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Inspector-General of Biosecurity

Uncooked prawn imports: effectiveness of biosecurity controls

Review report No. 2017-18/01

Review team

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Summary

1 Background

On 17 February 2017 I advised the Hon. Barnaby Joyce, Minister for Agriculture and Water Resources, of my intention to review:

- circumstances leading to the 6 January 2017 suspension of uncooked prawn imports into Australia, and
- biosecurity considerations relevant to future trade in uncooked prawns.

The suspension followed initial investigations into the source of an outbreak of the previously exotic white spot disease (WSD) in prawn farms and wild crustacean populations near the Logan River, in south-east Queensland.

WSD is caused by white spot syndrome virus (WSSV) infection of crustaceans. It is not of concern to human health. However, it is one of the most severe diseases of farmed prawns, especially the valuable black tiger prawn *Penaeus monodon* farmed in Australia. WSD can kill up to 100 per cent of prawns in a pond within two to five days of the first signs of disease. Since its emergence in China in 1992, WSSV has become endemic in all countries with prawn aquaculture industries, except New Caledonia and Australia, costing at least US\$1 billion a year.

On 21 March 2017 the Senate, through its Rural and Regional Affairs and Transport References Committee, finalised terms of reference of an inquiry into 'Biosecurity risks associated with the importation of seafood and seafood products (including uncooked prawns and uncooked prawn meat) into Australia'. The committee held public hearings and published its final report on 31 October 2017.

On 6 July 2017 the suspension of uncooked prawn imports lapsed. By this time, the Director of Biosecurity had put in place alternative import conditions for selected prawn products from specified countries. Implementation was underway when this report was being prepared.

Public submissions to both my review and the Senate inquiry have been published. The information summarised in my report is drawn from these documents and from the findings of my field work and internal inquiries at the Department of Agriculture and Water Resources.

2 White spot disease outbreak in south-east Queensland, 2016–17

2.1 Outbreak and disease control in prawn farms near the Logan River

On 22 November 2016 the owner of a prawn farm (first infected premises ‘1IP’) near the Logan River in south-east Queensland noticed unusual prawn deaths in one pond. He notified the Queensland Department of Agriculture and Fisheries (QDAF) on 24 November. By 28 November, 90 per cent of prawns in the first pond were dead, and prawns were dying in other ponds. On 30 November QDAF’s Biosecurity Sciences Laboratory found that specimens from 1IP tested positive for WSSV. On 1 December this was confirmed by the Australian Animal Health Laboratory (AAHL).

Australia’s Aquatic Consultative Committee on Emergency Animal Diseases (AqCCEAD) coordinated the subsequent response in accordance with a pre-existing disease control strategy. QDAF led the response, supported by the Department of Agriculture and Water Resources.

Despite rapid chlorination and destocking of 1IP, by 13 February 2017 WSD had spread to six nearby prawn farms. By late May 2017 these farms were also destocked and decontaminated.

The Australian Government provided financial support so that affected farms could remain destocked during the 2017–18 prawn-growing season. It was hoped they would be able to resume production the following season.

2.2 Spread to wild crustaceans and further control measures

Sampling found WSSV in wild prawns and crabs in the Logan River in December 2016, then in nearby southern Moreton Bay in January 2017 and eventually in north-west Moreton Bay, about 60 nautical miles away, in March 2017. From 9 December, QDAF imposed restrictions on fishing and movement of uncooked prawns and other crustaceans from a widening zone to protect other populations from possible infection. Progressively, some other state governments also imposed similar restrictions on uncooked crustacean movements from the infected zone.

Further environmental sampling in late August and September 2017 found no other WSSV-infected animals. However, wider environmental surveillance will be needed for at least two years after the last positive finding to ascertain whether WSSV infection in the wild has died out.

2.3 WSD outbreak costs

The Australian Government provided \$1.87 million in 2016–17 to help control the spread of WSD and will provide up to \$20 million in 2017–18. During 2016–17 the Queensland Government spent more than \$17 million on the WSD response and has committed up to \$9 million over the two years to 2018–19. Logan River prawn farming industry production losses in 2016–17 were estimated to be \$43 million (excluding their response costs). Of these costs, the Australian and Queensland governments reimbursed or would reimburse \$21.5 million and pledged a further \$30 million for concessional loans.

Commercial fishing industries subject to closures or movement controls and other state governments involved in response or surveillance also incurred substantial costs.

2.4 Source of infection of 1IP, Logan River

Immediately after the WSD outbreak at 1IP was reported, two investigations began into the possible source of the infection. In their separate investigations, independent aquatic health consultant Dr Ben Diggles and the Department of Agriculture and Water Resources (the department) considered potential pathways for the entry of WSSV into 1IP, including:

- hatchery broodstock or their progeny
- prawn feed
- longstanding, previously undetected infection in the local marine environment
- ballast water
- industry visitors to 1IP
- aquaculture equipment from overseas WSSV-infected prawn farms, or
- imported uncooked retail prawns used as bait or berley or for criminal sabotage.

Dr Diggles focused on the immediate sequence of infection spread in the infected premises and the likely epidemiology of local spread. He concluded that the most likely pathway for disease spread to 1IP was from infected imported prawns used as bait or berley. The department examined the other pathways in greater detail but found no evidence that any were higher risk than the bait pathway. Later genotyping studies by QDAF of WSSV recovered from Queensland crustaceans found only limited similarity between them and the viruses in any of the imported prawn products genotyped up to October 2017. Further genotyping work is needed.

Risk mitigation processes for each of the possible pathways of infection need reviewing and strengthening—a process that should involve industry and governments. However, the department has rightly focused on addressing evident biosecurity problems in the imported uncooked retail prawn pathway.

2.5 Risks of uncooked prawn imports into Australia led to import suspension, January 2017

On 6 January 2017 the Director of Biosecurity suspended the import of uncooked prawns for 6 months, effective from 9 January, after determining that the biosecurity risks of these imports had risen above Australia's appropriate level of protection (ALOP). This decision was based on:

- evidence (detected largely in late 2016) of major and systematic non-compliance with prawn import conditions by a number of prawn importers
- proof that fishers were using imported uncooked retail prawns for bait upstream from WSD-affected farms and that these bait prawns had tested positive for WSSV, and
- high levels of WSSV in imported uncooked prawns purchased within 10 kilometres of the infected prawn farms. On 4 January 2017 AAHL reported that 14 out of 19 samples (74 per cent) tested positive for WSSV. This final trigger led to the import suspension decision.

To understand how this happened, we must consider the history of prawn imports into Australia and the department's attempts to keep serious prawn diseases out while at the same time meeting Australia's import demands and its trade obligations.

3 Prawn production, trade and diseases

3.1 World and Australian prawn industries (wild-caught and farmed)

Australian demand for prawns is met by local and imported product. Over the last 20 years, supply has shifted towards a greater reliance on local prawn aquaculture and cheaper imports from Asian aquaculture industries. Australia's prawn industry (wild-caught and farmed) produces about 25,000 tonnes of prawns per year, worth about \$358 million. In 2016, 27 Australian prawn farms produced almost 5,000 tonnes of prawns worth \$87 million.

3.2 Prawn disease emergence and impact

Globally, the prawn farming industry has been threatened by emergence of serious crustacean diseases, the most severe being WSD. These diseases affect farmed and wild prawns and other crustaceans. WSD is lethal, not only to prawns but to freshwater crayfish, threatening farmed marron and wild yabbies. Overseas, prawn farmers have responded by farming more robust prawn species (mostly the lower-value *Penaeus vannamei* prawn, which is exotic to Australia) and increasingly with sophisticated on-farm biosecurity practices. WSD cost Asian prawn farming industries US\$6 billion in 1992–1993 after it first emerged.

3.3 Australian prawn diseases

Viral infections in northern Australian wild prawns were first found in the 1980s. In 1986 monodon baculovirus (MBV) was found in farms in northern Queensland's emerging prawn aquaculture industry. By 1995, 12 viral diseases had been identified. Most had been brought into prawn farms from the wild via broodstock used for hatchery post-larvae production. To mitigate this risk, protocols were put in place from 2005 for biosecure prawn broodstock translocations from northern tropical waters to Queensland prawn hatcheries. Because WSD and yellow head disease (YHD) were absent from Australia, prawn farmers could farm black tiger prawns without adopting costly on-farm biosecurity practices regarded elsewhere as 'world's best practice'.

3.4 'The Darwin incident'—incursion of WSSV in 2000

The only incursion of WSSV in Australia before December 2016 was in 2000, when three Darwin aquaculture facilities were found to be using imported uncooked prawns (which they thought were 'Australian') as aquaculture feed. As a result, these facilities had to be destocked and disinfected. Sampling in Darwin Harbour revealed a small number of WSSV-positive prawns and crabs, but no clinical signs of disease. A month later, further testing gave no positive results. In 2001–02 a comprehensive survey of wild prawns and other crustaceans from 64 sites around Australia found no evidence of WSSV. Due to this incident, in 2001 Australia introduced its first requirement for testing imported uncooked prawns.

4 Regulatory control of biosecurity risks in Australia

4.1 International obligations

The World Trade Organization's Agreement on the Application of Sanitary and Phytosanitary Measures (SPS agreement) sets out obligations for countries to ensure that biosecurity measures are undertaken on sound scientific grounds and do not restrict trade unnecessarily. Countries can set their own risk-based standards to achieve their appropriate level of protection (ALOP). The World Organisation for Animal Health (OIE) specifies international standards and recommendations for preventing the spread and/or introduction of terrestrial and aquatic animal diseases. Aquatic diseases are covered by the OIE's *Aquatic Animal Health Code* and *Manual of diagnostic tests for aquatic animals*.

4.2 National regulatory framework

Australia manages biosecurity risks associated with trade through the Department of Agriculture and Water Resources. The department undertakes risk assessments and imposes various pre-border and border management measures to minimise the entry of regulated pests and diseases into Australia through imported products. States and territories are responsible for biosecurity risk management and aquatic disease control within their boundaries, including 3 nautical miles out to sea. The Australian Government has jurisdiction in the Australian Fishing Zone, from 3 to 200 nautical miles from shore.

The department's biosecurity powers were reformed when the Commonwealth *Biosecurity Act 2015* superseded the *Quarantine Act 1908* in June 2016. This required a massive internal overhaul of policies, procedures, guidelines and training, as well as extensive stakeholder engagement. Implementation went smoothly and inspection and enforcement activities continued, but departmental resources were extremely stretched in the process. Key differences between the two Acts and the processes required to administer them affected management of the WSD outbreak, suspension and resumption of uncooked prawn imports, and management of the wider biosecurity risk framework.

The Intergovernmental Agreement on Biosecurity (IGAB), in place since 2012, has strengthened the partnership between Australian, state and territory governments to deliver national biosecurity system improvements. A recent IGAB review has reaffirmed its value and set new priorities for collaboration between governments.

4.3 Sharing responsibility between governments and industry

Biosecurity issues of national significance, including incursion responses, are managed through various cooperative national decision-making and cost-sharing arrangements between Australian, state and territory governments and relevant industries. These arrangements are less well-developed for aquatic than for terrestrial animal biosecurity.

Governments alone cannot deliver biosecurity. Agricultural industries must also be involved. This has been recognised since the 1990s, with the formation of Animal Health Australia and then Plant Health Australia. Formal cost-sharing agreements for emergency (terrestrial) animal and plant pest and disease incursion preparedness and responses have been invaluable to clarify roles of Australian, state and territory governments and industry in implementing their shared responsibility for post-border biosecurity outcomes. These agreements have often included provisions for animal industries to share responsibility for preventing disease outbreaks by implementing on-farm biosecurity programs.

Development of a similar agreement for aquatic animal diseases (an 'aquatic deed') has lagged due to the complex legal nature of the ownership and use of aquatic resources and the difficulty in apportioning ownership of the significant risks associated with historical emerging endemic diseases as well as exotic incursions.

4.4 Governance of laboratory testing for international trade quality assurance

Testing of imported products to identify unwanted pests or disease agents is an important component of biosecurity risk management and is highly technical. The OIE designates international reference laboratories and experts on specific diseases. Australia also designates national reference laboratories and experts. The International Organization for Standardization and the International Electrotechnical Commission maintain ISO/IEC 17025, a standard for the competence of testing and calibration laboratories. All laboratories conducting testing for trade purposes must comply with this standard. In Australia, the National Association of Testing Authorities (NATA) is responsible for ensuring that its member laboratories maintain quality assurance arrangements and comply with ISO/IEC 17025.

The Australian National Quality Assurance Program and the Laboratories for Emergency Animal Disease Diagnosis and Response network conduct proficiency testing to ensure that government veterinary laboratories are achieving comparable and accurate results. Both bodies are coordinated by the Animal Health Committee through its subcommittees.

The department approves both government and private laboratories to carry out import testing, with separate approval processes and requirements for handling specimens that may contain exotic pathogens, and specific technical requirements for the performance of different tests.

5 Generic import risk analysis (IRA) for prawns, 2009

5.1 Development of import conditions before and during the IRA process

From 1992 Australia responded to emerging prawn disease risks by progressively introducing conditions for the import of certain classes of prawns. The conditions were aimed at minimising biosecurity risks—especially those posed by WSSV and YHV—to farmed and wild-caught prawn industries and other crustacean industries. From 1997 the implementation of conditions was managed through a generic import risk analysis (IRA) process that concluded in 2009. New import conditions, especially the requirement to sample and test individual batches of prawns for freedom from certain diseases, led to importers successfully requesting that new categories of highly processed prawns, such as marinated prawns, be exempt from testing. Most stakeholders considered the final IRA was a major improvement over previous arrangements. However, a minority felt that selected arrangements were either unnecessary, too strict or not strict enough.

5.2 Achieving an appropriate level of protection

The 2009 IRA aimed to comply with WTO SPS agreement requirements and to achieve Australia's ALOP of 'providing a high level of sanitary and phytosanitary protection aimed at reducing risk to a very low level but not to zero'. The underlying assumptions about how application of the prawn import conditions in the IRA would achieve Australia's ALOP were poorly spelt out, lacked measurable verification measures, and were not revisited after 2009. It can be inferred that prawn import conditions were designed to allow only a very low level of WSSV and YHV in retail prawns. This would greatly reduce the risks that, if retail prawns were used for bait, any of them would be infected, and therefore risk infecting any nearby prawn farms or wild native crustaceans.

5.3 Sampling and testing a batch of imported prawns for WSSV and YHV

A key measure developed during the 2009 IRA process (and applied ever since) was the requirement to randomly sample and test each batch of certain classes of prawn products in an imported consignment. This was designed to detect viruses with 95 per cent probability, where the prevalence of infection in the consignment was assumed to be at least 5 per cent (the OIE standard in 2006). The technical parameters for determining what constituted a batch, and the sampling and testing regimes to be followed, were complex and not easily understood or verifiable. However, the accuracy of the final classification of batches as positive or negative depended heavily on correct sampling and test performance and interpretation.

6 Implementing IRA prawn import conditions, 2010 to 2016

6.1 Volume, value and source of imported prawns

The prawn import conditions recommended in the IRA were applied from 2010 to 2016 to prawn imports worth from around \$230 to 365 million per year. Annually, this represented between 10 to 14,000 tonnes of cooked prawns, 10 to 17,000 tonnes of uncooked prawns, 6 to 7,000 tonnes of marinated prawns and 2 to 3,000 tonnes of other highly processed prawns, including breaded and battered prawns. These imports were from up to 40 countries, mostly Vietnam, Thailand, China, Malaysia and Indonesia. The mix of countries exporting different categories of prawns changed from year to year.

6.2 Pre-border biosecurity risk management, 2010 to 2016

The department manages as many biosecurity risks as possible offshore, keeping risks as far away from Australia as possible. It assesses and approves competent authorities (listed overseas government agencies) to certify that consignments and batches of prawns meet Australia's conditions, including country, zone or compartment disease freedom; supply-chain segregation; and pre-export verification testing and/or labelling.

Specific offshore arrangements that applied from 2010–16 included:

- recognition that New Caledonia was free of WSSV, YHD and taura syndrome virus (TSV) and could therefore export uncooked whole prawns without inspection or testing on arrival, and
- approval for Thailand to re-export Australian wild-caught prawns processed through a government-approved supply chain.

For other uncooked prawn imports, importers had to obtain certification from a competent authority stating that each batch of prawns were free of visible signs of infectious disease, processed as stipulated and correctly labelled.

A batch was defined as 'a population from a different pond population or fishing period population'. However, in practice it was hard for a government official to verify that batches emerging from a processing plant complied with the batch definition in the import conditions.

A government inspector was most unlikely to be inspecting for signs of infectious disease in frozen whole prawns that arrived at a processing plant, or in the same prawns as they were being thawed and put onto a production line for sorting, shelling and deveining. Any inspector examining uncooked prawn meat post-processing could almost never find signs of disease.

The import conditions assumed that the country of origin of the prawns was the competent authority's country. However, without adequate tracing systems in place, it is likely that some batches of prawns arriving at processing plants came from other countries.

6.3 Border biosecurity management activities, 2010 to 2016

The task of verifying the new 2010 conditions was added to the duties of frontline assessors and inspectors—with little extra training and limited resources.

Based on import documentation for each declared uncooked prawn consignment, border assessors had to determine whether batches needed to be inspected (in quarantine approved premises), verified (to show that prawns were sufficiently highly processed to not require testing) or sampled and tested for WSSV and YHV.

Import permits were issued to importers for two-year periods. Each year, around 200 importers brought in about 4,000 consignments of prawns (cooked, processed and raw). Of these, about 1,100 consignments were inspected, 250 were verified and 900 were sampled and tested. Sydney and Melbourne each received about 30 per cent of consignments, with smaller volumes going to Brisbane, Adelaide and Perth.

In the three years to 2015–16, 3,474 inspection directions (including verification, sampling and testing) were recorded. On average, inspectors took about half an hour per consignment to complete the inspection directions at the warehouse, with costs recovered from the importer.

In this period, prawn samples were sent to 1 of 2 (and later 3) laboratories for testing, and 7 per cent of batches tested positive for WSSV. Positive batches had to be re-exported, cooked or destroyed—most were listed as being re-exported. Limited verification of re-export was carried out before late 2016, largely due to incompatibilities between Customs and Quarantine computer systems.

6.4 Post-border controls

All imported uncooked prawns and prawn products had to have the words 'For human consumption only—not to be used as bait or feed for aquatic animals' on each carton and plastic bag in which they were imported, and border inspectors had to check each batch for compliance. However, once a consignment had been released from quarantine, the Australian Government had no further control over it. Uncooked or marinated prawns were removed from their packaging and thawed for sale in fish shops or supermarkets. Most buyers, including recreational fishers, may not have realised that these prawns should not be used for bait.

The intent of requiring the warning statement on each package was to prevent wholesale purchase of imported prawns by bait shops, which would pose a much greater risk than retail prawns of transfer of any residual infection into wild crustaceans. Surveillance of bait shops was never undertaken to ensure that they were not selling uncooked imported prawns. Any legal powers for action against such practices were unclear or non-existent.

7 Non-compliance with prawn import conditions, 2010 to 2016

7.1 Mistaken release of WSSV-positive batches, 2010

In 2010 a WSSV-positive consignment of 20 tonnes of uncooked imported prawns was mistakenly released onto the retail market. This incident was investigated by the Interim Inspector-General of Biosecurity (IIGB), who found that the release was due to an inspector's 'human error'. However, the IIGB concluded that, though not all these prawns could be traced and recalled, the chance of infected prawns from this consignment introducing WSSV infection into high-risk pathways was extremely low, so there was a negligible likelihood of WSSV establishing in Australia due to this consignment's release. The department implemented the IIGB's recommended changes to laboratory test reporting and recording to reduce the chance of similar errors in future.

7.2 AAHL detection of WSSV in retail prawns, 2013

On 17 May 2013 AAHL advised the department that batches of uncooked prawns imported from 3 countries and purchased at 3 different Geelong supermarkets had tested positive for WSSV. On 13 December 2013 AAHL advised that it had confirmed that these prawns contained infectious virus by transmitting WSD to Australian prawns using inocula from these WSSV-positive prawns. This information was not shared with states and territories.

7.3 Operation East Leichhardt investigation into marinated prawn imports, 2014

In 2013 the department received allegations that inadequately marinated prawns were being re-processed after import and sold as uncooked prawns. In 2014 the department implemented Operation East Leichhardt, which found major irregularities in the importation of marinated prawns. Five of 7 targeted consignments failed inspection because the prawns were inadequately covered with marinade. As a result, 57.9 tonnes of prawn products were re-exported, although no importers were prosecuted. The export containers were tracked and no evidence of re-import attempts was found. No changes were made at that time to import conditions, but the findings led to more investigations of the imported uncooked prawn trade.

7.4 Non-compliance detected at border assessment and inspection 2013–14 to 2015–16

Between 2013–14 and 2015–16, a high proportion of uncooked prawn consignments arriving at the border were found to be non-compliant with import conditions, violating entry-level, document or inspection requirements. Minor errors were remedied on the spot, but re-export was ordered for consignments with more serious non-compliance. In some cases, importers were later detected trying to re-import these failed consignments.

7.5 Operation Cattai investigation into systematic importer non-compliance, 2016

In late 2016 Operation Cattai found systematic non-compliance with uncooked prawn import conditions by six major importers, who had handled 46.7 per cent of uncooked prawn imports in 2016. It also found an unexpectedly high level of WSSV in imported retail prawns.

The investigation found that a number of importers were misdeclaring prawn shipments or falsely presenting goods for inspection and foiling the random sampling stipulated in the import conditions. As a result, many batches likely to be WSSV-positive were not tested. In some cases, Australian prawns were substituted in some cartons from batches of imported prawns. These consequently tested negative, clearing the consignment for import.

Operation Cattai led to a much higher batch failure rate than business-as-usual inspection and testing. As a result, many containers full of uncooked infected prawns were listed for re-export by late 2016. Proving re-export of some consignments was difficult, and there was one confirmed case of re-import. By November 2017, after follow-up investigations, the department was taking action against nine importers who had handled about 70 per cent of uncooked prawn imports during 2016.

8 Lessons from Operation Cattai

8.1 Too much trust in importers to do the right thing

Several import conditions relied on importers to accurately and appropriately present prawn consignments for inspection, sampling and testing. Import conditions were hard to verify:

- Batches of prawns could not be traced back to farm level, making it difficult for both the competent authority and the border inspector to verify whether a consignment contained one or more batches.
- Complexity of the tariff codes and goods descriptions made it difficult for border assessors to direct consignments for the correct level of inspection, sampling and testing.
- The requirement for unpack rather than seals-intact inspections allowed importers to unload containers into freezers and later request an inspection of one or several mingled consignments at a time convenient for them.
- Delays between cargo discharge and inspection booking averaged four weeks and were sometimes much longer. This would allow certain cartons to be prepared so that they were likely to test negative for WSSV and marked so that they would be presented for inspection.

Importers and/or operators of cold stores were trusted and seen as clients. The department strove to complete prescribed inspections quickly to save importers money and facilitate trade.

8.2 Weak assessment and inspection procedures

Operation Cattai showed that inspection and sampling of prawn consignments was not being carried out as envisaged by the IRA's authors, due to technical and practical issues, including:

- Assessment of documents accompanying prawn imports was complex and needed more time than was generally allocated.
- Training on true random sampling had never been provided, was not incorporated in work instructions and in practice was impossible once consignments were unloaded into freezers, with cartons piled high and shrink-wrapped on pallets.
- Inspector safety would be compromised by working for any length of time in freezers (some down to -30°C), without suitable protective clothing. Freezers can be dangerous, with rapid forklift traffic moving heavy loads where there is limited visibility and space.
- A single inspector was expected to complete inspection and, if needed, sampling of a typical consignment in about half an hour. According to instructions at that time, inspectors had to enter the freezer, indicate which cartons were to be sampled and have them brought to an inspection point outside the freezer. There were differences in how this was applied locally.

In contrast, the detailed seals-intact inspections conducted during Operation Cattai (which found so many cases of non-compliance) needed at least two inspectors for four hours or more.

8.3 Variation in laboratory testing procedures and interpretation

Laboratories carrying out testing of imported prawns for WSSV were required to be NATA accredited and use a test described by the World Organisation for Animal Health (an 'OIE test'). However, detailed laboratory procedures and test result interpretations were not standardised.

Different testing methods and interpretation of results led to different rates of prawn batches failing WSSV testing, depending on where they were tested. Private screening laboratories, which were doing the bulk of the testing, were classifying as 'negative' some samples (and therefore batches) that the government screening laboratory would have called 'positive'.

9 Handling prawns during import suspension, 6 January to 6 July 2017

9.1 Implementing the suspension of uncooked prawn imports

From 6 January 2017 the department informed importers of its intention to suspend import permits for uncooked (including marinated) prawns effective from 9 January. By 13 January 2017, 246 permits were fully suspended and 63 partially suspended because they included other non-suspended product types.

Prawn consignments were subject to greatly strengthened assessment, inspection, sampling and testing procedures. Inspectors increased the verification of importer/broker declarations and inspection of consignments that appeared to have been incorrectly declared. All containers with declared uncooked prawn consignments were subjected to seals-intact inspections and supervised unpacking and sampling of cartons and batches by two or more inspectors.

Laboratory testing protocols were tightened, with standardised criteria for test result interpretation and retesting of negative samples by AAHL. Improved re-export verification procedures for any failed consignments were put in place.

A number of consignments of uncooked or marinated prawns were already on their way to Australia when the department announced the suspension. These were permitted entry, subject to these tighter procedures, or importers could re-export them without inspection.

9.2 Post-border withdrawal of uncooked and marinated prawns

Immediately after the import suspension, the department began withdrawing and testing (at AAHL) uncooked and marinated imported prawns from the post-border supply chain. It aimed to reduce the volumes of previously cleared WSSV-infected prawns reaching the retail market.

The department had powers to secure and test any product still in regulated freezers at approved arrangements. However, large quantities of the product had already moved into the complex domestic supply chain. A lack of recall or notification power under the *Biosecurity Act 2015* made it difficult to find the product.

The department used a 'secure-and-test' strategy that prioritised larger commercial stocks of uncooked imported prawns held by major retailers and distribution networks, followed by other approved and non-approved arrangements and retail outlets. This prevented the supply of prawns to the consumer retail market until they could be (re)-tested for WSSV.

By 18 October 2017 about 2,523 tonnes of post-border prawn product had been placed under biosecurity control, and 73 per cent of batches had tested positive for WSSV. Only product that tested negative or was cooked was cleared to re-enter the domestic supply chain. About 1,834 tonnes either tested negative and were released for sale, or were destroyed, cooked in an approved manner or exported. About 689 tonnes remained under biosecurity control.

The high rate of positive detections when samples were tested at AAHL led to some concerns that the testing applied by AAHL might be over-sensitive and detect contamination rather than true WSSV infection. However, most batches found positive by AAHL were at levels that would also have been classified as 'positive' by the government screening laboratory.

9.3 Variations to uncooked prawn import suspension order, January to June 2017

From January to June 2017, various categories of uncooked prawns were progressively exempted from the suspension order based on individual risk assessments. Some importers began importing different categories of uncooked prawns to meet the new requirements.

Before the suspension, marinated prawns had been classified as ‘highly processed’ and therefore exempt from testing. Import of these products was suspended due to their very high rate of WSSV and the possibility that some might be used as bait. ‘Breaded, crumbed or battered’ prawns were considered less likely to be diverted for sale as uncooked prawns so their import was not suspended. The requirement since 2014 had been that 25 per cent of these consignments were subject to verification inspections after being unpacked from their containers. However, between February and March 2017, there was a fourfold increase in consignments of breaded, crumbed or battered prawns. From 22 March 2017, 100 per cent of these consignments were scheduled to undergo full seals-intact inspections. Some importers then simply turned containers around for re-export without inspection.

Cooked prawns also arrived in greater volumes and they too were subject to a higher random inspection rate. Inspectors noted an increase in consignments of very lightly blanched prawns, with some cartons bearing the warning ‘Must be further cooked’.

When the suspension order lapsed at midnight on 6 July 2017, new interim import conditions were introduced. These required that all uncooked (including marinated) prawn batches be certified by the relevant competent authority as having passed pre-export, post-processing testing for WSSV and YHV. On arrival in Australia, these batches would then be subject to thorough seals-intact inspection, and once again sampled and tested.

10 Future pre-border and border measures for trade in prawns

10.1 Revising prawn import conditions

The interim conditions were to apply pending full revision of the 2009 IRA prawn import conditions, which should take at least two years. During the revision, the department would further consider whether or how uncooked prawn imports could meet Australia’s ALOP given that most countries with prawn aquaculture industries are infected with WSSV and YHD, and that other prawn diseases are emerging.

The prawn-farming industry has long argued for limiting the entry of prawn products to cooked product only. This would help protect Australia from WSD and other prawn diseases. And it would be in line with Australia’s requirement that pork and most other meat imports are cooked before final release into the market, unless the exporting countries are demonstrated to be free of specific serious exotic diseases. This measure will need reconsideration during the review of import conditions, but in the meantime some uncooked prawn imports will continue.

10.2 Future pre-border biosecurity risk management for trade in prawns

Competent authorities and the department will need to become more actively engaged in overseeing offshore measures to prevent infected uncooked prawn product being sent to Australia. Pre-export testing is a step forward in keeping more infected prawns out of Australia, but it can only reduce risks, not eliminate them. Overseas through-supply-chain traceability and biosecurity enforcement arrangements need strengthening to enable the department to have confidence that importers are sourcing product from disease-free countries, zones or compartments. Some countries and companies may be able to develop vertically integrated prawn production and processing facilities with quality assurance systems that provide biosecurity and food safety guarantees.

10.3 Future border biosecurity compliance management

Future imports of prawns and other frozen foods should receive thorough assessment and inspection over the longer term given evidence of serious non-compliance and the financial incentives to misdeclare or co-mingle prawn shipments with other products. Seals-intact inspections should apply indefinitely to all uncooked prawn shipments and randomly to a much greater proportion of other seafood and other frozen foods.

Encouraging industry self-regulation and quality assurance programs through the supply chain, with government as the regulator of last resort, is a key means of reducing unnecessary regulation. However, self-regulation needs to be monitored more closely, with more risk-based and unannounced spot audits. Higher levels of random inspection of all prawn products and other frozen foods may be relaxed once an importer has demonstrated compliance, but it would be most unwise to revert to previous levels of trust in importer declarations. The department needs to strike a better balance between facilitating efficient transborder movement of goods and ensuring that biosecurity risks are effectively managed, recognising that the key clients of the biosecurity system are the Australian community, industries and the environment.

Upskilling and motivating staff is an ongoing issue in the face of rapidly changing work environments. The department's training processes, instructional material and work directions need ongoing review and monitoring to ensure that they are up to date and can be applied as intended. The department needs to provide regular and ongoing feedback and recognition for excellent work and implement processes that detect and deter poor work practices.

10.4 Resourcing border biosecurity adequately into the future

Stronger pre-border and border biosecurity risk management measures to prevent unwanted pest or disease entry into Australia require long-term secured funding. Frontline inspector numbers have fallen by 25 per cent over the past five years, but volumes of incoming sea and air cargo, mail and passengers continue to rise steadily, as do accompanying biosecurity risks.

Governments are always trying to reduce public costs by various means, including imposing cost-recovery and average staffing level (ASL) ceilings or budget cuts. Biosecurity activities funded by cost-recovery should be exempt from ASL ceilings. This would enable the department to employ adequate staff during periods of increased trade or biosecurity risk.

Sufficient government or general levy funding should always be provided for verification of compliance with import conditions for commodities, and for risk-based targeted enforcement operations, which will always be labour-intensive to police. Ongoing investment in better IT systems and associated internal business process transformation will also be needed.

10.5 Stronger powers and penalties under the *Biosecurity Act 2015*

In the past, the low penalties for non-compliance (under the *Quarantine Act 1908*) and the difficulties of mounting successful prosecutions even for serious non-compliance, meant that it was difficult to deal effectively with many behaviours which increased biosecurity risks. In practice, the penalties available and applied were often not commensurate with the potential profits to be made or risks that could be caused by the non-compliant behaviour. While the *Biosecurity Act 2015* provides for greater powers and more severe penalties, these must be kept under active review to ensure that they can manage and deter illegal uncooked prawn importation.

Powers to impose direct penalties (for example, by ordering destruction of non-compliant imports) and penalty levels for serious offences need to be reviewed regularly and made easier to apply where appropriate. The department also needs to consider introducing powers to recall goods for biosecurity purposes.

10.6 Improve biosecurity risk governance and risk communication

The complexity of the system for managing the biosecurity risks posed by a dizzying range and volume of imports disguised rising risk levels in the prawn trade. These heightening risks were essentially invisible to the government and not actively managed with the urgency they deserved because of poor internal communication between frontline inspection, compliance enforcement, technical standard setting and policymaking staff. Competing priorities and resource constraints contributed to the problem.

The department needs to improve and continually review processes that enhance risk identification, communication, management and governance. Also needed is a defined and documented triaging and escalation procedure for communicating risks to the government, industry and the community.

Mechanisms for joint biosecurity risk assessment and communication between the department, states and territories and industry need to be reviewed and strengthened. Raising public awareness of issues and promoting behaviours that reduce biosecurity risks are complex tasks that require sustained joint action.

10.7 Better national technical coordination and oversight of laboratory testing

Reform of prescribed relationships between the department and all import testing laboratories should address potential conflicts of interest. Laboratories need to understand that, although the importer pays the bill for import testing, the department is the primary client for the results and relies on those results for border biosecurity protection.

The department, in collaboration with NATA, needs to take a stronger ongoing role in the oversight of standardised testing performance of all import testing laboratories and their alignment with overseas laboratories, to assist with pre-border biosecurity assurance.

The complementary roles of Australian, state and territory governments in managing biosecurity will require ongoing input from and oversight of wider national laboratory testing and quality assurance arrangements by the Animal Health Committee's National Laboratory Task Group and Sub-Committee on Aquatic Animal Health.

11 Future post-border biosecurity—implementing a shared responsibility

11.1 Stronger network of aquatic animal disease expertise

As a result of the WSD outbreak and response, the biosecurity and wider communities in Australia have been sensitised to issues around prawn production, its supply chains and biosecurity management. Emerging broader aquatic issues include increased aquaculture of many species (with accompanying disease risks) and climate change impacts on aquatic animal disease susceptibility. Specialised science is developing new diagnostic methods for aquatic animal diseases, genomic approaches for identifying viruses and their origins, and barcoding or e-DNA capability to detect prawn and other aquatic species. To benefit from these developments, the department must foster strong links with specialised aquatic health and production experts in governments, universities and industry nationwide and internationally.

The department needs to monitor the dynamics of serious prawn and other crustacean diseases worldwide, particularly in farmed and wild-caught prawns from countries that export prawns to Australia. This will enable timely and effective risk management.

11.2 Finalising an aquatic deed for emergency animal disease response

Lack of an aquatic deed hindered funding of and decision-making about the 2016–17 WSD response. A deed would be a critical step in implementing a shared responsibility between industry, states and territories and the Australian Government. Cost-sharing principles for the proposed aquatic deed are complex because Australia's relatively infant aquaculture industries are dispersed around the country, some interact with wild populations and each faces threats of many potentially serious diseases. Negotiations underway across all aquatic sectors aimed to reach an agreement on principles by the end of 2017 and finalise the deed by the end of 2018.

11.3 Stronger on-farm biosecurity programs for prawn and other aquaculture industries

The many lessons learned from the WSD outbreak should enable better preparedness for and handling of any future prawn disease outbreak. In particular, strengthening on-farm biosecurity by prawn and other aquaculture farmers needs ongoing attention. Requirements for minimum on-farm biosecurity standards should be incorporated into the aquatic deed and/or state and territory legislation as appropriate. Surveillance of nearby wild crustaceans may also be needed.

11.4 Post-border verification that risks of WSSV-infected prawns entering waterways are minimised

The authors of the 2009 IRA assumed that their recommended import conditions would allow only small quantities of WSSV to slip across the border. However, the high prevalence of WSSV in uncooked imported prawns at retail outlets (from at least 2013 onward) should have clearly indicated that this was not the case. Despite enhanced pre-border and border measures, the resumption of uncooked prawn imports still poses the risk of infected prawns entering Australia for retail sale and entering Australian waters. Measures for monitoring and minimising these risks, agreed and cost-shared between the department, states/territories and industry, as relevant, could include:

- periodic surveillance of retail prawns for target diseases
- periodic assessment of fishing practices
- targeted public awareness programs against use of imported prawns as bait
- prevention of recreational fishing close to prawn farms
- surveillance of bait shops to ensure that they are not selling imported uncooked prawns.

11.5 Uncooked prawns for food service industry versus retail sale

The intent of the 2010 prawn import conditions was that imported uncooked prawns would all be cooked once in Australia, so that virtually none would be diverted for bait and berley and thus enter waterways in an uncooked state. During the post-border prawn withdrawal program, some importers wished to send their products solely to food service industry outlets where they would definitely be cooked and then pose no risk. However, experience with managing marinated and other highly processed prawns has shown how difficult it is to prevent diversion of uncooked prawns destined for the food service industry to the retail sector.

Nevertheless, some importers supplying major food service and restaurant clients may be able to set up reliable post-border quality assurance supply schemes. In view of previous non-compliance with import requirements, any such scheme would need tight conditions and strong verification over time. The department does not have the legal jurisdiction or resources for this, so any such scheme would have to be driven by importers and the food service industry and have regulatory support from state and territory governments.

12 Conclusion

In 2016–17, the major WSD outbreak in Queensland prawn farms led to a six-month suspension of uncooked prawn imports into Australia. Very high levels of WSSV were found in imported uncooked prawns, destined for retail outlets across the country, which had already passed Australia's border biosecurity controls. This indicated a major failure of Australia's biosecurity system, which was not providing an appropriate level of protection.

During this review, I found several deficiencies in the management of the biosecurity risk of uncooked prawn imports, with broader implications for Australia's biosecurity risk management more generally. I found that specific policy elements and their implementation had sowed the seeds of failure many years before, while progressive and cumulative acts, omissions and systemic factors at many levels exacerbated the risks over time. Many of these failings have been swiftly addressed by the department and other stakeholders, but more needs to be done to manage the biosecurity risks of prawn imports in the future. I have made recommendations to improve this biosecurity risk management framework and its ability to deal with ongoing and emerging challenges. Long-term adequate resourcing will be a key success factor in this endeavour.

The importation of uncooked prawns and other seafood into Australia will continue to pose significant and changing challenges for the department and industry. The recent WSD outbreak in Queensland, and the subsequent findings of massive importation of WSSV-infected prawns, despite previous import requirements intended to keep this virus out, highlight the need for the department to remain vigilant, proactively review and update import requirements and policies, and maintain excellent communication with both government and industry stakeholders. Above all, detecting and deterring deliberate or inadvertent failures to implement biosecurity risk management policies effectively must be a priority. Governments and aquatic industries must cooperate to resource and implement these efforts. Failure to do so will imperil the future development of a sustainable and profitable aquaculture sector in Australia.

Recommendations and departmental responses

The department's full response to the recommendations is also at Appendix A.

Recommendation 1

The department, in consultation with industry and state/territory governments, should review risk mitigation measures for the various pathways for white spot disease to enter and establish in Australia.

Department's response: Agree. The department has commenced a review of the biosecurity risks of, and import conditions for, prawns imported for human consumption. There will be extensive consultation and engagement with aquatic health and production experts in Australian and state/territory government agencies, universities and industry to support the prawn risk review.

Recommendation 2

The department should, as a priority, review the sampling regime for consignments of imported uncooked prawns and prawn products.

Department's response: Agree. An improved sampling process for consignments of imported uncooked prawns and prawn products has been implemented. Sampling regimes will also be considered in the prawn risk review.

Recommendation 3

The department should facilitate research to validate the impact of cooking on:

- white spot syndrome virus inactivation, and
- white spot syndrome virus testing results.

Department's response: Agreed in principle. Research such as this, which could be commissioned by FRDC, will be considered in the context of the prawn risk review.

Recommendation 4

The department should review import conditions for uncooked prawns listed on its Biosecurity Import Conditions (BICON) system to ensure clarity and consistency with OIE terminology, scientific accuracy and usefulness for verification at the border.

Department's response: Agree. Import conditions have been reviewed and updated and will be further reviewed and updated as the risk review progresses.

