Ministry for Primary Industries
Manatū Ahu Matua

Risk Management Proposal:

Fresh Pumpkin, Squash and Butternut for Human Consumption or Decorative Purposes

MPI.IHS.FP.PUMPKIN

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New Zealand Government

Growing and Protecting New Zealand

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Submissions

The Ministry for Primary Industries (MPI) invites comment from interested parties on the proposed new import health standard (IHS) for Fresh Pumpkin, Squash and Butternut for Human Consumption or Decorative Purposes which is supported by this Risk Management Proposal (RMP).

The meaning of an IHS is defined in section 22(1) of the Biosecurity Act 1993 as "An import health standard specifies requirements to be met for the effective management of risks associated with importing risk goods, including risks arising because importing the goods involves or might involve an incidentally imported new organism".

MPI therefore seeks comment on the requirements (including measures) in the proposed IHS. MPI has developed this proposal based on the available scientific evidence and assessment of this evidence. If you disagree with the measures proposed to manage the risks, please provide either scientific data or published references to support your comments. This will enable MPI to consider additional evidence which may change how risks are proposed to be managed.

The following points may be of assistance in preparing comments:

- Wherever possible, comments should be specific to an IHS requirement (referencing section numbers or pest names as applicable).
- Where possible, reasons, data and supporting published references to support comments are requested.
- The use of examples to illustrate particular points is encouraged.

MPI encourages respondents to forward comments electronically (to arrive by close of business on 11 June 2018). Please include the following in your submission:

- The title of the consultation document in the subject line of your email;
- Your name and title (if applicable);
- Your organisation's name (if applicable); and
- Your address.

Send submissions to: plantimports@mpi.govt.nz.

However, should you wish to forward submissions in writing, please send them to the following address to arrive by close of business on 11 June 2018

Plant Imports
Plants, Food and Environment Directorate
Ministry for Primary Industries
PO Box 2526
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New Zealand

Submissions received by the closure date will be considered during the development of the final IHS. Submissions received after the closure date may be held on file for consideration when the issued IHS is next revised/reviewed.

Official Information Act 1982

Please note that your submission is public information. MPI policy is to provide a copy of all submissions received and the review of submission to all parties who lodge submissions.

Submissions may be the subject of requests for information under the Official Information Act 1982 (OIA). The OIA specifies that information is to be made available to requesters unless there are sufficient grounds for withholding it, as set out in the OIA. Anyone preparing a submission may wish to inform MPI if there are grounds for withholding specific information contained in their submission, such as the information is commercially sensitive or they wish personal information withheld.

Any decision to withhold information requested under the OIA is reviewable by the Ombudsman.

Contents

Purpose

(1) The purpose of this risk management proposal (RMP) is to:

a) consider and assess a new market access request for fresh pumpkin (*Cucurbita pepo*) [Cucurbitaceae] from Tonga. It will:

i) summarise the pests associated with the import of fresh pumpkin from Tonga that require measures and the strength of measure required to manage them;

ii) justify the measures proposed in the draft import health standard (IHS) for Fresh Pumpkin, Squash and Butternut for Human Consumption or Decorative Purposes to effectively manage known biosecurity risks; and

iii) explain how the proposed measures are consistent with New Zealand's domestic legislation and international obligations.

Note: the assessment (Appendix 1) only includes market access for *Cucurbita pepo* from Tonga

b) present a new commodity import IHS for fresh pumpkin (*Cucurbita pepo*), squash (*Cucurbita* maxima) and butternut (*Cucurbita moschata*) for human consumption or decorative purposes from all currently approved countries, with the addition of the new market access request for pumpkin from Tonga. The commodity import health standard will replace the existing country: commodity based standards; and

c) review the strength of phytosanitary measures for previously agreed pest lists, where different levels of measure apply for a given pest under existing import health standards.

(2) The draft IHS is the subject of consultation under section 23(3) of the Biosecurity Act 1993. This RMP provides information to support the consultation on the draft IHS but is not itself the subject of consultation. However MPI will accept comments and suggestions on the RMP in order to improve future IHS consultations.

Scope

(3) This RMP describes the information and process used to determine the pest risk management measures proposed in the draft IHS: Fresh Pumpkin, Squash and Butternut for Human Consumption or Decorative Purposes. The RMP includes:

a) a summary of pests directly associated with pumpkin at the point of export from Tonga;

b) a description of pre-export phytosanitary measures and their effectiveness considered for managing pests associated with fresh pumpkin, squash and butternut.

c) consideration and resolution of any inconsistencies in the level of measures required to manage biosecurity risks in existing import health standards for fresh pumpkin, squash and butternut; and

d) an outline of administrative changes (e.g. nomenclature and regulatory status changes).

(4) The IHS for Fresh Pumpkin, Squash and Butternut for Human Consumption or Decorative Purposes provides additional market access for fresh pumpkin from Tonga in addition to existing access. Though New Caledonia, Vanuatu, and Australia are included in the new commodity standard, no new market access has been included. Therefore currently the IHS only allows the importation of:

a) Fresh pumpkin for human consumption from Australia [existing market access];

b) Fresh pumpkin and squash for human consumption from New Caledonia [existing market access];

c) Fresh squash for human consumption from Vanuatu [existing market access];

d) Fresh squash and butternut for human consumption from Tonga [existing market access]; and fresh pumpkin for human consumption or decorative purposes from Tonga [new market access].

Background

(5) Fresh pumpkin (*Cucurbita pepo*) is currently approved for import from Australia and New Caledonia under IHS 155.02: *Importation and Clearance of Fresh Fruit and Vegetables Into New Zealand*.

(6) Other members of the *Cucurbita* genus that can be imported into New Zealand are:

a) IHS: Zucchini (*C. pepo*) from Australia
b) IHS: Squash (*C. maxima*) from Vanuatu
c) IHS: Squash and Butternut (*C. maxima* and *C. moschata*) from Tonga
d) IHS: 152-02 Fresh Fruit and Vegetables: Squash (*C. maxima*) from New Caledonia, Scallopini (*C. pepo*) from Australia and New Caledonia; and Zucchini (*C. pepo*) from New Caledonia.

(7) Since 2010 there have been the following imports of cucurbits:
a) no importation of fresh pumpkin from Australia and New Caledonia;
b) fresh butternut from Tonga (55 consignments); and
c) fresh squash from New Caledonia and Tonga (91 consignments).

Part 1: Context

Domestic

(8) The New Zealand biosecurity system is regulated through the Biosecurity Act 1993. Section 22 of the Act describes the meaning of an IHS, and requires that the IHS specifies requirements to be met for the effective management of risks associated with importing risk goods (including plants and plant products) into New Zealand.

(9) The Ministry for Primary Industries (MPI) leads the biosecurity system and is the government authority responsible for the effective management of risks associated with the importation of risk goods into New Zealand (Part 3, Biosecurity Act 1993).

(10) MPI engages with interested parties and/or affected New Zealand stakeholders and the exporting country requesting market access during the development of an IHS.

(11) MPI follows MPI policies and procedures for the development of an IHS and consultation.

