conditions for uncooked prawn in relation to White Spot Syndrome Virus (WSSV). FRDC Project 2016-066 Report to Australian Prawn farmers Association. 103 pgs.

b. ***Comments relating to the effectiveness of post-entry surveillance measures and 'end use' import conditions for uncooked prawns and prawn meat into Australia***

These are simply not effective. Clearly the post-entry surveillance measures chosen by DAWR after the 2009 Prawn IRA have proven inadequate for preventing incursions of exotic diseases, resulting in Australia's first outbreak of WSD. Despite biosecurity protocols requiring testing of 100% of shipments imported into Australia, large quantities of WSSV-infected frozen green prawns were transiting through border quarantine resulting in >50-80+% prevalence of WSSV in imported green prawns sold at the retail counter at supermarkets in Australia in November/December 2016. Furthermore, there was no testing required for other risky products like marinated prawns or soft shelled crabs, all of which have similar risks of containing viable WSSV given the large host range of the virus, which affects all decapod crustaceans.

The root of the problem is that Federal biosecurity authorities have not only underestimated risk and failed to deliver an effective testing program, they also have no control over end use once these risky products clear quarantine and/or are sold at the retail store. It is well known that recreational anglers commonly use supermarket bought seafood (including prawns) for bait and burley. Upon asking some of them why, I have found that besides being cheaper and more convenient (as reported by Kewagama Research 2007), anglers assume that whatever is sold in supermarkets is safe to eat and use however they see fit. They say "*if the risk to Australia was so great from these imported products, why would authorities let these products be sold in the first place* ?" Unfortunately it was well known by aquatic animal health professionals that imported prawn products carried viable viruses, yet it was technically not illegal to use them as bait. Indeed in all the supermarkets I visited leading up to Christmas/New Year 2016/17, not one of them were selling imported prawns over the delicatessen counter with warnings to customers that they should not be used as bait (Figure 2). In some supermarkets, bait freezers were actually located within the seafood section, effectively encouraging consumers to relate the two together (Figure 3).

Certainly, since introduction of WSSV into Australia much effort has been made to recall imported green prawns and educate anglers not to use supermarket products as bait. However, the correct way to control risk along a supply chain is to apply appropriate mitigation at appropriate critical control points. It makes no sense to try to apply risk mitigation after the retail sale is made, and to rely on people being educated and "doing the right thing", as after the point of sale the routes of entry to high risk pathways are too numerous and widely dispersed, making enforcement impossible. And without adequate enforcement, there is no incentive for people to educate themselves or "do the right thing". Clearly the only proper way to control risk in this supply chain is either pre border, or at the border. Once these products clear quarantine, and enter the retail chain, all control of the end use is lost.

As a final observation of the effectiveness (or lack thereof) of end use import conditions, despite all the effort put into education programs with anglers and consumers to try to prevent disease spread from imported seafood products, what is often not talked about in risk analyses are the real risks of deliberate introductions and even industrial sabotage (Jones 2012).

Figure 2. Assorted uncooked imported prawns being sold at supermarkets on the Gold Coast in December 2016. At none of the dozens of supermarkets in SE QLD I visited were there any signs or information informing consumers not to use these products as bait or burley.

Figure 3. In some SE QLD supermarkets examined, bait freezers (arrow) were located within the seafood section, encouraging consumers to relate the two together.

Not everyone wants to "do the right thing", and why would Australian investors want to invest 10's or 100's of millions of dollars into new prawn farms to open up economic opportunities in northern Australia if they knew that anyone so inclined could ruin their investment by purchasing $30 worth of imported green prawns from their local supermarket and introducing them into the waters next to their farm intake, or even into the farm itself ?

In the real world, the unfortunate but real risk of industrial sabotage of our local seafood production industries is a significant threat to Australia's food security. The findings of Operation Cattai demonstrate that some people are very willing to deliberately break the law, hence the risk of industrial sabotage must also be considered as real, providing yet another reason why strong border controls are necessary, including requiring cooking of imported prawn products to reduce the risks of such activities occurring.

c. *Areas for improvement in the biosecurity risk management framework and its implementation for future trade in prawns and related seafood.*

It is notable that the OIE code (OIE 2016b) requires that Australia reviews and modifies import measures following an outbreak of exotic disease and prior to any subsequent claim for freedom from that disease. See point c. below from the relevant article relating to country freedom.

Article 9.7.4 (OIE 2016b)

4. it previously made a *self-declaration of freedom* from WSD and subsequently lost its *disease* free status due to the detection of WSD but the following conditions have been met:
   a. on detection of the *disease*, the affected area was declared an *infected zone* and a *protection zone* was established; and
   b. infected populations have been destroyed or removed from the *infected zone* by means that minimise the *risk* of further spread of the *disease*, and the appropriate *disinfection* procedures (as described in Chapter 4.3.) have been completed; and
   c. previously existing *basic biosecurity conditions* have been reviewed and modified as necessary and have continuously been in place since eradication of the *disease*; and
   d. *targeted surveillance*, as described in Chapter 1.4., has been in place for at least the last two years without detection of WSD.

   In the meantime, part or all of the non-affected area may be declared a free *zone* provided that such a part meets the conditions in point 3 of Article 9.7.5.

Of course, the process of revising the prawn IRA not only has to identify where things went wrong, it also has to identify any new risks under current trading conditions, properly assess those risks, and identify options for mitigating those risks to within Australia's ALOP. Australia's ALOP reflects community expectations through government policy, and is expressed as providing a high level of sanitary or phytosanitary protection whereby risk of introduction of exotic diseases is reduced to a very low level, but not to zero. Until such time as the IRA is fully reviewed and updated to ensure the ALOP is met for these products, Australia is within its rights to uphold the current suspension of imports of uncooked prawns.