Recommendation 5

The department should work with competent authorities and industry to ensure that, where possible, uncooked prawn products are imported from specific pathogen-free countries, zones or compartments. This should be industry-driven and involve:

- quality-assured supply chain management
- competent authority verification of pre-border status of consignments, and
- regular departmental offshore audits or verifications of these arrangements..

Department's response: Agree in principle. In conducting the risk review, the department will consult with competent authorities and industry to consider the designation of specific pathogen-free countries, zones or compartments for the import of uncooked prawn products.

Recommendation 6

The department should continue to conduct full seals-intact inspections of uncooked prawn imports (by at least two inspectors). It should also review measures to ensure integrity of the seals-intact containers until inspection.

Department's response: Agreed and implemented.

Recommendation 7

The department should implement and publicise an ongoing program of random and risk-based, seals-intact inspections of frozen goods to ensure that uncooked prawns are not being imported as other frozen foods.

Department's response: Agree. This may be implemented as part of the department's cargo compliance verification program.

Recommendation 8

The department should ensure that inspections at approved arrangements, especially at regulated cold stores, are periodically carried out by two inspectors. If only single inspectors are available, they should be regularly rotated.

Department's response: Agree. Revised processes have been implemented.

Recommendation 9

The department should facilitate the development and implementation of a nationally consistent competence and verification framework covering staff involved in assessing and inspecting imported uncooked prawns and other commodities. This should be regularly reviewed and adequately resourced.

Department's response: Agree. The Department has implemented a national competency and verification framework for prawn inspections.

Recommendation 10

The department should improve internal communication to develop and implement training processes, instructional material and work directions that are technically sound, suit the conditions being experienced and are applied as intended. These should be monitored and regularly reviewed.

Department's response: Agree. The department has implemented improved internal communications arrangements, updated instructional material and has strengthened arrangements to ensure that the required processes are being applied as intended.

Recommendation 11

The Australian Government should commit to ensuring adequate long-term funding for biosecurity risk management, including border inspections and enforcement. Funding should be linked to growth in imports and biosecurity risks, with cost-recovered functions exempt from efficiency dividends and staff ceilings.

Department's response: Noted. This is a matter for government.

Recommendation 12

The department should consider seeking stronger powers under the *Biosecurity Act 2015* to apply direct penalties for serious non-compliance and impose administrative sanctions or on-the-spot fines for relatively minor non-compliance.

Department's response: Agree. While the Biosecurity Act already provides powers to apply direct penalties for serious non-compliance and penalties for relatively minor non-compliance in the form of infringement notices, the department will consider whether stronger powers are required.

Recommendation 13

The Director of Biosecurity should seek powers under the *Biosecurity Act 2015* to conduct a general recall of goods for biosecurity purposes.

Department's response: Agree in principle. Proposed changes to the Biosecurity Act have been drafted that will provide powers to enable the improved management of a similar event.

Recommendation 14

The department should continue to improve internal biosecurity risk governance and communication to rapidly identify emerging biosecurity risks. Risks should be communicated to governments, the wider community and industry through a defined and documented triaging and escalation procedure.

Department's response: Agree in principle. The department's Active Risk Management program is helping to improve internal biosecurity risk governance and communication to rapidly identify emerging biosecurity risks. Risks will be communicated to other governments, the wider community and industry as appropriate to the specific circumstances.

Recommendation 15

The department should discuss with the National Biosecurity Committee mandatory reporting of all post-border detections of prescribed exotic disease agents or pests to Australian and state/territory government departments.

Department's response: Agree. The Australian government reports post quarantine detections to state and territory governments and will seek the National Biosecurity Committee's agreement that states and territories share similar information with the Australian government and with each other.

Recommendation 16

The department should collaborate with state/territory agencies, Animal Health Australia and relevant industry bodies to review and implement more effective communication policies to aid the early dissemination of information about exotic aquatic diseases and pests and their management to stakeholders.

Department's response: Agree. Implementation is progressing.

Recommendation 17

The department should formalise, oversee and monitor stronger prescribed arrangements for laboratories undertaking import testing to ensure their accountability and ongoing implementation of prescribed testing standards.

Department's response: Agree. Implementation is progressing.

Recommendation 18

The department should, in collaboration with National Association of Testing Authorities, oversee the performance of import testing laboratories in quality assurance programs. This should include regular proficiency testing and assessment of control samples distributed among the laboratory network, with means to ensure that laboratories rectify any identified deficiencies in a reasonable period of time.

Department's response: Agree. Implementation is well progressed.

Recommendation 19

The department should promote an update of the old Australian and New Zealand standard diagnostic procedure for white spot syndrome virus including peer review of the new *Procedure for detection of white spot syndrome virus for biosecurity risk management*. This should be conducted by a suitably resourced national technical group formed from the Animal Health Committee's National Laboratory Task Group and Sub-Committee on Aquatic Animal Health.

Department's response: Agree. Implementation is progressing.

Recommendation 20

The department should maintain strong links with aquatic health and production experts in Australian and state/territory government agencies, universities and industry, to support decision-making based on:

- the latest scientific knowledge of new technologies, and
- international emergence, movements and risks to Australia of serious aquatic animal diseases.

Department's response: Agree. There will be extensive consultation and engagement with aquatic health and production experts in Australian and state/territory government agencies, universities and industry to support the prawn risk review.

Recommendation 21

The department should continue to work with Animal Health Australia, state/territory agencies and aquatic industries to develop an aquatic emergency animal disease response agreement (deed) as soon as possible.

Department's response: Agree. Development of the aquatic deed is well progressed.

Recommendation 22

The department and state/territory governments and industry should agree on (and cost share, as relevant) measures for monitoring and minimising risks of any imported uncooked prawn product entering waterways. Measures could include:

- periodic surveillance of retail prawns for target diseases
- periodic assessment of fishing practices
- targeted public awareness programs discouraging use of imported prawns as bait
- prevention of recreational fishing and surveillance of wild crustaceans close to prawn farms, and
- surveillance of bait shops to ensure they are not selling prawns imported for human consumption.

Department's response: Agree in principle – These issues will be considered as part of a systems based approach. Regulation of domestic fishing practices is a matter for state and territory governments.



Dr Helen Scott-Orr

Inspector-General of Biosecurity
12 December 2017

Acknowledgements

In undertaking this review, the IGB received cooperation and advice from industry organisations, prawn importers and related companies and individuals, university and laboratory specialists, and many government officials, especially from the Australian Government Department of Agriculture and Water Resources and the Queensland Department of Agriculture and Forestry. Their assistance is gratefully acknowledged. Written submissions to the IGB are available on the IGB website.

Chapter 1

Background

1.1 Origins and scope of review

On 17 February 2017 I advised the Hon. Barnaby Joyce, Minister for Agriculture and Water Resources, of my intention to review the circumstances leading to the 6 January 2017 suspension of uncooked prawn imports into Australia and biosecurity considerations relevant to future trade in uncooked prawns. This suspension followed an outbreak of the previously exotic white spot disease (WSD) in prawn farms and adjacent wild crustaceans near the Logan River, in south-east Queensland, and initial investigations into the potential source of infection.

On 6 July 2017 the suspension of uncooked prawn imports lapsed. By this time, the Director of Biosecurity had put in place alternative import conditions for selected uncooked prawn products. Some uncooked prawn imports under these new conditions had resumed when I ceased collecting data for this review.

The scope of this review covered operational policy and activities of the Department of Agriculture and Water Resources relevant to biosecurity risks associated with import of uncooked prawn products into Australia. It excluded detailed consideration of economic and social impacts of the WSD outbreak and activities of other agencies in dealing with it. The review considered:

- the effectiveness of biosecurity controls and their implementation for managing the biosecurity risks of importation of uncooked prawns and prawn meat into Australia
- the effectiveness of post-entry surveillance measures and 'end-use' import conditions for uncooked prawns and prawn meat into Australia
- areas for improvement in the biosecurity risk management framework and its implementation for future trade in prawns and related seafood.

1.2 Senate inquiry

On 16 February 2017 the Senate referred two inquiries to the Rural and Regional Affairs and Transport References Committee for inquiry and report. The terms of reference for the two inquiries focused on the reported outbreak of white spot syndrome virus (which causes WSD) in prawn farms in the Logan River area and suspension of uncooked prawn imports.

On 21 March 2017 the Senate adopted the recommendations in the committee's *Report on the inquiries into the importation of seafood and seafood products* and referred the matter for inquiry and report by 22 June 2017¹.

The Senate also finalised terms of reference² for an inquiry into 'The biosecurity risks associated with the importation of seafood and seafood products (including uncooked prawns and uncooked prawn meat) into Australia'. The committee required the department to produce the vast amount of data it held on this topic³, called for public submissions⁴, held public hearings⁵ and published an interim report⁶ on 22 June 2017 and a final report on 31 October 2017⁷.

1.3 Conduct of review

During this review, my team and I consulted extensively within and outside the Department of Agriculture and Water Resources. In particular, we:

- conducted a series of meetings with the department's senior executives to
 - establish background information about the circumstances leading to the suspension of prawns and prawn product imports
 - understand the work that the department undertook to strengthen biosecurity controls after the suspension of prawn import trade in early January 2017
 - provide periodic feedback on interim findings of the review
- consulted with, visited and obtained submissions (see Appendix C) from a range of industry and government stakeholders external to the department
- reviewed relevant scientific literature and reports and visited a number of laboratories that conducted testing for white spot syndrome virus (WSSV)
- held discussions with relevant department staff and read numerous policy guidelines, internal reports, procedural documents, work instructions and training material on all aspects of the department's management (over many years) of the biosecurity risks of importing prawns, including:
 - development and implementation of prawn import conditions
 - processes for document assessment, inspection, sampling, testing and release of imported prawn consignments
 - the extent to which established procedures were followed
 - compliance investigations completed and those underway to ensure that importers were not circumventing import requirements
- considered potential risks, including whether:
 - the department's risk-based methodologies (to detect, identify and control diseases) are inadequate or not applied correctly by staff or relevant stakeholders
 - the department lacks timely internal mechanisms to identify and respond effectively to emerging risks

- the department has insufficient resources or capabilities available to address relevant current and new or emerging biosecurity risks from imported uncooked prawns
- stakeholders do not provide the department with appropriate or timely information to allow it to carry out its responsibilities
- the department does not provide stakeholders with appropriate or timely information to allow them to carry out their responsibilities.

As required by the *Biosecurity Act 2015* I presented my draft report to the Director of Biosecurity for departmental consideration. The department's response to my recommendations is included in this report. Further, I provided a copy of my final report to the Director of Biosecurity and the Agriculture Minister.

Chapter 2

White spot disease outbreak in south-east Queensland, 2016–17

2.1 Outbreak and disease control in prawn farms near the Logan River

In 2016, the prawn aquaculture industry in the Logan River area, in south-east Queensland, consisted of seven prawn farms and one prawn hatchery. The operators mainly produced prawns for the domestic market at a value of more than \$20 million per annum. The area is also an important commercial fishery for local crabs and bait prawns for sale in Queensland and interstate, and a significant recreational fishery for fish, prawns and crabs.

On 22 November 2016 the owner of a prawn farm near the Logan River (infected premises '1IP') noticed unusual prawn mortality in one pond. On 24 November, as mortalities increased, he notified Biosecurity Queensland. Specimens were sent to the Queensland Department of Agriculture and Fisheries (QDAF) Biosecurity Sciences Laboratory (BSL).

Initially, WSD was not considered as a cause of disease or tested for. No other infectious diseases were detected, so the farmer flushed out and exchanged the water from the affected pond from 25 to 29 November⁸. By 28 November, 90 per cent of prawns in the first pond were dead, and dying prawns were observed in two nearby ponds. On 30 November specimens from 1IP tested positive at BSL for WSSV and on 1 December the Australian Animal Health Laboratory (AAHL) confirmed this finding.

WSD was exotic to Australia (except for a minor incursion in Darwin in 2000), so the World Organisation for Animal Health (OIE) was immediately notified. Australia's Aquatic Consultative Committee on Emergency Animal Diseases (AqCCEAD) convened that day and coordinated the subsequent response in accordance with a pre-existing disease control strategy under AQUAVETPLAN⁹. QDAF led the response, supported by the Australian Government Department of Agriculture and Water Resources^{10,11}. AQUAVETPLAN—the Australian Aquatic Veterinary Emergency Plan—is a series of manuals that outline Australia's approach to national disease preparedness and propose the technical response and control strategies to be activated in a national aquatic animal disease emergency. The AQUAVETPLAN for a white spot disease incursion was first developed in 2005, updated in 2010 and the current version approved for use by government and industry in 2013.

2.1.1 Spread of WSD to all prawn farms near the Logan River by February 2017

1IP (the first infected premises)—located westerly and upstream on the Logan River, away from Moreton Bay—is situated close to two other prawn farms (2IP and 3IP) (Map 1). Despite attempts to eradicate the infection on 1IP by chlorination and destocking, 3IP tested positive on 6 December 2016. The disease spread to 4IP on 9 December, to 2IP on 14 December, to 5IP on 29 December, to 8IP on 27 January and finally to 7IP on 13 February 2017.

Amongst the Logan farms, there were also four hatcheries. Three of them were associated with 4IP, 5IP and 8IP farms that also had grow-out ponds¹⁰. The fourth, a standalone hatchery (at-risk property 'ARP6'—not declared an IP), had no grow-out ponds and no animals on it during the response.

MAP 1 White spot disease—location of infected prawn farms along the Logan River

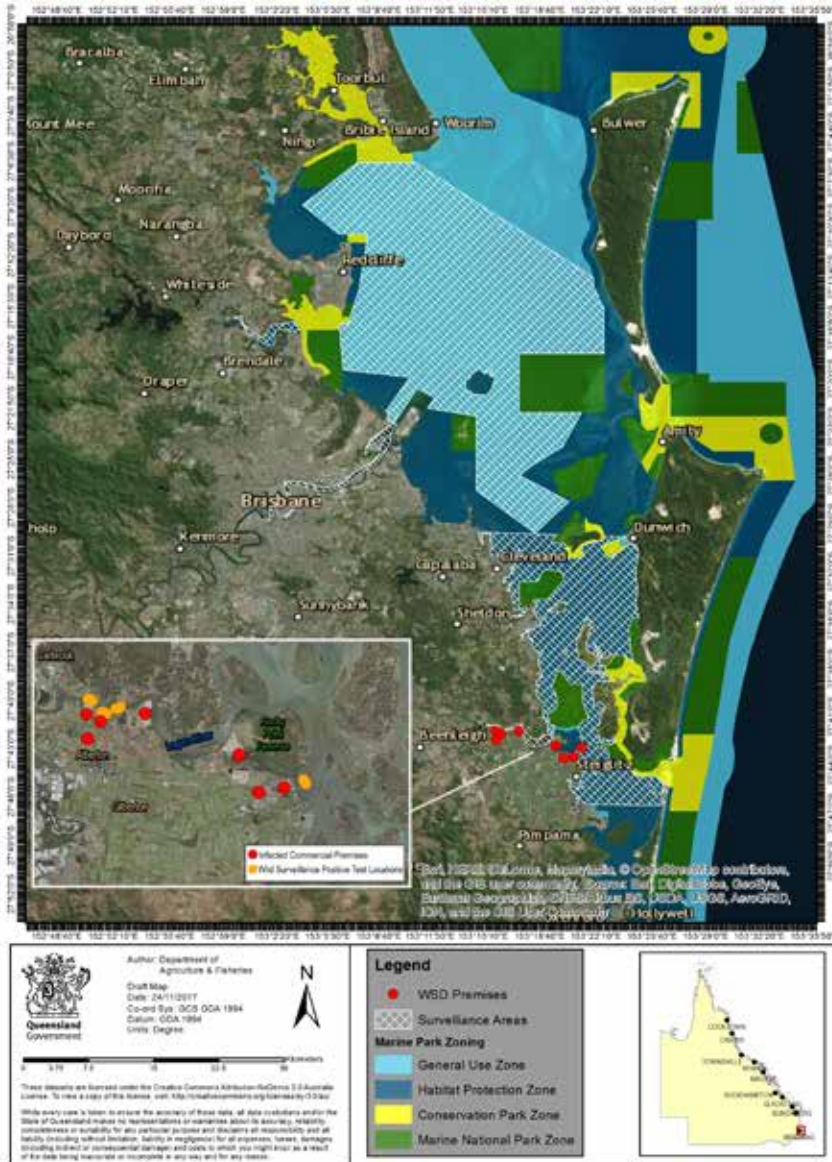


Source: Queensland Department of Agriculture and Fisheries

2.2 Spread to wild crustaceans and further control measures

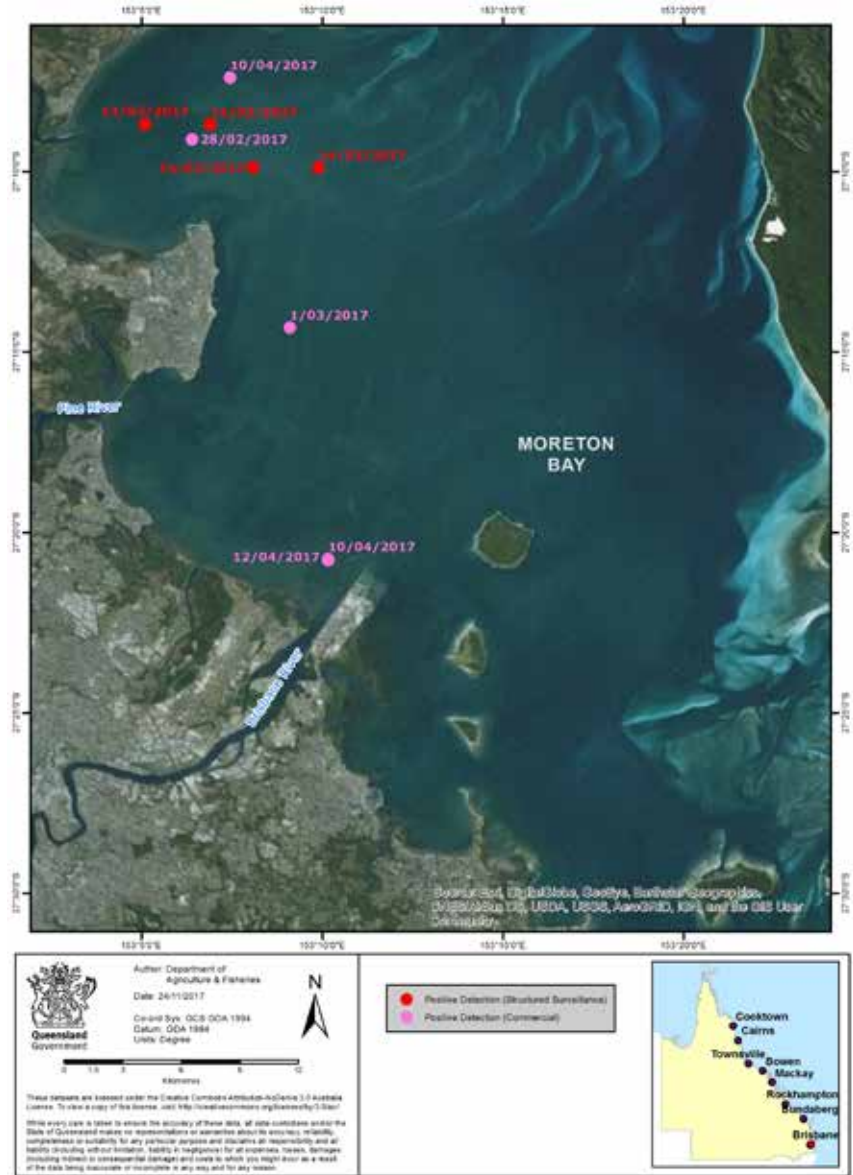
QDAF began sampling prawns and crabs caught near infected prawn farms as soon as the outbreak was confirmed. From December 2016 onward it found WSSV-infected prawns and crabs in the Logan River, then in nearby southern Moreton Bay, and eventually in the north-west of Moreton Bay (Map 2 and Map 3). This led to progressively wider environmental sampling up the east coast of Queensland and down to the NSW border.

MAP 2 White spot disease response surveillance areas, positive detections, Queensland, 1 December 2016 to 11 February 2017



Source: Queensland Department of Agriculture and Fisheries

MAP 3 White spot disease response, positive detections in northern Moreton Bay, Queensland, 28 February to 12 April 2017



Source: Queensland Department of Agriculture and Fisheries

2.2.1 Movement restrictions on uncooked crustaceans

Detection of WSSV in some wild prawns and crabs led to measures to protect other crustacean populations from possible infection. Queensland and other states¹² imposed restrictions on the interstate movement of prawns and other crustaceans. From 1 December 2016 to 16 June 2017 QDAF implemented movement controls over a progressively larger area, commencing with controls over 11P and followed by a movement control order¹³ that prescribed an area covering Morton Bay, extending from Caloundra to the New South Wales border and 100 metres off the eastern coasts of Bribie, Moreton and Stradbroke islands (Map 4). The movement control order prohibited all decapod crustaceans and polychaete worms caught in this area from being moved out of the movement restriction zone unless they were cooked first—because cooking destroys WSSV. Other states applied similar movement restrictions.

At 21 July 2017 Queensland movement restrictions for raw prawns, yabbies and marine worms were still in place¹³. Crabs, lobsters and bugs had been exempted because they were considered most likely to be cooked and eaten rather than used for bait.

MAP 4 Updated movement restriction zone, south-east Queensland, at 7 July 2017



Source: Queensland Department of Agriculture and Fisheries

2.2.2 Fishing restrictions

To help prevent further outbreaks of white spot in south-east Queensland, from 16 June 2017 fishing was prohibited within 100 metres of water intake and outlet channels and in drainage channels used by the infected prawn farms (Map 5). This included line fishing and the use of other fishing equipment such as crab pots, cast nets and yabby pumps.

MAP 5 Fishing restrictions, south-east Queensland, at 7 July 2017



Source: Queensland Department of Agriculture and Fisheries

Table 1 summarises results from the QDAF farmed and wild crustacean surveillance and testing program. From 1 December 2016 to 17 August 2017 QDAF collected samples of wild crustaceans, first in the Logan River and southern Moreton Bay near the infected prawn farms. It then collected more widely using a government-owned research trawler (the *Tom Marshall*) in Moreton Bay and across an extended east coast area. QDAF also obtained samples from commercial fishers. Between 1 December 2016 and 16 June 2017, 24,798 samples of wild prawns were tested for WSSV at the NSW Department of Primary Industries Elizabeth Macarthur Agricultural Institute (EMAI).

The 2017 positive results were low relative to the total samples taken. However, we do not know how exotic WSSV will behave in Australian native animal populations. Several seasons of surveillance may be required before AqCCEAD can determine whether WSSV has established or has disappeared, as was the case with the Darwin WSSV incursion in 2000 (see section 3.4).

In late August 2017 QDAF recommenced surveillance to determine whether WSSV was present in wild crustacean populations within and beyond the movement-restricted area in Queensland. By 12 October 2017 more than 4,120 prawn and crab samples, collected from 94 locations along the east coast of Queensland, as well as the Moreton Bay, Logan River and Brisbane River areas, had tested negative for WSSV. Further sampling will be carried out in early 2018, when the wild prawn populations are expected to be at their maximum production cycles¹⁴.

The OIE requires that such sampling be undertaken systematically for at least two years after the last positive finding to ascertain whether infection in the wild is likely to have died out.

TABLE 1 Surveillance for white spot disease, Queensland, 1 December 2016 to 17 August 2017

Location	Numbers of animals tested			Sites found positive or negative (in one or more samples)
	Prawns	Crabs and other crustaceans	Total	
Queensland prawn farms				
Infected Logan River farms a	17,949	1,777	19,726	Positive
Northern Queensland farms	5,712	94	5,806	Negative
Commercial bait prawns	2,242	0	2,242	Positive
Logan River a	13,217	549	13,766	Positive
Movement control area wild surveillance				
South Moreton Bay (<i>Tom Marshall</i>)	1,391	89	1,480	Negative
North Moreton Bay (<i>Tom Marshall</i>) b	2,052	1,107	3,159	Positive
Sandy Creek (near Logan River)	51	20	71	Negative
Jacobs Well foreshore	0	3	3	Negative
Pine River (commercial)	526	0	526	Negative
Brisbane River (commercial) b	1,320	3	1,323	Positive
Moreton Bay (commercial) b	1,135	29	1,164	Positive
Deception Bay (commercial) b	812	3	815	Positive
Extended east coast wild surveillance				
Bundaberg (commercial)	490	0	490	Negative
Cairns (commercial and recreational)	399	0	399	Negative
Tin Can Bay (commercial)	554	1	555	Negative
Gladstone (commercial)	262	0	262	Negative
Bowen	73	0	73	Negative
Mackay	194	0	194	Negative
Mooloolaba	104	0	104	Negative
Townsville	221	0	221	Negative
Noosa	143	0	143	Negative
Rockhampton	222	0	222	Negative

a Map 2. **b** Map 3.

Source: Queensland Department of Agriculture and Forestry

2.3 WSD outbreak costs

The Australian Government provided \$1.87 million in 2016–17 to help control the spread of WSD and will provide up to \$20 million in 2017–18. During 2016–17 the Queensland Government spent more than \$17 million on the WSD response and has committed up to \$9 million over the two years to 2018–19. Logan River prawn farming industry production losses in 2016–17 were estimated to be \$43 million (excluding their response costs). Of these costs, the Australian and Queensland governments reimbursed or would reimburse \$21.5 million and pledged a further \$30 million for concessional loans.

Commercial fishers also experienced significant business impacts as did other parties in the supply chain such as bait, feed and equipment suppliers, seafood processors and retailers. Recreational fishing activities were also affected throughout south-east Queensland¹⁵.

Between December 2016 and April 2017, the economic impact of the movement control order across the whole extended control zone (between Caloundra and the NSW border) on the gross value of production ('impacted' and 'at risk') of commercial wild fishery (including, beachworms, bloodworms, yabbies, mud and blue swimmer crabs, and prawns) was estimated as \$20.5 million¹⁶.

The Seafood Importers Association of Australasia Inc. estimated that the import suspension resulted in the loss of several thousand tonnes of seafood product that would otherwise have been sold in Australia. The six-month suspension was estimated to cost \$383 million to Australian businesses, with consequent price rises for consumers¹⁷.

2.4 Source of infection of 1IP, Logan River

2.4.1 Diggles study

The Australian Prawn Farmers Association, through the Fisheries Research and Development Corporation, commissioned Dr Ben Diggles to investigate the source of the outbreak. Dr Diggles concluded that retail prawns being used as bait were the most likely source of the infection⁸. He based his findings on the epidemiology and chronology of the disease spread and evidence of significant recreational fishing in and adjacent to the intake canal of 1IP. He also noted that biosecurity breakdowns at the Australian border had resulted in 50 to 54 per cent of imported raw prawns sold in retail outlets being WSSV positive⁸.

The first infected pond on 1IP was at the end of the inlet channel furthest from the Logan River and close to an adjacent road. From here, infected prawns could have been thrown into the channel. However, as Dr Diggles noted, on each new infected farm, the first infected pond was at the end of the inlet channel. This supported his theory that infected crustaceans from upstream were forced to the end of each inlet channel and into each index pond by incoming supply water⁸.

2.4.2 Government study

The Department of Agriculture and Water Resources began investigating the outbreak¹⁰ on 13 December 2016, identifying potential pathways for transmission of the virus. Departmental investigators visited the affected farms and made other detailed inquiries, including purchasing prawns from nearby retail outlets and interviewing recreational fishers in the Logan River area.

Pathways they considered included:

- diseased hatchery broodstock or their progeny,
- imported aquatic feed or feed supplements,
- uncooked imported prawns being used as bait,
- illegal human activity, including the importation of aquaculture equipment or deliberate sabotage,
- that the virus was previously present in Australian wild crustaceans at very low levels, or
- via ballast water¹⁰.

On 13 April 2017 the department's final report on this investigation stated that the true source of the outbreak might never be known¹⁰.

2.4.3 Likelihood of each pathway being the source of infection for 1IP

Hatchery broodstock

Hatchery broodstock are considered an unlikely source of infection for 1IP because the hatchery supplying 1IP with stock also supplied other prawn farms that did not become infected.

Before the WSD outbreak, wild-caught broodstock were already known to have introduced diseases into prawn aquaculture systems, overseas and in Australia. Consequently, in 2005 Queensland required that a health certificate accompany broodstock prawns sourced from interstate. This was strengthened in April 2016 when a screening protocol was developed to test each batch of broodstock for key diseases before they were introduced to Queensland hatcheries, with faecal samples from 20 broodstock prawns and the pleopods (swimming legs) of 20 broodstock prawns submitted for testing. From April 2016 each batch of wild-caught prawns imported from northern Australian waters to Queensland¹⁸ for hatchery broodstock was tested for WSSV and YHD—all returned negative results.

When wild-caught prawns are being prepared for breeding—a process known as 'conditioning broodstock'—they need to be fed a high protein, lipid and cholesterol diet. Formerly crustacean heads and polychaetes (marine worms) were used successfully as supplements. However, these are known to carry a high risk of infection with viruses such as WSSV¹⁹, so most hatchery supplements are now specially formulated mixes of squid, mussels and bloodworms.

Prawn feed or feed supplements

Prawn feed is also considered an unlikely source of the infection because the company supplying 1IP had also supplied several other prawn farms that remained uninfected. Their imported marine raw materials are heat treated to between 85 and 110 °C for 45 minutes, which destroys active viruses²⁰, and the company does not use farmed crustacean material in their feeds.

Prawn meals, even when made with infected prawn material, are not infective if subjected to heat treatment^{21, 22}. However, they may contain traces of viral DNA, which is no longer infective. Modern heat-treated prawn feeds have never been associated with outbreaks of WSSV disease. Article 9.8.3 of the Aquatic Animal Health Code²³ states that import conditions are not required for crustacean meal, crustacean oil and sufficiently cooked crustaceans, irrespective of their prior WSSV status.

Some feed samples from 1IP sent to AAHL by department staff investigating the source of the outbreak were reported to be positive for WSSV. According to the feed company, this was likely to be due to cross-contamination of feed at the farm; the same feed had been sent to other prawn farms and they had not been infected. Furthermore, prepared feed and feed ingredient samples taken from the feed mill were tested at both AAHL and EMAI. All of the feed samples and one of the raw materials tested by AAHL were positive, albeit at very high cut-off levels right on the limit of detection. In contrast, EMAI picked up a positive result for only one sample and at a very high cut-off, indicating an indeterminate result (very low level of DNA or none at all). During six retests, EMAI got positive, negative, positive, negative, negative and negative results—effectively a negative score^{24, 25}.

Previous undetected infection in wild Australian crustaceans

A longstanding wild source for the WSD outbreak is considered highly unlikely. Surveys of Australian wild-caught prawns have consistently proved negative for WSSV^{26, 27} and ongoing testing of Australian prawns re-entering Australia from overseas processing has always been negative²⁸.

In addition, 1IP was far from the river mouth, implying that a wild-sourced disease, if it came from the sea, bypassed farms closer to the marine environment.

Finally, if there is an Australian wild strain of WSSV, why has it taken over 40 years to appear in Australian prawn farms that use wild-sourced broodstock? And why has it not appeared in farms with no effective biosecurity, when other Australian native viruses struck aquaculture ventures last century?

Although various geographical isolates of WSSV with genotypic variability have been identified, they are all classified as a single WSSV species within the genus *Whispovirus*²⁹. When this report was being prepared, QDAF was undertaking genotyping on the WSSV strains isolated from farmed and wild crustaceans during the outbreak investigations, as well as on WSSV strains found in imported prawn products. By November 2017 results confirmed that the outbreaks in farms along the Logan River likely originated from the same source, and that the WSSV in Morton Bay was not a result of spread from Logan River (or vice versa) but had a different albeit closely related genotype³⁰. The origin of the WSSV genotypes from Queensland remains unclear.

Further genotyping of WSSV may assist in identifying the potential country of origin of the virus, but not how it entered the affected farms. A close similarity between the Australian WSSV sequences and any reported from overseas would support a very recent introduction rather than a longstanding endemic WSSV infection in Australian crustaceans.

Ballast water

Ballast water is considered an unlikely source of the WSD outbreak. The OIE states that under laboratory conditions, WSSV is viable for at least 30 days at 30 °C in seawater. In ponds, WSSV is only viable for at least 3 to 4 days³¹. The scarce evidence on persistence of WSSV in the environment suggests that the virus disappears in a relatively short time, especially in the presence of organic matter³². Taw³³ claimed that the virus died within 72 hours in prawn pond water that did not contain suitable hosts.

International ships entering Australian waters must manage ballast water. Under the *Biosecurity Act 2015*, it is an offence to discharge overseas-acquired ballast water in Australian seas. It is a requirement that before arrival in Australian ports or waters, all high-risk ballast water tanks undergo a deep ocean exchange outside the 12 nautical mile limit. This also applies to any towed vessel with the capacity to hold ballast water. Biosecurity officers may conduct a ballast verification and confirm that appropriate ballast exchanges have been completed³⁴. Assuming that these requirements were met, it seems unlikely that unmanaged ballast water was discharged in southern Moreton Bay. However, ballast water or processing waste was suggested as a possible source for the 2011–12 WSSV outbreak in Madagascar and Mozambique³⁵.

Contaminated equipment

Movement of equipment is an unlikely source of infection for 1IP and would, if it occurred, indicate a breakdown in Australian border controls. Used aquaculture equipment is subject to declaration and cleaning at the border; the virus cannot withstand desiccation for more than 3 hours and lives from 3 to 30 days in seawater^{36,37}. However, movement of damp equipment could explain intra-farm movement of the virus once the outbreak began.

Deliberate sabotage

Deliberate illegal activity remains a possible pathway³⁸ and sabotage by illegal introduction of infected prawns into the first infected pond of 1IP cannot be discounted. If that were the case, imported prawns bought at retail outlets would arguably have been the most likely source of infection because of their ready availability.

Apart from preventing infected prawns from being available at the retail level, the only defence against such activity would be very strict on-farm biosecurity.

Imported retail prawns used as bait or berley

The use of imported raw prawns by fishers for bait or berley was considered in the 2009 generic import risk analysis (IRA) to be a relatively minor practice. However, by 2016 the practice had become more common due to population increases and the availability at retail outlets of frozen imported prawn product, which was often far cheaper than comparable product sold in bait shops. Much of this retail product was infected, as shown by various studies. For example, in 2006 the WA and Queensland governments tested 14 batches of raw, peeled imported supermarket prawns (five prawns tested per batch) and found all batches WSSV positive, with a WSSV prevalence from 20 to 100 per cent per batch³⁹. In response to this finding, new risk management measures for uncooked prawn imports were introduced after 2007, and it was assumed the retail prevalence levels would therefore have subsequently decreased. Nevertheless, in 2016–17 around 70 per cent of retail prawns were found to be infected (chapters 7 and 9).

The label ‘not to be used for bait’ was originally required to prevent whole consignments of raw prawns being prepared overseas, imported and sent to bait shops. This can be monitored at the border, but it is not possible or practical for the Australian Government to monitor or enforce bait use other than by exception, as part of a special biosecurity operation.

However, imported uncooked prawns could end up in bait shops if they were being discarded from the human food chain for some reason (for example, past their use by date). Reported price differentials (up to fourfold) between bait and some retail prawns before 2017 could have been motivation for reselling imported prawns in bait shops, but this behaviour was not expected and therefore not looked for.

In view of the findings in this report, I consider that the use of infected imported prawns for bait or berley in the Logan River was a possible pathway of infection for 1IP. Nevertheless, all the possible pathways of WSD entry into Australia, and their risk mitigation, need active consideration by all relevant stakeholders.

Recommendation 1

The department, in consultation with industry and state/territory governments, should review risk mitigation measures for the various pathways for white spot disease to enter and establish in Australia.

Department's response: Agree. The department has commenced a review of the biosecurity risks of, and import conditions for, prawns imported for human consumption. There will be extensive consultation and engagement with aquatic health and production experts in Australian and state/territory government agencies, universities and industry to support the prawn risk review.

2.5 Risks of uncooked prawn imports into Australia led to import suspension, January 2017

At the start of the Logan River outbreak, recreational fishers near IIP were found to be using imported prawns for bait, which subsequently tested positive for WSSV.

- On 19 December 2016 investigators found two fishers, approximately 5 kilometres upstream from the first outbreak, fishing with imported uncooked prawns for human consumption. On 22 December 2016 the department received advice that these prawns had tested positive for WSSV.
- On 14 and 15 December investigators purchased 19 uncooked imported prawn products from retail outlets within 10 kilometres of the infected properties. On 4 January 2017 AAHL notified the department that 14 of the 19 samples had tested positive for WSSV⁴⁰.

The combination of these factors—retail availability of WSSV-positive imported prawns and evidence that these prawns were being used as bait—meant that the level of risk associated with these products had become unacceptable and led to the suspension of uncooked prawn imports into Australia for six months from 6 January 2017.

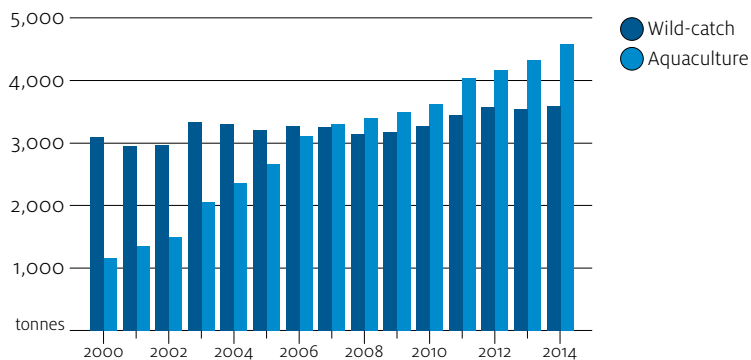
Chapter 3

Prawn production, trade and diseases

3.1 World and Australian prawn industries (wild-caught and farmed)

Prawns (also called penaeid shrimp) have been caught since antiquity, but world commercial catches increased rapidly from the early 20th century with the introduction of engine-powered ships and more efficient trawling technologies. Wild-caught catches have now levelled off at around 3.5 million tonnes per year (Figure 1).

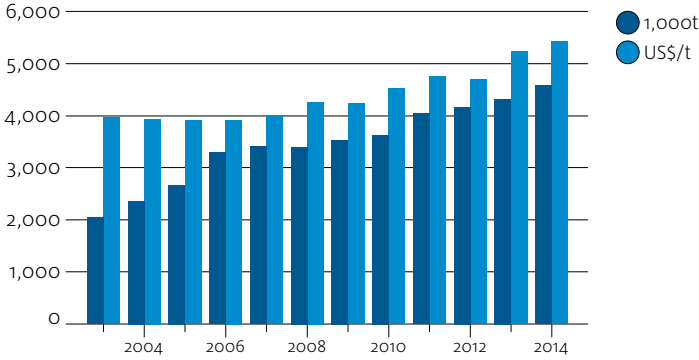
FIGURE 1 World aquaculture and wild-caught prawn production, by volume, 2000 to 2014



Source: Food and Agriculture Organization of the United Nations

Aquaculture of prawns has also increased dramatically since it became commercially viable in the 1970s. By 1980 production was about 72,500 tonnes, about 5 per cent of the world production at that time. Production increased steadily to rival and recently exceed the catch from wild fisheries. Worldwide, aquaculture produced around 4.6 million tonnes of prawns in 2014 (Figure 2), worth about US\$14,000 million⁴¹. The average global price per tonne for aquaculture prawns⁴¹ has changed remarkably little over the past 10 years even though production has doubled. The Global Aquaculture Alliance estimates that production fell by around 10 per cent in 2015 before increasing by about 4 per cent in 2016.

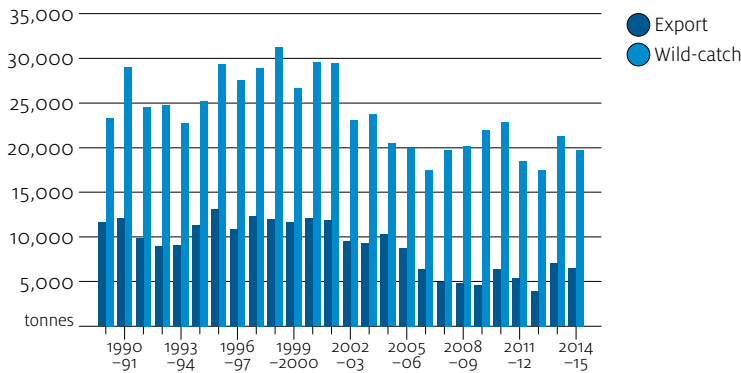
FIGURE 2 World aquaculture production of shrimp, by volume and value, 2003 to 2014



Source: Food and Agriculture Organization of the United Nations

Australia has a long history of commercial and recreational prawn fishing. Prawn trawling began in the 1950s in New South Wales, Queensland and Western Australia. Australia has 15 managed fisheries and many of the companies involved are longstanding family businesses. Commercial fisheries differ from most rural industries because of their reliance on wild stocks and the associated difficulties in harvesting and management⁴². The fall in exports of Australian prawns since about 2001 (Figure 3) is attributed to wild-catch reductions, exchange rate fluctuations and competition on the world market from aquaculture prawns⁴³. About 25,000 tonnes of Australian prawns are produced annually, worth about A\$358 million⁴³.