International

(12) Where possible, phytosanitary measures are aligned with international standards, guidelines, and recommendations as per New Zealand's obligations under Article 3.1 of the World Trade Organisation (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement), WTO 1995 and section 23(4)(c) of the Biosecurity Act 1993.

(13) The SPS Agreement states that phytosanitary measures must not discriminate unfairly between countries or between imported or domestically produced goods, and where there is a choice of phytosanitary measures to reduce risk to an acceptable level, WTO members must select the least trade restrictive measure.

New Zealand's Biosecurity System

(14) New Zealand operates a biosecurity system for which the phytosanitary aspect (covering plant health) is a key part.

(15) No biosecurity system is capable of reducing risk to zero. The objective of the system is to reduce to an acceptable level the likelihood of entry and establishment of quarantine pests

(16) Pests are defined as "Any species, strain or biotype of plant, animal or pathogenic agent injurious to plants or plant products" (ISPM 5: *Glossary of Phytosanitary Terms*). Pests are categorised as a quarantine pest for New Zealand (as per ISPM 11) if the pest:
a) is not present in New Zealand or is not widely distributed and under official control; or
b) is a vector of a quarantine pest for New Zealand; or

c) is a different strain to the pests present in New Zealand and has a different impact (e.g. host range, pathogenicity); and
d) has the potential to establish in New Zealand; and
e) has the potential to cause unwanted economic consequences should it establish in New Zealand.

(17) The New Zealand phytosanitary system focuses on ensuring that the most significant pests, for example economically important fruit flies, are unlikely to ever establish in New Zealand. The system also manages risk associated with all regulated pests.

(18) The focus of the IHS for plant-based goods is to manage unacceptable phytosanitary risks identified as being associated with the goods before arrival/ clearance at the New Zealand border. The expectation is that commercial consignments of plants and plant products meet New Zealand's phytosanitary import requirements on arrival (risk is managed off-shore).

(19) MPI monitors the pathway performance related to each IHS to ensure it provides the expected level of protection. This is achieved through verification and inspection activities at the border (and where possible, identification of pests detected) and audits of the export systems and critical control points contained in the *Export Plans*.

Strength of measures

(20) Measures are required for regulated pests (see paragraph 16) where the 'probability of introduction and spread' on a pathway is unacceptable (i.e. if it is able to enter through the pathway, find a suitable host, and able to establish and spread in New Zealand).

(21) The strength of the measure required should be no more than necessary to manage the risk the organism poses. MPI has classified measures into three categories of increasing strength: *Basic Measures, Targeted Measures* or *MPI-Specified Measures*.

(22) The strength of measure required depends on the risk posed by the organism on the pathway. This risk is determined by a combination of the consequences the pest may cause if it was introduced into New Zealand and the likelihood that the pest will enter and establish from a pathway. For pests that would result in very high consequences, such as economically important species of fruit fly, *MPI-Specified Measures* are required. This is because these pests would cause significant negative consequences to New Zealand, even if the risk (likelihood of them entering and establishing a transient population) is low.

(23) The greater the risk from a pest, the greater the level of assurance MPI requires that the pest is not present in a consignment unless the pest has been rendered non-viable (dead or sterile from irradiation). For *Targeted* and/ or *MPI-Specified Measure* pests an *Export Plan* will be negotiated with the exporting NPPO, supported by an MPI pathway assessment visit (if required). The *Export Plan* will identify how *Targeted* and *MPI-Specified Measures* will be applied. The *Export Plan* must be approved by MPI, and is subject to audit and review by MPI.

(24) The proposed IHS includes all measures accepted for pests assessed as being possibly associated with the commodity.

Importing Fresh Produce

(25) Fresh produce can only be imported subject to an IHS specifying the commodity, and from a country where MPI has approved the systems, programmes and standards for regulatory oversight by the National Plant Protection Authority (NPPO). The export system is subject to audit by MPI.

(26) In circumstances where regulated pests requiring *Targeted* or *MPI-Specified Measures* are associated with the commodity, MPI requires the exporting NPPO to negotiate an *Export Plan* with MPI. Exports to New Zealand under the new IHS cannot occur until the *Export Plan* has been agreed by MPI.

Part 2: Approach

Commodity Description

(27) This Risk Management Proposal (RMP) applies to fresh pumpkin, squash and butternut fruit of the species *Cucurbita pepo, C. maxima* and *C. moschata* for human consumption or decorative purposes ('fresh pumpkin, squash and/or butternut').

(28) This RMP also applies to fresh pumpkin, squash and butternut fruit imported for decorative purposes. Additional information is included where the risk from fresh pumpkin, squash or butternut being used for decorative purposes is higher than fresh pumpkin, squash or butternut used for human consumption.

(29) "Fresh pumpkin, squash and butternut" is defined as commercially produced and harvested pumpkin, squash or butternut fruit. The commodity is a mature, hard-skinned fruit, containing seeds, and trimmed at the point where the stem meets the peduncle.

(30) "Commercially produced" is defined as the production of export quality fruit sourced from sites that grow for export under standard cultivation, pest-management, harvesting, disinfestation and packing activities.

a) Commercially produced pumpkin, squash and butternut is graded to remove:
   - fruit in an immature state;
   - damaged fruit, and plant material (such as the leaves) other than what is included in the commodity description;
   - fruit which are infested or infected with visually detectable pests;
   - all plant material from species other than *Cucurbita pepo, C. maxima* or *C. moschata*

b) Private consignments and products produced through non-commercial systems (for example, 'backyard' production) do not meet the definition of commercially produced, and are excluded from the scope of this RMP and the IHS: Fresh Pumpkin, Squash and Butternut for Human Consumption or Decorative Purposes.

(31) This RMP does not apply to any immature or soft-skinned *Cucurbita pepo, C. maxima* or *C. moschata* varieties such as summer squash, zucchini or scallopini.

Information Sources

(32) The following information was used to identify risk organisms associated with fresh pumpkin from Tonga (Appendix 1) and determine appropriate measures to manage the risk of their introduction (entry and establishment) into New Zealand:

a) Pest assessments from MPI Import Risk Analyses (with consideration given to the fresh pumpkin pathway and the end use of the product) including:
   - Import Risk Analysis: Fresh Citrus Fruit (7 species) from Samoa (MAF, 2008).
   - Import Risk Analysis: Fresh Island cabbage leaves (*Abelmoschus manihot*) from Cook Is., Fiji, Samoa, Tonga and Vanuatu (MAF, 2011).
   - Import Risk Analysis: Pears (*Pyrus bretschneideri, Pyrus pyrifolia*, and *Pyrus* sp. nr. *communis*) fresh fruit from China (MAF, 2009).
   - Import Risk Analysis: Fresh Polynesian plum fruit (*Spondias dulcis*) from Cook Is., Fiji, Samoa, Tonga, Vanuatu (MPI, 2012).
   - Import Risk Assessment: Onion (*Allium cepa)* Fresh Bulbs for Consumption from China (MPI, 2016a).
   - Generic Pest Risk Assessment: Armoured scale insects (Hemiptera: Coccoidea: Diaspididae) on the fresh produce pathway (MPI, 2014).

b) The Risk Management Proposal: Fresh zucchini and scallopini (Cucurbita pepo) for consumption from the Kingdom of Tonga (MPI, 2015a).

c) Pest information supplied by Tonga's NPPO (MAFFF, 2012).

d) Relevant literature and database searches (including the Crop Protection Compendium and the Pacific Islands Pest List Database).
e) MPI pest interception data for other Cucurbitaceae import pathways (QuanCargo, 2017).