However, given new information on the risks of transmission of WSSV (Tables 2a, 2b), evidence of increasing use of imported seafood commodities through the bait and burley pathway in Australia (see Table 3), and the fact that the only existing analysis of disease risks via that pathway in Australia (Diggles 2011) is a static document now itself 6 years old and did not consider risks associated with use of imported fish or shellfish products (as they were outside the terms of reference), the risks posed not only by imported prawns, but other imported seafood products if they were introduced into the environment via the bait and burley pathway may also have been underestimated. The risks posed by use of other imported seafood products (crabs, lobsters, fish and molluscs) as bait or burley therefore also need to be reviewed to assess whether the risk profile for these other seafood commodities was even considered, and if so, whether these risks were also underestimated, or have changed.

The appropriate risk mitigation requirements to reduce these risks to within the ALOP will only become clear once the relevant risk analyses have been reviewed and updated to reflect the current situation. In the case of imported prawns, it is possible that a fully revised and updated prawn risk analysis may find that today, the risks posed by uncooked prawns can no longer be reduced below Australia's ALOP due to the much larger volumes of products imported, the changed risk profiles of these products due to new and emerging diseases of cultured prawns overseas, more precise understanding of the epidemiology of the known diseases, and the persistence of multiple pathways which move these products (and viable exotic pathogens within these products) into our waterways.

Education of anglers has been considered to be one way of potentially mitigating the risk of introduction of diseases such as WSSV via the bait and burley pathway. However, it is always difficult to engage all recreational fishers in educational campaigns and there is evidence that compliance will decline over time unless the educational message is followed up with strong enforcement. Given that it appears inevitable that if green imported prawns are made available for retail sale as seafood that some will be diverted into the bait and burley pathway, other risk mitigation methods will be required to keep the risks outside the international border if the risk of introduction of diseases such as WSSV are to be reduced to within an ALOP consistent with the sanitary risk reduction methods employed by Australia for other non seafood products, for example pork. Indeed, it is notable that compulsory cooking is required for pork products imported into Australia from countries with foot and mouth disease and several other important diseases of pigs (see Commonwealth of Australia 2004a, b).

Once WSSV was introduced into SE QLD, the fact that other States (WA and SA in particular), quickly moved to protect themselves by implementing controls on movements of uncooked crustaceans and other WSSV carriers from the Logan River to try to prevent WSSV incursions into their own waters, highlights a remarkable inconsistency in what is considered an Appropriate Level of Protection (ALOP) by State Governments in Australia, compared to the Federal Governments previous (pre-interim closure) position on imported prawn products. Having stricter controls requiring cooking of Australian prawns moved domestically from WSSV positive regions, yet still allowing uncooked imported prawns entry at the international border from WSSV positive regions overseas is an extraordinary situation that highlights exactly where the real risks lie.

Indeed, in the case of WSSV and several other diseases of imported prawns, replacement of uncooked frozen prawn products with cooked products may be the only way to reduce risks to within the ALOP consistent with the sanitary risk reduction methods employed by Australia domestically for other non seafood products imported for human consumption (Commonwealth of Australia 2004a, b). Sanitary conditions allowing entry of only cooked prawns (processed or whole unprocessed) would not only reduce the risk of introduction and establishment of WSSV to within Australia’s ALOP (as evidenced by Commonwealth of Australia 2004a, b), it would also be consistent with domestic biosecurity arrangements currently implemented for crustacean products originating from SE QLD during the current WSD incursion (DAF QLD 2017). Allowing entry of only cooked prawns would also reduce the risk of introduction and establishment of new and emerging diseases (Thitamee et al. 2016, Li et al. 2016, Bateman and

Stentiford 2017) for which, in the absence of identification and suitable diagnostic tools, there may be high risks of introduction (Lightner 1999, Gaughan 2002), without any currently available means of testing at-risk commodities at the border. There may be other sanitary treatment options that might provide equivalent risk reduction, such as irradiation, however the radiation dose rates required for WSSV and other prawn diseases have not been established, and radiation processes or certification processes are costly and may not be foolproof and/or subject to human error. Indeed, cost-wise the cooking option would not only be "least risk", it is also likely to be "least cost" as it would reduce processing costs pre-border (in the case of unprocessed prawns), and reduce testing and inspection costs post-border (colour change is a useful biomarker to verify that cooking has been achieved in crustacean tissues), potentially reducing retail costs to consumers for imported prawn commodities. Pre-border or at-border cooking of imported prawns may also be the only practical way to significantly reduce the risks of post-border industrial sabotage (Jones 2012).

Quarantine conditions requiring cooking of imported meat products are permissible within WTO and OIE rules and are widely accepted by consumers in Australia as necessary to protect our local cattle, pig and sheep industries (and hence our food security with regard to terrestrial meat products from species susceptible to foot and mouth). Why then, should the fishing and aquaculture industries of Australia being treated any differently? By requiring cooking prior to entry, the processes of inspection at the border would be simplified, additional costs of testing for diseases would be eliminated, and other risk mitigations like processing (removal of heads/peeling /deveining) may no longer be required, resulting in a more streamlined inspection process at the border and, potentially, a cheaper product to the end consumer. Furthermore, the technology required to cook seafood is virtually no cost, imposing little burden on exporting countries, and we would no longer have this ridiculous situation whereby uncooked commodities enter Australia from WSSV positive overseas countries, while commercial fishers and aquaculturists have to cook their commodities prior to moving them out of SE QLD. Such are the many advantages of compulsory cooking as a "least cost, high effectiveness" sanitary process, that was identified back during the 2009 IRA, but, unfortunately, was not fully implemented at the time.

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