FIGURE 3 Australian wild-capture prawn fishery production and exports of prawn products, 1989–90 to 2014–15



Source: Australian Bureau of Agricultural and Resource Economics and Sciences

Tropical prawn species are mainly found in tropical and subtropical waters, including Shark Bay in Western Australia, the Northern Territory and Queensland (including Torres Strait) and midway down the New South Wales coast. Map 6 shows the indicative distribution of the main prawn fisheries and commercially important prawn species⁴⁴, listed here (in order of approximate tonnage):

- tiger prawns (*Penaeus esculentus* and *P. semisulcatus*)
- western king prawns (*P. latisulcatus*)
- eastern king prawns (*P. plebejus*)
- banana prawns (*P. merguensis* and *P. indicus*)
- endeavour prawns (*Metapenaeus endeavouri* and *M. ensis*)
- school prawns (*M. macleayi*)
- greasyback prawns (*M. bennettæ*)
- red spot king prawns (*P. longistylus*)
- black tiger prawns (*P. monodon*).

MAP 6 Main prawn species found in Australian waters



Source: Love Australian Prawns campaign

Experimental prawn aquaculture began in the 1980s and by the early 1990s was established in the Northern Territory, Queensland and New South Wales. Production increased steadily as farming practices improved (Figure 4) but then plateaued from 2008 for various reasons, including costs and disease. Sporadic attempts to farm prawns in the Northern Territory by adapting barramundi farms led to one full-time prawn farm operating in 2007; this later ceased due to falling prawn prices⁴⁵. Box 1 describes the overall Australian prawn aquaculture system.

Australian hatcheries have been producing domesticated broodstock of *P. monodon* since at least 1995. Selective breeding from wild-caught Queensland broodstock by CSIRO's Brisbane research farm has resulted in significantly increased productivity⁴⁶. However, the egg production of these selected lines is inferior compared with those of wild-caught females⁴⁷, so hatchery owners still prefer wild-caught prawns⁴⁸. Wild-caught prawns come from the Bonaparte Gulf and northern Queensland. A biosecure prawn hatchery at Exmouth in Western Australia (established in 2013)⁴⁹ and the Broome Aquaculture Center (run by North Regional TAFE⁵⁰) also produce post-larvae from time to time, the last produced by the TAFE being in 2014 using broodstock obtained from WA waters as bycatch from the Northern Prawn Fishery⁵¹. The source of the broodstock for the Exmouth facility is unclear. WA *P. monodon* are a separate genetic stock that has less genetic variation than other Australian populations.

Box 1 Australian prawn aquaculture system

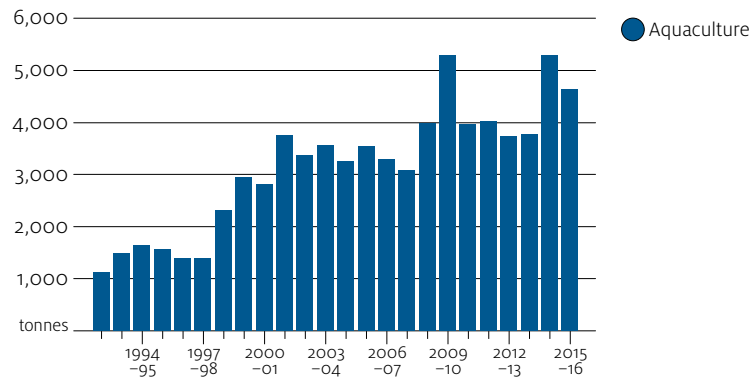
Six hatcheries in Queensland, two in New South Wales and one in Western Australia annually use about 5,000 adult broodstock prawns (comprising *P. monodon*, *P. merguensis* and *P. plebejus*). These are wild-caught from tropical Australian waters and fed a rich high-protein diet to produce large volumes of eggs.

After hatching, the larvae or nauplii moult several times before becoming post-larvae. Post-larvae are shipped to farms each year from September to November for a three to six month grow-out period. During grow-out, the pond water is monitored for quality and regularly changed and the prawns are fed manufactured heat-extruded feed three to four times a day. They are then harvested, most for the Easter market. Settling ponds are used to prevent excessive levels of nitrogen and effluent release into waterways. The grow-out ponds are then drained and left fallow for the next season⁵². Australian prawn farmers achieve a feed conversion ratio of between 1.6:1 and 2.2:1 and produce about 4.5 tonnes of fish per hectare, which is high by world standards.

Before the 2016–17 WSD outbreak, of the 23 prawn farms operating in Australia, 20 were in Queensland (including seven near the Logan River) and three in northern New South Wales, with a total pond area of about 900 hectares (a likely total water volume of 13,500 cubic metres). In 2015–16 Australian prawn aquaculture produced 4,628 tonnes of prawns, worth around \$80,500 million (Figure 4). Compared with Australian wild-caught prawns, Australian aquaculture represents a small but growing proportion of overall domestic prawn production and value (Figure 5).

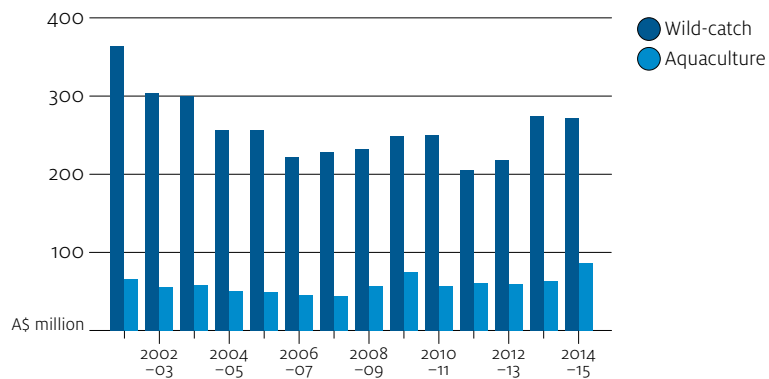
Commercial aquaculture prawn farms need very high investment for initial infrastructure and subsequent running expenditure. Prawn farm start-up costs range between \$100,000 and \$150,000 per hectare of pond, not including land costs⁵³. Capital costs vary depending on proximity to local infrastructure, site topography, vegetation and seawater access. Australian agrifood company Seafarms Group Ltd is developing Project Sea Dragon, a large-scale, integrated, land-based prawn aquaculture project in northern Australia designed to produce high-quality, year-round reliable volumes for export and local markets. Costs involved in this development led Seafarms Group to post a \$19.8 million loss for 2016–17⁵⁴.

FIGURE 4 Australian prawn aquaculture production, 1992–93 to 2015–16



Source: Australian Bureau of Agricultural and Resource Economics and Sciences

FIGURE 5 Value of Australian prawn production, wild-caught and aquaculture, 2001–02 to 2014–15



Source: Australian Bureau of Agricultural and Resource Economics and Sciences

3.2 Prawn disease emergence and impact

In the Americas, prawn aquaculture began to develop in the 1970s, producing post-larvae from wild-caught broodstock to grow out in ponds. Most new diseases were local in extent, derived from the wild broodstock. There was little movement of stock or international trade in prawn products at that time.

Globally, trade and the movement of stocks have contributed to the emergence of a number of serious diseases, including:

- **infectious hypodermal and hematopoietic necrosis virus (IHHNV)**—first recognised in Central America in 1981 and shown to cause acute, catastrophic outbreaks with cumulative mortality rates of about 60 to 90 per cent in semi-intensively or intensively cultured juvenile blue shrimp (*P. stylirostris*) stocks. Infected *P. monodon* can appear healthy, but *P. stylirostris* and *P. vannamei* are very susceptible to infection. By 2006 evidence indicated that the virus may have originated in South-East Asia. Researchers found that prawns in Australia had a benign ancient form of the virus integrated into their genome, which raised questions about the status of Australian prawns with respect to the virulent Asian strain.
- **P. monodon nudivirus (PmNV), formerly known as monodon baculovirus (MBV)**—emerged as a globally distributed problem in prawn aquaculture in the 1980s.
- **necrotising hepatopancreatitis (NHP)**—initially discovered in Texas in 1985, this intracellular bacterial disease is difficult to control and causes substantial mortalities. It spread through the Americas but did not establish in Asia until 2005–06 in Thailand. The disease requires high water temperatures and high salinity (from a prolonged dry season).
- **taura syndrome virus (TSV)** emerged in *P. vannamei* farms in Ecuador in 1991–92 and by 1999 was transmitted with live shrimp to Asia, where losses were severe.
- **white spot syndrome virus (WSSV)** emerged in China in 1992, and by the end of the 1990s had become endemic in all countries in Asia and the Americas. WSSV is spread mainly by translocation of live prawns for aquaculture or by imported uncooked prawns or their processing waste finding their way inadvertently into aquatic environments^{55,56,57}. Between 1995 and 1999 WSSV travelled in frozen shrimp to the eastern United States, where it spread to wild populations via processing wastes. The most recent outbreaks of WSD were in Brazil (2005), Saudi Arabia (2010–11), Mozambique (2011), Brunei and Madagascar (2012) and Queensland, Australia (2016–17). WSSV can infect a wide range of aquatic crustaceans such as marine, brackish and freshwater prawns, crabs and freshwater crayfish, including the highly susceptible Australian yabby *Cherax destructor*⁵⁸ and the Louisiana crawfish. No decapod crustacean has been found that is resistant⁵⁹. Vectors for the virus also include rotifers, marine molluscs, worms, non-decapod crustaceans, such as brine shrimp (*Artemia salina*), and copepods, slaters and certain insect larvae⁶⁰.

Losses from the 1992–93 WSSV outbreaks in Asia alone were estimated at US\$6 billion⁶¹. WSSV continues to cause major economic losses to Asian prawn farmers though they now farm lower-value, more resistant species. The virus has become more virulent and shows deletions in the genome—these are used to study patterns of spread. The most severe recent outbreaks have been in Vietnam (2014–16), southern China (2015–16) and India (2016). In early 2017 the media reported⁶² that huge quantities of raw prawns from Vietnam, Thailand, Ecuador

and Mexico were being smuggled into China for processing and sale as ‘product of China’ and to fill production quotas^{62,63}. Likewise, in 2016 Vietnam had imported over 300,000 tonnes of prawns for processing and re-export⁶⁴. WSD in 3,907 hectare of shrimp ponds in the Mekong Delta, Vietnam in 2015 resulted in losses estimated at US\$ 8.02 million. WSD is still estimated to cause annual losses of over US\$1 billion globally⁶⁵.

- **yellow head disease (YHD)**—appeared in Thailand in 1990, causing extensive prawn mortality and severe production losses. It is caused by genotype 1 of a single-stranded RNA virus (genus *Okavirus*, family Roniviridae, order Nidovirales). Six genotypes are known, but only genotype 1 is internationally notifiable. The related Australian gill-associated virus (GAV) is designated genotype 2 and causes reduced production⁶⁶. Genotypes 3 to 6 occur commonly in healthy *P. monodon* in East Africa, Asia and Australia and rarely or never cause disease.
- **infectious myonecrosis virus (IMNV)**—emerged in the Americas in 2002. By 2005 it had been transported to Java, Indonesia in live *P. vannamei*, presumably through smuggled broodstock from Brazil for commercial hatchery use⁶⁷, and was listed as notifiable by OIE.
- **acute hepatopancreatic necrosis disease (AHPND)**—emerged in China in 2009, spread to Vietnam and reached Mexico in 2013. It is commonly referred to as early mortality syndrome because mortality occurs early in the production cycle, about 35 to 45 days after shrimp are stocked. By 2014 a phage-modified *Vibrio parahaemolyticus* bacterium was shown to be the cause. This disease reduced Thailand’s prawn production from 600,000 tonnes in 2011 to 200,000 tonnes in 2014⁶⁸. It is spread by live animal movement, lax farm biosecurity, the use of live feeds such as polychaetes for hatchery broodstock conditioning, and ballast water. It is killed by freezing.
- **covert mortality nodavirus (CMNV)**—began in China in 2009, with losses of up to 80 per cent, and is so-called because prawns die in the bottom of the pond and are not seen.

Prawn diseases will likely continue to emerge for two reasons. Firstly, prawns commonly carry a range of viral diseases and their ability to sequester viruses may be a part of their immune response system⁶⁹. Secondly, prawn viruses have strong links to insect viruses, and cross-infection has been postulated but not proved⁷⁰.

From 1981 to 2012 infectious prawn diseases cost an estimated US\$10.6 billion worldwide⁷¹. As a result, international farming practices have changed, moving from wild-caught broodstock to specific pathogen free (SPF) hatchery production. Since 2000 many prawn farmers have shifted from *P. monodon* to *P. vannamei*, which is relatively resistant to WSSV^{68,71}. By 2006 *P. vannamei* was the dominant farmed shrimp in most countries except Australia, where it is an exotic species. Australia has been able to continue to farm the larger, higher value but more WSSV-susceptible *P. monodon*, but this situation may change if WSSV becomes established.

3.3 Australian prawn diseases

In 1980 the first evidence of viral infections in Australian wild-caught prawns was found in electron micrographs of baculovirus-like histopathology in *Metapenaeus ensis* from north-east Torres Strait⁷². The first recorded viral disease in Australia's developing aquaculture industry was monodon baculovirus (now known as *P. monodon nudivirus*) in 1987⁷³. By 1995 some 12 viral diseases had been described^{74, 75, 76}. Prawns from WA waters have viruses derived from Indian Ocean (not eastern Australian) populations⁷⁵.

In the past, Australian aquaculture farms acquired endemic viruses associated with wild-catch fisheries. This was often directly associated with the use of wild broodstock for hatchery post-larvae production⁷⁴. Broodstock were harvested from NT and WA waters with little consideration of disease risks. The spread of gill-associated virus into the Joseph Bonaparte Gulf was attributed to escapes of diseased prawns from NT farms³⁸. From the early 2000s Western Australia and Queensland developed protocols to manage prawn broodstock translocations. In 2005 these governments worked with industry to conduct a translocation risk assessment⁷⁷.

Despite this history of broodstock-acquired diseases, and ongoing submissions to the Australian Government about the dangers of prawn imports, adoption of biosecurity management on Australian prawn farms has lagged behind world's best practice^{78, 79}.

A complete list of aquatic animal diseases and infectious agents reported in Australia since 1970 is in Appendix D.

3.4 'The Darwin incident'—incursion of WSSV in 2000

On 15 November 2000 a box of frozen prawns labelled 'Cocktail prawns' and 'Product of Indonesia' was identified at the Darwin Aquaculture Centre, an NT Government research facility built in 1998 in Darwin Harbour. The box had been bought from a Darwin wholesaler on the understanding that the prawns were of Australian origin—the centre was following the policy of feeding only locally caught prawns to its fish stock to prevent disease incursion. As a result of this discovery, the centre conducted an immediate audit of the origin of earlier batches of prawns. One audited batch containing boxes labelled 'River prawns' had been purchased commercially. It was assumed that the batch contained 'Product of Australia' even though the boxes had no labelling to indicate their origin. When questioned, the wholesaler indicated that these 'River prawns' may have been imported from Indonesia via Perth or Adelaide.

Disease was not evident in the Darwin Aquaculture Centre's crabs or prawns. However, as a precaution against transmission of exotic diseases all crustaceans at the centre were destroyed, feeding of prawns stopped and holding tanks and all associated equipment disinfected. Representative samples of crab tissue were collected for testing for WSSV.

On 20 November 2000 the Deputy Director of the NT Department of Primary Industry and Fisheries (NT DPIF) informed the Australian Chief Veterinary Officer (ACVO) of this incident and the actions taken. The ACVO then informed state and territory CVOs and Directors of Fisheries. A CCEAD Joint Technical Working Group on Imported Prawns subsequently oversaw the technical response.

Following an audit of all NT institutions holding fish or shellfish, the NT DPIF identified that the Territory Wildlife Park had been feeding raw prawns to fish in its aquariums and to the raptors in its bird collection. The prawns were labelled 'Product of Australia', but there was concern that they may have been caught in Indonesian waters by Australian boats.

The Darwin Aquaculture School of the Northern Territory University had been using uncooked prawns to feed its black tiger prawns (*P. monodon*). The cultured prawns were killed, samples were sent for testing and the facility was disinfected.

By early December 2000 PCR results found WSSV in:

- prawns imported from Indonesia,
- Darwin Aquaculture School's cultured *P. monodon*, which had been fed the imported prawns,
- Darwin Aquaculture Centre's cultured mud crabs, which had been fed the imported prawns, and
- wild shore crabs and prawns adjacent to the discharge outlet of the Darwin Aquaculture Centre, Darwin Harbour.

This led to several national initiatives:

- i.** A 2001 national survey to determine the WSSV status of Australian wild and farmed crustaceans (including prawns and crabs)²⁶ showed that Australia was still free of WSSV, and infection in the shore crabs at Darwin no longer detectable. The WSSV PCR test developed by AAHL for the 2001 survey⁸⁰ would form the basis of the 'AAHL test' used subsequently by AAHL.
- ii.** The Department of Agriculture and Water Resources implemented controls to avoid a recurrence of this incident and to protect Australia's valuable aquaculture industries and the environment. Proposed controls included the department:
 - a** mandating interim conditions for the importation of uncooked prawns from all sources⁸¹, including testing of whole and unpeeled headless uncooked prawns from countries or zones unable to demonstrate freedom from WSSV; this required the prawns to enter a quarantine freezer in Australia, where samples would be tested. Shipments that were positive would either be destroyed or re-exported,
 - b** developing an education⁸² campaign with states and territories targeted at bait wholesalers, recreational fishers and restaurants,
 - c** developing codes of practice with industry for importers and domestic producers of prawns in the handling of waste, and
 - d** working with states and territories towards imposing post-entry controls to prevent diversion of imported prawns for bait⁸³.

Amendments to the interim import conditions continued until 2009, but over time most of the other initiatives lapsed.

Chapter 4

Regulatory control of biosecurity risks in Australia

4.1 International obligations

Biosecurity restrictions on imports must conform to Australia's rights and obligations as a WTO member country. These rights and obligations derive principally from the WTO SPS agreement, proclaimed in 1995. Specific international guidelines on risk analysis developed under the OIE are also relevant. The WTO SPS agreement provides for the following:

- A WTO member determines the level of sanitary and phytosanitary protection it deems appropriate, known as the appropriate level of protection or ALOP.
- An importing member has the sovereign right to take measures to achieve the level of protection it deems appropriate to protect human, animal or plant life or health within its territory.
- An SPS measure must be based on scientific principles and must not be maintained without sufficient scientific evidence. An SPS measure is any measure applied to protect human, animal or plant life or health within the member's territory from risks arising from the entry of pests and diseases or from contaminants in food.
- An importing member must avoid arbitrary or unjustifiable distinctions in the levels of protection it considers to be appropriate in different situations, if such distinctions result in discrimination or a disguised restriction on international trade.
- An SPS measure must not be more trade restrictive than required to achieve an importing member's ALOP, taking into account technical and economic feasibility.
- Where a relevant international standard, guideline or recommendation does not exist or where, in order to achieve an importing member's ALOP, a measure needs to provide a higher level of protection than accorded by the relevant international standard, such a measure must be based on a risk assessment; the risk assessment must take into account available scientific evidence and relevant economic factors.

- Where the relevant scientific evidence is insufficient, an importing member may provisionally adopt SPS measures on the basis of available pertinent information. In such circumstances, members shall seek to obtain the additional information necessary for a more objective assessment of risk, and review the SPS measures accordingly within a reasonable period of time. An importing member must recognise the concepts of pest- or disease-free areas and areas of low pest or disease prevalence, and shall take into account, inter alia, the level of prevalence of specific pests or diseases, the existence of eradication or control programs and appropriate criteria and guidelines that may be developed by the relevant international organisations.

A dispute about Canadian salmon imports to Australia from 1995 to 2000 (Box 2) had significant implications for the way Australia was to conduct import risk analyses. It showed that the WTO SPS agreement, backed by the WTO dispute settlement procedure, can exert very substantial discipline over design and implementation of quarantine restrictions.

Box 2 Case study on SPS application—the Canadian salmon dispute

Australia's prawn import risk analysis process began in 1996 while a dispute with Canada over importing salmon was still being resolved.

October 1995—under WTO dispute provisions, Canada requested consultations with Australia over the prohibition of imports of salmon from Canada, alleging this was inconsistent with the WTO SPS agreement. Consultations were not successful.

March 1997—Canada requested the establishment of a disputes panel.

June 1998—the panel report was circulated to members. The panel found against Australia, who appealed.

October 1998—the Appellate Body report was circulated to members. As a result, Australia carried out new import risk assessments on non-viable salmonids and salmonid products, non-viable marine finfish, and live ornamental fish imports.

July 1999—Australia announced proposed new measures on salmonids/salmonid products. However, some aspects were again contested by Canada through further dispute settlement panel proceedings.

February 2000—the panel found that Australia's requirement that imported fresh chilled or frozen salmon (other than from New Zealand) be imported in consumer-ready form was not supported by the risk assessment and was more trade restrictive than necessary to meet Australia's ALOP.

May 2000—the case was finally resolved after subsequent negotiation between the parties that saw Canadian salmon permitted into Australia under specified conditions, but not into Tasmania⁸⁴.

4.1.1 Australia's appropriate level of protection

The WTO SPS agreement defines the concept of an ALOP⁸⁵ (pp. 86–87). Australia's ALOP is expressed qualitatively as being 'a high level of sanitary and phytosanitary protection, aimed at reducing risk to a very low level but not to zero'. Successive Australian governments have adopted this conservative approach to managing biosecurity risks, reflecting community expectations about the importance of maintaining Australia's relative freedom from exotic pests and diseases.

Under this approach, commodities may not be imported unless biosecurity risks are reduced to a level consistent with Australia's ALOP. The Australian Government uses risk analyses to consider the level of biosecurity risk associated with importation of animals and animal material, consistent with SPS obligations and noting relevant OIE animal health standards.

If the Director of Biosecurity finds that the risks associated with importing a commodity exceeds the level of risk acceptable to Australia, appropriate risk management measures are proposed to reduce them to that level. If biosecurity risks cannot be reduced to an acceptable level, those imports are not permitted.

Australia exports approximately two-thirds of its agricultural production. Compliance with SPS rules and obligations allows Australia to expect similar compliance from its trading partners. This provides Australian exporters with significant benefits in accessing overseas markets.

4.2 National regulatory framework

Australia manages the biosecurity risks associated with trade through the Department of Agriculture and Water Resources. As the lead regulatory authority, the department undertakes risk assessments and imposes various pre-border and border management measures to minimise the entry of regulated aquatic diseases into Australia through imported prawns and prawn products. Australia's territorial sea extends from the coast out to 12 nautical miles. States and territories are responsible for biosecurity risk management and aquatic disease control within their boundaries, including 3 nautical miles out to sea. The Australian Government has jurisdiction in the Australian Fishing Zone, from 3 to 200 nautical miles from the shore. However, these arrangements are frequently varied through instruments known as Offshore Constitutional Settlement arrangements.

4.2.1 Change from the *Quarantine Act 1908* to the *Biosecurity Act 2015*

Biosecurity regulation was managed under the Commonwealth *Quarantine Act 1908* until 16 June 2016, when the Commonwealth *Biosecurity Act 2015* commenced. The *Quarantine Act 1908* had been designed to combat serious human diseases such as plague and yellow fever, rather than to cope with the complexity of biosecurity challenges posed by modern rapid movements of people and goods around the world, and the volumes entering Australia by sea and air.

However, the *Biosecurity Act 2015* aims to reflect a shared responsibility for biosecurity between government, business, industries, trading partners and the community. It provides a much better range of enforcement measures appropriate to achieve the regulatory outcome sought and reflect the level of biosecurity risk posed.

The change of legislation required a massive internal overhaul of policies, procedures, guidelines and training, as well as extensive stakeholder engagement. Implementation went smoothly and inspection and enforcement activities continued, but departmental resources were extremely stretched in the process.

4.2.2 Intergovernmental Agreement on Biosecurity (IGAB)

The IGAB, which came into effect in January 2012⁸⁶, is an agreement between the Australian Government and all state and territory governments except Tasmania. It has strengthened the working partnership between governments to deliver national biosecurity system improvements that minimise the impact of pests and diseases on Australia's economy, environment and the community. A recent review⁸⁶ has reaffirmed its value and re-prioritised areas for collaboration between governments.

The first deliverable under the IGAB was the National Environmental Biosecurity Response Agreement (NEBRA)⁸⁷. The NEBRA sets out emergency response arrangements (including cost-sharing) for responding to biosecurity incidents that primarily affect the environment and/or social amenity and where the response is for the public good. It includes marine pest incursions and other incidents that are not covered under the Emergency Animal Disease Response Agreement (EADRA)⁸⁸ or Emergency Plant Pest Response Deed (EPPRD). The Australian and all state and territory governments are signatories to the NEBRA.

4.3 Sharing responsibility between governments and industry

4.3.1 Animal Health Australia and the Emergency Animal Disease Response Agreement

The concept of biosecurity being a shared responsibility has been incorporated into Australia's biosecurity programs for many years. Governments alone cannot deliver biosecurity—agricultural industries must also be involved. This has been recognised since the 1990s with the formation of Animal Health Australia (AHA) and Plant Health Australia (PHA), and the inclusion of industry with governments in formal cost-sharing agreements for emergency animal and plant pest and disease incursion preparedness and response. All governments and relevant industries are involved in a range of national biosecurity cost-shared programs and in ongoing national surveillance, quarantine and compliance programs. These agreements have been invaluable in clarifying the roles of Australian, state and territory governments and industry in implementing their shared responsibility for post-border biosecurity outcomes. The agreements outline how industry and governments manage and fund responses to pest and disease outbreaks and detail roles and responsibilities for all participants and agreed cost-sharing formulas.

The EADRA (ratified in March 2002⁸⁸) is a formal, legally binding agreement (or deed) for managing and funding responses to emergency terrestrial animal disease incidents. The signatories are AHA, the Australian Government, all state and territory governments and 14 livestock industry bodies. The EPPRD binds PHA, governments and plant industry organisations in managing and funding emergency plant pest and disease responses.

4.3.2 Emergency Aquatic Animal Disease Response Agreement

The existing agreements do not cover diseases affecting aquatic animals or the industries that rely on them. Extending the existing terrestrial EADRA has long been considered for aquatic animal industries but found inappropriate for several reasons, including the different operating environment and the wide range of stakeholders other than ‘farmers’ (the EADRA focuses on farmers). Marine aquaculture industries in Australia exist in a continuum, with wild fish stocks that are of interest to recreational fishers, indigenous communities, tourism operators and the general public. In some jurisdictions, the state legally owns the wild fish. Other jurisdictions have a ‘commons’ approach and most wild-capture fisheries industries do not ‘own’ the fish until it is legally caught. In such a diverse environment, it is difficult to resolve issues such as compensation and associated levies to recover monies spent on biosecurity. Nevertheless, aquatic industries and governments recognised that stronger cooperative arrangements were desirable to improve the management of aquatic emergency animal diseases.

In October 2014 AHA commenced managing a new four-year project (funded by the department) to develop a formal government–industry emergency aquatic animal disease response agreement. An Aquatic Deed Working Group was formed, with representatives from governments and all major aquaculture and wild-capture industry sectors (tuna, abalone, salmon, prawns, edible oysters, pearl oysters, barramundi and aquarium industries).

The IGAB review panel identified an emergency response deed for aquatic animals as one of the deliverables under ‘National priority pests and diseases’, a key priority reform area⁸⁹ and recommended that it be finalised within 18 months of the IGAB review report⁸⁹.

4.3.3 Industry biosecurity plans

Industry biosecurity plans (IBPs) are industry-specific documents that identify and prioritise current and future biosecurity challenges for the industry and provide a framework for risk mitigation and preparedness activities. Each IBP describes how a specific industry operates in Australia and identifies exotic pests that could negatively affect that industry. It also guides the implementation of future biosecurity activity and post-response recovery to prevent or minimise the impact of an emergency animal disease incident. Various risk mitigation activities are considered during development of an IBP:

- biosecurity management—biosecurity officers implementing and coordinating biosecurity activities for the industry and biosecurity reference groups,
- on-farm biosecurity practices—farm biosecurity manual development and inclusion of biosecurity in industry best management practice,
- practices and/or quality assurance schemes—promotion of biosecurity signage, farm hygiene and surveillance, development of modules for testing on-farm biosecurity,
- surveillance—collection of surveillance data in a national database, increased general surveillance and implementation of surveillance for high-priority pests (for market access and/or early detection),
- development of pest-specific documents for high-priority pests—contingency plans or business continuity plans, fact sheets and posters, pest risk reviews, diagnostic protocols,

- awareness activities—biosecurity awareness campaign, promotion of biosecurity practices to farmers and development of extension material, and
- training of industry personnel—in the application of the EADRA and aquatic deed and in on-farm training programs for best practice biosecurity.

4.3.4 Aquaculture Farm Biosecurity Plan

In 2016 the Sub-Committee on Aquatic Animal Health released *Aquaculture Farm Biosecurity Plan for prawn aquaculture in Australia: generic guidelines and template*⁹⁰ to guide the development of biosecurity plans for application at the farm level. It is not targeted at a specific aquaculture sector but could be adapted for specific aquaculture sectors (for example, prawn farming).

4.4 Governance of laboratory testing for international trade quality assurance

4.4.1 International OIE reference laboratories

OIE reference laboratories are designated to pursue the scientific and technical problems relating to a named disease. The OIE also designates an expert (a leading and active researcher) who is responsible to the OIE and its member countries. The expert helps the reference laboratory provide scientific and technical assistance and expert advice on topics linked to diagnosis and control of the named disease. Reference laboratories also provide scientific and technical training for personnel from OIE member countries and coordinate scientific and technical studies with other laboratories or organisations, including through the OIE Laboratory Twinning program.

4.4.2 Australian national reference laboratories

Australian national animal health reference laboratories⁹¹ and designated experts have a role in Australia that aligns with the OIE's definitions of a reference laboratory. They are reviewed annually by the Australian Animal Health Committee (AHC). As with the OIE and NATA, AHC recognition of a reference laboratory depends on the expertise of named staff in that laboratory. The section of QDAF's BSL is an Australian national reference laboratory for WSSV, as is CSIRO's Australian Animal Health Laboratory (AAHL), based in Geelong, Victoria, which is a high-security laboratory for emergency animal disease diagnosis and research. AAHL has its own aquatic research team, the AAHL Fish Diseases Laboratory.

4.4.3 ISO/IEC 17025 and NATA laboratory accreditation

The International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) jointly publish *ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories*. This standard is used by testing and calibration laboratories worldwide. Accreditation to the standard is mandatory for laboratories seeking to be deemed technically competent. In many cases, suppliers and regulatory authorities will not accept test or calibration results from a laboratory that is not accredited. Accreditation is provided through organisations affiliated to the International Laboratory Accreditation Corporation (ILAC). ILAC's vision is 'tested once, accepted everywhere', which is critical in facilitating exports. ILAC established a global mutual recognition arrangement in 2000 to assist international trade. Under this arrangement, accreditation bodies must be evaluated every four years to ensure they comply with international standards.

NATA is a private not-for-profit Australian company whose members are testing laboratories. NATA's primary role is to facilitate provision of a reliable calibration, measurement, testing and inspection infrastructure to government, industry and the wider community. It provides independent assurance of technical competence for laboratory testing and the means for laboratories to meet the auditing requirements of ISO/IEC 17025.

The Australian Government and NATA are signatories to a memorandum of understanding that recognises NATA's role as the national authority for accreditation of laboratories and covers a number of government policy and regulatory interests. Under the memorandum, the department maintains a partnership with NATA for the quality assurance of national veterinary testing.

NATA, in a published 'scope of accreditation' for each laboratory, states that its accreditation is 'the procedure by which NATA gives formal recognition that a facility is competent to carry out specific tasks'. NATA lists the specific activities that an accredited facility has been peer assessed for and confirms that the facility has demonstrated its competence and capability. To gain accreditation, staff (not their qualifications) must be deemed competent to perform specific activities. NATA emphasises that 'The best management systems will never compensate for an inadequate level of practical competence in an organisation and this competence must be demonstrated collectively through peer assessment as part of the accreditation process'.

4.4.4 National animal health laboratory coordination

Valid laboratory results are essential for diagnosis, surveillance and trade and can only be achieved by the use of quality-assured management practices. Australia's Animal Health Committee (AHC) coordinates arrangements to maintain and continuously improve the national animal health diagnostic laboratory quality assurance system. Committee members include the chief veterinary officers of the Australian, state and territory governments and of New Zealand, representatives from AAHL, the Department of Agriculture and Water Resources and the Department of the Environment and Energy.

From 1990 to 2014 AHC managed arrangements through its Sub-Committee on Animal Health Laboratory Standards (SCAHLs). Initially, SCAHLs members were from Australian and NZ government laboratories, then later from private, university and public health laboratories, Animal Health Australia (AHA) and NATA. By 2014 the functions of SCAHLs included:

- Overseeing the Laboratories for Emergency Animal Disease Diagnosis and Response (LEADDR) network to ensure rapid and effective responses to major emergency animal disease incidents. Network members represent all government veterinary laboratories and the Department of Agriculture and Water Resources. The network, coordinated by AAHL, aims to standardise or harmonise testing platforms and assays for targeted emergency animal diseases.
- Overseeing laboratory proficiency testing activities of the Australian National Quality Assurance Program (ANQAP) and other relevant quality assurance functions, including liaison with NATA and other laboratory quality assurance providers through NATA's Veterinary Testing Accreditation Advisory Committee.
- Maintaining and improving Australian and NZ standard diagnostic procedures (ANZSDP) in support of official testing for endemic and emergency animal diseases in Australia and New Zealand, consistent with international standards.

- Encouraging new or modified test development and evaluation, and maintaining an online register of test methods suitable for national emergency animal diseases.
- Nominating and monitoring Australian national reference laboratories for the testing of specific diseases to support national disease control and management programs.
- Promoting laboratory biosafety and biosecurity matters associated with the holding and testing of specimens and materials containing animal and zoonotic disease agents.
- Fostering national laboratory capability and performance standards through appropriate training programs and opportunities for developing relevant professional skills.
- Supporting the role and functions of the OIE National Focal Point for Veterinary Laboratories.

In 2014 SCAHLS was abolished as part of a regular government review of committees. However, in 2015 an AHC review of SCAHLS functions supported the need for its continuation and new arrangements to rationalise its coordination or management. Most activities are now coordinated by an AHC National Laboratory Task Group, with administrative support and national and international coordination provided by the Department of Agriculture and Water Resources. This task group liaises with other stakeholders, including university, private and industry laboratory experts and bodies, to address specific laboratory topics as needed.

A notable change from former arrangements is that aquatic animal health laboratory diagnostics are now managed by AHC's Sub-committee on Aquatic Animal Health (SCAAH). SCAAH's purpose is to provide scientific, technical and strategic advice to the AHC on aquatic animal health issues. Its core members are Australian and NZ government, AAHL and university representatives (normally aquatic animal health specialists). Other academic or private specialists are co-opted when needed.

This arrangement is understandable given the huge diversity of aquatic animals and their varied health issues. However, laboratory diagnostic testing for aquatic animal diseases should also be subject to national coordination and oversight through the National Laboratory Task Group, especially in regard to quality assurance and test standardisation.

4.4.5 Departmental approval for laboratories to conduct import testing

Under the *Biosecurity Act 2015*, the Department of Agriculture and Water Resources has a national policy and regulatory role in approved arrangements concerning biocontainment facilities.

The department also approves government and private laboratories to carry out import testing. It has separate approval processes and requirements for handling specimens that may contain exotic pathogens, and technical requirements for the performance of different tests.

Chapter 5

Generic import risk analysis (IRA) for prawns, 2009

5.1 Development of import conditions before and during the IRA process

Before 1992 the Australian Government did not have an animal health-related policy for prawn imports. The only restriction on these products related to insect contamination of dried prawn imports. From 1992 to 2010 an emerging awareness of disease risks resulted in import requirements being progressively strengthened.

Uncooked prawn meal and feed making its way into prawn hatcheries was considered the most direct and high-risk pathway into Australia of WSSV and other diseases. In 1992 the Australian Government Department of Primary Industries and Energy introduced a requirement for import permits for imported prawn meal and feeds, with the condition that these products be heat treated to inactivate any virus present.

In 1996 the National Taskforce on Imported Fish and Fish Products⁹² recommended that the importation of prawns and prawn products be reviewed as a high priority. Recognising the high risks of disease introduction if imported uncooked prawns were used for bait, the department 'banned' the import of uncooked prawns for bait use by requiring that all uncooked prawn imports be labelled 'For human consumption only—not to be used for bait or feed for aquatic animals'. The aim was to prevent bait sellers from importing wholesale quantities of prawns, but it was understood that the measure would not prevent recreational fishers from using imported raw prawns as bait.

In 1997 the department initiated a *Generic import risk assessment for prawns and prawn product*. It focused on biosecurity risks associated with imports of prawns for human consumption and the potential use of imported prawns as bait or aquaculture feed. A risk assessment team of aquatic disease experts from around Australia ('the IRA team') worked on this for 12 years, releasing the final IRA in late 2009. Because of the length of the project, team membership changed substantially over the 12 years.

The 2009 IRA³⁹ was produced under the *Quarantine Act 1908* (Cth) and followed the procedures outlined in the 2007 *Import risk analysis handbook*⁹³, a work developed out of the findings of the Canadian WTO court challenge. The 2009 IRA-recommended prawn import conditions were accepted and implemented by the Australian Government Department of Agriculture, Fisheries and Forestry, delivering a policy that at the time was believed to be consistent with government policy and characterised by sound science, transparency, fairness and consistency³⁹ (sec. 1.3.2),⁹³.

5.1.1 2009 IRA risk management targets

The IRA team reviewed the risks that pathogens might pose to Australia's prawn and other crustacean industries and populations. They found a small number whose unrestricted risk estimate (Table 2) was deemed not to achieve Australia's ALOP. For these pathogens, risk management measures would be necessary to reduce the associated risk to an acceptable level.

TABLE 2 Unrestricted risk estimate for prawn pathogenic agents

Pathogenic agent	Unrestricted annual risk
White spot syndrome virus (WSSV)	High
Yellow head virus (YHV)	High
Necrotising hepatopancreatitis bacterium (NHPB)	Moderate (for chilled product only)
Taura syndrome virus (TSV)	Low

Source: Biosecurity Australia (2009)

The team then considered pre-import and post-import measures that might be applied, including the recommendations in the international standard for trade in aquatic animal products⁹⁴.

Each measure and combination of measures was evaluated to determine its effect on the likelihood of the pathogenic agent entering Australia and/or the likelihood of susceptible host animals becoming exposed. Where the effect was to reduce the overall annual risk to 'very low' or lower, the measure was deemed acceptable.

From 2008 onward, any attempt by Australia to ban the importation of raw prawns because of a perceived risk from WSSV would have faced a challenge from importers or competent authorities in exporting countries. This would have involved the WTO Disputes panel⁹⁵. As a result, the team developed an approach aimed at minimising but not eliminating potential risks.

5.1.2 Management options considered in the IRA to reduce disease entry risks

Option 1 Sourcing imports from disease-free countries or zones

This was expected to reduce the overall risk associated with each pathogenic agent to meet Australia's ALOP—subject to a satisfactory assessment of the country's competent authority and its capacity to determine and maintain disease freedom. In practice, this was a limited option because only New Caledonia was recognised as free of WSSV.

Option 2 Pathogen inactivation—cooking or freezing

Importation of prawns could be permitted subject to cooking offshore in a premises approved by and under the control of the competent authority. This would ensure inactivation of the pathogenic agent(s) of concern. Alternatively, prawns could be cooked post-arrival, at a quarantine approved premises in Australia.