(33) The same information sources were used for the consolidation of the existing pumpkin, squash and butternut import health standards into the new import health standard. A full list of sources is included in the reference list (Part 4).

Assessment

(34) The above information sources were used to assess an organism's risk. The pest risk assessment process follows part 2.1 of the International Standard for Phytosanitary Measures (ISPM) 11: *Pest risk analysis for quarantine pests*, MPI import risk analysis procedures and considers (see also Appendix 1):
a) presence or absence in the exporting country;
b) presence or absence in New Zealand;
c) regulatory status in New Zealand;
d) association with the commodity and pathway;
e) potential for establishment and spread in New Zealand; and
f) potential to cause unwanted consequences in New Zealand.

(35) The level of hazard identification and pest risk assessment is only undertaken to the extent necessary and varies based on the existing information available on, and measures applied to, certain species, pest groups, or taxa (MPI, 2006b). As this commodity (pumpkin from Tonga) is similar to a number of existing assessments and standards, assessments were primarily targeted at knowledge gaps and a review of the existing standards to ensure consistency.
a) To the extent necessary means that pest risk assessment is undertaken to the degree required for a robust and transparent decision.

(36) All pests identified as 'potential quarantine pests' were assessed by MPI to determine:
a) the 'probability of introduction and spread' (entry into New Zealand, exposure to suitable hosts, establishment and spread) in New Zealand (following part 2.2 of ISPM 11);
AND
b) the 'potential economic consequences' (including economic, environmental, socio-cultural and human health consequences), following part 2.3 of ISPM 11.

(37) A pest is considered 'appropriate for pest management' if:
a) the 'probability of introduction and spread' is sufficient to justify risk management (i.e. if it is able to enter through the pathway, find a suitable host, and able to establish and spread in New Zealand);
AND
b) the 'potential economic consequences' are sufficient to justify risk management (i.e. if it is likely to cause unacceptable economic, environmental, socio-cultural or human health impacts in New Zealand).

Description of measures

(38) The biosecurity system in New Zealand operates a series of components or layers (pre-border, border, and post-border) that together provide a high level of assurance that pests are unlikely to establish in New Zealand (refer Table 1, page 14). No one part of the system is able to achieve the necessary assurance on its own. The main components in the pre-border and border system include:
a) commercial production (*Basic Measures*) to reduce pest prevalence on a commodity;
b) application of an additional measure in the exporting country to reduce pest prevalence on a commodity (*Targeted* and/ or *MPI-Specified Measure* where required);

c) official pre-export phytosanitary inspection and certification to verify that pre-export measures have been undertaken and effective as required by MPI and that the consignment is free from regulated pests;

d) on-arrival inspection of documentation in New Zealand to verify compliance with the IHS. Inspection of a consignment may also be conducted in New Zealand to verify pests are not present in a representative sample (e.g. no live regulated visible pests in a 600 unit sample);

e) remedial action (for example treatment) as required (e.g. if a regulated pest is detected during on-arrival inspection).

(39) Measures of different strengths (*Basic*, *Targeted*, or *MPI-Specified*) are applied according to the level of the pest risk on the pathway to effectively mitigate the risk of pest introduction via a commodity.

Basic Measures

(40) *Basic Measures* are required to manage all organisms that could enter and establish in New Zealand. *Basic Measure* pests are pests identified through risk assessment as possibly being on the pathway. *Basic Measures* include (but are not restricted to) the following required components:

Commercial production

(41) All fresh produce for export to New Zealand, regardless of the associated pests, must be commercially produced using a quality system, recognised standard cultivation, pest management, harvest and packaging activities.

(42) Commercial production of fresh pumpkin, squash and butternut includes:

a) Recognised standard cultivation:
- production site management such as plant health monitoring, appropriate use of agrichemicals, environmental controls, management of records;
- crop hygiene practices such as in-field weed control.

b) Pest management:
- pest monitoring;
- management of pests and diseases including cultural, biological and chemical controls.

c) Harvest activities:
- sorting of fruit to remove extraneous matter (such as plant material and soil) and non-export quality produce.

d) Packaging activities:
- removal of debris (including soil) and visible pests from pumpkin, squash and butternut fruit;
- packing pumpkin, squash and butternut into clean packaging material;
- maintaining product security following export certification to prevent pest re-infestation.

(43) All fresh produce for export to New Zealand must be of export quality to minimise the likelihood of infested or infected fruits entering the supply chain.

(44) For many pests *Basic Measures* are sufficient to reduce their prevalence in a consignment to a very low level thus limiting their potential to enter, establish and spread in New Zealand if they entered undetected.

Targeted Measures

(45) *Targeted Measures* are used to manage the risk of entry and establishment of pests that are unlikely to be sufficiently managed by *Basic Measures*.

(46) Pests which present a higher risk (consequence and likelihood of introduction) require measures of a greater strength (e.g. *Targeted Measures*) compared with those pests where the risk is lower.

(47) An *Export Plan* is required for all commodities that may be associated with pests identified by MPI as requiring *Targeted Measures*. The components of an *Export Plan* may differ between countries and

commodities because the pest profiles, agricultural practices, and production and export regulatory systems may differ but can be similarly effective. The *Export Plan* provides a description of how the agreed *Targeted Measures* will be applied to manage these pests (where required) and is negotiated between New Zealand and the individual exporting country NPPO.

(48) *Targeted Measures* include a wide range of options and provide MPI with the assurance that pest incidence on the exported product is reduced to a level that will effectively mitigate the risk of an organism successfully establishing in New Zealand.

(49) A *Targeted Measure* may also be efficacious against non-target pests.

(50) The following measures are examples of those that may be considered for managing pests requiring *Targeted Measures*:

a) Country freedom;
   - additional measures or an *Export Plan* are not required where 'country freedom' status is recognised by MPI for the export country.

b) Pest free area;
   - MPI will audit and approve the management of pest free areas for compliance with ISPM 4: *Requirements for the establishment of pest free areas*.

c) Pest free place of production;
   - MPI will audit and approve the management of pest free place of production for compliance with ISPM 10: Requirements for the establishment of pests free places of production and pest free production sites.

d) Systems Approaches;
   - a Systems Approach is composed of two or more independent measures, as negotiated between MPI and the exporting country NPPO, and in accordance with ISPM 14: *The use of integrated measures in a systems approach for pest risk management*;
   - independent measures may vary between exporting countries.

e) Pest control activities (in-field);
   - In-field pest control activities efficacious against the target pest (may target several life cycle stages).

f) End-point treatment.
   - An end point treatment considered efficacious against the target pest – options may include heat, cold, irradiation or chemical (e.g. MPI's Approved Biosecurity Treatments) treatments.