Typically, cooking raw prawns involves placing the product in potable boiling water at 100 °C for short periods (for example, 3 to 5 minutes) until the product is cooked through (protein is coagulated) and neither raw on the inside nor overcooked.

In 2009 wild-caught prawns were usually cooked on board trawlers following the guidelines in *Handling prawns at sea: a guide for prawn trawler crew at level 1*⁹⁶. The 2009 IRA quoted these guidelines and an FAO guideline⁹⁷:

When boiling prawns at a ratio of 1 kg raw prawns to 20 litres of water (with 3–5 per cent salt), the temperature of the water will fall to approximately 95 °C when the prawns are added and then return to the boil in 1–2 minutes. At least 3 minutes total cooking time is usually sufficient.

The size and quality of the prawn will determine the amount of cooking time required to ensure that the whole prawn is completely cooked (all protein is coagulated). This is normally determined through experimentation by the seafood processor. Winkel⁹⁸, in an evaluation of the cooking process for Australian farmed *P. monodon*, recommended cooking prawns to a core temperature of 85 °C to ensure the product is marketable—completely cooked, not chewy, has no black spot and is aesthetically acceptable. Winkel⁹⁸ graded uncooked prawns by weight, from 11 to 28 grams. Depending on weight, the prawns took from between 2.40 and 4.55 minutes to reach a core temperature of 85 °C from a starting temperature of 20 °C.

The IRA team considered that cooking prawns in boiling water for short periods such as those quoted by Winkel⁹⁸ would be sufficient to kill many prawn pathogens (including WSSV)³¹ or substantially reduce more robust pathogenic agents. They acknowledged that standard commercial cooking practices may not inactivate or may only partially inactivate viruses of concern such as TSV.

Cooking was also expected to significantly reduce the likelihood of imported prawns being diverted for use as bait or as crustacean broodstock feed or being further processed in Australia (given the limited value-adding processing options following cooking).

Consequently, the IRA team expected cooking to reduce the partial likelihood of release and exposure to at least 'very low' and therefore reduce the overall risk to an acceptable level. Freezing was expected to inactivate some agents such as NHPB but not viruses such as WSSV, YHV and TSV.

Option 3 Testing

The testing of imported uncooked prawns on arrival in Australia at a government-approved laboratory was another option that the IRA team considered for managing disease risk. Under this option, only batches that tested negative would be released for retail sale. Testing was required to be to a standard consistent with that recommended in the OIE Manual of diagnostic tests for aquatic animals⁶⁰ or equivalent. The standard provides 95 per cent confidence of detecting the agent if it is present in the tested batch at a prevalence of 5 per cent or more.

The IRA recognised that the approach could result in a small number of infected prawns entering Australia, but this had been occurring for a long time without controls and without disease establishment. The goal was to minimise risk, consistent with Australia's ALOP.

The IRA also specified that the option of testing offshore should be considered case by case. The decision to test would depend on whether:

- the overseas competent authority had the ability and capacity to audit and provide assurance that the testing standards and test validity met the requirements of Australian Government authorities, and
- product integrity had been maintained throughout the chain of custody.

Given uncertainty at the time about the sensitivity of available tests for prawn pathogens, this option alone was not expected to reduce the likelihood of entry and exposure sufficiently to reduce the overall risk to an acceptable level.

Option 4 Highly processed prawns

The IRA team determined that imported uncooked prawns that had been highly processed could be permitted. This included all shelled, headless prawn products that were coated for human consumption, such as those that were breaded, battered or marinated to a minimum standard or prepared in dumplings, spring rolls, samosas, rolls, balls, dim sums or similar products. Such measures were expected to reduce the risk of uncooked prawn heads and shells entering Australian waters. It would also reduce the likelihood of unintended end-use such as for recreational fishing bait—recreational fishers showed a preference for heads-on prawns⁹⁹ and were less likely to use the more costly highly processed prawns. This option was expected to reduce the likelihood of exposure to at least ‘very low’ and therefore achieve Australia’s ALOP.

Option 5 Minimum size

One of the early risk management measures introduced during development of the IRA was to only permit imported prawns that were above a minimum size. At the time, research indicated that recreational fishers preferred small whole prawns. This measure was expected to reduce the likelihood of imported prawns being used as recreational fishing bait.

A national bait and berley survey in 2002⁹⁹ and a follow-up survey in 2006, reported in 2007¹⁰⁰, found anecdotal evidence that some recreational fishers used peeled uncooked prawns purchased from retail seafood outlets as bait. The proportion of fishers using these prawns in 2002 was relatively low (about 6 per cent) but had increased to about 8 per cent in 2006. In the 2002 survey, fishers reported a preference for whole uncooked prawns in smaller size categories (less than 13 centimetres).

The IRA team recognised that the effectiveness of minimum size restrictions would be significantly reduced if fishers purchased larger prawns and then cut them into smaller pieces for use as bait. However, the results of the 2006 follow-up survey showed that this practice was not common.

Minimum size restrictions were not expected to reduce the likelihood of farmed or hatchery crustacean broodstock being fed imported whole prawns. Nor were such limits expected to significantly reduce the likelihood of prawns destined for import being harvested from a pond as a disease outbreak started to minimise disease-related losses. Therefore, minimum size restrictions alone were not considered likely to reduce the overall risk to an acceptable level.

Option 6 Labelling for human consumption

Labelling of imported prawns 'For human consumption only—not to be used as bait or feed for aquatic animals' might reduce the likelihood of exposure by making the intended end-use clear and prevent diversion at wholesale level. However, because this labelling was not always displayed at retail sale, the IRA team recognised that members of the general public were probably unaware that the product should not be used as bait. This labelling option alone was not considered likely to reduce the overall risk to an acceptable level.

Option 7 Post-harvest inspection to ensure absence of clinical signs of disease

The IRA team also considered the option of having the overseas competent authority verify that prawns destined for import showed no signs of clinical disease on post-harvest inspection. This measure was expected to reduce the number of clinically infected prawns in imports and reduce the number of prawns containing significant amounts of pathogenic agent. However, because many of the diseases of concern could result in subclinical infection, the IRA team considered the verification option would provide only a minimal level of risk reduction.

Option 8 Head/shell removal

The IRA team considered the option of allowing importation of uncooked prawns with their heads and shells removed (except for the last shell segments and tail fans). This would be subject to offshore inspection and attestation by the overseas competent authority and post-arrival verification by the Australian Quarantine Inspection Service (AQIS). For those pathogenic agents deemed to require risk management, this measure would reduce the amount of agent present in prawns by at least half (strictly on a weight basis) and thereby the likelihood of release. In an infected prawn, the cephalothorax (fused head and thorax) contains about half of the total amount of WSSV and the tail shell about one third¹⁰¹.

The IRA team considered that head and shell removal would not completely eliminate any of the pathogenic agents. It would eliminate the risk of imported prawn peelings (shells and heads) being discarded into Australian waterways. It would also reduce the risk of unintended end-use, such as for recreational bait/berley or feed for hatchery broodstock. Recreational fishers were unlikely to pay higher prices for peeled prawns and reportedly preferred head-on prawns, and farmers did not favour using peeled prawns as hatchery broodstock feed.

The likelihood of this option reducing the release and/or exposure of a pathogen would depend on the nature of the pathogenic agent of concern.

Option 9 Sourcing from wild stocks

The IRA team considered allowing the import of wild-caught prawns from populations that had been tested, found free of pathogenic agents of concern and verified by the overseas competent authority. This measure might reduce the amount of hazard present in prawns, thereby reducing the likelihood of release.

The IRA team found this option was unfeasible because existing audit procedures in most exporting countries would not enable competent authorities to verify the product. However, they recognised that it might be possible to introduce species restrictions, so only species known not to be farmed were permitted entry. The effectiveness of such measures would depend on the pathogenic agent of concern, as well as the practicality of setting up and ensuring compliance with a system for prawn species identification. This option was not considered further.

5.1.3 Pathogenic agent-specific risk management measures for WSSV

The overall unrestricted risk associated with WSSV was estimated as 'high'. Of the pathogenic agents covered in this risk analysis, the highest likelihood of entry and exposure was associated with WSSV. The likelihood of WSSV entry and exposure was calculated as 'low' for farmed crustaceans (exposure group 1) and 'high' for both hatchery populations (exposure group 2) and wild crustaceans (exposure group 3).

The IRA team considered that the following risk management measures would each reduce the overall WSSV risk from 'high' to at least 'very low' and therefore achieve Australia's ALOP:

- Option 1 Country or zone freedom—expected to meet Australia's ALOP.
- Option 2 Cooking—expected to reduce the likelihood of WSSV entry and exposure to 'negligible' for exposure groups 1 and 2 and to at least 'extremely low' for group 3³⁹ (p. 171).
- Option 3 Testing and option 8 Head/shell removal—expected, in combination, to reduce the likelihood of WSSV entry and exposure to 'extremely low' for exposure groups 1 and 2 and to at least 'very low' for group 3³⁹ (p. 171).
- Option 4 High level of processing—expected to reduce the likelihood of WSSV entry and exposure to 'negligible' for exposure groups 1 and 2 and to at least 'very low' for group 3³⁹ (p. 171).

5.1.4 Interim 2001 import conditions introduced testing requirement

The first draft of the IRA for uncooked prawns for human consumption was released in 2000¹⁰². This report, and the Darwin incident described in section 3.4, led the department to introduce interim 2001 import conditions¹⁰³, aimed at managing WSSV and YHV risks. These included:

- a ban on uncooked, whole prawns weighing less than 15 grams (to minimise use as bait),
- health certification by the overseas competent authority that prawns had not been emergency harvested, and
- post-arrival AQIS inspection and testing for WSSV and YHV in Australia of all imported batches of uncooked whole prawns or unpeeled headless prawns.

As a result, few or no consignments of uncooked prawns appear to have arrived in the first year of this requirement being in place.

5.1.5 Interim 2002 import conditions exempted 'highly processed' prawns from testing

After a public workshop in May 2002, the department introduced additional interim 2002 conditions¹⁰⁴. These allowed the importation of 'highly processed' uncooked prawns or prawn products without the requirement to undergo WSSV and YHV testing. These products were defined as uncooked prawns or prawn products that:

- had been peeled to at least the last tail segment
- were breaded or battered
- had a finished product grade size count of at least 21 to 25 per pound (55 per kilogram)
- were packaged in lots of no more than 3 kilograms in weight.

It was expected that these highly processed prawns would not be diverted from human consumption for use as bait.

5.1.6 2006 revised draft IRA report considered emerging disease risks

In August 2004 the IRA team identified a need for trials on the susceptibility of selected species of Australian crustaceans to taura syndrome virus (TSV). This research was tendered out to the University of Arizona's Aquaculture Pathology Laboratory. By late 2005, the department determined that, given the increased availability of imported farmed vannamei prawns (*Litopenaeus vannamei*) from Asia and the spread of TSV to Asia from the Americas, importation of frozen vannamei prawns presented an unacceptable quarantine risk. However, the department considered that the interim measures targeting WSSV and YHV introduced in 2001 would address this TSV risk, pending completion of the IRA.

The 2006 IRA also introduced measures to address risks posed by two emerging disease threats: infectious hypodermal and hematopoietic necrosis virus (IHHNV) and necrotising hepatopancreatitis bacterium (NHPB).

In 2006 the WA and Queensland state governments conducted PCR testing of 14 batches of raw peeled imported supermarket prawns (5 prawns tested per batch) and found all batches WSSV positive, with WSSV prevalence of 20 to 100 per cent per batch³⁹.

In November 2006 a revised draft IRA report¹⁰⁵ proposed that imported uncooked prawns and prawn products for human consumption be either:

- sourced from a country that is recognised by Australia to be free of WSSV, YHV, IHHNV, TSV and NHPB to the satisfaction of Australian Government authorities, or
- headless and peeled (except for the last shell segment and tail fans), and each imported batch held on arrival in Australia under quarantine control and tested and found to be free of WSSV, YHV and IHHNV, or
- highly processed (headless and peeled except for the last shell segment and tail fans) and coated for human consumption by being breaded (crumbed) or battered, or the uncooked prawn meat processed into dumplings, spring rolls, samosas, rolls, balls, dim sums or similar products, or

- cooked in premises approved by and under the control of the competent authority to a standard where all the protein in the prawn meat is coagulated, no uncooked meat remains and the core temperature of the prawn or prawn product reaches 85 °C.

It was considered that any one of these measures would reduce the quarantine risks to a 'very low level', consistent with Australia's conservative approach to quarantine.

5.1.7 Interim 2007 import conditions added a new category of 'marinated prawns'

After receiving 51 stakeholder submissions on the 2006 revised draft IRA¹⁰⁶, the department conducted further industry consultation. As a result, the interim 2007 conditions¹⁰⁷ included more stringent conditions such as the requirement that both head and shell be removed from all uncooked prawns and each batch be virus tested for WSSV, YHV, and IHNV.

In response to the 2006 submissions, the department expanded the definition of the 'highly processed' prawn category to include a subcategory of marinated prawns and marinara mix. This would allow more uncooked prawns to be brought into Australia without virus testing, provided they were satisfactorily marinated.

In their submission to this IGB review¹⁰⁸, the Seafood Importers Association of Australasia Inc. emphasised that not testing product in the 'marinated prawns and marinara mix' subcategory would not pose a greater risk of disease introduction. The subcategory was:

... designed to provide a greater level of confidence that prawns would be used as intended in foodservice outlets (that is, consumed); difficult for anglers to access; and to be less appealing as bait. It was assumed that this would negate the need for testing. Supporting this were minimum standards for the type and percentage of ingredients used, verified by manufacturers' declaration and photos.

Two requirements were removed from the interim 2007 conditions:

- Competent authorities were no longer required to certify that batches of uncooked prawns had not been emergency harvested. The department considered such certification impossible, partly because it was difficult to distinguish genuine small species of prawns from emergency harvested prawns.
- Minimum size requirements on certain classes of highly processed prawns were lifted due to demand for small prawns in marinara mixes, cocktails and stir-fry, and the expectation that these types of prawns would go to the food service industry.

5.1.8 Interim 2008 import conditions removed IHNV testing requirement

As early as 2007 Australian prawns were known to have an infectious hypodermal and haematopoietic necrosis virus (IHNV) integrated sequence in their genome. This sequence is also known to occur in Madagascar prawn populations and is considered non-infectious. However, in 2008 (shortly after the release of the 2007 draft IRA) the Seafood Importers Association of Australasia Inc. commissioned a laboratory in Thailand to test for the infectious strain of IHNV in Australian prawns from a farm in northern Queensland¹⁰⁹. The positive results were reported to the Australian Chief Veterinary Officer and subsequently confirmed by AAHL.

On the basis of this finding, the department removed the requirement for IHNV testing from the interim 2008 conditions¹¹⁰. This meant that prawns sourced from New Caledonia, which was WSSV and YHV free but IHNV positive, could be imported to Australia without the requirement to test for IHNV. The infectious strain has not been detected in Queensland since 2008¹¹¹.

In 2009 a draft final IRA report was assessed by the independent Eminent Scientists Group¹¹² to ensure stakeholder comments had been taken into account. Most of the submissions received were outside the grounds of appeal that the Eminent Scientists' Group could consider. Several changes were made to the draft final IRA report, but no significant changes were made to the final recommended risk management measures contained in the 2008 interim conditions.

5.1.9 Final 2009 IRA report

The final 2009 IRA report recommended that imported prawns either:

- be sourced from a country or zone that is recognised by Australia to be free of WSSV, YHV and TSV; and in addition, NHPB (for chilled or unfrozen product), or
- have heads and shells removed (except for the last shell segments and tail fans); if prawns are not from a disease-free source, each batch must be tested on arrival and test negative for WSSV and YHV, or
- be 'highly processed' (heads and shells-off except for the last shell segments and tail fans), and coated for human consumption by being breaded or battered, marinated in a wet or dry marinade, marinated and placed on skewers, or processed into dumplings, spring rolls, samosas, rolls, balls, dim sums or similar products, or
- be cooked to a standard where all protein is coagulated and no uncooked meat remains¹¹³.

The final IRA report was issued in October 2009 with a 30-day appeal period. Four appeals were received: two from countries exporting prawns to Australia, one from the Seafood Importers Association of Australasia Inc. and one from the Australian Prawn Farmers Association (APFA). By December 2009 the IRA Appeals Panel had disallowed the four appeals because they were outside the grounds of appeal that it could consider^{39, 114}.

The basis of the APFA appeal was that:

- there is no evidence that marination of prawns or washing the flesh of raw prawns denatures viruses in dead prawns; therefore, the import of marinated prawns constitutes an unacceptable risk,
- there is no evidence that the pathological strain of IHNV exists in natural populations in east coast prawn stocks or that there is exchange between the populations of the Northern Territory and the east coast; therefore, the import of prawns without risk management measures for IHNV constitutes an unacceptable risk, and
- the import of prawns from other than a disease-free source without TSV testing of each batch constitutes an unacceptable risk.

5.1.10 Final 2010 import conditions

In 2010 the Director of Animal and Plant Quarantine determined that the import of prawns and prawn products to Australia could continue, subject to the *Quarantine Act 1908* and the application of sanitary measures specified in the finalised 2009 IRA³⁹. The final measures in the determination¹¹⁵ were not significantly different from the interim measures implemented in October 2007 and amended in September 2008. Changes included:

- removal of risk management measures for IHNNV due to the presence of this agent in Australia,
- inclusion of marinated products in the 'highly processed' product category, subject to inspection, and
- clarification that risk management measures for NHPB only applied to unfrozen product.

5.2 Achieving an appropriate level of protection

It is clear from careful examination of the recommendations of the 2009 prawn IRA that the level of WSSV-infected prawns that would be tolerated was not zero. The IRA accepted that the testing regime proposed was incapable of detecting all infected prawns. Instead, the intention was to reduce the level of infected prawns to a 'level consistent with the ALOP'.

The authors of the IRA seem to have assumed that:

- only a small percentage of imported uncooked prawns available for retail sale would be WSSV or YHD positive,
- a small proportion of retail uncooked prawns might be used as bait, but only a few of these would be infected,
- most recreational fishers would continue to buy bait at bait shops because it would be cheaper and more suitable for their needs than buying retail prawns,
- most prawns used as bait would be eaten by fish rather than crustaceans; even if infected, this prawn meat would not last uneaten long enough to transmit disease or cause a transient or more long-lasting infection in the wild, and
- as most recreational fishers would not be near prawn farms that are close to only a very small proportion of the Australian coastline, an even smaller number of any infected prawns used as bait would be used near prawn farms, so the resultant risks of infecting one or more of those prawn farms would be negligible. The IRA did not address the possibility that recreational fishers would fish in the inlet channels to prawn farms.

However, these assumptions were not clearly expressed in the IRA, and verification measures were not put in place to check that any of them were holding true over time.

An important consideration when evaluating the effectiveness of risk management measures is the ability to confirm that the measure will be properly implemented and deliver the desired effect^{39 (p. 165)}.

Another important consideration not included in the IRA was that Australia had imported substantial volumes of frozen prawns from WSSV-affected countries such as Thailand since the discovery of the virulent pathogen in that country in 1994. As a result, an increasing number of infected prawns could have been used for broodstock conditioning (as in the Darwin incursion in 2000)³⁹ (p. 183) or for bait. However, apart from the Darwin incident, Australia had no known incursions of WSSV over the 14 years to 2010. Indeed the Darwin incident seemed to highlight the difficulty the virus faced in establishing and spreading ongoing infection in the wild³⁹ (p. 114).

The various conditions exempting types of highly processed prawns from testing, while verifying at the border that they met various definitions of 'highly processed', clearly assumed that any such products once sold would virtually always be cooked and eaten by people rather than being used as bait. Consequently, such prawns might be infected but pose no risks.

Any practice that contradicted these assumptions could materially change the level of risk.

The 2009 IRA identified the use of imported uncooked prawns as bait or berley as a high-risk pathway³⁹. Internationally, the main method of spreading WSSV virus has been through feeding dead infected prawns to naive prawn populations²⁶. To gain an understanding of the likely use of prawns by recreational fishers, in 2007 the IRA authors had commissioned a survey of recreational fishers⁹⁹ from the company that surveyed this demographic in 2002¹⁰⁰. The authors determined that, if the recommended controls were in place, the risk of an incursion by this pathway was low enough to meet the ALOP. However, by 2016 circumstances had changed because of a failure to ensure that:

- the level of infected prawns on the market remained at the low level assumed by the IRA,
- imported uncooked prawns were not diverted to the bait market, and
- recreational fishers were aware of the advice not to use imported prawns as bait.

The department did not conduct ongoing or periodic assessments to determine whether critical (but implicit) assumptions in the IRA were being achieved. In particular, there was no verification that only low levels of WSSV-infected prawns were detectable at retail outlets. Rather, the department failed to seriously consider the possibility that higher levels of WSSV detections at retail outlets might dangerously increase the risk of spillovers of virus and disease into wild or farmed prawn populations. Because this potential increase in risk was not being measured systematically, it could not be communicated to key stakeholders such as prawn farmers and relevant state/territory government agencies.

The role of prawn farmers in maintaining good on-farm biosecurity that might protect them from such an event was not included in the risk estimation. Like many other Australian agricultural producers that have not experienced a pest or disease outbreak, prawn farmers assumed (or hoped, despite misgivings) that the system of pre-border and border controls set up under the IRA would protect them, and that they would not need to go to the lengths required of overseas prawn farmers in protecting their farms.

The failure to keep WSSV out of Australia was later identified by the department in Senate hearings^{116 (p.29)}:

The results of our compliance investigation known as Operation Cattai, show that the following three factors resulted in infected prawns being available for sale at retail. These factors are: testing methods; our inspection practices; and importer behaviour. Firstly, on testing methods, the variation in methods used by individual laboratories contributed to an inconsistent approach to determining infection rates in prawns.

However, I consider that a major underlying cause of failure was a lack of verification that the import controls, and especially sampling and testing processes, were working as originally envisaged by the team who wrote the IRA. As detailed in this report, the sampling and testing regime prescribed by the IRA was extremely complex and costly to deliver reliably; and it was never implemented in a way that would deliver the intent of the IRA.

5.3 Sampling and testing a batch of imported prawns for WSSV and YHV

The introduction of a requirement to test some categories of uncooked prawns post-import to establish whether individual batches were infected with WSSV and YHV was fraught with difficulty. The basic technical parameters for Australia's prescribed regime were developed using highly skilled epidemiological and laboratory technical expertise. Assumptions about how some biosecurity risks would be managed by the sampling and testing regime were dependent on its precise implementation over time. This proved to be unachievable in practice.

5.3.1 Sampling

Prawn consignments often arrive in container loads weighing up to 20 tonnes, and each container may consist of one or more batches. The 2009 IRA defined a batch as 'a population from a different pond population or fishing period population'^{39 (p. 178)} and assumed that within a group of prawns harvested from the same pond or caught at sea on the same day, any diseased prawns were likely to be reasonably evenly distributed within the batch.

In practice, farms in Thailand range from less than 1 hectare to nearly 30 hectares in production water surface area. Farms in Vietnam are much smaller, generally less than 3 hectares. The average size of prawn farms in Thailand is 6.96 ± 1.36 hectares per farm, compared with only 1.76 ± 0.61 hectares per farm in Vietnam¹¹⁷. Average pond production (based on two harvests per year) is 17.7 ± 2.0 metric tonnes per hectare per year in Thailand and 9.3 ± 1.9 metric tonnes per hectare per year in Vietnam. This means that a 20-tonne container, filled after one or more production runs at a processing factory, could contain prawns from either a single large pond or from up to 40 small ponds (at the minimum 0.5 tonne per hectare).

The sampling regime implemented in the 2007 interim import conditions is still in use today. It was designed to detect the agent if present at 5 per cent prevalence or greater, with 95 per cent confidence (the OIE standard). Statistical modelling, accurately applied to a true random sampling regime, shows that a surprisingly small number of samples will accurately reflect the true prevalence within a large batch of prawns. If true random samples are taken from each batch, it can be calculated statistically that, to detect a within-batch prevalence of at least 5 per cent with 95 per cent confidence, a total of 65 prawns (5 from each of 13 cartons) must be collected and tested with a highly sensitive test. If a lower prevalence (level of infected prawns) is targeted, more prawns need to be sampled and tested. For example, for surveillance for proof of freedom, a 95 per cent chance of detecting an infected population where 2 per cent or more of animals are infected (the OIE standard), would require a sample of 149 prawns per batch to be tested (assuming a test of 100 per cent sensitivity and specificity)¹¹⁸.

If each batch of uncooked prawns is sampled randomly to detect a within-batch prevalence of ≥ 5 per cent with 95 per cent confidence, there is about a 3.5 per cent chance of not finding any infected prawn in a sample of 65 prawns from a population 'batch' with a true prevalence of 5 per cent infected (using the formula $\text{Risk} = (1 - \text{prevalence})^n$, where n is the sample size).

This assumption and definition of a batch are critical to the sampling regime's ability to deliver a meaningful result. If more than one 'batch' is sampled as one, test-positive or negative prawns may be clustered such that a random sample of the whole consignment may not accurately reflect the true prevalence within the batch. A container load will consist of 10×1 -kilogram packets in a carton, and 1,800 boxes in a container. The prawn packets within a carton will be non-random and the boxes will be non-random with respect to disease, so the assumptions around the 13×5 are violated.

True random sampling may be carried out by selecting cartons in an order prescribed by a chart of random numbers or even by a simple roll of the dice on each decision. Counterintuitively, random sampling will not be achieved by a person picking boxes 'at random' because various biases will come into play (for example, the first box in a large series is almost never selected).

This calculation did not take into account the likely mixing of multiple batches at the prawn processing factory, non-homogeneity of the batch and whether differences in the prevalence of infected batches being presented for processing and then import might affect the risks of the sampling and testing regime being able to deliver the target prevalence and confidence level.

The prawn sampling regime prescribed in the 2007 import conditions was designed to find a target prevalence of virus-infected prawns present in a pond. It is unsuitable for sampling a full container of up to 20 tonnes of processed prawns from an unknown number of farms or ponds. This means that the 2007 sampling regime is inadequate for finding the design prevalence of a targeted virus in a typical import consignment.

The inadequacy of the 2007 sampling regime was revealed during this review, when clear articulation of both the problem and a potential solution emerged from a multidisciplinary discussion. The discussion canvassed the possibility that a much greater statistical rigour might be achieved by taking 1 prawn from each of 65 randomly selected cartons. It would take no longer for two inspectors attending a full seals-intact inspection to collect, and cost no more to test, than the existing regime. If statistically validated, a revised sampling regime could be shared with overseas competent authorities.

Recommendation 2

The department should, as a priority, review the sampling regime for consignments of imported uncooked prawns and prawn products.

Department's response: Agree. An improved sampling process for consignments of imported uncooked prawns and prawn products has been implemented. Sampling regimes will also be considered in the prawn risk review.

5.3.2 Test sensitivity and specificity

The 'sensitivity' of a test for WSSV is a measure of its ability to correctly identify all the prawns (in a sample) that are infected with WSSV. The higher the test sensitivity, the lower the proportion of truly infected prawns that will not be detected (false negatives). A test with 100 per cent sensitivity correctly identifies all prawns that are infected. A test with 90 per cent sensitivity will miss 10 per cent of the infected prawns.

The 'specificity' of a test is a measure of its ability to correctly identify all the prawns (in a sample) that do not have WSSV. A test with 90 per cent specificity will correctly identify 90 per cent of prawns that were free of WSSV (true negatives), but it will also classify 10 per cent of the samples as positive when they are not (false positives).

No test is 100 per cent sensitive and 100 per cent specific. There is normally some trade-off. A very sensitive test that will correctly pick up all positives is likely to find some false positives, and a very specific test is likely to miss some truly positive samples but correctly identify all negative samples. A less sensitive test will lead to false negative results, which may allow virus-positive material to move across the border. A less specific test will lead to false positive results, which could support regulatory decisions to export or destroy high-value cargo.

The purpose of the test will also determine whether a more sensitive or more specific test is needed. For example, establishing whether WSSV is present in the wild requires a highly specific test that minimises false positives. In contrast, preventing a disease agent from entering the country through trade requires a highly sensitive test to catch and exclude as many infected products as possible.

To approach the ideal target of 100 per cent for both parameters, a two-step testing regime can be implemented, with tests of varying sensitivity and specificity. In this case, it is normal to screen samples using a more sensitive test first to find as many positive samples as possible. The potential positives are then tested using a highly specific confirmatory test to eliminate false positives without increasing the risk of missing some true positives.

Reversing the order of testing will reduce the efficiency of the process. If the screening test is less sensitive than the confirmatory test, and the confirmatory test is less specific than the screening test, the screening test will find fewer true positives and confirmatory testing is likely to find more false positives.

A 2007 departmental report¹¹⁹ recognised the tension between achieving high sensitivity and high specificity in prawn import testing. When considering the 2007 import conditions, which specified testing for three diseases (WSSV, YHV and IHHNV), Morris et al.¹²⁰ identified an increase in levels of false positives when multiple tests were applied to the same sample. The issue of false positives (low specificity) is greatly exacerbated when a consignment has to pass three separate tests. This is called parallel test interpretation (positive to any one of the tests is a fail). In parallel test interpretation, sensitivity is increased but specificity is reduced. The interim 2008 import conditions did not include IHHNV on the list of diseases to be tested for, so problems associated with parallel test interpretation were not as great as they could have been.

5.3.3 Testing prawns for WSSV by polymerase chain reaction (PCR) tests

The PCR technique was developed in the 1980s and early 1990s and is known as conventional PCR. A modification to improve sensitivity and specificity involves two successive runs of PCR, the second set amplifying a secondary target within the first run product. This is known as a “nested PCR”. In the mid 1990s it was also realised that the PCR reaction could be monitored using a fluorescent label bound to the accumulating PCR product. This fluorescence could be measured “in real time” thus is known as quantitative real time (RT) or qPCR.

Box 3 Quantitative polymerase chain reaction (qPCR) test for white spot syndrome virus

Prawns are tested for WSSV by the quantitative real time (q)PCR. This involves preparing a sample of DNA from prawns in a solution containing tiny fragments of a single strand of target viral DNA (known as a primer or probe) and precursor chemicals for building DNA (a ‘mastermix’). This mixture is put through a series of heating and cooling cycles. As the solution is heated, the existing DNA in the sample uncoils and if any matching DNA is present, the primer will bind to the targeted DNA uncoiled strand. An enzyme called polymerase detects the newly bound primer/target DNA compound and at each heating and cooling cycle this enzyme exponentially amplifies or doubles the targeted DNA (a ‘chain reaction’) and causes the release of a fluorescent compound.

The testing machine detects the increasing fluorescent signal, and when this crosses a threshold (the cycle threshold or C_t value) calculated by the PCR system software, the sample is considered WSSV positive. If no signal is detected or it does not reach the threshold, the sample is considered WSSV negative. Because the primer is tiny and will only bind with an exactly (or almost exactly) matching DNA sequence, PCR can detect tiny fragments of target DNA in a sample.

The higher the C_t value found in a qPCR test, the lower the amount of viral DNA present in the sample. Running the qPCR for more cycles may increase the sensitivity—picking up and amplifying very tiny DNA fragments—but eventually decrease the specificity of the test, due to amplification of non-target DNA, fluorescence caused by primer-primer interaction or increasing machine errors^{121, 122, 123}. To determine how many virus copies were in the tested sample, the sample is subjected to PCR reaction alongside a serially diluted synthetic DNA standard. After reaction, the PCR system software automatically determines the C_t value for each PCR sample. Based on the C_t values, the software calculates the standard curve for standard dilution and determines the WSSV copy number for the DNA samples by extrapolating values from the standard curve.

In 2007 the department sought expressions of interest to test imported prawns at the border using PCR methods recommended by the OIE. Most tests recommended by the OIE are designed to support targeted surveillance and diagnosis for freedom from disease. The OIE tests for WSSV are published in chapter 2.2.8 of its *Manual of diagnostic tests for aquatic animals*⁶⁰. As of November 2016, the OIE referred to the following PCR tests for WSSV:

- Two-step PCR test called a ‘nested PCR’, described by Lo et al. in 1996¹²⁴. This test is commonly used by prawn farmers in South-East Asia to test for WSSV in post-larvae (PLs) prawns at the hatchery. PLs that are positive at the first step have a heavy viral load, meaning they are likely to succumb to WSD before harvest. PLs that are only positive at the second step—called ‘one-step negative two-step positive PLs’—are safer to use because the low level of virus detected by the two-step nested PCR ensures that a successful harvest can be achieved before an outbreak occurs⁶⁰. The second step will detect 50 WSSV copies per 10 ng of total DNA.
- ‘TaqMan[®] qPCR’, described by Durand and Lightner in 2002²⁵, and now generally referred to as ‘the OIE test’ or ‘the OIE TaqMan[®] test’. This test is extremely sensitive and will detect as little as four WSSV copies per 10 ng of total DNA.
- IQ2000 kit¹²⁵, a commercial kit that has been validated and approved as a test by the OIE but does not appear to be in use in Australia.

The nested and qPCR tests for WSSV have not been put through a formal validation process by the OIE but have been in wide use internationally for many years without reported problems.

Before the OIE TaqMan[®] test was developed, AAHL had developed an in-house real-time WSSV qPCR assay (‘the CSIRO WSSV qPCR test’ or ‘the AAHL test’)¹²⁶, which was more sensitive than the nested PCR. This AAHL test was used in the 2002 survey (section 3.4) to prove WSSV freedom after the Darwin incident in 2000²⁶. The primers used in this test identify a different part of the WSSV viral genome to the OIE test. This test is therefore not strictly ‘equivalent to the OIE test’ specified by the 2009 IRA or by the department in its requirements for screening laboratories. However, up to 2017, AAHL continued to use this test and the OIE TaqMan[®] test in parallel to build the case for ‘equivalence’ between the two tests. According to AAHL, its test has very similar sensitivity to the OIE TaqMan[®] test.

Most testing conducted by AAHL involves detection of serious exotic and enzootic pathogens. This requires the use of the most sensitive testing methods. For this reason, AAHL does not apply any cut-off (C_t) value, meaning that any sample that generates a typical amplification curve (even if only one of two duplicate samples) is categorised as positive. The qPCR tests are run for 45 cycles or more and any reaction occurring up to 45 cycles is reported as a positive. As prescribed by the OIE *Manual of diagnostic tests for aquatic animals*⁶⁰, additional confirmation that very high C_t value results truly represent viral DNA is often undertaken by sequencing any amplicons (DNA fragments) detected.

The OIE does not recommend a specific C_t value for real-time PCR tests using the TaqMan® system, and its chapter on WSSV⁶⁰ specifies that the C_t value for the assay is unique to each laboratory's method and systems. Laboratories frequently select a subjective cut-off value for real-time amplification assays, above which a C_t value is deemed false¹²¹. The C_t value may vary within a reasonable range but it is still possible to specify a cut-off value for regulatory purposes. If all laboratories use a procedure prescribed in enough detail, it should be possible to achieve consistency of testing results across laboratories.

Following the request for expressions of interest, the department approved two laboratories to test prawn imports for YHV and WSSV: Advanced Analytical Australia Pty Ltd (AAA), a private laboratory, and Elizabeth Macarthur Agricultural Institute (EMAI), the NSW Government's central veterinary laboratory. EMAI was approved as a veterinary laboratory for carrying out a range of tests and AAA was approved to carry out specific tests, including WSSV. Both were NATA accredited to conduct WSSV qPCR. From 2007 to 2015 both laboratories regularly successfully completed quality assurance inter-laboratory testing for WSSV, and NATA conducted several routine audit visits to each laboratory.

Properly designed and carried-out qPCR tests (Box 3) can detect minute fragments of genetic material (DNA or RNA) specific to the organism being tested for. As a result, they have become a preferred diagnostic test method. However, they are so sensitive that they may detect particles of virus that are not able to infect cells. Consequently, a positive qPCR result for WSSV does not always mean that infectious virus is present¹²⁷. The WSSV genome consists of around 293,000 base pairs. The qPCR targets a sequence of only 69 of the base pairs, which may remain intact and cause a positive test reaction even after severe degradation of the virus.

Persistent infection of prawns with WSSV is common. Viral loads during persistent infection can be extremely low and difficult to detect even when using sensitive methods such as qPCR. Confirmation that a high C_t sample contains infectious WSSV requires a bioassay showing that the sample, if inoculated into prawns, will infect them. This is expensive, time-consuming and impractical for routine testing of imported prawns.

A strongly positive (low C_t value) sample almost always indicates that WSSV infection has been present in the prawn. If that prawn has been cooked, the virus will no longer be infective, but fragments of its inactive DNA may still be detected¹²⁸. However, the OIE states that cooking destroys the viability of the virus. Further research is required to determine the effect of cooking on both the virus and on WSSV testing results.

Recommendation 3

The department should facilitate research to validate the impact of cooking on:

- white spot syndrome virus inactivation, and
- white spot syndrome virus testing results.

Department's response: Agree in principle. Research such as this, which could be commissioned by FRDC, will be considered in the context of the prawn risk review.

5.3.4 Potential sources of contamination

The qPCR method is extremely sensitive and will detect even degraded WSSV DNA on any surface and even from air currents¹²⁹.

Prawns or samples taken from them may have fragments of viral DNA due to contamination that can occur at multiple points along the supply chain:

- **During offshore processing**—traces of viral DNA can adhere to prawns while being shelled and deheaded and during washing or saline perfusion processes in the factory. Traces can adhere to product bags and packing and to packers' gloves.
- **During sampling in Australia**—traces of viral DNA can adhere to inspectors' gloves or remain in the air if containers, warehouses and sampling benches used by department inspectors are contaminated, perhaps from cooked prawns in the same facility.
- **During laboratory testing**—traces of viral DNA can remain on the laboratory bench after samples have been unpacked, or in the 'clean room' in the laboratory, in pipettes or in reagents. Even laboratories with the most rigorous methods sometimes experience contamination that causes false positive qPCR testing results.

The department has implemented measures to reduce the risks of contamination during prawn sampling or laboratory testing in Australia, but contamination can rarely be completely eliminated.

Chapter 6

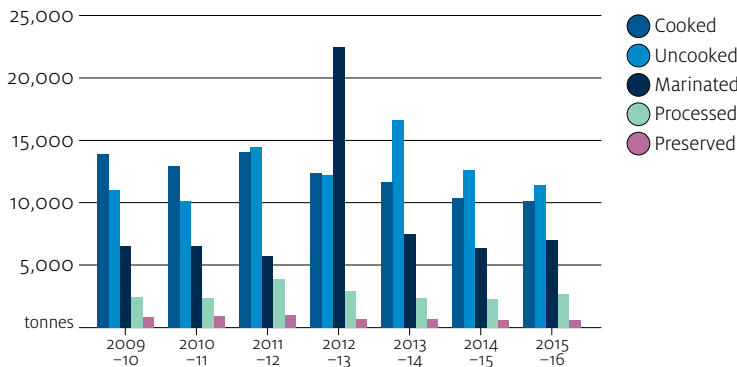
Implementing IRA prawn import conditions, 2010 to 2016

From 2009–10 to 2015–16 Australia’s prawn import conditions underpinned the annual import of between 10,000 to 14,000 tonnes of cooked prawns, 10,000 to 17,000 tonnes of shelled and headless uncooked prawns, 6,000 to 7,000 tonnes of marinated uncooked prawns and 2,000 to 3,000 tonnes of highly processed uncooked prawns (including breaded, battered and crumbed prawns). These imports originated from more than 40 countries, but the majority were from Thailand, China, Vietnam, Malaysia and Indonesia. The mix of countries exporting different categories of prawn product varied from year to year.

6.1 Volume, value and source of imported prawns

Australia imports a substantial quantity of primarily frozen prawns—cooked and uncooked. Import volumes rose only slightly from 34,000 tonnes in 2009–10 to 38,000 tonnes in 2015–16 (Figure 6). This stability may have created a false sense of security after the IRA was finalised in 2009.

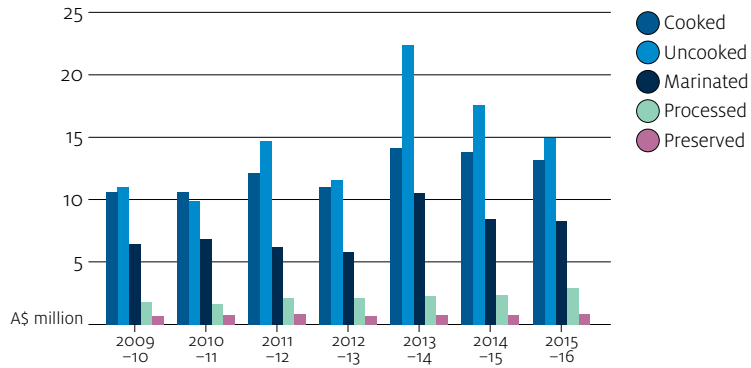
FIGURE 6 Imports of frozen, raw, marinated, processed and preserved prawns, by weight, 2009–10 to 2015–16



Source: Department of Agriculture and Water Resources

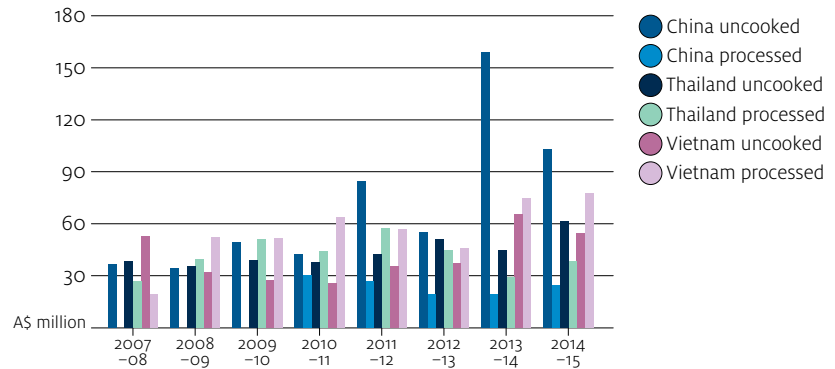
The mix of countries sending prawns to Australia changed from year to year. For example, in 2013–14 imports of uncooked prawns from China increased to a high of 12,300 tonnes, worth A\$159 million (Figure 7 and Figure 8). The type of product imported also changed. For example, before 2011–12 imports from Thailand consisted mostly of processed prawns, but after that uncooked prawns predominated (Figure 8). There was little if any assessment of whether these changes in amount and product type might be due to market forces or disease outbreaks.

FIGURE 7 Imports of frozen, raw, marinated, processed and preserved prawns into Australia, by value, 2009–10 to 2015–16



Source: Department of Agriculture and Water Resources

FIGURE 8 Change in value of prawn imports from selected countries, 2007–08 to 2014–15



Source: Department of Agriculture and Water Resources

6.2 Pre-border biosecurity risk management, 2010 to 2016

The department manages as many biosecurity risks as possible offshore, keeping risks as far away from Australia as possible. It does this by assessing and approving competent authorities (listed overseas government agencies) to certify a range of pre-border measures. The department publishes a list of approved competent authorities on the Biosecurity Import Conditions (BICON) system¹³⁰. Competent authorities are authorised to certify that consignments and batches of prawns meet Australia's import conditions, including country, zone or compartment disease freedom, supply-chain segregation, pre-export verification testing and labelling.

6.2.1 New Caledonia freedom from WSSV, YHD and TSV

The department approved New Caledonia in 2001 to export cooked or uncooked prawn products to Australia without further inspection or testing on arrival. Approval was based on the department having:

- assessed New Caledonia as free of WSSV and YHV (in 2000–02) and free of TSV (in 2006–08),
- confirmed that the New Caledonian Veterinary, Food and Rural Affairs Directorate (the competent authority) could ensure the effective administration of biosecurity and animal health policies to maintain their favourable aquatic animal health status, and
- confirmed that the laboratory capacity in New Caledonia was adequate to undertake animal health surveillance and export testing for prawn diseases.

Australia received three prawn consignments from New Caledonia under these arrangements, in 2009–10, 2010–11 and 2012–13.

6.2.2 Secure supply chain for Australian prawns processed at a Thai factory

In 2015 Thailand was approved to process wild-caught prawns of Australian-origin without further inspection or testing on arrival. The prawns would pass through a government-approved biosecure supply chain for re-export to Australia as uncooked whole, packaged or uncooked peeled/partially peeled, head-off product¹³¹.

This approval covered only wild-caught prawns of Australian-origin processed at a single Thai factory, Thai Union Frozen Products PCL. The department assessed the risks of product substitution and cross-contamination from the point of importation into Thailand to the point of re-export to Australia and confirmed that the robust biosecurity and traceability systems overseen by Thailand's Department of Fisheries (DoF) could ensure product integrity throughout processing in Thailand. This approval followed completion of:

- a written submission from DoF with evidence of controls in place to ensure supply chain integrity,
- an Australian Government Department of Agriculture desk audit of the competence of DoF and controls in place to ensure supply-chain integrity, including a review of bilateral trade and on-arrival viral testing compliance history, and
- an in-country verification visit to inspect Thai ports, DoF offices and the Thai factory.

As at 15 September 2017, 15 shipments of prawns had been imported under this arrangement. The department had not yet conducted any follow-up audits of the whole arrangement.

6.2.3 Indian application to conduct pre-export testing of prawns

In 2015 the Department of Agriculture and Water Resources had evaluated a proposed pre-export testing program to be administered by the Export Inspection Council (EIC) as the competent authority of India. The intent was to have required prawn testing carried out pre-export in India and to implement a random on-arrival verification testing program in Australia. The department's final evaluation report stated that India's EIC has the capacity to meet Australia's import requirements and provide equivalent risk management measures by testing uncooked prawns in India. However, until the department was able to organise and implement a random on-arrival verification testing program, India's pre-export testing program could not commence.

6.2.4 Competent authority certifications of uncooked prawns from countries not free of WSSV and YHD

Most of Australia's prawn imports are from Asian countries. In the decade to 2016–17 the main exporters have been China, Vietnam, Thailand, Malaysia and Indonesia. Prawn farms in these countries are often distributed along crowded seashores and estuaries. Farms and their input suppliers are often some distance apart, a situation that contributes to disease spread. Batches of harvested prawns may be sent to large processing factories with high throughput for shelling, deveining and other pre-export processes. There is a high probability of infection being present in many of the harvested batches, and an even greater probability of cross-contamination between batches at processing plants. Some companies and countries have made efforts to develop vertically integrated prawn production and processing facilities, with quality assurance systems to provide guarantees around food safety and biosecurity.

From 2010 to 2016, for each consignment of prawns imported to Australia, the importer was required to obtain batch- and/or carton-specific certification issued by the relevant competent authority in the country of origin.

Under the requirements, a batch is defined as 'a population from a different pond population or fishing period population'. For each batch, the certificate must:

- describe the product being exported (such as, peeled deveined tail off; head off and peeled with tail on),
- state that the prawns have been processed, inspected and graded in premises approved by and under the control of the competent authority,
- state that the prawns are free from visible signs of infectious disease,
- state that each package is marked with the words 'For human consumption only— not to be used as bait or feed for aquatic animals', and
- be signed by a competent authority representative (government official) endorsing the quantity of prawns/products being exported.

In practice, it was very difficult for competent authorities to ensure that all of these requirements had been fulfilled. The country of origin of the prawns was assumed to be the country where prawn processing took place, but anecdotal evidence suggests this was not always the case^{62, 63}.

Prawns are a globally traded commodity and the competent authority was only required to certify the prawns at the point of processing and packing. They may sometimes have been unaware of the country of production. It may have been unclear whether the 'country of origin' specified on the import certificate was the country where the prawns were grown or the country where the processing and grading was done and from where the prawns were being exported.

The batch of origin of the prawns would also be very difficult for the competent authority to certify. Without specific measures in place for traceability of individual batches back to the farm and their segregation from other batches during processing (see 6.2.2) it would be difficult for the competent authority to certify that prawns in a consignment came from one or several batches, as defined in the import conditions.

Freedom from clinical signs of infectious disease would also be difficult for a competent authority to ascertain. Detecting signs of infectious disease (such as WSD) at the processing plant would require physical inspection of a sample of the prawns from each batch before they were shelled. There is no evidence that this was ever carried out. It would be impossible to detect disease by macroscopic inspection once prawns were shelled and deheaded.

These offshore requirements, which were very difficult to monitor effectively, may have engendered a false sense of security in the overall safety of uncooked prawn imports.

6.3 Border biosecurity management activities, 2010 to 2016

6.3.1 Entry management

Goods imported into Australia are classified under the *Customs Tariff Act 1995*. A memorandum of understanding between the Department of Agriculture and the Australian Customs and Border Protection Service (Customs), signed on 21 July 2011, defined each party's respective biosecurity and border protection responsibilities.

Two interlinked electronic information management systems were used for clearing imported goods (such as prawn consignments) at the border:

- the Integrated Cargo System (ICS)—managed by Customs
- the Agriculture Import Management System (AIMS)—managed by the department and used by staff to profile, target and record real-time processes, including entry management, point-to-point movement of imported goods, inspection findings and WSSV/YHV testing outcomes as part of arrival clearance procedures, and directions for re-export or destruction of failed consignments.

The ICS automatically refers all import consignments of biosecurity concern (including prawns and prawn products) to AIMS. Some of these referrals are based on tariff codes targeted by community protection profiles (CPPs) set by the department. Inspectors at the first port of arrival were responsible for clearing imported consignments in their region.

Two types of inspection could be used to evaluate imported prawn consignments:

- **seals-intact inspection**—where the department applied directions requiring that the container that had been sealed overseas pre-shipping remain sealed until an inspector was available to supervise the breaking of the seal and unloading of the container, or
- **unpack inspection**—where the importer or person in charge of a QAP unpacked the goods from the containers they were shipped in. An inspector subsequently inspected the goods to ensure they met import conditions. Before August 2016 inspections of uncooked unprocessed prawns were normally undertaken as an unpack inspection.

The following section describes the at-border processes that the department had in place before the suspension of uncooked prawn and prawn products in January 2017.

Step 1 Document assessment by front office staff

The broker/importer of a consignment of uncooked prawns or prawn products submitted copies of accompanying documentation to the department's regional office in person, via courier or as email attachments.

Entry management staff (officers trained to assess import documentation) at the front office would assess and stamp documents, update the consignment entry on the AIMS database and issue a direction to the broker/importer to contact booking officers in the region to organise an inspection and direct the consignment to a quarantine approved premises (QAP). Entry management staff would also contact the broker/importer if they required additional documents (or clarification) to ensure all import requirements were met.

Documents accompanying each imported consignment of prawns or prawn products were assessed to determine that the following were included:

- a valid import permit
- a consignment-specific health certificate issued by the competent authority of the country of origin, and
- documentation from the exporter, supplier or competent authority verifying the number of batches in the consignment and their labelling—for example, commercial invoice, manufacturer's declaration, importer declaration, bill of lading or packing list and all statements/declarations required by the import permit conditions.

Entry staff ensured that offshore import conditions had been met and that all outcomes of the inspections were recorded in AIMS.

Step 2 Importer request for inspection and sampling

The broker/importer was responsible for moving the consignment to a QAP, which was required to hold the consignment under quarantine control. The broker/importer would then contact the department's regional office to organise the inspection and sampling appointment. Because all prawn consignments are frozen, there was no perceived need for prompt inspection. The average time from consignments being ordered into quarantine to inspected was four weeks.

Step 3 Inspector assigned to conduct inspection

Until 2011–12 bookings in regional offices were taken by a small team of officers who would, using a whiteboard, assign inspection of consignments to individual inspectors. At the start of the day, each inspector would list their assigned entries in a notebook and drive to QAPs to undertake inspections. In 2012 the department introduced an electronic system (Client Contact Group database) that enabled regional offices to manage bookings.

6.3.2 Inspection and sampling at quarantine approved premises

An inspector (normally alone) would attend the QAP to carry out inspection and sampling in accordance with the department's *'Instruction and guideline: Prawn sampling for disease testing'*¹³² (see Box 4).

Box 4 Inspection and sampling of imported uncooked prawn consignments at QAPs under the *Quarantine Act 1908*, before 16 June 2016

Step 1

Inspector attended a quarantine approved premises (QAP) for a booked inspection appointment and verified that the number of boxes in the consignment and the sizing categories matched commercial documentation.

Step 2

Importer then completed and signed a 'Raw prawn sampling declaration' form nominating the testing laboratory and the number of batches to be tested.

Step 3

Inspector checked that:

- batch numbers matched declaration form and consignment documentation
- the number of boxes/cartons and sizing matched commercial documents
- the uncooked prawns were peeled and headless
- the carton/box labelling that the statement 'For human consumption only—not to be used as bait or feed for aquatic animals' was visible.

Step 4

Inspector:

- selected 13 cartons from each batch identified, drew 5 prawns from each of the 13 cartons, pooled each carton's prawns in 1 bag, then placed 13 bags containing a total of 65 prawns in a tamper-evident bag
- sealed tamper-evident bag, attached barcode and packed samples for transport in a container with frozen gel packs
- completed 'Raw prawn sampling' attachment sheet and attached the barcodes that identified the batches/boxes/consignment
- placed a copy of the documents (including the testing directions) inside the plastic sleeve located on the outside of the container and sealed the container with tape and tamper-proof seals
- retained the original documents.

Step 5

Inspector returned to the office and:

- organised transport of samples to the approved prawn testing laboratory nominated by the broker/importer (Advanced Analytical Australia or Elizabeth Macarthur Agricultural Institute)
- emailed the 'Raw prawn sampling' attachment sheet to the broker/importer and nominated laboratory
- completed the AIMS Inspection—prawn sampling direction as 'Performed OK' and added any charges (normally only for time spent at the QAP) and relevant comments
- added 'Secure—pending test results' direction to the AIMS entry and sent a copy of the direction to the person in charge of the QAP.

6.3.3 Assessment, inspection and sampling results

Between 2013–14 and 2015–16 the department assessed 11,970 consignments of prawn and prawn products imported from 39 countries. Nearly 85 per cent of these consignments were imported from Vietnam, Thailand, China and Malaysia and the remaining 15 per cent were from 35 other countries (Table 3).

TABLE 3 Assessment of prawn product consignments, 2013–14 to 2015–16

Country of origin	2013–14	2014–15	2015–16	Total
Vietnam	1,169	1,295	1,164	3,628
Thailand	1,124	1,260	1,236	3,620
China	1,034	705	710	2,449
Malaysia	419	288	352	1,059
Indonesia	114	75	98	287
Myanmar	61	37	47	145
Philippines	42	55	45	142
Korea (Republic of)	43	38	52	133
India	56	25	26	107
Sri Lanka	17	29	31	77
Japan	12	29	20	61
Taiwan	17	21	19	57
Denmark	21	13	22	56
Hong Kong	15	16	9	40
Singapore	6	10	2	18
United Kingdom	2	5	6	13
Bangladesh	1	7	2	10
Spain	2	3	4	9
Australia	6	1	1	8
Nigeria	–	5	2	7
Other 19 countries	13	15	16	44
Total	4,174	3,932	3,864	11,970

Source: Department of Agriculture and Water Resources

Of the 11,970 consignments assessed, 29 per cent were directed for inspection, 23 per cent were sampled, 6 per cent were verified and 23 per cent were tested for WSSV and YHV (Table 4). Often brokers/importers would book multiple consignments for inspection, verification and/or sampling during the one visit.

TABLE 4 Directions for prawn consignments, 2013–14 to 2015–16

Direction type	2013–14	2014–15	2015–16	Total
Inspection	1,282	1,071	1,121	3,474
Sampling	1,002	818	879	2,699
Verification	280	253	242	775
Testing	1,046	829	837	2,712

Source: Department of Agriculture and Water Resources

From 2013–14 to 2015–16 the department billed importers across all ports for a total of 1,595 hours (Table 5) for inspection, sampling, verification and testing activities undertaken by biosecurity officers (Table 4). This indicates that inspectors spent an average of 35 minutes per consignment in QAP premises carrying out inspection, verification and sampling tasks. Time spent back at the office arranging paperwork and sample submissions to laboratories was not generally cost-recovered. Nearly 75 per cent of the total hours billed during 2013–14 to 2015–16 were at Melbourne and Sydney ports.

TABLE 5 Prawn inspection and sampling, billed hours, by port, 2013–14 to 2015–16

Port of entry	2013–14	2014–15	2015–16	Total
Melbourne	317	193	176	686
Sydney	142	152	210	504
Brisbane	56	71	93	220
Fremantle	44	38	58	140
Adelaide (sea and airport)	7	11	15	33
Albany	0	0	10	10
Geelong	–	0	2	2
Total	566	465	564	1,595

Source: Department of Agriculture and Water Resources

The majority of batches tested in this period originated in China, followed by Malaysia, Vietnam, and Indonesia (Table 6).

Whole or partial batches that tested positive for WSSV and/or YHV were referred to as ‘failed batches/consignments’. These were ordered to remain in quarantine until importers indicated their preferred choice of an action: retesting at AAHL (also called ‘confirmatory testing’), destruction or re-export. Failure rates between countries and between years showed considerable variation, with a notable upsurge in 2015–16 for several countries.

TABLE 6 WSSV and YHD testing of imported uncooked prawn and prawn products, by country of origin, 2013–14 to 2015–16

Country	Consignments tested (no.)			Consignments passed (no.)			Consignments failed (no.)			Failure rate (%)		
	2013–14	2014–15	2015–16	2013–14	2014–15	2015–16	2013–14	2014–15	2015–16	2013–14	2014–15	2015–16
China	613	399	400	544	382	372	69	17	28	11.3	4.3	7.0
Malaysia	150	157	139	148	155	137	2	2	2	1.3	1.3	1.4
Vietnam	73	123	122	67	121	111	6	2	11	8.2	1.6	9.0
Indonesia	66	55	43	61	52	36	5	3	7	7.6	5.4	16.3
India	–	15	–	–	14	–	–	1	–	–	6.7	–
Thailand	–	39	–	–	37	–	–	2	–	–	5.1	–
Bangladesh	–	–	6	–	–	2	–	–	4	–	–	66.7

Source: Department of Agriculture and Water Resources

In 2013–14 to 2015–16, of the 188 failed batches and/or consignments, brokers/importers chose to have 12 per cent retested at AAHL, 2 per cent either destroyed, released or partially exported and 86 per cent re-exported in entirety (Table 7).

TABLE 7 Actions selected by brokers/importers for WSSV and YHD positive batches or consignments, 2013–14 to 2015–16

Action	2013–14	2014–15	2015–16	Total	Percentage (%)
Destroy	1	–	–	1	0.5
Re-export	82	27	52	161	86
Release	–	1	1	2	1
Partially re-export	1	–	–	1	0.5
Retest	18	5	–	23	12
Total	102	33	53	188	100

Source: Department of Agriculture and Water Resources

Re-export of failed consignments was expensive for brokers/importers and required them to source alternative markets for their prawns, presumably at a cheaper price—a significant incentive for importers to divert or re-import failed consignments. The department's measures for ensuring that re-export occurred were cumbersome and rarely carried out. This was largely due to incompatibilities between the Integrated Cargo System (ICS), managed by the Australian Customs and Border Protection Service (Customs), and the Agriculture Import Management System (AIMS), managed by the Australian Government Department of Agriculture, Fisheries and Forestry.

6.4 Post-border controls

All imported uncooked prawns and prawn products were required to have the words 'For human consumption only—not to be used as bait or feed for aquatic animals' on each carton and plastic bag they were imported in. Inspectors were required to check a sample of each batch to ensure compliance. However, at a practical level, once a batch or consignment had been released from quarantine, the Australian Government had no further control over it. Any further action to enforce this provision would require state/territory government powers and be extremely difficult to implement.

The labelling remained visible on retail frozen prawns that were still packaged, but any prawns that were thawed and presented for sale in supermarkets or fish shops did not carry this labelling. Consequently, most Australians were unaware of the end-use requirement and recreational fishers reputedly used retail imported prawns as bait or berley because they were cheap and the prawns were intact.

One intent in requiring the end-use statement on each package was to prevent wholesale purchase of imported retail prawns by bait shops. If bait shops sold imported uncooked prawns, there would be a greater risk of exposing larger numbers of wild crustaceans to residual infection. No surveillance of bait shops was undertaken to ensure that they were not selling imported uncooked prawns. Legal powers for action if such a practice were discovered were unclear or non-existent.

Chapter 7

Non-compliance with prawn import conditions, 2010 to 2016

7.1 Mistaken release of WSSV-positive batches, 2010

In July 2010 the department mistakenly released a consignment of raw peeled prawns intended for human consumption that had tested positive for WSSV. The Director of Biosecurity requested the Interim Inspector-General of Biosecurity (IIGB) to ascertain the causes and recommend practices to mitigate the risk of a recurrence.

In his review, the IIGB noted that the consignment contained frozen raw, peeled, deveined prawns with the tail on (3,500 kilograms) and off (5,000 kilograms). These two separate batches were released before the laboratory result had been received. He concluded:

Overall, the circumstances surrounding the release of the consignment of prawns examined as part of this review would suggest that the primary cause of the mistaken release was human error or accidental oversight by the officer involved.

However, further work undertaken during the examination indicates that this error may not be isolated, and similar mistaken releases may have occurred in the past and may continue to occur in the future if improvements to the controls are not implemented¹³³.

Based on my assessment, there is an extremely low likelihood that an amount of infected prawns likely to introduce WSSV infection entered high-risk pathways from this consignment.

There is a negligible likelihood that WSSV would have established in Australia as a result of the release of this consignment of prawns. This finding is principally underpinned by the conclusion above that there is an extremely low likelihood that significant numbers of infected prawns from this consignment entered high-risk pathways¹³⁴.

The IIGB recommended various measures to improve the reporting of laboratory results. Records show that the department implemented all the recommendations apart from one, about improving IT infrastructure:

The development of a system interface between the laboratory and AIMS to allow for testing results to be directly input into AIMS, which would reduce the risk of human error. We understand that a similar automated update process has been implemented for consignments sent for testing under the *Imported Food Control Act 1992* and BSG [the department] should evaluate whether this automated process can be extended to prawn releases¹³⁴.

This recommendation is being implemented as part of the department's current major biosecurity IT reform program. The Biosecurity Integrated Information System (BIIS) should be rolled out by 2019. It will improve the department's ability to collect, collate and analyse information and result in better and more timely decision-making⁸⁶.

The IIGB's findings regarding the negligible risk of WSSV establishment related to this particular incident only. However, submissions to this IGB review indicate that his report may have inadvertently led to a more general perception that risks of a WSD outbreak in Australia were much lower than they later proved to be.

7.2 AAHL detection of WSSV in retail prawns, 2013

On 17 May 2013 AAHL advised the department that the three batches of imported prawns it had purchased at three different Geelong supermarkets had tested positive for WSSV. On 13 December 2013 AAHL provided a follow-up report to the department advising that it had conducted further experiments using inocula from the WSSV-positive prawns it had purchased from supermarkets. These experiments confirmed that infectious WSSV was present at relatively high levels in the prawns available at retail outlets in Geelong.

At that time, the AAHL Fish Diseases Laboratory was collaborating with the department on a project to deliver a regional proficiency program for South-East Asian aquatic animal disease diagnostic laboratories. Imported prawns were thought to be the most convenient source of negative control material for the proficiency test, assuming that they would have already tested negative for WSSV in order to be allowed into Australia. The positive test results for WSSV were therefore completely unexpected.

The department considered it unlikely that source batches would have passed the mandatory post-arrival batch testing program, and hence suspected that the prawns may have been imported as marinated prawns (which did not need testing) and had the marinade washed off. It did not share this information with states and territories.

7.3 Operation East Leichhardt investigation into marinated prawn imports, 2014

From 2010 a category of 'marinated prawns' had been included in a wider category of 'highly processed prawns' that were exempt from the WSSV and YHV testing requirements for other uncooked prawns. This was on the assumption that, if they were sufficiently marinated, they would be sold and used for human consumption only and not used as bait.

From 2012 the department received industry allegations that some commercial parties were importing highly processed (marinated) prawns to avoid the requirement for virus testing and then washing off the marinade in order to sell the product as raw, peeled prawns.

This led to the implementation of Operation East Leichhardt in 2014. Investigators aimed to test whether particular importers of marinated prawns complied with import conditions. Central to the operation was the possibility that some importers were using the 'highly processed prawns' description for marinated prawns to bypass testing requirements.

Investigators focused on 'at border' inspections to ensure that there were required amounts of marinade on the prawns. Five of 7 targeted consignments failed inspection because the prawns were inadequately covered with marinade. These consignments were not tested for WSSV but all 5 containers (containing 57.9 tonnes of prawn products) were re-exported. The exported containers were also profiled to mitigate against a future re-import attempt. The profiling found no attempts to re-import the previously exported goods in the same shipping container.

Apart from export container profiling, no extra surveillance measures or other regulatory sanctions arose from Operation East Leichhardt. No importers were prosecuted and no fundamental changes were made at that time to wider import conditions. However, the operation did lead to more investigations of the imported prawn trade.

Operation East Leichhardt identified significant subjectivity by inspectors who were implementing verification of import requirements for highly processed prawns. Its final report recommended that the operational processes for determining what were 'highly processed prawns' should be reviewed. Nevertheless, the problem was seen as one of specific non-compliance by a few importers rather than a wider problem.

7.4 Non-compliance detected at border assessment and inspection 2013–14 to 2015–16

Emerging doubts about the imported prawn trade led the department to begin tabulating and examining in detail non-compliance with prawn import conditions which was detected by border assessors and inspectors.

Between 2013–14 and 2015–16 the department identified many cases of potential or actual non-compliance with prawn import conditions (Table 8). The failed consignments violated entry-level, document or inspection requirements:

- **Entry level**—the broker/importer did not comply with import requirements
- **Document related**—accompanying documentation did not fulfil the department's Minimum Documentary and Import Declaration Requirements Policy¹³⁵
- **Inspection related**—imported product did not meet mandatory import requirements, and
- **other.**

The 2,048 instances of non-compliance occurred in a total of 2,712 prawn consignments directed for inspection (Table 4), but some consignments may have had multiple faults.

TABLE 8 Non-compliance with import conditions for prawn consignments, 2013–14 to 2015–16

Nature of non-compliance	2013–14	2014–15	2015–16	Total
Entry level (broker)	136	402	329	867
Document related	79	350	233	662
Inspection related	95	147	197	439
Other	10	32	38	80
Total	320	931	797	2,048

Source: Department of Agriculture and Water Resources

Minor errors were remedied on the spot and re-export was ordered for consignments with more serious non-compliance. Some importers were later detected trying to re-import some failed consignments.

7.5 Operation Cattai investigation into systematic importer non-compliance, 2016

7.5.1 Reasons for Cattai

After a long planning phase and due to its increasing concern about evidence of lack of compliance with prawn import requirements, the department commenced Operation Cattai on 16 March 2016¹³⁶. In late 2014 this issue had not ranked as highly as others for aggressive investigation. However, by 2015 the department had further investigated previously non-compliant importers, including those identified in Operation East Leichhardt and in later compliance investigations. This had led to suspicions that some importers were deliberately and regularly avoiding departmental border controls such as imported prawn testing. Consequently, the prawn import investigation was upgraded from an assessment to a targeted campaign. The focus was still on individual non-compliance, with investigators aiming to:

- identify importers deliberately avoiding prawn import controls, and
- take action to address and deter this behaviour to reduce the level of risk of prawn imports.

Implementation of Operation Cattai consisted of three phases.

7.5.2 Phase 1 Retail purchase and testing of imported uncooked prawns, May to June 2016

Department staff bought uncooked prawns from a total of 30 retail and wholesale outlets across the cities of Brisbane (7), Sydney (13) and Melbourne (10), targeting the products of importers who were suspected of avoiding departmental prawn import controls. When tested at EMAI and retested at AAHL in June 2016, 54 of the 63 samples (86 per cent), including 7 out of the 8 marinated products (88 per cent), tested positive for WSSV. None tested positive for YHV.

Goods that did not meet import conditions were also identified, including prawns imported with shells intact and incorrect species identification. Prawn species testing at AgriGen Biotech confirmed that 60 of the 63 samples were vannamei prawns (which are found in Asia) and the remaining 3 were tiger prawns (likely to be Australian). Five products had incorrect species information on the packaging and a further 23 contained no species information at all.

Phase 1 testing and review of screening laboratory tests from 2014–2016 found differences in results for WSSV testing between the laboratories approved by the department. This informed the design of phase 2 viral testing protocols.

7.5.3 Phase 2 Seals-intact inspection, sampling and testing of targeted imported uncooked prawn consignments before their release from biosecurity control, August to December 2016

During this phase, targeted shipments containing prawns imported by particular importers were required to undergo a seals-intact inspection before being unloaded from the container into a freezer.

This targeting required different sections of the department to conduct extra and more rigorous assessment of each of the 248 consignments of raw peeled prawns which arrived during Phase 2. The department permitted 183 consignments to continue through the normal 'business as usual' unpack inspection process but with updated, more stringent work instructions for inspection, and sampling for testing¹³⁷.

The department directed 77 targeted consignments for secure seals-intact inspections. This involved biosecurity officers breaking the seals on the recently imported containers and inspecting and sampling the cartons of prawns as they were being unloaded from the container. Of the 77 consignments, 54 contained raw peeled prawns and the remaining 23 contained other types of seafood.

Phase 2 incorporated a revised approach to viral testing: screening laboratories were required to supply raw data to the department for technical review prior to results being reported, and AAHL conducted confirmatory testing for WSSV presence. Of the 54 raw prawn consignments, 31 (57 per cent) failed WSSV virus testing and were directed for re-export. By contrast, of 160 'business as usual' prawn inspections performed, only 24 (15 per cent) tested WSSV positive.

The rise in detections of WSSV-positive batches from August 2016 onwards was obtained by targeting a number of importing entities. By November 2016, a decline in positive results was noted, when a number of these targeted entities ceased to import. However, some other entities that were not the subject of investigations significantly increased their imports. Testing of those imports, which were still secured, returned high rates of positive test results.

Phase 2 detected a highly non-compliant imported raw, peeled prawn trade (Table 9). Of 66 consignments inspected, only 23 were fully compliant, while in 43 (65 per cent) one or more non-conformities were detected.

TABLE 9 Operation Cattai phase 2, summary of observed importer non-compliant behaviour, August–December 2016

Behaviour	Consignments where behaviour detected (no.)
Undeclared batches of uncooked peeled prawns	24
Carton marking (non strapping)	22
Additional packaging	10
Carton marking using strapping/taping	8
Undeclared goods	6
4 consignments with sample cartons	
2 consignments with commercial amounts (154 cartons of cooked prawns and 240 cartons of marinated prawns)	
Disregarding secure seals-intact direction	4
Product re-labelling	3
Incorrect/missing documentation	3
Suspected consignment substitution	2
Incorrect country of origin labelling on goods	2
Possible re-import of prawns previously exported after a positive viral test	1
Mismatch between importer lodging declaration and importer listed on cartons	1
Documentation not matching import permit	1
Total number of behaviours (66 consignments)	87

Source: Department of Agriculture and Water Resources¹³⁸ (p. 26)

The investigation concluded that six of the nine targeted importers were incorrectly presenting goods for inspection and foiling the random sampling envisaged in the import conditions. As a result, many batches likely to be WSSV positive were not being tested. In some instances importers substituted product, presenting Australian prawns as imported prawns to ensure a negative testing result for the consignment.

Operation Cattai led to a much higher batch failure rate than 'business as usual' inspection and testing. As a result, 512 tonnes of uncooked infected prawns were listed for re-export by late 2016. Verification of re-export in 2017 was difficult, but investigators identified some cases where compliance with re-export orders could not be verified, and one case of confirmed re-import. It is possible that some of this failed product may have been impermissibly diverted into the retail market, leading to wider availability of cheaper infected product in late 2016.

7.5.4 Phase 3 Monitoring importer manipulation of 'highly processed prawns' criteria to avoid prawn testing, August to December 2016

During this phase, investigators aimed to define how importers were using the marinated prawn category and possible post-border marinade washing to avoid biosecurity viral testing. It ran concurrently with phases 1 and 2 and was intended to continue into 2017, but could not be completed as planned once the import suspension was implemented.

7.5.5 Overall outcomes of Operation Cattai

Operation Cattai found an unexpectedly high level of WSSV in retail imported prawns. It also found that by late 2016 six major importers were involved in systematic non-compliance with uncooked prawn import conditions. These importers had handled a total of 46.7 per cent of uncooked prawn imports during 2016.

The findings led to the revocation of 17 import permits and one approved arrangement premises (a cold store handling imported prawns). The findings also indicated a need for a strengthened 'fit and proper person' test to be implemented when future import permits were issued. However, revocation of the approved arrangement was extremely cumbersome and time-consuming to impose.

By October 2017 the department's Enforcement section had conducted 12 investigations into 10 entities involved in prawn importations. Seven of the investigations related to significant matters that required intervention by Enforcement staff:

- one matter was before the courts,
- a brief of evidence was being prepared for another investigation to be adjudicated for referral to the Commonwealth Director of Public Prosecutions,
- one matter was ongoing,
- five investigations had been finalised by issuing letters of warning or letters of advice, and
- four investigations had been closed with 'No further Enforcement action'.
The department could not advance these matters because no offence had been detected. However, in some cases, the department took administrative action.

By November 2017, after follow-up investigations, the department was taking action against nine importers who had handled about 70 per cent of uncooked prawn imports during 2016. This level of non-compliance is likely to have resulted in significant volumes of uncooked WSSV positive prawns entering Australia.

Chapter 8

Lessons from Operation Cattai

At the time, Operation Cattai (2016) was the biggest and most complex compliance campaign the department had ever undertaken. Not only did it reveal non-compliant importer behaviour, it also identified problems with the prawn import controls and internal operations of the department. For example, the import conditions prescribed in the 2009 IRA were complex, unrealistic and impractical to administer. No single branch in the department had responsibility for implementation—different branches administered different parts of the conditions—so no-one had the whole picture. The department had also experienced significant organisational change and resource pressures, since the IRA had been implemented.

In contrast to the specific temporary measures implemented during Operation Cattai, the department's routine procedures were ineffective for managing the biosecurity risks of imported prawns at the border. Operation Cattai implementation needed:

- considerable extra assessment of import documents to detect potential importer non-compliance,
- better targeting of prawn consignments for extra inspection,
- extra inspector training,
- revised work instructions, and
- better personal protective equipment for work in freezers.

Considerable extra resources had to be applied to carry out seals-intact inspections as part of Operation Cattai. Diversion of newly trained inspectors to meet targeted prawn consignments strained resources in several ports, especially Melbourne, and displaced some other biosecurity operations. Information management issues associated with the scale and complexity of the operation, and a lack of shared network drives for officers across different divisions, complicated information sharing and control. This partly accounted for the longer than expected planning time, which delayed the start of Operation Cattai by several months. But some clear lessons emerged.

8.1 Too much trust in importers to do the right thing

The department demonstrated a remarkable level of naivety about the potential for importers to wilfully circumvent import conditions for any class of prawns that required viral testing.

The import conditions enabled importers to control the presentation of prawn consignments for inspection, sampling and testing. For example:

- the complexity of the tariff codes, the nature of the documentation provided and goods descriptions made assessment of the correct direction difficult,
- the department did not require that inspections take place within a specified time after arrival of the goods; delays between cargo discharge and inspection booking averaged four weeks and sometimes much longer, allowing for different contents of consignments to be presented for inspection, and
- the requirement for unpack rather than seals-intact inspections allowed importers to unload containers into freezers before requesting an inspection of one or several mingled consignments as determined by them; this would allow product to be presented for inspection that was likely to test negative for WSSV.

The department's overall attitude towards importers was to consider them as clients. This meant that inspectors, in order to facilitate trade, completed prescribed inspection measures at QAPs as quickly as possible once an inspection was booked. Field officers are more exposed than most of the department's workforce to the regulator versus facilitator role tension. Before Cattai phase 2, inspectors may have been unclear about which approach was more important and valued: performing a quick inspection (facilitation) versus a detailed sample collection (regulation).

As phase 2 of Operation Cattai progressed (August to December 2016), inspectors undertaking prawn inspection and sampling increased their understanding and non-compliance detection capability. Inspectors were briefed regularly on various non-compliance measures as they arose and given inspection summaries of those behaviours and explained how to identify them.

8.2 Weak assessment and inspection procedures

Operation Cattai found that inspection and sampling of prawn consignments was not being carried out in the manner envisaged in the IRA due to a range of technical and practical issues.

8.2.1 Extra assessment of import declarations was needed

The department's routine assessment processes for documents accompanying prawn imports needed to be strengthened. During Operation Cattai, specially trained assessors compared the highly variable tariff coding with the importers' complex description of the goods to determine any directions for onshore inspection/treatments required by the import permit. This primary assessment took about 15 minutes longer per consignment than previous assessments.

Because Operation Cattai was targeting suspect importers, whose identity was sensitive and confidential, a second manual check was made by Compliance staff to identify any raw peeled prawn consignments that were being presented by these entities.

8.2.2 Difficulty in defining a batch or identifying prawn species

The inspector verified the goods by matching the paperwork supplied, confirming the number of batches in the shipment and verifying that the number of boxes in the consignment and the sizing categories met the commercial documentation. Definitions of batch varied and were difficult for inspectors to verify. It was impossible for border inspectors to verify that a declared batch had come from a single pond harvested on a single day—even though the integrity of the sampling procedure relied on this.

In practice, one or several entire containers of frozen uncooked prawns (with up to 20 tonnes of prawns per 40-foot container) were often declared as a single batch. There were incentives to declare a consignment as a single batch—every extra batch that needed sampling and testing incurred a significant extra cost and the risk of batch failure and consequent re-export would be even more costly.

The onus was on the inspector to check sufficient cartons for clues to verify whether consignments consisted of more than one batch. The instructional material relating to batch identification and sampling had been written from an overseas production perspective rather than a border field inspection perspective. Clues to help inspectors identify different batches (incorporating labelling applied to cartons before export) had been added into different work instructions and instructional material over time. Clues included checking for different production dates, lot numbers, processing plants or pond numbers, different processing runs, different species or country of origin and whether the prawns had been farmed or wild-caught.

During Cattai phase 2, new instructions with a more detailed definition of a 'batch' enabled inspectors to identify the increasing numbers of undeclared prawn batches. This indicated that most consignments assessed before the introduction of the new instructions were unlikely to have been sampled sufficiently to demonstrate with 95 per cent confidence that they contained less than 5 per cent of WSSV-positive prawns.

According to Compliance staff, lack of inspector training may have enabled some importers to systematically substitute yellow Australian banana prawns for grey imported vannamei prawns at two Sydney quarantine approved premises, undetected by attending inspectors. However, it would have been impossible for any macroscopic inspection of peeled frozen prawns to reliably detect different prawn species. Only sampling for DNA species testing could do this.

8.2.3 Industry sometimes selected cartons to be sampled

Before Cattai phase 2 began, a number of field verification visits in early 2016 found that carton selection was sometimes organised by the importer/QAP operator but not the inspector. After importers booked the inspections, they had enough time potentially to move tampered cartons to the front of pallets for sampling.

Work instructions required inspectors to randomly select the pallets/cartons to be sampled so that the broker/importer/person in charge of the QAP could bring them out to a safe sampling area. However, in practice, it was impossible to select cartons randomly once consignments had been unloaded into freezers, with cartons piled high and shrink-wrapped on pallets. This again compromised sampling validity. While inspectors might enter the freezers briefly to indicate the pallets and/or cartons to be sampled, it was (and is) unsafe for inspectors to working for any length of time in freezers that might be as cold as -30°C , and they did not have suitable protective clothing for this. Freezers are dangerous, often cramped for space, poorly lit and frequently accessed by high-speed forklifts with heavy loads.

The cost of the inspection would be recovered from the broker/importer, who was keen to minimise the inspection time and sometimes assist the inspector by having the cartons and sampling area ready when the inspector arrived. This compromised verification of the number of batches in a consignment as well as random sampling.

8.2.4 Inspectors worked alone under time and importer pressure

Inspectors were normally on tight schedules and were often required to conduct several inspections and/or samplings of different imported goods at different establishments across the city on the same day. Inspectors often visited the same broker/importer repeatedly and were rarely rotated, particularly in locations where consignment volumes and the number of trained inspectors were lower.

Most significantly, a single inspector was expected to complete inspection and sampling of a typical consignment in approximately half an hour, and this was reflected in the schedules set by their supervisors and in importer expectations.

During Operation Cattai, the department realised that it would not be possible for a single inspector to carry out a seals-intact inspection—verifying the consignment, conducting random sample selection and processing—in the 30-minute time frame typically allocated for ‘business as usual’ prawn unpack inspections. The department instead allocated a total of four hours each for two inspectors to conduct seals-intact inspection (an estimated total eight hours per inspection). However, some seals-intact inspections took 16 hours of inspector time because of the numbers of batches in a consignment or the levels of non-compliance detected.