(51) *Targeted Measures* are subject to pathway assurance audits by MPI once trade has commenced.

MPI-Specified Measures

(52) An *Export Plan* is required for all commodities with associated pests identified by MPI as requiring *MPI-Specified Measures*.

(53) *MPI-Specified Measures* are required when the consequence of establishment of a pest is very high and where entry and establishment is possible as a result of the unmanaged pathway.

a) The selection of an appropriate *MPI-Specified Measure* is based largely on quantitative data that supports a high level of phytosanitary assurance. Quantitative data may be supported by qualitative information, especially with respect to approval of a systems approach.

b) A *MPI-Specified Measure* may also be effective against non-target pests.

(54) Wherever possible, MPI uses ISPMs (or regional standards if applicable) to identify the appropriate requirements for imported plant commodities.

(55) *MPI-Specified Measures* are subject to pathway assurance audits by MPI.

Certification and verification

Pre-export inspection and phytosanitary certification

(56) Pre-export inspection and phytosanitary certification by the exporting NPPO of all commercially produced fresh produce (including cut flowers and foliage) for export to New Zealand is required to provide assurances of freedom from visually detectable regulated pests. Assurance is also required that measures for pests that are not visually detectable have been applied as described in the *Export Plan*.

(57) The phytosanitary certification process includes:

a) verification that any *Basic*, *Targeted* and *MPI-Specified Measures* required by MPI have been met;

b) sampling and inspection to determine pest freedom;

i) a minimum sample of 600 randomly selected pumpkin, squash or butternut fruit must be visually inspected by the exporting country NPPO or its authorised agencies or personnel using official procedures and, where necessary, at 10x magnification to ensure detection of cryptic or small pests. The visual inspection can include cutting pumpkin, squash or butternut fruit to identify pests located within the fruit. Consistent with international practice, the inspected sample must be free from regulated pests.

ii) where any live regulated pest is found in the inspected lot, an appropriate measure must be applied (for example fumigation with an efficacious chemical) or the lot must be rejected for export to New Zealand.

c) any remedial action taken as agreed with MPI.

Verification on arrival in New Zealand

(58) When a consignment arrives in New Zealand MPI will conduct a documentation check to ensure the phytosanitary certification conforms to the requirements laid out in the IHS.

(59) Consignments without phytosanitary certification, or accompanied by incorrect certification, will be held in a transitional facility until correct documentation is presented. Failure to present correct documentation may result in the consignment being re-shipped or destroyed.

(60) MPI will normally sample and inspect consignments of fresh produce on-arrival to verify the absence of regulated pests. In a few cases where a pathway is, historically, highly compliant inspections may be conducted on an audit basis. Any reduction in the level of inspection from current on-arrival levels is based on sound evidence of the compliance of a pathway.

(61) When live regulated pests are detected on consignments on arrival in New Zealand, one of the following remedial risk management activities will be applied:

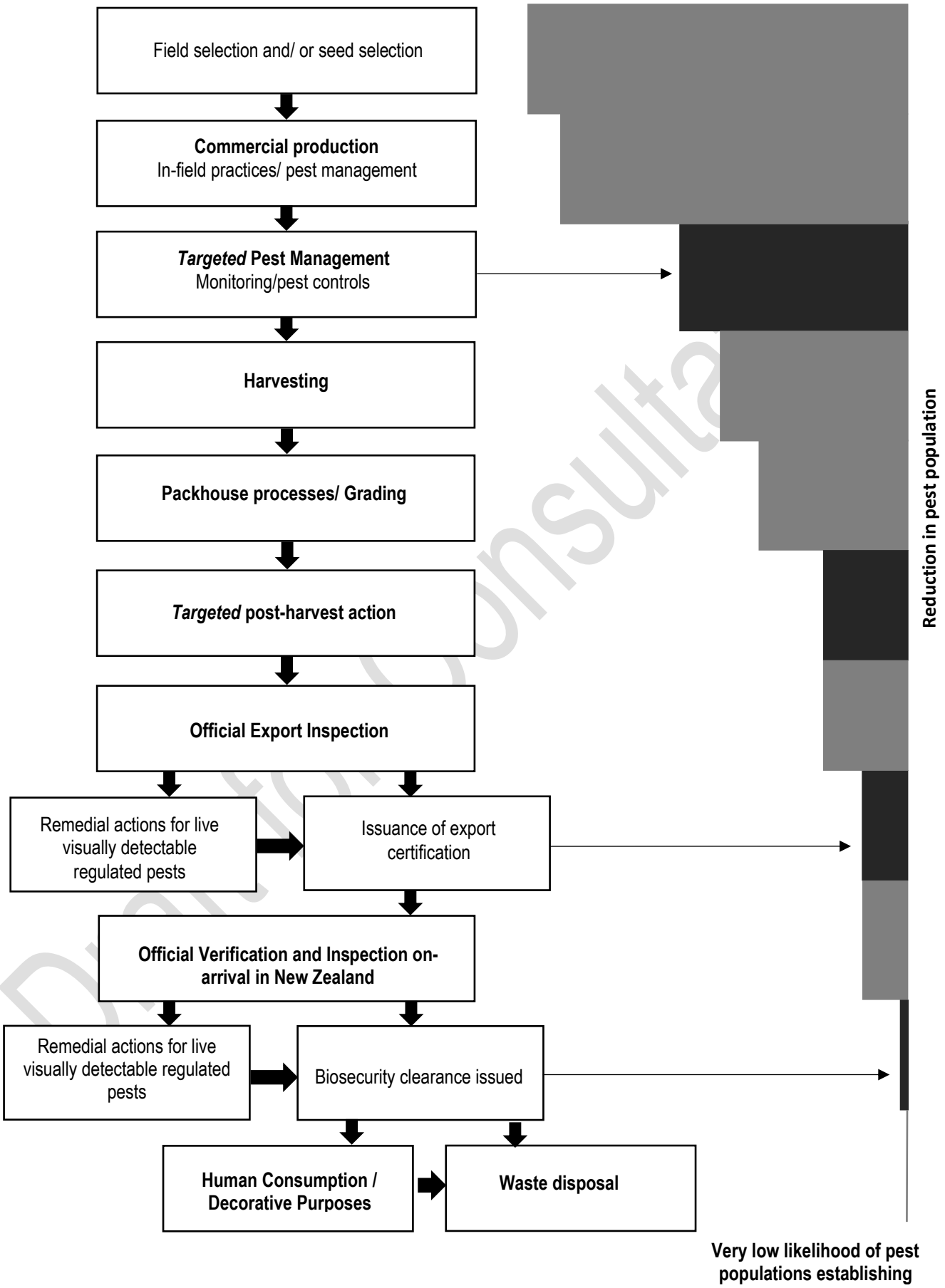
a) reshipment of the consignment; or

b) destruction of the consignment; or

c) treatment of the consignment. Treatment may include:

- re-conditioning to remove infested or infected stems; or
- fumigation with an efficacious chemical to kill regulated pests.