8.3 Variation in laboratory testing procedures and interpretation

Differences in the testing methods and interpretations of each laboratory resulted in significantly different rates of batches failing the WSSV testing procedure. All laboratories testing imported prawns for WSSV were required to be NATA accredited and to use a test described by the World Organisation for Animal Health (an 'OIE test or equivalent'). However, their laboratory procedures and interpretation of the test results were not nationally standardised. This meant that some samples with low levels of WSSV DNA were classified by one laboratory as 'negative' and by another laboratory as 'positive'. This difference may have resulted in some infected batches of prawns being released from quarantine.

8.3.1 Arrangements for testing prawns for WSSV up to 2016

From 2009 to 2016 any broker/importer whose consignment tested positive for WSSV at either EMAI or AAA could request to have the sample sent to AAHL for a confirmatory test at their own expense, presumably with the hope that it would be found to be negative. Most prawn samples sent for confirmation during this period were confirmed as WSSV-positive by AAHL.

The private screening laboratory, AAA, tested the majority of imported prawn samples from 2010 onwards. However, from 2014 to 2016 the number of samples sent to EMAI for testing declined (Table 10). In contrast, an increase in tests sent to AAA resulted in the private laboratory carrying out the bulk of imported prawn testing during that period.

In May 2016 the department informed importers and industry that it had approved a third laboratory, AgriGen Biotech, for testing imported prawns. AgriGen Biotech was provisionally approved as a QAP from April to June 2016 (when the *Quarantine Act 1908* ceased) but was not accredited for WSSV testing by NATA until September 2016. It formally became an approved arrangement under the *Biosecurity Act 2015* on 6 October 2016.

AgriGen Biotech had a small number of staff who had previously worked under contract to AAA. When these staff left AAA, they took their own equipment and opened a new purpose-built laboratory on 5 May 2016. Meanwhile, samples that AAA was not resourced to test were subcontracted to EMAI until AAA could employ new staff and replace the equipment. There was no review of the changed QAP status of AAA by the department nor did NATA carry out a new audit of AAA to address changes in staff and equipment.

TABLE 10 Imported uncooked prawn specimens tested for WSSV at EMAI, 2007–2016

Year	Total count (no.)	
	Batches	Clients
2007	43	11
2008	148	13
2009	241	12
2010	159	10
2011	275	7
2012	187	8
2013	202	5
2014	231	2
2015	79	2
2016	44	2

Source: Elizabeth Macarthur Agricultural Institute, New South Wales

These oversights of required departmental laboratory approval processes may reflect the extreme pressure the department was under through 2016. At the time, the department was revising all its administrative and regulatory processes before, during and after the transition from the *Quarantine Act 1908* to the *Biosecurity Act 2015* (which commenced on 16 June 2016). Throughout this process, import trade continued unabated and had to be serviced.

8.3.2 Operation Cattai found discrepancies in WSSV test results from different laboratories

In May 2016 EMAI found an unexpectedly high number of WSSV-positive results in some prawn tests subcontracted from AAA, who were unable to carry out the testing at that time. The department investigated this potential problem in results obtained by different laboratories as part of Operation Cattai. Investigators retrospectively analysed prawn import test results reported by different laboratories between 2014 and 2016 and found stark differences in the reported rates of positive detections (Table 11).

TABLE 11 Rates of positive WSSV and YHD findings, by laboratory, 2014–16

Laboratory	Total tests	Total WSSV-positive		Total YHV-positive	
		No.	%	No.	%
Advanced Analytical Australia	1,665	74	4	3	0.2
AgriGen Biotech	26	0	0	0	0
Elizabeth McArthur Agricultural Institute	331	60	18	13	4

Source: Department of Agriculture and Water Resources

In August 2016, in an effort to understand the differences in laboratory results, the department requested raw data from the three laboratories. The department's specialists reviewed the data before each laboratory released their test results of consignments targeted under Operation Cattai. The operation order was also revised to allow for the department to initiate confirmatory testing at AAHL for sample cut-off values reported in the so-called marginal negative region of 36 to 39.

EMAI and the two private laboratories were following the 'the OIE test or equivalent' standard set by the department for screening laboratories. However, the department had not set a standard for the level at which results should be reported as positive. AgriGen staff (previously contracted to AAA) had made an internal decision about samples with 'weak' positive reactions (cut-offs of 36 or greater). In their opinion, rather than indicating true infection, these samples probably represented only very low levels of virus or viral fragments, less than one viral genome copy¹³⁹.

Staff at EMAI had decided that, consistent with the reported OIE TaqMan® method, they would report as positive any sample with a cycle threshold (C_t value) of 39 or less. This is a standard threshold for their many other qPCR assays.

The differences in result between the three laboratories in interpreting C_t values between 36 to 39 PCR cycles meant that any sample with a C_t value between 36 and 39 would have been considered as a positive by EMAI and a negative by private laboratories with a lower cut-off.

Government authorities and other key stakeholders were unaware that the methodologies and interpretations adopted by screening laboratories had been influencing the proportions of WSSV-infected batches that passed the required sampling and testing regime.

8.3.3 Changed confirmatory testing by AAHL, August 2016 to 8 January 2017

From August 2016 when the department became concerned about inconsistencies in WSSV test results between laboratories, it mandated that negative samples had to be sent to AAHL for confirmatory testing. AAHL tested these samples with two qPCR tests, both the 'OIE test' and the 'AAHL test' (section 5.3). They reported the findings as positive if either test showed amplification after each had been run out to 45 cycles or more.

This was a significant change to the previous testing regime where importers had had an option to request that samples tested positive by a screening laboratory be sent to AAHL for retesting (at importer expense).

Differences in laboratory testing methods and interpretations resulted in many more consignments failing confirmatory testing at AAHL, and consequent importer questioning of the validity of AAHL's results. The role of AAHL, its separate PCR test and its more sensitive interpretation, were raised in the Senate inquiry¹⁴⁰. The department provided explanatory material¹⁴¹ estimating that AAHL testing had likely accounted for a certain amount of extra failed product, but nearly all of this extra detection would have been due to the low cut-off values previously applied by the private laboratories. These values would likely have allowed some infected product to pass the testing regime.

By May 2017, the department estimated that before Operation Cattai, significant amounts of WSSV-positive prawns were not being detected at the border by its inspection, sampling and testing activities. The department considered that this was largely due to non-compliant importer behaviour, with weak inspection practices and variations in laboratory test performance and interpretation playing contributory roles¹¹⁶.

Chapter 9

Handling prawns during import suspension, 6 January to 9 July 2017

9.1 Implementing the suspension of uncooked prawn imports

On 6 January 2017 the Director of Biosecurity ordered¹⁴² the suspension of uncooked prawn imports from countries affected by WSD. From then until the suspension was lifted, the department posted external Biosecurity Import Conditions (BICON) system¹³⁰ alerts informing prospective importers of its intention to suspend import permits and of subsequent changes to the suspension order. The department engaged with importers via email and import industry advice notices, and provided periodic updates on its website¹⁴³.

To prevent further imports, between 11 and 13 January 2017 the department suspended import permits for uncooked prawn products, fully suspending 246 permits and partially suspending 63 where the permit included other prawn product types not affected by the suspension.

The evidence of serious and widespread non-compliance with previous import conditions, and the large discrepancies between government and private screening lab testing results led to a tightening of procedures. From 9 January 2017 prawn consignments of all types were subject to greatly strengthened assessment, inspection, sampling and testing to minimise the entry of WSSV. Actions included:

- increased verification of the authenticity of broker/importer declarations by conducting more inspections of possibly misdeclared consignments,
- seals-intact inspections of all containers with declared raw prawn consignments, and supervised unpacking and sampling of cartons/batches by two or more inspectors, with times charged up to 8 hours per consignment, and
- strengthened laboratory testing protocols requiring screening laboratories to run their qPCR tests out to 45 cycles, standardising criteria for test result interpretation and all negative samples from the screening laboratories to be sent to AAHL for confirmatory testing.

When the department announced the suspension of prawn imports, a number of consignments of uncooked or marinated prawns were already in transit to Australia. Importers could either import the consignments subject to the new enhanced procedures or re-export them without inspection.

9.2 Post-border withdrawal of uncooked and marinated prawns

Following Operation Cattai, the department realised that consignments of imported uncooked and marinated prawns that had previously been released from biosecurity control—after what had been thought to be satisfactory inspection and testing—could still be positive for WSSV and pose an unacceptable risk if presented for retail sale.

Consequently, when uncooked prawn imports were suspended, the department decided to identify and secure as much of this product as possible in the domestic market. Once secured, the product was sampled and re-tested by AAHL. Product that tested positive for WSSV was directed for either treatment (cooking), export or destruction.

9.2.1 Identifying imported uncooked product that needed to be withdrawn from sale

Around 17,000 tonnes of uncooked prawns (raw and marinated) are imported into Australia each year (Box 5). In the 12 months to January 2017, 18,043 tonnes of uncooked prawns were imported. Uncooked prawns frozen at -20°C may be stored for up to 18 months before deteriorating. Between 80 and 90 per cent of imported uncooked prawns move through a ‘fast’ supply chain and are sold within two to three months of being imported. The remaining 10 to 20 per cent move through a ‘slow’ supply chain and are sold within 15 months of being imported.

Box 5 Import volumes of uncooked and marinated prawns, 2015–16

Uncooked prawns = 11,319 tonnes

Marinated prawn products = 6,365 tonnes

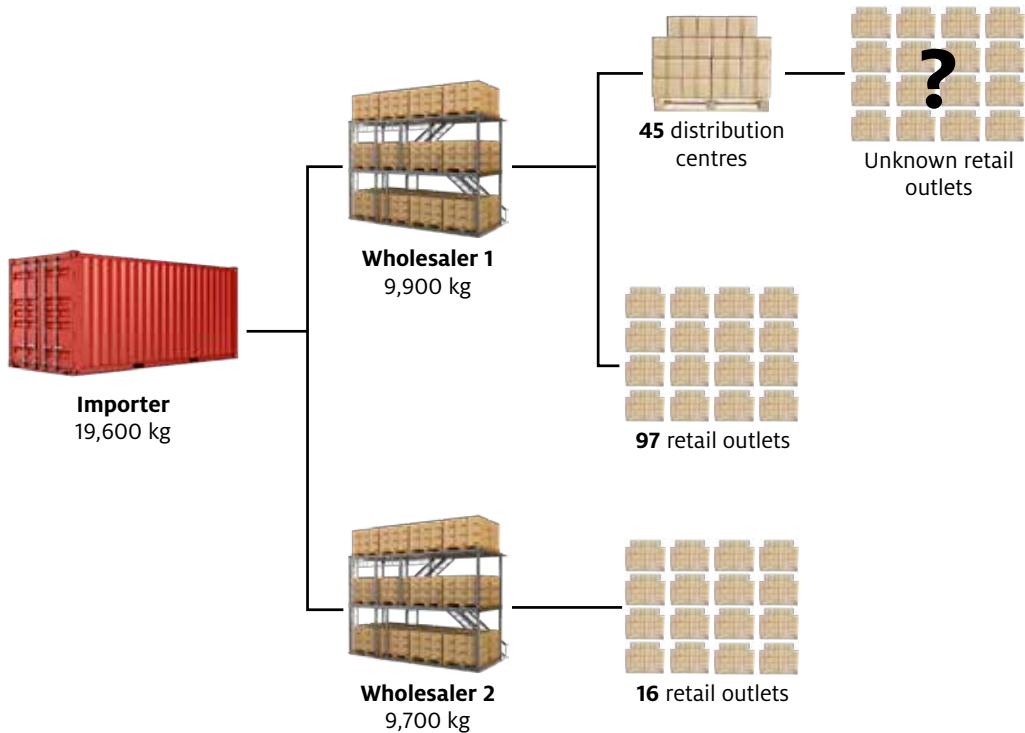
Total = 17,684 tonnes ^a

^a This quantity of prawns equates to approximately 982 × 40-foot containers, based on an average container weight of 18 tonnes.

On 6 January 2017 the department asked five importers who had had WSSV-positive prawns detected by Operation Cattai or by retail testing to voluntarily withdraw similarly sourced consignments. For legal, financial and practical reasons, the importers were reluctant to request the return of these goods. They no longer owned or had legal control over the goods and it would have been very difficult to identify where the product had been distributed in the multilayered domestic prawn distribution and retail network. Nevertheless, one importer voluntarily secured the return of 5,994 kilograms of prawns.

Where possible, the department used powers under the *Biosecurity Act 2015* to secure and test product in retail outlets and freezers. Efforts by the department to track down and remove product from the domestic supply chain were hampered by the complexity of the system (Figure 9) and the lack of recall or notification powers under the *Biosecurity Act 2015*. However, once a positive testing result was received from AAHL, the department could use powers under the Act to secure the product and direct it for cooking, export or destruction.

FIGURE 9 Typical domestic distribution chain for single container load of imported uncooked prawns and prawn products, Australia



Source: Department of Agriculture and Water Resources

9.2.2 Stocks of uncooked imported prawns in domestic supply chain

The department focused on major national grocery retail chains, wholesalers, distribution centres and approved arrangements, rather than the enormous number of end-point retailers who might stock uncooked imported prawns but who might have sold much of it by the time they were approached. Over 2,500 tonnes of uncooked imported prawns in various sectors of the domestic supply chain were quickly identified.

Retail and distribution centres

From 6 January to 3 March 2017 the department liaised with the four major national food/grocery retailer chains (Coles, Woolworths, ALDI and Metcash/IGA), who agreed to WSSV testing of stock in the supply chain. Three of the four also voluntarily secured stock pending the WSSV test results. Departmental officers initially inspected 156 sites, including over 130 retail sites on the east coast (from Far North Queensland to Tasmania), in parts of Western Australia and at some inland locations, with additional inspections at distribution centres. Uncooked imported prawns were purchased at these sites and tested for WSSV.

Approved arrangement wholesaler sites

On 15 and 16 February 2017 the department directed all 238 operators of freezers at approved arrangements regulated under the *Biosecurity Act 2015* to secure any stock of uncooked imported prawns. Seventy-six of these sites reported having uncooked imported prawns in stock. Verification audits confirmed that the other operators did not have prawn stocks.

Non-regulated wholesaler sites

These sites were more difficult to identify. On 26 May 2017 the department directed a further 131 domestic freezers (including food service distributors supplying restaurants and caterers) to secure any uncooked prawns until they could be tested for WSSV. Only eight of these facilities reported that they held relevant product.

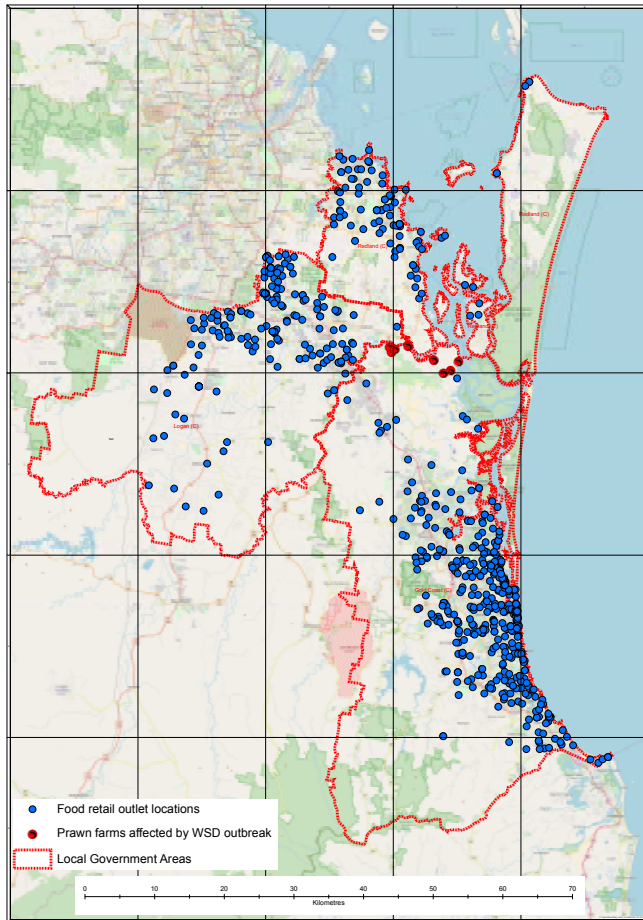
Retail sites (retailers and wholesalers)

Sites where batches had previously tested WSSV positive were prioritised for unannounced inspections to ensure no infected product remained. Batches found to be positive were traced back to the importer and then traced forward to wholesale or retail businesses that had purchased more than 50 kilograms of the WSSV-positive batch. At these sites, inspectors identified and secured over 200 batches of uncooked imported prawns that had either not previously been tested (marinated uncooked prawns) or had not previously been identified for re-testing (unprocessed uncooked prawns). Nearly all these inspections and the securing of goods occurred by the end of April 2017.

Other food/grocery or specialty seafood retailers

Retailers close to key prawn farming areas, such as Logan River (Map 7), Bundaberg, Mission Beach, Proserpine and Yamba were also contacted. It was not practical for departmental officers to visit every one of the tens of thousands of businesses that could be selling uncooked imported prawns in the domestic supply chain. Nevertheless, by October 2017 the department had contacted more than 1,000 additional food/grocery and specialty seafood retail businesses to ensure that uncooked prawns imported before the suspension had either been removed from the domestic supply chain or had been sold and most likely consumed.

MAP 7 Retail food outlets in the Logan River area, November 2017



Note: Indicates only those outlets identified by the Department of Agriculture and Water Resources.
Source: Department of Agriculture and Water Resources

Table 12 summarises the WSSV testing results of marinated and unprocessed uncooked prawns that had been imported in 2016, had passed border controls at that time, and were progressively secured and re-tested in 2017. The WSSV-positive rate for unprocessed prawn batches sampled at approved arrangement wholesaler sites was close to 50 per cent. This provides a possible approximation of the overall rate of positive batches passing border controls, as it was the closest to random sampling and involved a significant quantity of prawns.

However, some of the sampling undertaken by the department was targeted at importers suspected of non-compliant activity. A higher failure rate was observed here. And, the very high rates of positive marinated prawns (which did not require testing) indicated that this category might have been used by some importers to import infected product into Australia.

Post-border WSSV testing from 2016 to 2017 found that 88 per cent of marinated batches and 64 per cent of unprocessed batches were positive—an overall failure rate of 74 per cent for targeted and randomly selected post-border batches of uncooked prawns (Table 13). Product tested included purchases from retail outlets during Operation Cattai and product identified by department staff investigating the WSD outbreak and implementing the post-border withdrawal program in 2017. All of this product had been imported before the import suspension and was either on sale at retail outlets or in storage in the domestic supply chain awaiting sale.

TABLE 12 Post-suspension WSSV testing of uncooked imported prawns in the domestic supply chain, January–October 2017

Business category	Sites targeted (no.)	Date product removed from domestic supply chain	Estimated initial volume (tonnes)	Type of prawns	Batches tested (no.)	WSSV-positive batches (no.)
Retail and distribution centres						
Major national food/grocery retail chains and targeted retail outlets	156	6 January, 17 February, 3 March 2017	307	Unprocessed	47	33
				Marinated	0	0
				Total	47	33
Approved arrangement sites						
Sites approved under the <i>Biosecurity Act 2015</i> capable of storing uncooked imported prawns	238	15 and 16 February 2017	1,975	Unprocessed	206	101
				Marinated	240	207
				Total	446	308
Non-approved arrangement sites						
Targeted freezers	131	26 May 2017	232	Unprocessed	16	8
				Marinated	13	10
				Total	29	18
Retail/wholesaler verification						
Unannounced targeted inspections at sites that purchased part of WSSV-infected batch of prawns	247	Directions to secure product issued on the spot from April to August 2017 (majority in April)	na	Unprocessed	125	95
				Marinated	89	86
				Total	214	181
Total	772	na	2,514	–	736	540

na Not applicable.

Source: Department of Agriculture and Water Resources

TABLE 13 WSSV test results up to October 2017 of post-border prawn batches imported in 2016

Product type	Batches		
	Total (no.)	Positive (no.)	Positive (%)
Marinated	355	313	88
Unprocessed	466	296	64
Total	821	609	74

Source: Department of Agriculture and Water Resources

By 18 October 2017 about 2,523 tonnes of post-border prawn product across the retail and distribution networks and within both approved and non-approved arrangements had been placed under biosecurity control; 689 tonnes remained under biosecurity control, while the balance of 1,834 tonnes had either subsequently tested negative or been released for sale, destroyed, cooked in an approved manner or exported.

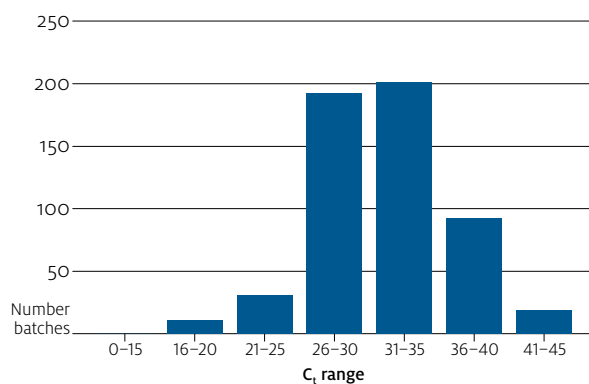
The department contracted AAHL to conduct WSSV testing of prawn batches identified during the post-border withdrawal program. The intention was to identify and remove as much infected product from the post-border supply chain as possible. The testing results obtained between February and September 2017 were classified according to the lowest C_t value in each set of 5 prawns per batch (Table 14, Figure 10). Only 26 per cent of batches tested were found to be negative for WSSV. The requirement to run the tests out to 45 cycles accounted for only 2.6 per cent of total batches (or 3.5 per cent of positive batches) being classified as positive. A further 71 per cent of batches had lower C_t values, indicating stronger viral loads.

The high rate of positive detections when samples were tested at AAHL led to some importers being concerned that the testing applied by AAHL might be over-sensitive and detect contamination rather than true WSSV infection. However, most samples found positive by AAHL were at levels that would also have been classified as 'positive' by the government screening laboratory.

TABLE 14 Strength of WSSV-positive results, AAHL testing of post-border prawn batches

Range of C_t values	Batches	
	No.	%
Negative (more than 45)	196	26.4
40 to 45	19	2.6
36 to less than 40	77	10.4
Less than 36	450	60.6
Total	742	100

Source: Australian Animal Health Laboratory

FIGURE 10 Range of C_t values in WSSV-positive post-border prawn batches found by AAHL

Source: Australian Animal Health Laboratory

9.3 Variations to uncooked prawn import suspension order, January to June 2017

From January to June 2017 various categories of uncooked prawns were exempted from the suspension order based on importer representations and individual risk assessments by the department (Table 15).

TABLE 15 Changes to import conditions, 9 January to 7 July 2017

Date	Category of prawns	New import conditions
9 January 2017	All uncooked prawns, uncooked prawn meat, uncooked marinated prawns and uncooked prawn meat	Imports suspended after determination from 6 January 2017
	Prawns in transit on or before 8 January 2017 or arrived but not yet released from biosecurity control	Seals-intact direction, 100% inspection of consignment and sampling inspection and testing of all consignments. Importers could export goods if they did not want them inspected. Interference with goods prior to inspection by a biosecurity officer would result in a direction to export being issued and possible prosecution.
	Uncooked prawns and uncooked prawn meat from New Caledonia	Exempted from suspension—continuation of previous import conditions
	Uncooked prawns and uncooked prawn meat processed into dumplings, spring rolls, samosas, rolls, dim sums or similar products	Exempted from suspension—continuation of previous import conditions
	Uncooked breaded, crumbed or battered prawns and uncooked prawn meat	Exempted from suspension—continuation of previous import conditions On 22 March inspection rate increased from 25% to 100%, and goods subject to seals-intact inspection.
6 February 2017	Dried prawns and shelf-stable prawn-based food products	Exempted from suspension—continuation of previous import conditions
	Irradiated bait for aquatic use, pet fish food and aquaculture feed	Exempted from suspension—continuation of previous import conditions
	Uncooked prawns from Australia's exclusive economic zone beyond 12 nautical miles, excluding Australian caught prawns that had been exported to another country for processing	Exempted from suspension—continuation of previous import conditions

continued

TABLE 15 Changes to import conditions, 9 January to 7 July 2017 *continued*

Date	Category of prawns	New import conditions
28 February 2017	Uncooked prawns and uncooked prawn meat harvested in Australia (other than the area that the Movement Control Order relates to) and sent to the external territories	Exempted from suspension— continuation of previous import conditions
	Uncooked prawns and uncooked prawn meat harvested from the external territories and imported into mainland Australia or moved between the external territories	Exempted from suspension— continuation of previous import conditions
	Uncooked prawns harvested in Australia (wild-caught in Australian territory other than the area that the Movement Control Order relates to) exported for processing in a facility approved by the Thailand Department of Fisheries and re-exported to Australia	Exempted from suspension— continuation of previous import conditions
	Uncooked prawns and uncooked prawn meat imported into Australia as transhipped goods for outgoing passenger vessels engaged in international travel and as laboratory or food samples for analysis	Permitted to transit without testing
15 May 2017	Uncooked marinated prawns	Exempted from suspension, subject to overseas testing for freedom from WSSV and YHV and on-arrival seals-intact inspection and testing
7 July 2017	Uncooked (including marinated) prawns	Suspension lifted, subject to overseas testing for freedom from WSSV and YHV and on-arrival seals-intact inspection and testing

After Operation East Leichhardt, from 2014, some highly processed prawn products ('marinated and marinara mix' and 'breaded, crumbed or battered') had been subjected to 25 per cent inspection on arrival in Australia to verify that they were sufficiently marinated or breaded. Both categories had been exempt from sampling and testing.

Marinated prawns and marinara mix were included in the initial January 2017 suspension due to their very high rate of WSSV and the possibility that they might be washed post-border and presented for retail sale as uncooked prawns.

Breaded, crumbed or battered prawns were considered less likely to be diverted for sale as uncooked prawns. They did not require testing, but the department decided to standardise the criteria for 'adequate coverage' of the prawns by crumbs or batter and require 25 per cent of randomly selected consignments to undergo full seals-intact inspections.

Some prawn importers began importing different categories of uncooked prawns that did not require enhanced inspection and testing. For example, after marinated prawn imports were suspended in January 2017 imports of breaded and battered prawn consignments increased fourfold (February to March 2016). In response, on 22 March the department increased the inspection rate for this category to 100 per cent of consignments.

As the failure rate of different categories of prawn products became apparent, some importers simply turned containers around for re-export, so that they were never inspected (Table 16).

TABLE 16 Prawn consignments re-exported without inspection, 9 January to 17 October 2017

Types of prawn/prawn product	Consignments (no.)
Marinated, cooked/uncooked	23
Raw	20
Battered breaded	9
Dried	1

Source: Department of Agriculture and Water Resources

Imports of cooked prawn product increased markedly. Inspectors also noted a trend to import very lightly blanched prawn consignments, some with cartons marked 'must be cooked further'. This raised the question of whether such imports contained infective WSSV and, noting the paucity of studies on inactivation of WSSV, the significance of positive tests on such products.

9.3.1 New interim import conditions after suspension expired

The import suspension on uncooked prawns lapsed at midnight 6 July 2017¹⁴⁴ and enhanced import conditions¹⁴⁵ for prawns and prawn products were implemented from 7 July 2017. Uncooked prawns, marinated prawns and Australian prawns processed overseas (excluding those processed in an Australian Government-approved supply chain) were consolidated into the one product class—uncooked prawns.

The country of origin's competent authority was required to certify that each batch (limited to a total size of one container load) of uncooked prawn imports had been found to be free of WSD and YHD. This would be achieved through post-processing and pre-export sampling and testing based on methods recognised by the OIE.

On arrival, each shipment would also be subject to a full seals-intact inspection, with further sampling and testing of each batch at an approved Australian screening laboratory, using a standardised qPCR testing method. Any sample with C_t values of up to 44 would be considered positive. Samples giving readings over 40 would be submitted to AAHL for confirmatory testing. Only batches that passed testing for both WSSV and YHD would be released from biosecurity control.

By 26 September 2017 eight countries (Bangladesh, Brunei Darussalam, China, Denmark, India, Malaysia, Thailand and Vietnam) had provided written confirmation that they could meet these new offshore testing and certification conditions. These countries were placed on an 'approved country' list for uncooked prawn imports.

By 1 December 2017, 142 consignments (191 batches) of uncooked prawns had been imported under the enhanced import conditions and 22 more consignments were in transit. Of these 142 consignments, 100 consignments (133 batches) had tested negative for WWSV, 3 consignments (3 batches) had tested positive and the remaining 39 consignments (55 batches) were held under biosecurity control pending test results. Two of the consignments that tested positive were to be re-exported while the owner of the third was yet to decide whether to request confirmatory testing at AAHL or re-export.

Chapter 10

Future pre-border and border measures for trade in prawns

10.1 Revising prawn import conditions

It is clear that the previous prawn import conditions (as they were applied from 2010 to 2016), which relied largely on border biosecurity risk management measures, were singularly ineffective at keeping WSSV out of Australia. The cumulative effect of failures of pre-border and border measures is shown by:

- high levels of WSSV found in retail prawns during Operation Cattai
- the high batch failure rate of prawns imported in 2015–16 (as re-estimated in early 2017)
- the detection in 2017 of over 70 per cent of WSSV positivity in uncooked prawn batches imported in 2016 (as found by the post-suspension prawn withdrawal and testing described in section 9.2), and
- possibly the WSD outbreak in south-east Queensland.

Following the 2016–17 WSD outbreak, and progressive elucidation of the whole prawn import history and findings described in this report, the department announced on 16 May 2017 that it would undertake a review of the biosecurity risks of and the import conditions for prawns and prawn products for human consumption from all countries¹⁴⁶. This review was expected to take at least two years and would also presumably take into account the findings of the IGB and Senate reviews and re-examine risk management measures needed to achieve Australia's ALOP.

The department continually assesses and updates its response to biosecurity threats. Since 2009 the IRA process has been refined and the Act replaced. However, resource constraints make full reviews of IRAs challenging. For example, it took the department 12 years to develop the 2009 prawn IRA (chapter 5). Resource constraints also potentially affect the department's ability to conduct the depth of stakeholder consultation and to commission research in response to challenges to specific conditions and appeals, which it was able to do in developing the previous IRA up to 2009.

A number of submissions to both this review (submissions 1 to 3 in Appendix C) and the Senate review⁴ put the case for importing only cooked prawns into Australia to avoid the risks of (re)-importing WSSV and other known or emerging prawn diseases. These submissions argued that limiting prawn imports to cooked or irradiated product would remove the need for certain pre-border or border biosecurity measures (notably sampling and testing of individual consignments) that had proven to be either ineffective or difficult to implement. They drew parallels with the far more stringent import requirements for different terrestrial animal products such as beef, pork and chicken meat, where cooking is a precautionary risk management measure imposed on most products from countries that are not free of key exotic diseases^{8, 147}.

It is clear that requiring cooking or irradiation of prawns, either offshore or in an approved premise in Australia, would minimise the risk of entry of infected uncooked prawns to Australia and their subsequent availability on the Australian retail market. This would be analogous to arrangements for imported pork products, such that no uncooked product is permitted post-border entry¹⁴⁸. However, there remain questions about whether virus in 'cooked' product is truly inactivated, especially in lightly cooked product imported with labels indicating that further cooking is required (section 5.3.3; Recommendation 3).

Nevertheless, the department has already implemented several changes to prawn import conditions during and since the import suspension, and uncooked prawn imports have recommenced under the enhanced conditions described in Section 9.3. It therefore seems likely that uncooked prawn products will continue to be imported into Australia for at least the next two years. For these reasons, we must consider how the biosecurity risks of uncooked prawn imports can be managed better in future.

10.2 Future pre-border biosecurity risk management for trade in prawns

When the prawn IRA was being developed over a decade ago, the department considered it impractical to rely much on pre-border risk management activities because arrangements between the department and competent authorities (CAs) were often poorly formalised. Since that time, the department has improved its pre-border risk management processes. The requirement for CAs to certify that uncooked prawn imports have passed offshore WSSV and YHD testing, with further seals-intact inspection and testing on arrival, is a step forward in keeping infected prawns out of the country.

However, prawn sampling and testing regimes, even as enhanced recently by the department, can only be expected to exclude most but not all infected prawn batches. Hence their limitations will still apply when this pre-export testing is carried out. Some batches cleared overseas will still be found to be WSSV positive by border sampling and testing on arrival—even those subjected to a rigorously applied sampling and testing regime that aims to detect a 5 per cent within-batch prevalence with 95 per cent confidence. Even with this repeated batch testing implemented perfectly, a small number of virus-infected batches of prawns will enter Australia.

The department interacts regularly with key pre-border and border stakeholders to promote better understanding and awareness of biosecurity risks in the prawn trade. Stakeholders include overseas competent authorities and embassies, brokers and importers, and owners and managers of approved arrangements (warehouses and laboratories). The department updates these stakeholders on import conditions, and encourages their enhanced compliance with biosecurity requirements and controls, by:

- updating import requirements in its Biosecurity Import Conditions (BICON) system¹³⁰ as it identifies changes in biosecurity risk in source countries, as a result of ongoing surveillance and intelligence activities, OIE notifications and International Biosecurity Intelligence System alerts, and
- issuing BICON alert notices when required on changes to import requirements, outbreak of a pest in a country of origin or an area within a country, on test regimes and laboratories approved for testing WSSV and YHV.

The current import requirements in the BICON system for uncooked peeled prawns require accompanying official government certificate to state the following:

Product from each batch has been found post-processing to be free of white spot syndrome virus and yellow head virus based on a sampling and testing method recognised by the World Organisation for Animal Health (OIE) for demonstrating absence of disease.

However, there is no method in the OIE *Manual of diagnostic tests for aquatic animals*¹⁴⁹ for demonstrating complete absence of disease in a consignment. Article 1.4.8 of the *Aquatic Animal Health Code*²³:

Scientific methods cannot provide absolute certainty of the absence of disease. Demonstrating freedom from disease involves providing sufficient evidence to demonstrate (to a level of confidence acceptable to member countries) that disease with a specified pathogen is not present in a population. In practice, it is not possible to prove (that is, be 100 per cent confident) that a population is free from disease. Instead, the aim is to provide adequate evidence (to an acceptable level of confidence), that disease, if present, is present in less than a specified proportion of the population (that is, threshold prevalence).

This is why the 2009 IRA conditions specified '95 per cent confidence in detecting a batch prevalence of 5 per cent or greater'. Indeed, the OIE suggests that for a test that is 100 per cent sensitive and specific, a random sample size of 150 prawns will still only detect an infection at 2 per cent or greater in a population.

It would be useful for the department to review import requirements currently in the BICON system and align them with OIE terminology.

Recommendation 4

The department should review import conditions for uncooked prawns listed on its Biosecurity Import Conditions (BICON) system to ensure clarity and consistency with OIE terminology, scientific accuracy and usefulness for verification at the border.

Department's response: Agree. Import conditions have been reviewed and updated and will be further reviewed and updated as the risk review progresses.

After resumption of imports in July 2017, the department moved to an ‘approved country’ list (section 9.3), enabling it to provide the competent authority (CA) in an approved country with feedback on non-compliance by a supplier. This would allow the CA to take corrective action, with provisions to delist exporters or suspend imports from a country if an exporter consistently failed to meet import requirements. The department intended to audit CAs and evaluate compartments and zones that are free of WSSV and YHV in the near future.

The new import requirements provide an opportunity for countries (and specifically their CAs) to work with their prawn industries and major companies to establish specific pathogen free (SPF) biosecure supply chains. Many global examples of such chains exist, for varied agricultural commodities, with biosecure arrangements ‘from farm to fork’ underpinned by verifiable quality assured, hazard analysis and critical control point (HACCP)-based systems. Such arrangements will require overseas prawn farms to maintain their freedom from WSSV and YHD by excellent on-farm biosecurity. Linkages through their processing plants to exporters will help ensure that the integrity of each batch is maintained throughout processing without contamination from or mixing with other batches.

Some countries and companies are already developing such vertically integrated prawn production and processing facilities and quality assurance systems that help provide biosecurity and food safety guarantees. It might also be possible for some or all of the four large retailers in Australia to implement approved supplier arrangements with large offshore prawn producers, where they tightly source WSSV- and YHD-negative prawns for import. However, implementation of vertically integrated systems all the way from overseas prawn farms to Australian retail chains over time may not be feasible, given the complexity and likelihood of changes in offshore prawn production and processing arrangements.

Recommendation 5

The department should work with competent authorities and industry to ensure that, where possible, uncooked prawn products are imported from specific pathogen-free countries, zones or compartments. This should be industry-driven and involve:

- quality-assured supply chain management
- competent authority verification of pre-border status of consignments, and
- regular departmental offshore audits or verifications of these arrangements.

Department's response: Agree in principle. In conducting the risk review, the department will consult with competent authorities and industry to consider the designation of specific pathogen-free countries, zones or compartments for the import of uncooked prawn products.

10.3 Future border biosecurity compliance management

10.3.1 Strengthened assessments and inspections must continue

Future imports of prawns and other frozen foods should receive enhanced assessment and inspection over the longer term given the evidence of serious non-compliance and the apparent incentives to misdeclare or co-mingle prawn shipments with other products. Operation Cattai (2016) showed that targeted consignments did not always contain the declared products and that cartons inside did not always contain the product on the label. Other reports^{150, 151} regarding other seafood imports document strategies such as incorrect labelling of consignments. Examples include labelling canned abalone as another product such as vegetables, mixing abalone with other product so it passes undetected on cursory inspection or placing a layer of lobster on top of a bin of abalone and declaring the entire consignment as 'lobster'. Another documented method of avoiding inspection is simply to remove the goods from the docks, effectively 'losing' the container.

For these reasons, the enhanced inspection protocols for imported uncooked prawns should place a high reliance on seals-intact inspections of containers. The process of collecting random samples from each batch of uncooked prawns in a consignment cannot be effectively carried out by a single inspector; it also requires two inspectors to be present for when each container is being unpacked.

Recommendation 6

The department should continue to conduct full seals-intact inspections of uncooked prawn imports (by at least two inspectors). It should also review measures to ensure integrity of the seals-intact containers until inspection.

Department's response: Agreed and implemented.

Rigorous assessment and inspection of declared consignments of uncooked prawns is unlikely to be sufficient to guard against non-compliant behaviour. Uncooked prawns must be imported as frozen product. Unscrupulous importers may try to bring in prawns labelled or otherwise presented as other frozen goods that do not have to go to approved arrangements but can proceed to an unregulated freezer^{150, 151}. A way to discover and/or deter such behaviour is to implement and publicise an ongoing program of random seals-intact inspections of all frozen foods, including cooked prawns, other seafood and any other frozen food. This option will require consideration of the logistics and cost-recovery implications over time and at different ports. This program will require implementation at a level, which will provide a real deterrence to non-compliance.

It should be possible to scale up or down to a higher or lower random inspection rate of cooked prawns and other foods depending on whether compliance is demonstrated. It would seem most unwise to revert to the previous regime of relying largely on importer declarations.

Recommendation 7

The department should implement and publicise an ongoing program of random and risk-based, seals-intact inspections of frozen goods to ensure that uncooked prawns are not being imported as other frozen foods.

Department's response: Agree. This may be implemented as part of the department's cargo compliance verification program.

The longstanding practice of having lone inspectors visit importers' premises to inspect and/or sample imported goods places these inspectors in a difficult position. It creates potential for 'client capture' and for deliberate deception^{152, 153, 154}. Frontline inspection staff are also under pressure to perform difficult tasks requiring judgement and concentration in potentially dangerous and hostile workplaces.

In 2008, after considering submissions about the department's staff rotation policy, an independent review by Beale et al. noted:

While there are obvious advantages to be gained through staff rotation, such as the avoidance of regulatory capture and the career development of staff, there are also disadvantages in terms of the loss of expertise, administrative expense and additional training and supervisory burdens for the organisation. The Panel found that the existing rotation policy was overly rigid and that in some cases, the rotation periods had been too short. The Panel observed that staff rotations were not always based on improving the capability and effectiveness of individual staff members. Instead they were sometimes influenced by industrial considerations, such as a perception of 'equitable' access to overtime or shift loadings, which are issues that should be dealt with through other mechanisms. The management of the Authority will need to develop a carefully thought through policy on staff rotation. In the Panel's view, this policy should address more than just regional staff rotation, and be expanded to include the issue of rotating staff between policy and operational roles^{85 (pp. 216-17)}.