Table 1. New Zealand biosecurity system - Layers of protection for imported fresh produce



Part 3: Pest Risk Management Assessment

(62) Part 3 contains the following sections:

a) New market access request: Fresh pumpkin for decorative purposes or human consumption from Tonga
   i) A summary assessment for pests of fresh pumpkin from Tonga.

b) Consolidation of existing import health standards
   i) As part of the process of consolidating existing pumpkin, squash and butternut IHSs into the new commodity IHS format, MPI completed a review of existing pest lists and measures to ensure consistency across import pathways.
   ii) The review focuses on the following areas:
      - Confirming that the strength of measure required for each pest is consistent across all fresh pumpkin, squash and butternut import health standards, and determining the appropriate level of measures where the existing measures were inconsistent.
      - Confirmation of the current regulatory status of each pest on the existing pest lists.
      - A review of interception data for each pathway.

3.1 New market access request: Fresh pumpkin from Tonga

(63) This section only includes a review of pests identified from the information sources included in paragraph 32 of this RMP.

(64) A summary assessment for pests of fresh pumpkin can be found in Appendix 1. Pest risk assessment was primarily carried out using information on pest morphology and life history taken from other import risk analyses as the risk is the same regardless of the pathway. Throughout the pest risk assessment process expert workshops were held with risk analysts and risk managers to determine areas that would require further analysis and areas that were sufficiently covered by existing assessments. It is important to note that while most information was taken from other import risk analyses, the 'entry' and 'exposure' assessments do take into account the fresh pumpkin pathway.

(65) Due to the possible use of the commodity, fresh pumpkin exported for decorative purposes may require a greater measure than required for other fresh produce pathways (ISPM 32: *Categorization of commodities according to their pest risk*). This is because the volume of fruit that goes to waste (either compost, landfill or disposal in home gardens) as a result of its usage is a key component of the exposure assessment:

a) Waste from fresh pumpkin (regardless of pathway) is significant (e.g. skin and viable seeds).
b) Fresh pumpkin used for decorative purposes may be carved and exposed to the outdoor environment. Carving of pumpkins provides an opportunity for development of any pests that may be present on the pumpkin at the time of import, and a higher level of exposure to other plants and soil than normal composting/disposal practices.

(66) Pests identified as potentially associated with fresh pumpkin produced in Tonga were included in this assessment. These include species that use the commodity for some part of their lifecycle, as well as species where there is existing evidence to suggest they have an opportunistic association with the commodity.

(67) Pests and quarantine pests are defined and categorised as per ISPM 5 and ISPM 11 (see paragraph 16).

(68) Assessment identified 31 potential pests (Appendix 1) associated with fresh pumpkin that present a potential risk on this import pathway because they:

a) are present in Tonga;
b) are absent from New Zealand; and
c) are associated with pumpkin (*C. pepo*).

(69) Pests that did not meet the criteria of paragraphs 68 are not included in Appendix 1 as they do not require additional assessment.

(70) Nineteen of the 31 pests present a non-negligible risk on the Tongan fresh pumpkin pathway (are associated with the product at point of export, capable of establishing and spreading in New Zealand, and causing harmful economic consequences).These are identified in Table 2 below, and are discussed further in this section.

a) The remaining 12 organisms are not considered to present a risk on the pathway and therefore do not require further assessment.

b) A summary of the pest risk assessments undertaken in the assessment for the 31 pests is presented in Appendix 1.

Table 2. Quarantine pest groups that present a risk on fresh pumpkin from Tonga

Group	Pests	
Arthropods	*Aulacophora indica*	*Dysmicoccus brevipes*
	Aulacophora quadrimaculata	*Ferrisia virgata*
	Aphis fabae	*Leptoglossus gonagra*
	Aspidiotus destructor	*Maconellicoccus hirsutus*
	Bactrocera facialis	*Pinnaspis strachani*
	Bactrocera kirki	*Planococcus minor*
	Bactrocera sp. nr. *Passiflorae*	*Pseudaulacaspis pentagona*
	Bactrocera xanthodes	*Tetranychus neocaledonicus*
	Diaphania indica	*Tiracola plagiata*
Fungi	*Choanephora cucurbitarum*	

Determination of phytosanitary measures included in the draft IHS

(71) MPI requires measures to be applied to reduce the risk of entry and establishment of pests on the pathway to a very low level. Attaining zero biosecurity risk is not possible in any system.

(72) The following phytosanitary measures have been identified by MPI to manage pests associated with the importation of fresh pumpkin from Tonga (refer to Appendix 1 for reasons and supporting evidence).

a) The options for additional measures are not specific to one exporting country. The options require agreement by MPI and the exporting country and are documented in an *Export Plan* describing how they will be applied.

b) A measure identified for one pest may also reduce the likelihood of entry and establishment for other pests on the import pathway.

Basic Measures

(73) *Basic Measures* are justified for the pests in paragraph 74 based on the evidence for their low risk summarised from the sources identified in paragraph 32. Pests identified as requiring *Basic Measures* have been grouped based on taxon.

(74) *Basic Measures* are sufficient and justified to manage the following pests on the fresh pumpkin from Tonga import pathway for both human consumption and decorative purposes unless otherwise specified:

- *Tetranychus neocaledonicus*
- *Aulacophora indica*
- *Aulacophora quadrimaculata*
- *Aphis fabae*
- *Leptoglossus gonagra*
- *Aspidiotus destructor*
- *Pinnaspis strachani*

- *Pseudaulacaspis pentagona*[1]
- *Maconellicoccus hirsutus*
- *Planococcus minor*
- *Dysmicoccus brevipes*
- *Ferrisia virgata*
- *Diaphania indica*
- *Tiracola plagiata*
- *Choanephora cucurbitarum*

(75) The following reasons and evidence support the determinations below:

a) Unless otherwise referenced, all material included in this section is sourced from Appendix 1.

Acari (mites)

(76) *Basic Measures* are justified and sufficient to manage the low to moderate risk posed by *T. neocaledonicus* because:

a) Commercial production activities will reduce populations of *T. neocaledonicus* in pumpkin production sites to a low level.
   i) Commercial production includes monitoring for plants displaying signs/symptoms of infestation during production. Monitoring will identify obviously affected plants, resulting in pest controls being applied (see Commercial Production).
   ii) Signs/symptoms of infestation include chlorosis of leaves, twigs and fruit

b) Harvest, grading and packing activities will reduce the likelihood of *T. neocaledonicus* being associated with fresh pumpkin at export to a very low level.
   i) Adult *T. neocaledonicus* are likely to be removed during packhouse activities, as they are visually obvious.
      - *T. neocaledonicus* is small (0.5mm) and of noticeable colour (red).
      - *T. neocaledonicus* is mobile and movement will make them more noticeable.
   ii) Other lifestages of *T. neocaledonicus* are unlikely to be associated with pumpkin fruit.
      - Eggs are laid on secondary hosts with mobile adults then moving to primary hosts such as Cucurbits (MAF, 2008).
   iii) The IHS specifies 'commercially produced' export quality fruit (which includes grading to remove damaged fruit). Heavily infested and damaged pumpkin will not be export quality and therefore will be removed during grading and packaging (see Commodity Description).

c) *T. neocaledonicus* is likely to be detected and managed during official pre-export inspection by the exporting NPPO (see Pre-export inspection and phytosanitary certification).
   i) The mite's mobility and coloration will make them visually obvious.
   ii) Detection of *T. neocaledonicus* will require remedial action (e.g. end point treatment) prior to export certification.

Coleoptera (beetles)

(77) *Basic Measures* are justified and sufficient to manage the low risk posed by Coleoptera (*Aulacophora indica* and *Aulacophora quadrimaculata*) because:

a) Commercial production activities will reduce populations of Coleoptera during pumpkin production to a low level.
   i) Commercial production includes monitoring for plants displaying signs/symptoms of infestation during production. Monitoring will identify affected plants, resulting in pest controls being applied (see Commercial Production).
   ii) Signs and symptoms of infestation include defoliation, damage to the fruit surface and puncture wounds (MPI 2015a).

[1] Human consumption pathway

b) Harvest, grading and packing activities will reduce the likelihood of Coleoptera being associated with fresh pumpkin at export to a very low level.
    i) These Coleoptera are likely to be removed during packhouse activities, as they are relatively conspicuous:
        - Adults of these species are 6mm or larger and of distinct black, red and/or yellow colour.
        - Larval damage is visually noticeable.
    ii) The IHS specifies 'commercially produced' export quality fruit (which includes grading to remove damaged fruit). Heavily infested and damaged pumpkin will not be export quality and therefore will be removed during grading and packaging (see Commodity Description).

c) Coleoptera are likely to be detected and managed during official pre-export inspection by the exporting NPPO (see Pre-export inspection and phytosanitary certification).
    i) Their distinct yellow and black colour and size will make them visually obvious and they are mobile making them more noticeable.
    ii) Detection of *A. indica* or *A. quadrimaculata* will require remedial action (e.g. end point treatment) prior to export certification.

Hemiptera: Aphididae (aphids)

(78) *Basic Measures* are justified and sufficient to manage the low risk posed by *Aphis fabae* because:

a) Commercial production activities will reduce populations of *A. fabae* in pumpkin production sites to a low level.
    i) Commercial production includes monitoring for plants displaying signs/symptoms of infestation during production. Monitoring will identify obviously affected plants, resulting in pest controls being applied (see Commercial Production).

b) Harvest, grading and packing activities will reduce the likelihood of *A. fabae* being associated with fresh pumpkin at export to a very low level.
    i) Adult *A. fabae* are likely to be removed during packhouse activities, as they are visually obvious.
        - Adults of these species are large (1.3-3.1mm) with distinct colouration (matt black or yellow against the orange or green parts of the commodity).
    ii) Other lifestages of *A. fabae* are unlikely to be associated with pumpkin fruit.
        - Eggs, the overwintering life stage, are laid on barky tissues (not Cucurbitaceae).
        - nymphs are sap-suckers on leaves and stems, and not associated with fruit.
    iii) The IHS specifies 'commercially produced' export quality fruit (which includes grading to remove damaged fruit). Heavily infested and damaged pumpkin will not be export quality and therefore will be removed during grading and packaging (see Commodity Description).

c) *A. fabae* is likely to be detected and managed during official pre-export inspection by the exporting NPPO (see Pre-export inspection and phytosanitary certification).
    i) The aphid's size and coloration will make them visually obvious.
    ii) Detection of *A. fabae* or *A. gossypii* will require remedial action (e.g. end point treatment) prior to export certification.

Hemiptera: Coreidae (coreid bugs)

(79) *Basic Measures* are justified and sufficient to manage the low risk posed by *Leptoglossus gonagra* because:

a) Commercial production activities will reduce populations of Coreidae in pumpkin production sites to a low level.
    i) Commercial production includes monitoring for plants displaying signs/symptoms of infestation during production. Monitoring will identify obviously affected plants, resulting in pest controls being applied (see Commercial Production).
        - Breeding has been found to occur in decaying fruits of Citrus spp (MPI, 2008).
    ii) Signs and symptoms of infestation include colour break, puncture wounds and subsequent fungal infection (MPI, 2008).

b) Harvest, grading and packing activities will reduce the likelihood of Coreidae being associated with fresh pumpkin at export to a very low level.
   i) Adults are likely to be removed during packhouse activities, as they are visually obvious.
      - Adults of this species are large (15mm).
   ii) Other lifestages of Coreidae are unlikely to be associated with pumpkin fruit.
      - Eggs are laid on leaves and stems, but not fruit. Nymphs feed on other plant species, but may be found on leaves, stems, and developing fruit.
   iii) The IHS specifies 'commercially produced' export quality fruit (which includes grading to remove damaged fruit). Heavily infested and damaged pumpkin will not be export quality and therefore will be removed during grading and packaging (see Commodity Description).

c) Coreidae are likely to be detected and managed during official pre-export inspection by the exporting NPPO (see Pre-export inspection and phytosanitary certification).
   i) The Coreid bugs size will make them visually obvious.
   ii) Detection of *L. gonagra* will require remedial action (e.g. end point treatment) prior to export certification.

Hemiptera: Pseudococcidae (mealybugs)

(80) *Basic Measures* are justified and sufficient to manage the risk from Pseudococcidae (*Maconellicoccus hirsutus*, *Dysmicoccus brevipes, Planococcus minor* and *Ferrisia virgata*) associated with fresh pumpkin from Tonga because:

a) Commercial production activities will reduce populations of Pseudococcidae during production.
   i) Pseudococcidae damage plants directly by feeding on phloem and indirectly by producing honeydew, promoting growth of noticeable sooty mould.
   ii) Commercial production includes monitoring for plants displaying signs/symptoms of infestation during production. Monitoring will identify obviously affected plants, resulting in pest controls being applied (see Commercial Production).

b) Harvest, cleaning and packing activities will reduce the likelihood of Pseudococcidae eggs, crawlers and adults being associated with fresh pumpkin at export.
   i) Pseudococcidae lay eggs on leaves and stems, which are not included in the commodity description.
   ii) Mobile crawlers are delicate and likely to be damaged or removed during harvest and packing.
   iii) Adult Pseudococcidae range from (2-5 mm long) and are visually detectable.
   iv) The IHS specifies 'commercially produced' export quality fruit (which includes grading to remove damaged fruit). Heavily infested and damaged fruit will not be export quality and therefore will be removed during grading and packaging (see Commodity Description).

c) Pseudococcidae are likely to be detected during visual inspection.
   i) Pseudococcidae that are not detected and removed during production, harvest, grading and packing are likely to be detected during pre-export NPPO visual inspection (see Pre-export inspection and phytosanitary certification).
   ii) Detection of Pseudococcidae will require remedial action (e.g. end point treatment) prior to export certification.