The panel recommended that:

[Recommendation 84] The National Biosecurity Authority should review staff training and rotation practices to ensure that they provide an optimum balance between development of broadly skilled officers, the deepening of expertise through experience in a role and the avoidance of regulatory failure through officers developing inappropriately close relationships with the clients they are servicing^{85 (p. 217)}.

During Operation Cattai, the department found no evidence that there had been any ‘client capture’ or regulatory failure due to inspectors forming close relationships with prawn importers. Nevertheless, such behaviour remains a possibility^{155, 156, 157}, which can be mitigated by periodically deploying two staff or by single staff rotation.

Recommendation 8

The department should ensure that inspections at approved arrangements, especially at regulated cold stores, are periodically carried out by two inspectors. If only single inspectors are available, they should be regularly rotated.

Department’s response: Agree. Revised processes have been implemented.

The issuing of import permits and ‘approved arrangement’ status to individuals and companies must be monitored more closely. The department is strengthening processes to delist people and entities that do not pass a ‘fit and proper person’ test. This will need to be kept under review and appropriately resourced.

Encouraging industry self-regulation and quality assurance programs through the supply chain, with government as the regulator of last resort, is a key means of achieving compliance while reducing unnecessary regulation. However, the pendulum can swing too far towards remote assessment and reliance on industry operating approved arrangements. Self-regulation needs to be monitored more closely, with more risk-based, unannounced spot audits of approved arrangements.

The department’s culture of ‘service delivery’, was embodied in the previous name of the division that employs its assessment and inspection staff, and by a charter of client service that specifies an expectation of prompt service to facilitate trade. This approach, while commendable, can reinforce a perception that biosecurity officers are there to do their job with as little interference as possible in the smooth progress of goods through required border biosecurity risk management operations. A balance must be struck between facilitating efficient trans-border movement of goods and ensuring that biosecurity risks are effectively managed, recognising that the final ‘clients’ of the biosecurity system are the Australian community, industries and the environment. It is notable that the previous Service Delivery Division has more recently been renamed the Biosecurity Operations Division, which more accurately reflects its function.

Upskilling and motivating staff is an ongoing issue in the face of rapidly changing working environments. Also needed are feedback and recognition for excellent work—sometimes as little as a letter of appreciation or a cup of coffee¹⁵⁸—and processes that detect and deter poor work practices.

Recommendation 9

The department should facilitate the development and implementation of a nationally consistent competence and verification framework covering staff involved in assessing and inspecting imported uncooked prawns and other commodities. This should be regularly reviewed and adequately resourced.

Department’s response: Agree. The Department has implemented a national competency and verification framework for prawn inspections.

Training processes, instructional material and work directions need ongoing review and monitoring by operational and technical senior staff to ensure that they are up to date and can be applied as intended.

Recommendation 10

The department should improve internal communication to develop and implement training processes, instructional material and work directions that are technically sound, suit the conditions being experienced and are applied as intended. These should be monitored and regularly reviewed.

Department's response: Agree. The department has implemented improved internal communications arrangements, updated instructional material and has strengthened arrangements to ensure that the required processes are being applied as intended.

10.4 Resourcing border biosecurity adequately into the future

Strengthening pre-border and border biosecurity risk management measures to prevent unwanted pest and disease entry into Australia requires long-term secured funding.

10.4.1 Impact of cuts in frontline staff resources

Frontline inspector numbers have fallen by 25 per cent over the past five years (Table 17). However, the volumes of imported goods, mail and passengers continue to rise steadily.

Biosecurity risks are also increasing, with increased global population and food production intensification accelerating the spread of pests and diseases. Better use of IT, robotics, remote sensing and other technologies can vastly improve the efficiency of some biosecurity risk management processes and replace repetitive work, transforming work practices and organisational behaviour. Nevertheless, as shown with prawn imports, human inspection and enforcement need strengthening to detect and prevent sophisticated non-compliant behaviour. Flexibility in deploying inspection staff to targeted operations without compromising other biosecurity operations also requires sufficient staff availability.

TABLE 17 Inspector workforce, Department of Agriculture and Water Resources, 2013–14 to 2017–18

Year	Staff (full-time equivalent)
2013–14	1430.09
2014–15	1247.93
2015–16	1071.87
2016–17	1087.98
2017–18	1064.00

Source: Department of Agriculture and Water Resources

For example, as Operation Cattai was rolled out in late 2016, a number of Sydney-based importers ceased raw prawn imports. At the same time, Melbourne required more inspections than predicted due to the levels of non-compliance found there. This resulted in increased pressures on inspection staff and required redeployment of some staff for extended periods, often with no potential for backfill. This in turn led to the suspension of the Cargo Compliance Verification program, which could also have created other vulnerabilities. In 2017 the massive effort required for securing, testing and withdrawing previously cleared, imported and uncooked prawns from the domestic supply chain meant that many other routine and targeted biosecurity operations had to be deferred.

10.4.2 Balance between cost-recovered and government-funded activities

Governments are always trying to reduce public costs and unnecessary regulation that can impose extra costs on businesses. Cost-cutting strategies (referred to as ‘productivity dividends’), such as imposing ceilings or cuts on the department’s budget and average staffing level (ASL), directly affect the department’s ability to resource biosecurity management.

The department recovers most of its pre-border and border biosecurity costs from importers. Activities funded by cost-recovery should be exempt from ASL ceilings. This would ensure that the department has adequate staff to respond to increased trade or biosecurity risk management of different imports—without compromising other necessary functions.

The department also needs a sufficient level of government or general levy funding to verify compliance with import conditions for commodities (such as imported frozen foods) that may be subject to risks of misdescription. It is dangerous to set funding too low and particularly to remove funding for random detection activities. The department needs sufficient government funding for both targeted enforcement operations and random surveillance of imported frozen goods to ensure that importers are not diverting product and exposing Australia to biosecurity risks such as WSSV.

If implemented, recommendations in this chapter will require the ongoing deployment of extra staff, a cost that will not be fully recoverable. For example, it would be unreasonable to charge an importer of frozen peas the cost of a randomly selected full seals-intact inspection of their consignment—unless serious non-compliance were detected.

The considerations of the independent review of Australia’s quarantine and biosecurity arrangements in 2008⁸⁵ remain highly relevant today. After considering submissions to their review, Beale et al. noted that:

The Panel’s earlier recommendations will only be effective if the National Biosecurity Authority is adequately resourced and able to adopt a risk-return approach to allocating its resources. Cost recovery arrangements cannot be an excuse for this not occurring. A risk-return approach also requires sufficient senior management capacity to ensure the Authority is able to look beyond its day-to-day workload to comprehend its strategic direction. The management structure should provide clear national priorities, standards and operating directions and allow for tactical allocation of resources at a regional level^{85 (p. 193)}.

The panel recommended that:

[Recommendation 77] In developing cost recovery arrangements, the National Biosecurity Authority should consult with business groups, but have the ultimate responsibility of recommending to the responsible Minister a cost recovery package that will support the provision of an effective and efficient regulatory function including:

- a adequate and long-term investment in infrastructure, including information technology and information services;
- b appropriate funding for staff and training;
- c the costs of auditing pre-border and border biosecurity certification; and
- d the cost of diagnosing a proportion of interceptions to inform a risk-return approach to activities^{85 (p. 213)}.

Recommendation 11

The Australian Government should commit to ensuring adequate long-term funding for biosecurity risk management, including border inspections and enforcement. Funding should be linked to growth in imports and biosecurity risks, with cost-recovered functions exempt from efficiency dividends and staff ceilings.

Department's response: Noted. This is a matter for government.

10.5 Stronger powers and penalties under the *Biosecurity Act 2015*

Key differences between the *Quarantine Act 1908* and the *Biosecurity Act 2015* and the processes required to administer them affected management of the WSD outbreak, suspension and resumption of uncooked prawn imports, and management of the wider biosecurity risk framework. Further amendments to the *Biosecurity Act 2015* were underway at the time this report was being prepared.

Up to June 2016, under the *Quarantine Act 1908*, the low penalties available for minor non-compliance, and the difficulties of mounting successful prosecutions even for serious non-compliance, meant that it was difficult to take a risk-based approach to deal effectively with many non-compliant behaviours, which increased biosecurity risks. In practice, the penalties available and applied were often not commensurate with the potential profits or risks caused by the non-compliant behaviour.

For example, Operation Penaeus, an investigation into a number of east coast prawn farms, regarding illegal importation from Taiwan of feed supplements used in prawn hatcheries, began in 2006. The goods were imported in containers of bulk grow (pelletised) without valid import permits. The matters were only finalised in court in 2010 with the relevant directors being sentenced to varying terms of imprisonment and the companies being fined¹⁵⁹.

The *Biosecurity Act 2015* modernises previously complex regulatory provisions and administrative practices, and provides new powers including:

- an enhanced range of enforcement options, for example:
 - additional infringement notices
 - civil penalties
 - enforceable undertakings — written agreements between the department and someone who poses a risk of non-compliance, with provision for civil prosecution where a person fails to comply with the specified obligations
 - injunctions, issued by a relevant court, to compel a person to undertake a particular action, or to refrain from carrying out a particular action,
- a ‘fit and proper person’ test allowing the government to use compliance history to assess the appropriateness of a person or business to be able to import goods or enter into an approved arrangement,
- provisions enabling information gathering to support the biosecurity system,
- mechanisms to clearly identify biosecurity risks offshore, onshore and at the border, and manage these risks using a broad range of Commonwealth powers,
- expanded onshore powers for the Commonwealth to cooperatively manage and address pest and disease incursions with state governments and/or the private sector, and
- provisions for an approved arrangement scheme that replace the previous duplicative quarantine approved premises and compliance agreement provisions.

However, these extra powers and penalties are still not commensurate with the very high potential profits and risks associated with circumventing pre-border and border biosecurity controls and importing cheap, low-quality uncooked prawns to Australia.

The new Act also provides a range of protections for individuals and their goods. The protections increase as the level of intervention becomes more significant, for example for the destruction of high-value goods. There are higher threshold requirements for exercising biosecurity risk assessment and management and powers over goods that are no longer subject to biosecurity control.

The use of destruction of non-compliant consignments by departmental order, where there is clear evidence of deliberate attempts to circumvent biosecurity controls, should be considered. By comparison, there are far wider powers and more severe penalties in the Commonwealth *Fisheries Management Act 1991*, for inspectors to seize and order destruction of boats, fishing gear and illegally-caught fish where illegal fishing is detected.

The experience of dealing with severe non-compliance detected by Operation Cattai demonstrated the desirability of being able to suspend accreditation of approved arrangements with immediate effect when there is compelling evidence of ongoing unacceptable biosecurity risk in the form of entity recklessness or deliberate subversion of controls.

Powers to impose direct penalties (for example, by ordering destruction of non-compliant imports or rapidly withdrawing permission for approved arrangements) and penalty levels for serious offences need to be reviewed and made easier to apply where appropriate.

Recommendation 12

The department should consider seeking stronger powers under the *Biosecurity Act 2015* to apply direct penalties for serious non-compliance and impose administrative sanctions or on-the-spot fines for relatively minor non-compliance.

Department's response: Agree. While the Biosecurity Act already provides powers to apply direct penalties for serious non-compliance and penalties for relatively minor non-compliance in the form of infringement notices, the department will consider whether stronger powers are required.

The post-border withdrawal/testing program to manage the biosecurity risks associated with imported WSSV-infected prawns entering Australian retail markets was designed to optimise use of the powers of the *Biosecurity Act 2015*. Where there were no powers for testing or withdrawal under the Act, the department worked closely with key stakeholders to encourage voluntary access for the department to test prawns. This resulted in the identification of WSSV-infected prawn batches and, by bringing the product within the scope of the Act, their withdrawal from the supply chain.

However, the program could have been far more effective if the *Biosecurity Act 2015* provided powers to conduct a general recall of goods for biosecurity purposes, as can be done under state and territory food-related health legislation.

Recommendation 13

The Director of Biosecurity should seek powers under the *Biosecurity Act 2015* to conduct a general recall of goods for biosecurity purposes.

Department's response: Agree in principle. Proposed changes to the Biosecurity Act have been drafted that will provide powers to enable the improved management of a similar event.

10.6 Improve biosecurity risk governance and risk communication

10.6.1 Internal risk management and communication

The complexity of the department's system for managing biosecurity risks associated with a dizzying array and volume of imports disguised the rising risk levels in the prawn trade. Many indicators led the department to launch investigations through operations East Leichhardt (2014) and Cattai (2016). However, the broader significance of the heightening risks was overlooked and the situation was not actively managed with the urgency it deserved. This was partly a result of poor internal communication between staff operating in frontline inspection, compliance enforcement, technical standard setting, and policymaking. It was also a consequence of competing priorities and resource constraints. Poor internal communication is likely to have contributed to the breakdown of biosecurity controls designed to prevent WSSV entering Australia.

The department responded regularly to potential non-compliance with import requirements that had been identified through inspection, intelligence reports or information provided by third parties. However, it had not formalised an internal communication plan when systemic non-compliance with Australia's prawn biosecurity controls was uncovered during operations East Leichhardt and Cattai.

Within the department, the Compliance Division would be the first area to investigate such matters. Compliance officials would raise the issue with the relevant policy area (in this instance, in the Biosecurity Animal Division) and brainstorm potential consequences. If a matter was considered sufficiently serious, it would also be brought to the attention of the department's senior executives. Following this, an action plan would be developed and formalised to target entities engaged in suspected non-compliant activities, and the department would direct internal resources to undertake an investigation. As explained to the Senate, the department routinely has up to 70 compliance investigations underway at any time¹⁶⁰ and is reluctant to advertise ongoing investigations that might later compromise a prosecution.

Operation Cattai was still in progress when WSD broke out in prawn farms on the Logan River. The department acknowledges that its findings were not reported within the department in a manner or time frame commensurate with the increasing proof of non-compliance, the resulting presence of WSSV and consequent risk of WSD. The failure to recognise the significance of the mounting evidence was surprising, because serious non-compliance would be expected to increase biosecurity risks. It was reasonable to assume that extensive non-compliance with uncooked prawn import conditions would result in an increased risk of WSSV or other pathogen importation and therefore a risk of WSD or other diseases entering Australia.

However, the assumptions detailed in section 5.2 and the lack of previous establishment of exotic prawn diseases in Australia appear to have resulted in department staff discounting the emerging evidence of potential biosecurity risks. This discounting of risks was only dispelled when WSD broke out in Queensland and staff conducted subsequent investigations.

New processes for enhanced risk identification, communication, management and governance must be developed and regularly reviewed. The department is undertaking a range of actions to address learnings from the outbreak and suspension, such as additional processes for risk identification and resolution, decision-making and information-sharing. These include:

- a senior executive group (comprising First Assistant Secretaries and the Deputy Secretary responsible for biosecurity) for strategic issues management and decision-making
- an Assistant Secretary-level group to monitor performance of the risk management system, track and resolve issues as they arise and support effective consultation on changes that affect the whole department, and
- specific programs, such as common issue registers and workshops, to enable the department to identify and resolve issues.

Recommendation 14

The department should continue to improve internal biosecurity risk governance and communication to rapidly identify emerging biosecurity risks. Risks should be communicated to governments, the wider community and industry through a defined and documented triaging and escalation procedure.

Department's response: Agree in principle. The department's Active Risk Management program is helping to improve internal biosecurity risk governance and communication to rapidly identify emerging biosecurity risks. Risks will be communicated to other governments, the wider community and industry as appropriate to the specific circumstances.

10.6.2 Improving external risk communication

In 2016, without a disease outbreak or a cost-sharing agreement defining mutual obligations of all parties for risk mitigation, communication about the compliance failures in the prawn import trade to either states/territories or industry may not have led to changed behaviours or better management of potential biosecurity risks. Public disclosure of the evidence may well have increased risk and made non-compliance harder to find in the short term.

Nevertheless, the lack of external risk communication meant that the Australian Government was shouldering a greater risk burden because the other parties could assume that the border risk management and the 2009 IRA were being effectively implemented. Under the circumstances, these parties could argue that they were lulled into a false state of security.

Mechanisms for joint biosecurity risk assessment and communication between the department, states/territories and industries need to be reviewed and strengthened. Raising public awareness of issues in a way that will promote behaviours that reduce biosecurity risks is a complex task. Nevertheless, it requires sustained joint action.

Communication by the department with post-border stakeholders—state/territory government agencies and Australian agricultural and aquaculture industries—about potential or emerging risks normally relates to serious pest and disease risks or incursions.

When any suspect exotic animal disease is detected post-border by a state or territory government agency that agency must inform the Australian Government, and the diagnosis must be confirmed by AAHL so that true detections can be reported internationally. However, there is not always an obligation for an Australian government agency to report a post-border detection of an exotic agent to the relevant state or territory government. For example, the Darwin WSSV incident of 2000 was reported by the relevant NT agency to the Australian Chief Veterinary Officer, who convened an AqCCEAD meeting for national consideration of its significance and oversight of a response. However, the 2013 detection of WSSV in retail prawns by AAHL did not trigger an AqCCEAD meeting because it was made by an Australian Government agency and reported to the department, which then determined that the risks were not significant enough to warrant a national discussion.

From at least August 2016, the department (through Operation Cattai) was aware that large numbers of consignments of imported raw prawns and prawn products were infected with WSSV and that these products posed a significant ongoing risk. However, the department did not share this information with state agencies^{161, 162}, and only briefed the Minister and the Assistant Minister on 5 January 2017¹⁶³, one day before the prawn import suspension.

The department needs to consider a complementary requirement for any post-border detection of an exotic agent (for example, WSSV in retail prawns) to be reported to the relevant state/territory authority. States and territories, not the Australian Government, have powers to carry out disease control within their borders.

Recommendation 15

The department should discuss with the National Biosecurity Committee mandatory reporting of all post-border detections of prescribed exotic disease agents or pests to Australian and state/territory government departments.

Department's response: Agree. The Australian government reports post quarantine detections to state and territory governments and will seek the National Biosecurity Committee's agreement that states and territories share similar information with the Australian government and with each other.

10.6.3 National engagement and communication framework

Effective communication is critical to biosecurity risk management and should focus on developing a shared view of controls (import requirements) and an understanding of the needs and capabilities of all stakeholders. Most industry participants are likely to recognise the greater long-term benefits of a transparent and cooperative approach.

Under the IGAB, a National Biosecurity Engagement and Communication Framework¹⁶⁴ was developed and endorsed by the National Biosecurity Committee in February 2013 to:

- implement nationally consistent biosecurity communication strategies to achieve national goals and objectives
- develop national tools and products to improve accessibility to biosecurity information
- share effective and relevant communication tools and products for use among jurisdictions
- establish, review and revise governance of engagement and communication activities
- establish education, communication and engagement methods and arrangements to facilitate non-government stakeholder participation in biosecurity activities (such as passive surveillance and compliance).

The department is implementing^{138, 165} some of these measures with funding from the Australian Government's *Agricultural Competitiveness White Paper*¹⁶⁶ initiative. The funding aims to improve active management of biosecurity risks. This will include the development of an integrated information system coupled with a biosecurity analytics capability¹⁶⁷.

Biosecurity sectoral committees are developing supporting strategies and plans for engaging and communicating with stakeholders on relevant issues.

During fieldwork, the IGB met several industry stakeholders (including industry representatives, individual importers and laboratory staff undertaking WSSV and YHV testing) who raised concerns about the department's lack of transparency in sharing information.

It is in the interests of both industry and the department to work together and resolve any issues through regular communication. It is commendable that the prawn industry and community are cooperating with the department through Biosecurity Queensland in its attempt to contain and eradicate WSD from Australia.

Recommendation 16

The department should collaborate with state/territory agencies, Animal Health Australia and relevant industry bodies to review and implement more effective communication policies to aid the early dissemination of information about exotic aquatic diseases and pests and their management to stakeholders.

Department's response: Agree. Implementation is progressing.

10.7 Better national technical coordination and oversight of laboratory testing

10.7.1 Strengthening prescribed arrangements for import testing

The department does not undertake its own testing of imported animal products. Under the *Quarantine Act 1908*, it had no powers to order a test. For this reason, WSSV testing was made an import permit condition when the Director of Quarantine introduced mandatory WSSV testing in 2001 on all uncooked unpeeled and headless prawn imports from countries or zones that were not WSSV free. Importers were responsible for meeting permit conditions and for arranging a test certificate verifying that the prawn batch was negative for WSSV and YHV before it could be released. The department ‘facilitated’ that process by directing the samples to a place approved under Section 46A of the *Quarantine Act 1908* as ‘a place where goods of a specified class that are subject to quarantine may be treated or otherwise dealt with’.

The public call in 2007 for expressions of interest to carry out viral testing of prawn imports (section 5.3.3) required any laboratory tendering for work to be a quarantine approved premises and to be NATA accredited for molecular virological testing. Importers would choose an approved laboratory and departmental inspectors submitted the samples for testing to the laboratory. Importers paid for testing and could therefore be viewed as the clients of the laboratory.

Under the *Biosecurity Act 2015*, a biosecurity officer may direct product to be tested by a person of their choosing. This provides for the department to order testing on its own account. Laboratories are now effectively testing for the department as the client rather than the importer, as was the case in the past. However, the importer still pays for testing, which can create a potential conflict of interest. To avoid this, the department could have a formal arrangement with each testing laboratory (under their approved arrangement) that covers issues including:

- what the laboratory is required to do in the way of testing
- what the department expects in the way of quality assurance (QA)
- who pays for the QA
- what the department will monitor
- what happens if the laboratory fails a QA test
- who owns the samples and intellectual property (for example, for WSSV sequence data)
- who owns the results and what happens to the residual material, and
- what happens if the laboratory is found to have poor performance.

The current quality assurance regime ensures that screening laboratories are able to perform well in inter-laboratory tests and have NATA accreditation. However, the department should still verify that import testing is consistently performed to the departmental standard, without non-compliance. This could be achieved in a number of ways. For example, the inspector rather than the importer could choose the laboratory from a roster, or the department could implement a system where the inspector randomly forwarded duplicate samples to be tested in parallel at a second screening laboratory.

Recommendation 17

The department should formalise, oversee and monitor stronger prescribed arrangements for laboratories undertaking import testing to ensure their accountability and ongoing implementation of prescribed testing standards.

Department's response: Agree. Implementation is progressing.

10.7.2 Test standardisation

Testing technology is constantly changing and the commercial equipment and reagents essential to the testing are also changing. This requires a consistent laboratory approach to testing and result interpretation.

An Australian and New Zealand standard diagnostic procedure¹⁶⁸ for WSSV, which included a nested PCR, was approved for use in 2008, but it was not implemented uniformly across states and territory agencies undertaking WSSV testing. On 30 July 2007 the department invited an expression of interest from interested laboratories to test prawns. It specified that the test be based on the PCR tests included in the current version of the OIE manual (that is, 2007 version) or equivalent. Laboratories made their own interpretations, especially at the margins of test positivity (section 8.3). From mid-2016, during Operation Cattai, the department progressively realised that there were significant variations between laboratories in WSSV laboratory test interpretation and possibly performance. It began planning with NATA and the four laboratories to hold a ring test in September 2016, but this did not occur despite WSSV-positive test samples being available for use in the test. A meeting was finally convened on 16 May 2017 by NATA using an independent chair. This led to the development of a standardised protocol for the performance and interpretation of the qPCR tests for WSSV.

In October 2017 the department released a standard operating procedure (SOP), *Procedure for detection of white spot syndrome virus for biosecurity risk management* to all approved laboratories, AAHL and NATA. It covered OIE-approved and AAHL WSSV qPCR tests, including criteria for determining positive and negative results. This procedure was to be used by all import testing laboratories and NATA would assess the implementation of the procedure in each laboratory. The department also provided a copy of this SOP to prawn trading partners and recommended that exporting country laboratories implement the procedure when undertaking pre-export testing of uncooked prawns for WSSV. The method was based on the qPCR test in the current version of the OIE *Manual of diagnostic tests for aquatic animals*¹⁴⁹. The department's SOP specified that:

- Real-time PCR must run for 45 cycles.
- A negative result is where there is no amplification of WSSV DNA within 45 cycles (C_t) in all 13 samples.
- A positive result is where there is detectable amplification of WSSV DNA before 40 cycles ($C_t < 40$) in any one of the 13 samples.
- A suspected positive result is where there is detectable amplification between 40 and 45 cycles in any one of the 13 samples.
- When a laboratory determines one or more suspected positive results in a batch, the laboratory should advise the importer to request confirmatory testing from AAHL.

Under this SOP, only samples with a suspected positive test result are subject to confirmatory testing. Samples that tested negative at approved laboratories would not be sent for confirmatory testing. This is a change from the approach implemented in July 2017. If the importer chooses not to request confirmatory testing for suspected positive samples, these samples will be treated as positive for WSSV. If a batch contains positive and suspected positive samples, the importer has the option to request confirmatory testing for those samples at AAHL. If suspected positive samples again produce a C_t value before 45 cycles, these samples will be reported as positive. This is because AAHL are able to conduct additional testing to further confirm these samples are positive for WSSV.

This test standardisation is a necessary first step in achieving comparability of results. For trade purposes, all screening laboratories should use the same tests—preferably the OIE-approved tests and methods for import testing. This would better meet the new requirement for testing of uncooked prawn consignments overseas and retest on arrival in Australia.

10.7.3 Quality assurance of laboratory results

Before October 2017 none of the Australian import testing laboratories followed the OIE WSSV qPCR test precisely. Instead, they had adapted the test to their particular circumstances (for example, using different machines and consumables). This is allowed under OIE guidelines, but laboratories were required to standardise and validate their own variants of the test against the OIE test to demonstrate that their test was equivalent to the OIE test. To assist with validation, the OIE *Manual of diagnostic tests for aquatic animals*¹⁴⁹ has a detailed chapter on Principles and methods of validation of diagnostic assays for infectious diseases. NATA has a similar document¹⁶⁹. Laboratories must keep and regularly update the validation folder for each of their tests so they can satisfy an auditor that they are validating and standardising their tests. Laboratories are required to make validation folders available to the NATA auditor on request.

NATA relies on the advice of specialised technical auditors, drawn from a small pool, to review laboratory applications for NATA accreditation. However, auditors can only examine in detail a subset of tests, so although an audit may take two days, a specific test such as WSSV might not be audited. The NATA audit is a process audit that does not focus on specifics. This means that a laboratory can pass an audit provided the paperwork is in order, the inter-laboratory tests have been satisfactory and the staff training records are complete. A NATA audit is not designed to pick up any deliberate non-compliance and NATA has no power to discipline a laboratory other than the ultimate sanction of withdrawing accreditation. This situation has been exacerbated by the demise of the Subcommittee on Animal Health Laboratory Standards (SCAHLs), a panel of national experts who provided another level of oversight on laboratory standards, including specific inter-laboratory diagnostic test evaluation and validation.

10.7.4 Proficiency testing of laboratories by ANQAP/LEADDR

An essential criterion for ISO/IEC 17025 accreditation is that the laboratory participate in a quality assurance program. Part of that program involves participation in inter-laboratory (ring) tests, where laboratories test unknown samples sent out by an independent testing authority to demonstrate their ability to correctly apply the test and achieve the required results. The department funded all the Australian laboratories involved in the WSSV testing program to undertake proficiency testing through the Australian National Quality Assurance Program (ANQAP)¹⁷⁰. However, ANQAP is a pass/fail system, with no opportunity to share experience between participants. The use of proficiency test panels provides some level of assurance on a laboratory's system but only addresses the basics of laboratory diagnostic tests and does not provide for peer review and improvement.

For the highest priority diseases, a rigorous system of laboratory and test evaluation needs to be established so that national, state and territory chief veterinary officers have the highest possible confidence in the results issued by diagnostic laboratories. Awareness of this need led to the formation of the Laboratories for Emergency Animal Disease Diagnosis and Response network (LEADDR) in early 2009. The network is managed by AAHL and aims to standardise or harmonise routine frontline testing for a number of targeted terrestrial and aquatic diseases through ANQAP or its own programs. LEADDR has targeted WSSV in the past. Currently, the network consists of all government animal health laboratories and AAHL. Commercial laboratories were not included, which may account for the past similarities in AAHL and EMAI test results and the variations in results from the private laboratories.

Neither the NATA audit system nor the proficiency testing programs will detect deliberate non-compliance. The department, in collaboration with NATA, needs to take a stronger role in overseeing the QA arrangements of the laboratories that it approves to carry out import testing.

Recommendation 18

The department should, in collaboration with National Association of Testing Authorities, oversight the performance of import testing laboratories in quality assurance programs. This should include regular proficiency testing and assessment of control samples distributed among the laboratory network, with means to ensure that laboratories rectify any identified deficiencies in a reasonable period of time.

Department's response: Agree. Implementation is well progressed.

Diagnostic test interpretation rightly resides with the diagnostic specialists in the diagnostic laboratories. However, in the absence of a suitable national body, little effort was made to ensure the laboratories agreed on the definitions for negative and positive results and their confirmation—particularly with regard to molecular tests for the detection of WSSV. This oversight role used to be filled by SCAHLS. Peer review is crucial to achieving high levels of technical specification consistent with scientific best practice and developments. As noted in section 4.4 of this report, the Animal Health Committee has now formed a National Laboratory Task Group and a Sub-committee on Aquatic Animal Health. Representatives of both these bodies should be tasked to review and update the current (but out-of-date) Australian and New Zealand standard diagnostic procedure for WSSV. This should include peer-reviewing the department's recently issued *Procedure for detection of white spot syndrome virus for biosecurity risk management*. The same bodies could contribute to stronger national oversight, informed by specialised and rapidly evolving scientific knowledge, of aquatic animal health laboratory standards more generally.

Recommendation 19

The department should promote an update of the old Australian and New Zealand standard diagnostic procedure for white spot syndrome virus including peer review of the new *Procedure for detection of white spot syndrome virus for biosecurity risk management*. This should be conducted by a suitably resourced national technical group formed from the Animal Health Committee's National Laboratory Task Group and Sub-Committee on Aquatic Animal Health.

Department's response: Agree. Implementation is progressing.

Chapter 11

Future post-border biosecurity—implementing a shared responsibility

11.1 Stronger network of aquatic animal disease expertise

11.1.1 Other Australian laboratories carrying out WSSV testing—past and potential roles

The department approves government and selected private laboratories to carry out import testing for exotic agents such as WSSV, according to stringent biosecurity and technical criteria, and generally discourages testing for diseases exotic to Australia by non-approved laboratories. It routinely refers suspect exotic disease cases to AAHL, which is funded for that work by the department.

Sound biocontainment and trade issues underpin this policy. It was originally developed with culture-based testing in mind rather than molecular testing, which looks for traces of DNA and does not culture live organisms. However, state government veterinary laboratories, which carry out surveillance for endemic diseases, also require capability to diagnose exotic diseases. Although Australia claimed freedom from WSD, the virus was found in product that could be bought in Australian supermarkets until at least 2007, was known by aquatic disease specialists to occur in supermarkets from 2007 to 2016, and was tested for in Australian university and government laboratories other than those approved to carry out import testing¹⁷¹.

A similar situation occurred in 1993 with gourami iridovirus. Ornamental fish infected with the virus were readily available in Australian pet shops despite the viral disease being considered exotic to Australia. As a result, there were a number of instances of Australian laboratories testing for both WSSV and gourami iridovirus^{172, 173}. The policy of allowing certain laboratories with both ISO/IEC 17025 accreditation and QAP status to test for these exotic viruses undermined the 'no exotic disease testing' policy. In addition, with the development of the LEADDR (Laboratories for Emergency Animal Disease Diagnosis and Response) network, testing for specified exotic diseases amongst government laboratories is facilitated. It may be appropriate for Animal Health Committee and the department to review relevant policy guidelines on testing for exotic diseases in Australia, taking account of these variations.

There is a real shortage of expertise and experience in aquatic diseases in Australia, particularly those affecting prawns¹⁷⁴ and much of that experience resides outside of the government system. While the government laboratories undoubtedly have excellent skills and facilities, they were very stretched in dealing with the WSD outbreak and post-border prawn withdrawal program. A greater effort by the department to engage with specialists in the university sector (who had both the skills and equipment to carry out WSSV testing) could have been helpful in mobilising a wider group of experts to examine the problems. Knowledge of the whereabouts of such expertise can be readily obtained through SCAAH or the FRDC.

11.1.2 Science needs

Australia's fisheries/aquaculture sector makes a significant contribution to export earnings and job creation, especially in regional Australia. These industries are vital to our future prosperity.

Australia is fortunate to have an aquatic animal sector free from many diseases that could significantly affect the productivity of our aquaculture industry, reduce trade or result in significant social and economic costs. It is vital for Australia to maintain this disease-free status, not only to enhance our competitiveness but also to protect Australia's unique natural resources. However, Australia also has a range of poorly understood host species and endemic pathogens. This includes local strain variations of internationally significant pathogens that are becoming increasingly important for our export trade. Known significant pathogens/diseases currently in Australia include oyster herpesvirus¹⁷⁵, oyster oedema disease¹⁷⁶, abalone herpesvirus¹⁷⁷, salmon or pilchard orthomyxo-like virus¹⁷⁸, *Cardicola* spp. in southern bluefin tuna¹⁷⁹ and viruses associated with yellow head disease in prawns¹⁸⁰.

Compared with the terrestrial animal industries, the state of knowledge of aquatic animal health management is very limited. This includes the epidemiology of disease threats, physiology of hosts and technology for managing disease. Research has a critical role in expanding this knowledge and enhancing management practices to prevent disease or limit its impact on the expanding fisheries/aquaculture sector and on recreational fisheries and natural resources¹⁸¹.

To date, more than 20 pathogens are known to cause diseases in prawns. It is not yet possible to develop vaccines for prawns because the crustaceans lack an adequate adaptive immune response¹⁸². As a result, the prawn aquaculture industry needs not only SPF (specific pathogen free) stocks but also SPR (specific pathogen resistant) stocks¹⁸². Research findings on prawn and copepod responses to bacteria, parasites and viral pathogens are regarded as experimental or theoretical models^{154, 183, 184, 185, 186}. However, with well-designed breeding programs, gains in WSSV resistance of 2 to 5 per cent per generation should be possible³⁵. Governments and industry should prioritise research into the molecules and mechanisms of immune response in order to develop SPF and SPR prawn broodstock.

Globally, farmed and wild aquatic animal populations are affected by emerging diseases and increasing evidence suggests that Australia is not exempt. The impacts of emerging diseases can be wide-ranging, including direct economic losses not only for the affected aquaculture enterprise but also for associated industries. Other impacts include a reduction in ecosystem stability and sustainability (for example, impacts of reduced pilchard populations after the 1995 and 1998 pilchard mortalities on the food chain)^{187, 188}, loss of cultural heritage (extinction of native species) and reduced regional employment.

Previous Australian efforts to manage diseases in farmed aquatic animals have had mixed success. Recent outbreaks of oyster herpesvirus outbreaks¹⁸⁹, amoebic gill disease in Atlantic salmon¹⁹⁰, pilchard mortalities¹⁹¹ and abalone herpesvirus¹⁹² have caused big losses to emerging and previously profitable aquaculture industries. Eradication of disease in the aquatic environment is difficult but possible^{193, 194, 195, 196} with concerted, persistent and resource-intensive effort. Overseas, the direct and indirect economic impact of disease can mount into the billions of dollars^{79, 197, 198} and the environmental impacts can be even costlier. Many aquatic diseases are likely to continue to spread because pathogens in the aquatic environment are difficult to control and there is limited understanding of their biology. For example, researchers have a poor understanding of:

- factors that trigger disease emergence,
- immunity and/or disease resistance mechanisms in aquatic animal species, particularly invertebrates (molluscs and crustaceans), and consequently few examples of effective vaccines for viral diseases of aquatic animals,
- geographical and host ranges,
- pathogen/host/environment interaction,
- mechanisms of disease transmission within populations and other critical epidemiological factors such as biological reservoirs, vectors, and stability in the environment, and
- disease management.

In addition, there are few fully validated diagnostic tests available, particularly for the detection of subclinical infections.

As aquaculture expands, the range of native aquatic animals being farmed is also increasing, making research on aquatic animal health issues more necessary than ever. Australia has at least 70 aquatic species under aquaculture development. Of these, 40 are farmed commercially. Australia is therefore in an excellent position to take advantage of the global increase in demand for quality seafood. However, new diseases will inevitably emerge and we are unable to predict where and when the next threat will arise. We need research on all types of aquatic animals (finfish, crustaceans, molluscs and amphibians) from tropical, temperate, marine, brackish or freshwater environments. By supporting research on the diseases of current concern, Australia will build capability, capacity and expertise in all areas of aquatic animal health. This will help ensure that the aquaculture sector builds resilience and continues to grow in a sustainable manner, providing Australia with socio-economic and environmental benefits into the future.

Recommendation 20

The department should maintain strong links with aquatic health and production experts in Australian and state/territory government agencies, universities and industry, to support decision-making based on:

- the latest scientific knowledge of new technologies, and
- international emergence, movements and risks to Australia of serious aquatic animal diseases.

Department's response: Agree. There will be extensive consultation and engagement with aquatic health and production experts in Australian and state/territory government agencies, universities and industry to support the prawn risk review.

11.2 Finalising an aquatic deed for emergency animal disease response

It has been difficult to incorporate aquaculture industries in national emergency animal disease response arrangements due to their complexity, relatively small size and interconnections with aquatic environments and wild fisheries. In the past, the department led efforts to prepare for possible incursions of serious aquatic animal diseases. These included developing AQUAPLAN¹⁹⁹, which has a chapter on responding to an outbreak of WSD in prawn farms.

However, when WSD broke out in Queensland, an aquatic deed was still under development. The outbreak was managed according to the AQUAVETPLAN strategy. But, funding of and decision-making about the response was complicated because neither the prawn-farming industry nor the wider aquaculture industry had yet signed a cost-sharing deed.

The WSD outbreak and response gave extra impetus to the development of an aquatic deed. By August 2017 an overall cost-sharing formula had been agreed:

- one-third from the Australian Government
- one-third from potentially affected states and territories in aggregate, and
- one-third from potentially affected industries in aggregate.

When this report was being prepared, further negotiations were underway on the subsidiary sharing of costs between potentially affected states and territories, and between industries where only aquaculture sectors are potentially affected or where aquaculture and wild-capture sectors are potentially affected.

The prawn aquaculture industry was represented through the National Aquaculture Council as an associate member of Animal Health Australia (AHA). AHA's role and experience in brokering joint action and cost-sharing between the Australian and state/territory governments and industry is significant. The prawn and other aquaculture industries should benefit from the engagement between the National Aquaculture Council and AHA in the future, if/when the aquatic deed is finalised.

A completed draft aquatic deed is scheduled for stakeholder consultation by the end of 2017. Commitments by all signatories are expected to be completed by the end of 2018. These will depend on cost-benefit analysis, regulatory impact statements, and information for cabinets and treasuries and industry peak bodies.

Recommendation 21

The department should continue to work with Animal Health Australia, state/territory agencies and aquatic industries to develop an aquatic emergency animal disease response agreement (deed) as soon as possible.

Department's response: Agree. Development of the aquatic deed is well progressed.

Once a deed is finalised, arrangements for early response to emergency aquatic animal disease incidents can be implemented more easily. For example, Australia has established a Rapid Response Team (RRT) of experienced government staff to respond to emergency animal or plant disease incidents in any state or territory of Australia. AHA manages the RRT and the department coordinates its deployment during an emergency disease response. Through AQUAPLAN 2014–2019, the capability of the RRT to provide a national first response to aquatic animal diseases will be considered by the department (Activity 2.3)¹⁹⁹ (p. 15). A key focus of that activity will be for governments to establish whether existing resources and expertise available through the RRT are sufficient or should be expanded.

11.3 Stronger on-farm biosecurity programs for prawn and other aquaculture industries

Effective on-farm biosecurity practices and management are essential in reducing the risk of the introduction of pests and diseases. A farm that practices effective on-farm biosecurity is likely to be better protected against biosecurity risks already present in Australia and those that enter the country. This was not the case with the WSD-infected farms on the Logan River. Department scientists who visited the farms with investigators after the WSD outbreak noted¹³⁸ (p. 41):

... that biosecurity measures had not been implemented or were implemented in only limited ways. None of the farms implemented biosecurity measures that might be expected of modern prawn farming operations (apart from some water filtering, pond fallowing and probiotic use).