Hemiptera: Diaspididae (armoured scale insects)

(81) *Basic Measures* are justified and sufficient to manage the low risk posed by Diaspididae (*Aspidiotus destructor* and *Pinnaspis strachani* (and *Pseudaulacaspis pentagona* on fresh pumpkin for human consumption)) because:

a) Commercial production activities will reduce populations of *A. destructor, P. strachani* and *P. pentagona* during production.
   i) Diaspididae damage plants directly by feeding on phloem and indirectly by producing honeydew, which promotes the growth of noticeable sooty mould.
   ii) Commercial production includes monitoring for plants displaying signs/symptoms of infestation during production. Monitoring will identify obviously affected plants, resulting in pest controls being applied (see Commercial Production).

b) Harvest, cleaning and packing activities will reduce the likelihood of *A. destructor, P. strachani* and *P. pentagona* eggs, crawlers and adults being associated with fresh pumpkin at export.
   iii) Diaspididae often lay eggs on leaves and on stems, which are not included in the commodity description.
   iv) Mobile crawlers are delicate and likely to be damaged or removed during harvest and packing.
   v) Adult Diaspididae range from (2-5 mm long) and are visually detectable.
   vi) Diaspididae often secrete sticky honeydew which in heavy infestations promotes the growth of sooty mould which is visually detectable.
   vii) The IHS specifies 'commercially produced' export quality fruit (which includes grading to remove damaged fruit). Heavily infested and damaged fruit will not be export quality and therefore will be removed during grading and packaging (see Commodity Description).

c) *A. destructor, P. strachani* and *P. pentagona* are likely to be detected during visual inspection.
   i) Diaspididae that are not detected and removed during production, harvest, grading and packing are likely to be detected during pre-export NPPO visual inspection (see Pre-export inspection and phytosanitary certification).
   ii) Detection of *P. strachani* or *P. pentagona* will require remedial action (e.g. end point treatment) prior to export certification.

Fungi

(82) *Basic Measures* are justified and sufficient to manage the low risk from *Choanephora cucurbitarum* because:

a) Commercial production activities will reduce inoculum of fungi in pumpkin production sites to a low level.
   i) Commercial production includes monitoring for plants displaying signs/symptoms of infection during production. Monitoring will identify obviously affected plants, resulting in pest controls being applied (see Commercial Production).
   ii) Signs/symptoms of infection include extensive mould/fungal growth on leaves and fruit, floral lesions, rot through the plant and stem canker

b) Harvest, grading and packing activities will reduce the likelihood of fungi being associated with fresh pumpkin at export to a very low level.
   i) Advanced symptoms of fungal damage (fungal growth, damaged fruit tissues) are likely to be obvious during harvest, grading and packing.
   ii) The IHS specifies 'commercially produced' export quality fruit (which includes grading to remove obviously damaged fruits). Heavily infected and damaged pumpkin will not be export quality and therefore will be removed during grading and packaging (see Commodity Description).

c) Fungi are likely to be detected and managed during official pre-export inspection by the exporting NPPO (see Pre-export inspection and phytosanitary certification).
   i) Fungi that are not detected and removed during production, harvest, grading and packing are likely to be detected during pre-export NPPO visual inspection (see Pre-export inspection and phytosanitary certification).
   ii) Detection of *C. cucurbitarum* will require remedial action (e.g. resort) prior to export certification.

Lepidoptera (moths)

(83) *Basic Measures* are justified and sufficient to manage the low risk posed by Lepidoptera (*Diaphania indica* and *Tiracola plagiata*) because:

a) Commercial production activities will reduce populations of Lepidoptera in pumpkin production sites to a low level.
   i) Commercial production includes monitoring for plants displaying signs/symptoms of infestation during production. Monitoring will identify obviously affected plants, resulting in pest controls being applied (see Commercial Production).
   ii) Signs and symptoms include defoliation, warping of leaves and surface damage to fruits from feeding (MPI, 2015a; MPI, 2008).

b) Harvest, grading and packing activities will reduce the likelihood of Lepidoptera being associated with fresh pumpkin at export to a very low level.
   i) Larvae are likely to be removed during packhouse activities, as they are visually obvious.
      - *D. indica* larvae are up to 25mm long and *T. plagiata* larvae are up to 60mm long.
   ii) Other lifestages of Lepidoptera are unlikely to be associated with pumpkin fruit.
      - Eggs are laid on leaves and developing fruit, but not usually mature fruit.
   iii) The IHS specifies 'commercially produced' export quality fruit (which includes grading to remove damaged fruit). Heavily infested and damaged pumpkin will not be export quality and therefore will be removed during grading and packaging (see Commodity Description).

c) These species are likely to be detected and managed during official pre-export inspection by the exporting NPPO (see Pre-export inspection and phytosanitary certification).
   i) The size of the larvae will make them visually obvious.
   ii) Detection of *D. indica or T. plagiata* will require remedial action (e.g. end point treatment) prior to export certification.

Targeted Measures

(84) The following measures are justified based on the evidence of their moderate risk to New Zealand, summarised from the sources identified in paragraph 32 (also see Appendix 1).

(85) The following pests have been identified as requiring a *Targeted Measure,* in addition to *Basic Measures*:

- *Pseudaulacaspis pentagona*

(86) *Targeted Measures* may also be effective against non-target pests that only require *Basic Measures*.

Hemiptera: Diaspididae (armoured scale insects) – decorative purposes only

(87) *Targeted Measures* are justified and sufficient to manage *P. pentagona* because:

a) The likelihood of exposure is higher than for the human consumption pathway because pumpkins may be displayed outdoors (decorative purposes).
   i) *P. pentagona* are relatively immobile, but wind dispersal of crawlers from exposed pumpkins would increase the level of exposure compared to waste disposed into compost.

b) *Targeted Measures* will effectively manage risk from P. pentagona, either by excluding it, reducing populations to a very low level, limiting its potential for establishment in the New Zealand environment, or removing or eliminating it from the pathway. *Targeted Measures* include:

Pest Exclusion

c) Pest freedom status either at the country, area or production site will effectively exclude *P. pentagona* from the pathway. The options for pest freedom are as per the ISPMs.
   i) Country freedom;
      - additional measures or an *Export Plan* are not required where 'country freedom' status is recognised by MPI for the export country.
   ii) Pest free area (PFA);
      - MPI will audit the management of pest free areas for compliance with ISPM 4: *Requirements for the establishment of pest free areas*.
   iii) Pest free place of production (PFPP);
      - MPI will audit the management of pest free place of production for compliance with ISPM 10: Requirements for the establishment of pests free places of production and pest free production sites.

Pest Removal or Elimination

d) An effective chemical treatment targeting the pest prior to or after harvest. Pest removal or elimination include:
   i) Systems Approaches;

- a Systems Approach is composed of two or more independent measures, as negotiated between MPI and the exporting country, and in accordance with ISPM14: *The use of integrated measures in a systems approach for pest risk management*;
- independent measures may vary between exporting countries.

ii) Pest control activities (in-field);

- In-field pest control activities efficacious against the target pest (may target several life cycle stages).

iii) End-point treatment.