According to department scientists, all commercial aquaculture farms along the Logan River lacked crab-proof fences. This enabled the movement of crabs in and out of the river, between ponds and between farms. Similarly, some of the farms did not have in place measures to prevent bird predation. Some farms also lacked effective water filtration methods. Consequently, wild prawns were either transferred into ponds and grew there alongside farmed prawns or were allowed to grow in inlet channels, potentially allowing free WSSV to move into production ponds each time the ponds were topped up with water from the inlet channel¹³⁸ (p. 41).

In March 2017 an international expert visiting the infected prawn farms at the farmers' request, also emphasised²⁰⁰ the need for strengthening on-farm biosecurity practices:

What the prawn farmers in Australia need to do is to develop a system that allows them to work under open environment conditions, since the farms they have are open ponds.

The system needs to be able to live with those new challenges and that means having control over the brood stock, because it is from the brood stock that you obtain the offspring that will be stocked in the pond.

This is the first step in the process. The other step is to make sure that biosecurity measures are in place so that when a farm is working ... the risks are down to a minimum level.

Standard protocol in Asian prawn farms is that inlet water is not allowed directly into production ponds but is first filtered to 250 microns, chemically treated to kill crustaceans and kept for at least 72 hours before use^{201,202}. The Asian prawn aquaculture industry has found these processes necessary in the presence of endemic WSSV in wild crustaceans. The processes add significant costs to prawn production, requiring more land for settling ponds, more fuel for pumping water and a budget for purchasing and managing required chemicals. For example, a drum-filter designed to filter incoming water can cost up to \$100,000 to install³⁵.

Prawn farmers disagreed with the department on how on-farm biosecurity was managed on affected farms before the WSD outbreak happened, and witnessed to the Committee:

... one that farmers probably get most upset about as a line of inquiry is poor on-farm biosecurity practices ... It really fails to recognise the extreme lengths that people need to go to protect themselves against white spot. This is not a process that should be entered into lightly. It is certainly not the type of process that people would enter into, for want of a better word, prophylactically—in other words, in case something happened. That is just not reality. The whole pretext of on-farm biosecurity practices being one of the factors I think the whole industry finds quite offensive. I think we really need to try and put that into some context ... trichlorfon, for instance, the chemical used overseas as a crusticide, is not even registered for use in Australia yet. So to say that on-farm biosecurity practices are an issue is really a problem²⁰³.

The level of future on-farm biosecurity required and applied—if Australian prawn farmers decide to continue growing prawns—will depend on whether or not WSSV continues to be detected in the wild. The Queensland Government is committed to working with the Australian Prawn Farmers Association and local farmers to ensure that on-farm biosecurity practices are at an acceptable minimum standard^{138 (p. 41)} before prawn farming operations recommence. Some requirements relating to these standards may be included in the aquatic deed. In the meantime, industry should be encouraged to customise and use the Sub-Committee on Aquatic Animal Health's *Aquaculture Farm Biosecurity Plan: generic guidelines and template*⁹⁰.

After the 2011–12 outbreak of WSD in Madagascar and Mozambique, the lack of surveillance of wild prawns was identified as an issue³⁵. It emerged that WSSV had arrived in wild prawns some months before it infected the farms. Had the virus been detected earlier, farms could have responded with increased biosecurity. As WSSV is now endemic in the Mozambique Channel, some prawn farms there have now implemented ongoing targeted surveillance of wild crustaceans near their farms. In future, it may also be appropriate for Australian prawn farmers to consider this, irrespective of the results of environmental surveillance for WSSV in the next few years.

11.4 Post-border verification to minimise risk of WSSV-infected prawns entering waterways

The department assumed that, under the import conditions before 2017, only a small amount of WSSV would enter Australia undetected. However, the high prevalence of WSSV in some uncooked imported prawns at retail outlets (from at least 2013) clearly indicated that this was not the case. Despite enhanced pre-border and border measures, the resumption of uncooked prawn imports still carries risks that some WSSV-infected prawns may enter Australia for retail sale and could enter Australian waters. The Department of Agriculture and Water Resources, state and territory government agencies and industry should agree on measures for monitoring and minimising these risks and establish cost-sharing arrangements, as relevant. Measures could include:

- periodic surveillance of retail prawns for target diseases,
- periodic assessment of fishing practices,
- public awareness programs designed to discourage use of imported prawns as bait,
- measures to prevent recreational fishing close to prawn farms, and
- future surveillance of bait shops to ensure they are not selling imported prawns.

11.4.1 Monitoring WSSV in imported retail prawns

The sampling and testing regime introduced in 2009 was expected to exclude most but not all WSSV-infected batches of imported uncooked prawns. The risk of any infection moving from the retail environment to a prawn farm was thought to be very small, so the department did not consider repeated discoveries of WSSV in retail prawns to be significant. The department may have assumed that some infected prawns were getting in but would all be cooked and eaten or that high levels of positivity were likely to be due to cross-contamination.

However, the high levels of WSSV found in 2016 and 2017—in around 70 per cent of retail prawn batches—showed that biosecurity measures to keep WSSV out of Australia were not working. In retrospect, the effectiveness of the inspection and testing service prior to 2017 could have been monitored by periodic surveillance of retail prawns for target diseases.

The efforts that the department has gone to in 2017 to test and withdraw from sale any WSSV-positive product, and the new enhanced import conditions, should mean that detectable levels of WSSV in prawns at points of retail sale will diminish, but the previous high levels of WSSV DNA will take some time to disappear. Factors that may influence this include ongoing cross-contamination from ice and equipment in retail outlets where infected prawns were present in the past, and possible cross-contamination of uncooked imported (and perhaps Australian) prawns by non-viable WSSV DNA from cooked prawns sold through the same retail outlets.

The sampling framework for any such surveillance would need to be carefully designed and would benefit from preliminary research into levels of WSSV positivity and infectivity in retail-level uncooked and cooked, imported and Australian prawn products.

11.4.2 Protecting our environment through creating awareness

Preventing any new pest or disease from entering our aquatic ecosystems is critical because once a pest or disease enters the environment it is difficult and costly to manage. Unless detected and dealt with early, it is impossible to completely remove a pest or disease, and both direct and indirect costs can quickly run into the millions.

A greater understanding of the science and management of sustainable fisheries will contribute to ensuring a sustainable and biosecure future for Australia's aquatic ecosystems. States and territories have been running successful educational campaigns targeted at recreational fishers and anglers to raise awareness about sustainability and biosecurity^{204, 205, 206}. Experience has shown that behavioural change is achieved by educating people before they access recreational sites. Enabling access without adequate and ongoing education and awareness leads to non-sustainable use and exposes recreational resources to increased biosecurity risks²⁰⁷.

Following the Darwin incident in 2000 (chapter 3.4), the department announced⁸³ tighter controls to avoid a recurrence and to protect Australia's valuable aquaculture industries and environment. One of these control measures focused on the development of an education campaign with states and territories that targeted bait wholesalers, recreational fishers and restaurants. The status of this education campaign is unknown.

Consideration should be given to the fishing exclusion zones that were declared near the infected prawn farms on the Logan River, and whether state/territory legislation is needed to require fishing exclusion zones close to or upstream from all prawn farms. This would be like an easement and may be possible under planning laws. It would resemble various environmental conditions that are imposed on new prawn farm developments. However, the concerns of recreational and other local fishers would have to be considered before introducing such a measure.

11.4.3 Preventing the use of imported uncooked prawns for bait or berley

The 2009 IRA team had considered the use of imported raw prawns for bait or berley as a risk pathway for prawn disease introduction, but that it was likely to be a relatively minor pathway (chapter 5). However, raw imported prawns recovered from retail outlets near the affected properties tested positive to WSSV. On 14 and 15 December 2016, department investigators purchased 19 raw imported prawn products from 13 retail outlets, mostly within a 10-kilometre radius of the infected properties. On 4 January 2017 the department established that 14 of the 19 products tested positive for WSSV⁴⁰.

Investigators also found evidence that imported prawns for human consumption were used by recreational fishers operating in the river, and that these may have been discarded or fed to birds at the end of the fishing activity. Using prawns as bait for fishing therefore represents a possible entry and exposure pathway for susceptible crustaceans in the environment. Diggles⁸ estimated that up to 50 per cent of fishers in Queensland might have been using imported prawns as bait. Population increase in Australia is also likely to have resulted in a higher absolute number of recreational fishers since the 2009 IRA.

Considerable anecdotal evidence in early 2017 indicated that the practice of using prawns for bait had increased by 2016. This was due to the greater availability at retail of frozen imported product, which was often far cheaper than that available in bait shops. The practice was also reportedly promoted online and in fishing magazines.

In late 2016 the world market was flooded with cheap small prawns (see section 6.2.4) out of Asia^{62,63}. Some of these may have been recently imported or ‘on the water’ to Australia when the suspension was announced. It is not known whether this product contributed to an increase in the prevalence of infected prawns entering Australia. However, Operation Cattai may have resulted in some importers unloading their infected prawns cheaply onto the retail market in late 2016. It is clear that the end-use requirement ‘For human consumption only—not to be used as bait or feed for aquatic animals’ is not effective as a risk mitigation measure. The condition ‘not to be used for bait’ was originally inserted to prevent whole consignments of raw prawns being prepared, imported and sent to bait shops.

It is not possible for the Australian Government to monitor or enforce bait use other than by exception, as part of a special biosecurity operation.

The intent of the 2009 IRA, that uncooked imported prawns be consumed by people and therefore be unavailable for use as bait, may be more effectively controlled by better supply-chain management of uncooked prawns rather than by labelling. In many cases, labelling is discarded during distribution or before retail display.

The two potential pathways for imported uncooked prawns to end up in bait shops are:

1. Prawns pass their ‘use by’ date or are ‘freezer burned’ or otherwise rendered unsuitable for the human food chain.
2. Prawns are repackaged.

Retail prawns may have been resold in bait shops before 2017 because of the reported price differentials between bait and retail prawns. However, the department did not expect resale to occur and therefore did not look for it.

Recommendation 22

The department and state/territory governments and industry should agree on (and cost share, as relevant) measures for monitoring and minimising risks of any imported uncooked prawn product entering waterways. Measures could include:

- periodic surveillance of retail prawns for target diseases
- periodic assessment of fishing practices
- targeted public awareness programs discouraging use of imported prawns as bait
- prevention of recreational fishing and surveillance of wild crustaceans close to prawn farms, and
- surveillance of bait shops to ensure they are not selling prawns imported for human consumption.

Department’s response: Agree in principle – These issues will be considered as part of a systems based approach. Regulation of domestic fishing practices is a matter for state and territory governments.

11.5 Uncooked prawns for food service industry versus retail sale

It would appear that the 2009 IRA advice to label product 'For human consumption only—not to be used as bait or feed for aquatic animals', and the various dispensations for different classes of highly processed prawns, assumed that all imported uncooked prawns would be cooked once in Australia and that virtually none would enter waterways in an uncooked state.

Because they are readily available, cheap and in large quantities, uncooked prawns sold at retail level pose a far greater risk of being diverted to bait or berley than do prawns provided to food service supply chains or direct to restaurants.

Consequently, it may be possible to implement post-border QA or HACCP-based schemes for some importers supplying major food service clients, as opposed to the retail sector. Any scheme reliably differentiating between uncooked prawns for retail sale and uncooked prawns for supply to food service and restaurant enterprises would need verification over time that there is no risk of diversion back to the retail market.

The department is not in a position to resource implementation of such a scheme, nor does it have the legal jurisdiction. Any such scheme would have to be driven by importers and industry and have regulatory support from states/territories. In view of the level of non-compliance with import requirements, conditions would need to be extremely tight and monitored over time.

Chapter 12

Conclusion

Australia is a high-value market for prawn products, consuming about 55,000 tonnes in 2016, of which only 20,000 tonnes were Australian, wild-caught or from prawn farms. From 2010 to 2016, we imported around 30-40,000 tonnes of prawn products each year, mostly from Asia, where WSSV is rife. Well over half the imported product was uncooked.

The 2016–17 white spot disease outbreak in seven Queensland prawn farms was a significant blow to Australia's prawn aquaculture industry, costly also for governments and other seafood industries. Detection in February 2017 of WSSV-infected prawns and crabs up to 60 nautical miles away from affected prawn farms raised the possibility that WSSV may have become endemic in Australian waters, although extensive later environmental surveillance had found no further positives by November 2017. Further environmental surveillance will be needed for years to monitor the situation.

The source of infection for the first infected farm was not conclusively proven, but there was strong circumstantial evidence that it could have been from imported uncooked prawns used as bait by fishers near the prawn farm. This led to a six-month suspension of uncooked prawn imports into Australia, from 6 January to 6 July 2017. Investigations before and after this suspension revealed a major failure of Australia's biosecurity system. Very high levels of WSSV were found in imported uncooked prawn products destined for retail outlets across the country. These products, imported in 2016, had already passed Australia's border biosecurity controls, intended to keep most WSSV out.

Import conditions for prawns and prawn products had remained unchanged since 2010, following a 12-year long import risk analysis. For biosecurity risk management, the 2010 import conditions relied heavily on sampling and testing uncooked imported prawn batches at the border before they were released from quarantine into the domestic supply chain. Many of the technical and practical difficulties and limitations of implementing these conditions, pre-border, border and post-border, only became fully apparent to the department in 2017. Human resources devoted to managing the biosecurity risks had diminished substantially in previous years even as the risks were increasing.

It appears that some importers may have incorrectly declared or presented consignments of uncooked prawn products to avoid border testing. These actions may have been facilitated by weak inspection policies and practices, and poor governance of the laboratory testing regime. Naivety about the extent to which all importers could be trusted, and complexity of internal information flow and risk governance, meant that emerging risks were not seen in their entirety.

During this review, I found several deficiencies in the management of the biosecurity risk of uncooked prawn imports, with broader implications for Australia's biosecurity risk management more generally. I found that specific policy elements and their implementation had sowed the seeds of failure many years before, while progressive and cumulative acts, omissions and systemic factors at many levels exacerbated the risks over time.

The department has shown a commendable willingness to examine its management of the biosecurity system and rectify the identified problems. Many of these problems have been swiftly addressed by the department and other stakeholders but more needs to be done to manage the biosecurity risks of prawn imports in the future. I have made recommendations to improve this biosecurity risk management framework and its ability to deal with ongoing and emerging challenges. Long term adequate resourcing will be a key success factor in this endeavour.

Australia must maintain a strong biosecurity system that preserves and protects our favourable animal and health status. While Australia relies heavily on imports, the importation of uncooked seafood presents significant biosecurity risks due to the numerous complex, variable international production systems and trade pressures. It is essential that the department manages these risks effectively and efficiently—a difficult task given the spread of severe diseases such as WSD and the emergence of new or variant pathogens.

Previous incursions of exotic animal diseases have been disruptive and costly to governments and industry. In planning future biosecurity arrangements for Australia's aquaculture industries, the department needs to improve communication and cooperation with stakeholders, to ensure a better understanding of needs, roles and responsibilities in order to achieve agreed solutions.

At the international level, Australia enjoys a reputation for technical expertise and the integrity of its biosecurity system. To continue to maintain Australia's favourable aquatic animal health status, the department should continue to actively pursue a working partnership with aquaculture industries and state/territory government agencies, to better prevent, prepare for and respond to any future disease or pest incursions.

The importation of uncooked prawns and other seafood into Australia will continue to pose significant and changing challenges for the department and industry. The recent WSD outbreak in Queensland, and the subsequent findings of massive importation of WSSV-infected prawns, despite previous import requirements intended to keep this virus out, highlight the need for the department to remain vigilant, proactively review and update import requirements and policies, and maintain excellent communication with both government and industry stakeholders. Above all, detecting and deterring deliberate or inadvertent failures to implement biosecurity risk management policies effectively must be a priority. Governments and aquatic industries must cooperate to resource and implement these efforts. Failure to do so will imperil the future development of a sustainable and profitable aquaculture sector in Australia.

Appendix A: Agency response



Australian Government
Department of Agriculture
and Water Resources

SECRETARY

Ref: EC17-000588

Dr Helen Scott-Orr
Inspector-General of Biosecurity
Australian Government Department of Agriculture and Water Resources
PO Box 657
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Via email: InspGenBiosecurity@agriculture.gov.au

Dear Inspector-General *Helen*

Thank you for your letter dated 20 November 2017 and the review report No. 2017-18/01, *Uncooked prawn imports: effectiveness of biosecurity controls*. The contribution that you and your co-authors have made to our biosecurity system through this review report and its recommendations is appreciated.

The department's response to the recommendations is at **Attachment A**. I am pleased to advise that the department has agreed or agreed in principle to the recommendations and has already begun to action some of the recommendations. Please note that recommendation 11 is noted as this is a matter for consideration by the government.

Thank you again for your report.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Daryl Quinlivan'.

Daryl Quinlivan

7 December 2017

Attachment A: Recommendations and Department of Agriculture and Water Resources responses

DEPARTMENTAL RESPONSE TO IGB RECOMMENDATIONS

Recommendation 1

The department, in consultation with industry and state/territory governments, should review risk mitigation measures for the various pathways for white spot disease to enter and establish in Australia.

Department's response: Agree. The department has commenced a review of the biosecurity risks of, and import conditions for, prawns imported for human consumption. There will be extensive consultation and engagement with aquatic health and production experts in Australian and state/territory government agencies, universities and industry to support the prawn risk review.

Recommendation 2

The department should, as a priority, review the sampling regime for consignments of imported uncooked prawns and prawn products.

Department's response: Agree. An improved sampling process for consignments of imported uncooked prawns and prawn products has been implemented. Sampling regimes will also be considered in the prawn risk review.

Recommendation 3

The department should facilitate research to validate the impact of cooking on:

- white spot syndrome virus inactivation, and
- white spot syndrome virus testing results.

Department's response: Agree in principle. Research such as this, which could be commissioned by FRDC, will be considered in the context of the prawn risk review.

Recommendation 4

The department should review import conditions for uncooked prawns listed on the Biosecurity Import Conditions system (BICON) to ensure clarity and consistency with OIE terminology, scientific accuracy and usefulness for verification at the border.

Department's response: Agree. Import conditions have been reviewed and updated and will be further reviewed and updated as the risk review progresses.

Recommendation 5

The department should work with competent authorities and industry to encourage the import of uncooked prawn products from specific pathogen-free countries, zones or compartments.

This should be industry-driven and involve:

- quality-assured supply chain management
- competent authority verification of pre-border status of consignments, and
- regular departmental offshore audits or verifications of these arrangements.

Department's response: Agree in principle. In conducting the risk review, the department will consult with competent authorities and industry to consider the designation of specific pathogen-free countries, zones or compartments for the import of uncooked prawn products.

Recommendation 6

The department should continue to conduct full seals-intact inspections of uncooked prawn imports (by at least two inspectors). It should also review measures to ensure integrity of the seals-intact containers until inspection.

Department's response: **Agreed and implemented**

Recommendation 7

The department should implement and publicise an ongoing program of random and risk-based, seals-intact inspections of frozen goods to ensure that uncooked prawns are not being falsely imported as other frozen foods.

Department's response: **Agree. This may be implemented as part of the department's cargo compliance verification program.**

Recommendation 8

The department should ensure that inspections at approved arrangements, especially at regulated cold stores, are periodically carried out by two inspectors. If only single inspectors are available, they should be regularly rotated.

Department's response: **Agree. Revised processes have been implemented.**

Recommendation 9

The department should facilitate the development and implementation of a nationally consistent competence and verification framework covering staff involved in assessing and inspecting imported uncooked prawns and other commodities. This should be regularly reviewed and adequately resourced.

Department's response: **Agree. The Department has implemented a national competency and verification framework for prawn inspections**

Recommendation 10

The department should improve internal communication to develop and implement training processes, instructional material and work directions that are technically sound, suit the conditions being experienced and are applied as intended. These should be monitored and regularly reviewed.

Department's response: **Agree. The Department has implemented improved internal communications arrangements, updated instructional material and has strengthened arrangements to ensure that the required processes are being applied as intended.**

Recommendation 11

The Australian Government should commit to ensuring adequate long-term funding for biosecurity risk management, including border inspections and enforcement. Funding should be linked to growth in imports and biosecurity risks, with cost-recovered functions exempt from efficiency dividends and staff ceilings.

Department's response: **Noted. This is a matter for government.**

Recommendation 12

The department should consider seeking stronger powers under the *Biosecurity Act 2015* to apply direct penalties for serious non-compliance and impose administrative sanctions or on-the-spot fines for relatively minor non-compliance.

Department's response: **Agree. While the Biosecurity Act already provides powers to apply direct penalties for serious non-compliance and penalties for relatively minor non-compliance in the form of infringement notices, the department will consider whether stronger powers are required.**

Recommendation 13

The Director of Biosecurity should seek powers under the *Biosecurity Act 2015* to conduct a general recall of goods for biosecurity purposes.

Department's response: Agree in principle. Proposed changes to the *Biosecurity Act* have been drafted that will provide powers to enable the improved management of a similar event.

Recommendation 14

The department should continue to improve internal biosecurity risk governance and communication to rapidly identify emerging biosecurity risks. Risks should be communicated to governments, the wider community and industry through a defined and documented triaging and escalation procedure.

Department's response: Agree in principle. The department's Active Risk Management program is helping to improve internal biosecurity risk governance and communication to rapidly identify emerging biosecurity risks. Risks will be communicated to other governments, the wider community and industry as appropriate to the specific circumstances.

Recommendation 15

The department should discuss with the National Biosecurity Committee mandatory reporting of all post-border detections of prescribed exotic disease agents or pests to Australian and state/territory government departments.

Department's response: Agree. The Australian government reports post quarantine detections to state and territory governments and will seek the National Biosecurity Committee's agreement that states and territories share similar information with the Australian government and with each other.

Recommendation 16

The department should collaborate with state/territory agencies, Animal Health Australia and relevant industry bodies to review and implement more effective communication policies to aid the early dissemination of information about exotic aquatic diseases and pests and their management to stakeholders.

Department's response: Agree. Implementation is progressing.

Recommendation 17

The department should formalise, oversee and monitor stronger prescribed arrangements for laboratories undertaking import testing to ensure their accountability and ongoing implementation of prescribed testing standards.

Department's response: Agree. Implementation is progressing.

Recommendation 18

The department should, in collaboration with National Association of Testing Authorities, oversee the performance of import testing laboratories in quality assurance programs. This should include regular proficiency testing and assessment of control samples distributed among the laboratory network, with means to ensure that laboratories rectify any identified deficiencies in a reasonable period of time.

Department's response: Agree. Implementation is well progressed.

Recommendation 19

The department should promote an update of the old Australian and New Zealand standard diagnostic procedure for white spot syndrome virus including peer review of the new *Procedure for detection of white spot syndrome virus for biosecurity risk management*. This should be conducted by a suitably resourced national technical group formed from the Animal Health Committee's National Laboratory Task Group and Sub-Committee on Aquatic Animal Health.

Department's response: Agree. Implementation is progressing

Recommendation 20

The department should maintain strong links with aquatic health and production experts in Australian and state/territory government agencies, universities and industry, to support decision-making based on:

- the latest scientific knowledge of new technologies, and
- international emergence, movements and risks to Australia of serious aquatic animal diseases.

Department's response: Agree. There will be extensive consultation and engagement with aquatic health and production experts in Australian and state/territory government agencies, universities and industry to support the prawn risk review.

Recommendation 21

The department should continue to work with Animal Health Australia, state/territory agencies and aquatic industries to develop an aquatic emergency animal disease response agreement (deed) as soon as possible.

Department's response: Agree. Development of the aquatic deed is well progressed

Recommendation 22

The department and state/territory governments and industry should agree on (and cost share, as relevant) measures for monitoring and minimising risks of any imported uncooked prawn product entering waterways. Measures could include:

- periodic surveillance of retail prawns for target diseases
- periodic assessment of fishing practices
- targeted public awareness programs discouraging use of imported prawns as bait
- prevention of recreational fishing and surveillance of wild crustaceans close to prawn farms, and
- surveillance of bait shops to ensure they are not selling prawns imported for human consumption.

Department's response: Agree in principle – These issues will be considered as part of a systems based approach. Regulation of domestic fishing practices is a matter for state and territory governments.

Appendix B: Review team biographies

Dr Helen Scott-Orr PSM (IGB)

Dr Scott-Orr is the inaugural Inspector-General of Biosecurity (IGB). Dr Scott-Orr has over 40 years' experience in veterinary and agricultural science in Australia, Indonesia and the United Kingdom.

She has an extensive record of achievement in biosecurity and wider agricultural research and delivery management, having served as Director Health Sciences, Strategic Alliances and Evaluation with the New South Wales Department of Primary Industries; and previously for eight years as Executive Director, Research, Advisory and Education; for ten years as Chief Veterinary Officer; and earlier as Director, Brucellosis and Tuberculosis Eradication, with New South Wales Agriculture.

Dr Scott-Orr is a Fellow of the Australian Institute of Company Directors. She has served as a director on the board of Animal Health Australia, and on the boards of Cooperative Research Centres for Invasive Animals, Weeds, Beef, Sheep, Cotton and Rice.

She has led several veterinary capacity-building projects in Indonesia, focusing on zoonotic disease control. She has also worked on increasing preparedness for a rabies incursion into Northern Australia.

Dr John Brian Jones

Dr Jones has extensive research experience in aquatic pathology and is an international expert in fish pathology. He is currently the Principal Advisor Aquatic Animal Health (Ministry for Primary Industries, Wellington, New Zealand). He is an Adjunct Professor at Murdoch University, Western Australia.

Dr Jones was Principal Fish Pathologist and Pearling Inspector (WA Government; 1995–2013) and one of the panel members who drafted Biosecurity Australia's *Generic Import Risk Analysis Report for Prawns and Prawn Products* (2009). He was a member of numerous state and federal committees (1995–2013), including Chair of National Aquatic Animal Health Technical Working Group (2003–06), and from 2001–12 was a member of the Scientific Advisory Committee to the Fisheries Research and Development Committee Subprogram on Fish Health. He has published about 180 peer-reviewed articles in international scientific journals, and also co-supervised 11 scholars for PhD and Master's research programs.

Dr Naveen P Bhatia

Dr Bhatia holds a PhD in Plant Science, and MSc and BSc degrees in Agriculture. He is a Biosecurity Auditor in the Inspector-General of Biosecurity team (2016 onwards) and assists the IGB in her role to provide independent review of the performance of functions and exercise of powers by the Director of Biosecurity. He has also assisted previous Interim Inspectors-General of Biosecurity (Dr Kevin Dunn, 2011–13 and Dr Michael Bond, 2013–16) in a similar role.

Dr Bhatia has previously played roles in the department's plant import operations area (2010–11), compliance and regulation (Office of the Gene Technology Regulator, 2007–09) and advanced scientific research at the Australian Nuclear Science & Technology Organisation, Stanford Synchrotron Radiation Light Source (USA), Lawrence Berkeley National Laboratory (USA), Argonne National Laboratory (USA) and High Energy Accelerator Research Organization (Tsukuba, Japan). He has published over 40 research articles in international scientific journals and also supervised a PhD scholar.

Appendix C: Submissions to Inspector-General of Biosecurity review

Copies of the submissions are available on the [IGB website](#).

Number	Individual/agency/organisation
1	DigsFish Services Pty Ltd
2	Australian Prawn Farmers Association
3	Queensland Seafood Industry Association
4	Seafood Importers Association of Australasia Inc.
5	Monckton Consulting Pty Ltd
6	Australian Council of Prawn Fisheries
7	Great Ocean Foods Pty Ltd
8	Spencer Gulf & West Coast Prawn Fishermen's Association

Appendix D: Summary of aquatic animal diseases and infectious agents in Australia

Year identified	Host animal	Pathogen/disease	State/territory
2016	Prawns	White spot syndrome virus	Queensland
2013	Prawns	Yellow head virus/gill-associated virus genotype 7	Queensland
2012	Ornamental fish (farmed)	Megalocytivirus	Queensland
	Salmonids	Orthomyxo-like virus	Tasmania
2011	Farmed abalone	Viral ganglioneuritis	Tasmania
2010	Native catfish	<i>Edwardsiella ictaluri</i>	Northern territory
	Barramundi	Herpesvirus	Victoria
	Pacific oysters	Ostreid herpesvirus	New South Wales
	Trout	Aquabirnavirus	Victoria
2008	Southern bluefin tuna	Blood fluke (<i>Cardicola fosteri</i>)	South Australia
	Grouper (wild)	Mortalities (<i>Streptococcus</i> sp.)	Queensland
	Kingfish mortality	–	Western Australia
	Abalone (in processing plants)	Viral ganglioneuritis	Tasmania
	White tail	<i>Macrobrachium rosenbergii</i> nodavirus	Queensland
	Prawns	New strain (previously exotic) of infectious hypodermal and hematopoietic necrosis virus (IHHNV)	Queensland
2007	Salmonids	Orthomyxo-like virus	Tasmania (Tamar River)
2006	Eels mortality	Rhabdovirus (suspected/unconfirmed)	Victoria
	Pearl oysters	Oedema disease	Western Australia
	Abalone (wild)	Viral ganglioneuritis	Victoria

Appendix D: Summary of aquatic animal diseases and infectious agents in Australia

Year identified	Host animal	Pathogen/disease	State/territory
2005	Carp mass mortality	–	Victoria
	Abalone (farmed)	Viral ganglioneuritis	Victoria
	<i>Penaeus merguensis</i>	Gill-associated virus	Western Australia
2004	Australian bass and other finfish	Nodavirus	New South Wales
	Leatherjacket mass mortality	–	New South Wales
2003	Murray cod	Iridovirus	Victoria
	Prawns (<i>Penaeus monodon</i>)	infectious hypodermal and hematopoietic necrosis virus (IHHNV) (integrated sequence?)	Queensland
	Goldfish	Herpesviral haematopoietic necrosis	Western Australia
2001	Salmonids	Rickettsia-like organism	Tasmania
	Pearl oysters	Ciliate infection/disease	Western Australia
2000	Barramundi	Hump-back syndrome	Queensland
	Redclaw crayfish	Parvo-like virus	Queensland
1998–99	Pilchards	Herpesvirus	All southern states
	Pilchards	Orthomyxo-like virus	South Australia
	Salmonids	Aquabirnavirus	Tasmania
	Yabbies	Thelohania	Western Australia
1997	Tuna	<i>Uronema nigricans</i>	South Australia
	<i>Penaeus japonicus</i>	Hepatopancreatic parvo-like virus	Queensland
	Pearl oysters	Ciliate infection/disease	Western Australia
1996	<i>Penaeus monodon</i>	Gill-associated virus	Queensland
	<i>Penaeus monodon</i>	Mourilyan virus	Queensland
	<i>Metapenaeus bennettiae</i>	Bennettae baculovirus	Queensland
1995	Pilchards mass mortality	Herpesvirus	All southern states
	Pearl oysters	Haplosporidiosis	Western Australia
1994	Salmonids	Atypical <i>Aeromonas salmonicida</i>	Tasmania
	Prawns	Mid-crop mortality syndrome	Queensland
1993	Giant clam, <i>Tridacna gigas</i>	Rickettsia-like organism	Queensland
	Redfin perch	Aquareovirus	Victoria
	Hybrid <i>Penaeid</i> prawns	Penaeid haemocytic rod-shaped virus	Queensland
	<i>Penaeus monodon</i>	Monodon baculovirus (now known as <i>P. monodon nudivirus</i>)	Queensland
	Pearl oysters	Papova-like virus infection	Western Australia

Year identified	Host animal	Pathogen/disease	State/territory
1992	Snapper	Lymphocystis	South Australia
	Hybrid <i>Penaeid</i> prawns	infectious hypodermal and hematopoietic necrosis virus (IHHNV)	Queensland
	Oysters (edible)	<i>Bonamia</i> sp.	Victoria
1991	<i>Penaeus monodon</i> , <i>P. merguensis</i> and <i>P. esculentus</i>	Lymphoidal parvovirus	Queensland
1990	Barramundi	Lymphocystis	All states and Northern Territory
	<i>Macrobrachium rosenbergii</i>	Parvo-like virus	Queensland
1989	Barramundi	Nodavirus	Queensland
	Atlantic salmon	Aquareovirus	Tasmania
	<i>Penaeus merguensis</i>	Hepatopancreatic parvovirus	Queensland
1988	Trout	Mycobacteriosis	Victoria
1987	<i>Penaeus plebejus</i>	<i>Penaeus</i> baculovirus	Queensland
1986	Atlantic salmon	Amoebic gill disease	Tasmania
1984	Redfin and rainbow trout	Epizootic haematopoietic necrosis virus	Victoria
1980s	Abalone	<i>Perkinsus</i> sp.	New South Wales
	Oysters	<i>Marteilia sydneyi</i>	New South Wales
	Pearl oysters	Vibriosis	Western Australia
	Salmonids	<i>Flexibacter</i> , <i>Yersinia ruckeri</i> , <i>Vibrio</i>	Tasmania
1980	Goldfish	Goldfish ulcer disease (atypical <i>Aeromonas salmonicida</i>)	Victoria
1970	Finfish	Epizootic ulcerative syndrome (fungal infection)	New South Wales, Northern Territory, Queensland, Victoria, South Australia and Western Australia

Source: University of Queensland Centre for Marine Science

Glossary

Term	Definition
1IP	First infected premises on Logan River, Queensland (first signs of prawn mortality 22 November 2016).
2IP	Infected premises on Logan River, Queensland (tested positive for white spot syndrome virus 14 December 2016).
3IP	Infected premises on Logan River, Queensland (tested positive for white spot syndrome virus 6 December 2016).
4IP	Infected premises on Logan River, Queensland (tested positive for white spot syndrome virus 29 December 2016).
5IP	Infected premises on Logan River, Queensland (tested positive for white spot syndrome virus 29 December 2016).
6ARP	Hatchery on Logan River, Queensland. Not in production at time of Logan River WSSV incursion. Not confirmed as infected with white spot syndrome virus (WSSV) but is an 'at risk premises'.
7IP	Infected premises on Logan River, Queensland (tested positive for white spot syndrome virus 13 February 2017).
8IP	Infected premises on Logan River, Queensland (tested positive for white spot syndrome virus 27 January 2017).
AAA	Advanced Analytical Australia, an independent laboratory accredited for WSSV testing.
AAHL	Australian Animal Health Laboratory, operated by CSIRO. Leading laboratory for animal health in Australia and accredited for WSSV testing.
AgriGen Biotech	Independent laboratory accredited for WSSV testing.

AHA	Animal Health Australia is a not-for-profit public Company established by the Australian Government, state and territory governments and major national livestock industry organisations. The company manages national animal health programs on behalf of its members.
AHC	Animal Health Committee of the National Biosecurity Committee develops science-based and nationally consistent policy on animal health issues and advises NBC on animal health. Committee members include chief veterinary officers of Australian, state and territory governments, representatives from AAHL (CSIRO), Department of Agriculture and Water Resources and Department of the Environment and Energy, and observers from Animal Health Australia, Wildlife Health Australia and the NZ Ministry for Primary Industries.
AIMS	Agriculture Import Management System, managed by Department of Agriculture and Water Resources.
ALOP	Appropriate level of protection against biosecurity risks.
APFA	Australian Prawn Farmers Association
AqCCEAD (or Aquatic CCEAD)	Aquatic Consultative Committee on Emergency Animal Diseases is a national committee comprising state and territory directors of fisheries or chief veterinary officers, Department of Agriculture and Water Resources and CSIRO representatives and industry bodies. Chaired by Australian Chief Veterinary Officer.
AQIS	The Australian Quarantine and Inspection Service was the Australian government agency responsible for enforcing Australian quarantine laws, as part of the Australian Government Department of Agriculture. AQIS was dissolved in 2012.
aquaculture	Farming of aquatic organisms, including prawns.
AQUAVETPLAN	Australian Aquatic Veterinary Emergency Plan is a series of manuals outlining Australia's approach to national disease preparedness. It details technical response and control strategies to be activated in a national aquatic animal disease emergency.
Aquatic Animal Health Code	World Organisation for Animal Health's code sets out standards for improving health and welfare of farmed fish worldwide, and for safe international trade in aquatic animals and their products.
Beale review	<i>One biosecurity: a working partnership.</i> The independent review of Australia's quarantine and biosecurity arrangements (published September 2008).
BICON	Biosecurity Import Conditions system, managed by Department of Agriculture and Water Resources.
BIMS	Biosecurity Incident Management System, managed by Department of Agriculture and Water Resources. BIMS has been developed to provide guidance on contemporary practices for the management of biosecurity incident response and initial recovery operations in Australia.
biosecurity	Management of risks to the economy, environment and community posed by pests and diseases entering, emerging, establishing or spreading.
Biosecurity Act	<i>Biosecurity Act 2015</i> (Cth). Commenced 16 June 2016 and replaced <i>Quarantine Act 1908</i> (Cth).

Biosecurity Australia	Biosecurity Australia was an arm of the Australian Government Department of Agriculture, Fisheries and Forestry. It provided science-based quarantine assessments and policy advice to protect Australian agricultural industry, and to enhance Australia's access to international animal and plant related markets. Biosecurity Australia also provides policy advice to AQIS concerning the importation of quarantine risk material to Australia. Biosecurity Australia was abolished in 2012.
biosecurity continuum	Series of locations where biosecurity risks may arise and where biosecurity activities take place pre-border, at the border and within Australia.
Biosecurity Queensland	Service area of Queensland Department of Agriculture and Fisheries. Leads Queensland Government efforts to prevent, respond to and recover from pests and diseases threatening agricultural prosperity, the environment, social amenity and human health. Aims to maintain access to markets, protect animal welfare and reduce risk of contamination from agricultural chemicals.
biosecurity risk	Potential for disease or pest to enter, emerge, establish or spread in Australia.
CCEAD	Consultative Committee for Emergency Animal Diseases
competent authority	Official service or authority established by government of exporting state. Has responsibility and competence to ensure or supervise implementation of animal, plant or public health standards.
decontamination	Cleaning and disinfection to remove contamination from an area, object or person.
department	Australian Government Department of Agriculture and Water Resources Former portfolio names: 1987 to 1998—Department of Primary Industries and Energy 1998 to 2013—Department of Agriculture, Fisheries and Forestry 2013 to 2015—Department of Agriculture
Director of Biosecurity	Secretary of the Australian Government Department of Agriculture and Water Resources, responsible for managing biosecurity risks and ensuring Australia's international rights and obligations are met.
EMAI	Elizabeth Macarthur Agricultural Institute, the NSW Department of Primary Industry's Centre of Excellence for Plant and Animal Health. Accredited for WSSV testing.
exotic	Disease that does not normally occur in Australia.
FRDC	Fisheries Research and Development Corporation
ICS	Integrated Cargo System, managed by the Australian Government Department of Immigration and Border Protection
infected premises	Defined area (all or part of a property) in which a disease exists or is believed to exist, or in which the causative agent of that disease exists or is believed to exist.
IRA	Import risk analysis is a highly formal process that involves analysing the biosecurity risk of certain goods. Used to develop policy to ensure level of biosecurity risk in the goods achieves the ALOP for Australia. See section 166 of the <i>Biosecurity Act 2015</i> (Cth).

movement control	Restrictions placed on the movement of fish, people and other objects or materials likely to transmit disease in order to prevent spread of disease.
NHPB	necrotising hepatopancreatitis bacterium
OIE	World Organisation for Animal Health (also known as Office International des Epizooties)
PCR	Polymerase chain reaction is a method of amplifying targeted DNA sequences to detectable levels. Can be used to confirm presence of disease-causing DNA, such as WSSV DNA.
prawn products	Prawn meat products and products of prawn origin (for example, prawn eggs) for human consumption or use in animal feeding.
QAP	A quarantine approved premises is a place approved, under section 46A of the repealed <i>Quarantine Act 1908</i> (Cth), as a place where goods of a specified class that are subject to quarantine may be treated or otherwise dealt with.
QDAF	Queensland Department of Agriculture and Fisheries
Quarantine Act	<i>Quarantine Act 1908</i> (Cth). Repealed 1 May 2016 and replaced by <i>Biosecurity Act 2015</i> (Cth).
SCAHLs	Sub-committee on Animal Health Laboratory Standards (active 1990 to 2014)
SPS agreement (WTO SPS agreement)	World Trade Organization's Agreement on the Application of Sanitary and Phytosanitary Measures (entered into force 1995)
TSV	taura syndrome virus
WSD	white spot disease
WSSV	white spot syndrome virus
WTO	World Trade Organization
YHV	yellow head virus

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