- An end point treatment considered efficacious against the target pest – options may include heat, cold, irradiation or chemical (e.g. MPI's Approved Biosecurity Treatments) treatments.

e) Detection of regulated pests will require remedial action, such as fumigation with methyl bromide, to eliminate them prior to export certification.

MPI-Specified Measures

(88) The following measures are justified based on the evidence of their high risk to New Zealand, summarised from the sources identified in paragraph 32 (also see Appendix 1).

(89) The following pests have been identified as requiring a *MPI-Specified Measure,* in addition to *Basic Measures*:

- *Bactrocera facialis*
- *Bactrocera kirki*
- *Bactrocera sp. nr. passiflorae*
- *Bactrocera xanthodes*

(90) *MPI-Specified Measures* may also be effective against non-target pests that only require *Basic Measures* or *Targeted Measures*.

Diptera: Tephritidae (fruit flies)

(91) *MPI-Specified Measures* are justified and sufficient to manage Tephritidae (B. *facialis, B. kirki, B.* sp. nr. *passiflorae* and *B. xanthodes*) because:

a) These Tephritidae pose a high risk to New Zealand, and are unlikely to be sufficiently managed by *Basic Measures* or *Targeted Measures*.

- Many of New Zealand's important commercial crops are recorded as major hosts of these Bactrocera fruit flies, including avocado, tomato, capsicum, and citrus.
- If these Bactrocera fruit flies were to enter on fresh pumpkin, it is possible that an individual fruit could be infested with any number of eggs or larvae, including both males and females.
- These Bactrocera fruit flies are likely to be able to establish at least seasonal populations in restricted distributions during the warmer months.
- If these Bactrocera fruit flies established even a transient population, the economic impacts are likely to be high, due to direct damage to fruit crops and disruption to trade.

b) *MPI-Specified Measures* will effectively manage risk from *B. facialis, B. kirki, B*. sp. nr. *passiflorae* and *B. xanthodes* by excluding, removing or eliminating them from the pathway. *MPI-Specified Measures* options include:

Pest Exclusion

c) The pest host status of fresh pumpkin to *B. facialis, B. kirki, B*. sp. nr. *passiflorae* and *B. xanthodes* will effectively exclude them from the pathway because undamaged mature fruit are a conditional non-host of fruit fly as per (ISPM) 37: Determination of host status of fruit to fruit flies (Tephritidae).

- Only soft skinned varieties of *C. pepo* are reported as hosts of *B. facialis, B. kirki, B*. sp. nr. *passiflorae* and *B. xanthodes.*

- Heimoana (1996) demonstrated that a number of other Cucurbitaceae species (cucumber, bitter gourd, spongy gourd, watermelon) are non-hosts to *B. facialis, B. kirki, B*. sp. nr. *passiflorae* and *B. xanthodes* when they are in an undamaged mature condition.
- Mature pumpkin have hard skin over hard flesh. Extensive fruit sampling conducted in the Pacific (Leblanc et al, 2012; Leblanc et al, 2013) has not resulted in *B. facialis, B. kirki, B*. sp. nr. *passiflorae* and *B. xanthodes* being detected in association with undamaged pumpkin.
- A conditional non-host status requirement excludes any pumpkins which are immature, or damaged (mechanically, by pests, or by pathogens).
- Note, soft skinned varieties of *C. pepo* are not eligible for importation under this IHS (see Commodity Description).

Summary of proposed categories of measures for pumpkin from Tonga

(92) MPI considers the pest risks associated with the importation of fresh pumpkin will be effectively managed by applying a combination of *Basic, Targeted* and *MPI-Specified Measures* (Table 1 and Table 3), which will be negotiated in an *Export Plan*, specifically:

- Commercial production.
- An end point treatment (e.g. fumigation) or, pest free area or pest free place of production or, a systems approach or, in-field pest control activities.
- Processes to achieve conditional non-host status for fruit flies based on undamaged hard skinned fruit.
- Pre-export inspection and certification, overseen by the exporting country NPPO.
- Audit of the *Export Plan* by MPI and the exporting NPPO.

(93) Each step in the export system reduces the likelihood of pests being present on the pathway. MPI will verify and inspect the consignment to ensure the requirements in the IHS have been met. Non-compliant consignments will be treated, re-shipped or destroyed.

(94) The measures MPI has identified as necessary to manage pests associated with pumpkin are described below:

Table 3. Measures required to manage the risk associated with the fresh pumpkin from Tonga import pathway.

Organism type	***Basic Measures***	***Basic* plus *Targeted Measures***	***Basic* plus *MPI-Specified Measures***
Arthropods	*Tetranychus neocaledonicus* *Aulacophora indica* *Aulacophora quadrimaculata* *Aphis fabae* *Leptoglossus gonagra* *Aspidiotus destructor* *Pinnaspis strachani* *Pseudaulacaspis pentagona*[2] *Maconellicoccus hirsutus* *Dysmicoccus brevipes* *Planococcus minor* *Ferrisia virgata* *Diaphania indica* *Tiracola plagiata*	*Pseudaulacaspis pentagona*[3]	*Bactrocera facialis* *Bactrocera kirki* *Bactrocera* sp. nr. *passiflorae* *Bactrocera xanthodes*
Fungi	*Choanephora cucurbitarum*	-	-

[2] Human consumption pathway
[3] Decorative purposes pathway

(95) The measures contained in the IHS are subject to regular review based on pathway compliance, pest interceptions, emerging risk assessment, new information/ intelligence, and results of audit of the *Export Plan.*

(96) MPI will monitor interceptions of all regulated pests (and hitchhikers) and the appropriateness/ effectiveness of phytosanitary measures during trade.

3.2 Consolidation of existing import health standards

(97) Pumpkin, squash and butternut are combined into one commodity standard:
- a) because each hard-skinned cucurbit variety has a similar pest profile.
  - i) Pests that are associated with pumpkin are often also associated with squash and butternut (MPI, 2016d; MAF, 2006a).
- b) to harmonise phytosanitary measures across pathways and base measures on international standards, guidelines or recommendations, where they exist.
  - i) WTO SPS Agreement.
- c) to provide a mechanism to effectively amend IHSs consistently.

(98) Existing standards that were included in the consolidation have been reviewed. The review includes:
- a) assessment of potential pests identified through the emerging risks system
- b) assessment of live interceptions on pumpkin, squash and butternut at the New Zealand border
- c) inclusion or removal of pests identified through the assessment for pumpkin from Tonga
- d) alignment of existing pest measures and nomenclature between countries
- e) an update on presence/absence in New Zealand and regulatory status for the existing pest lists
- f) administrative and clarity changes

(99) Updates and inconsistencies in pest lists are addressed because:
- a) Pests are now grouped by the measures applied to them
  - i) Previously pests have been grouped by their risk i.e low, medium, high risk or Risk Group (RG) 1, RG2, RG3.
  - ii) Pests are now grouped into those requiring *Basic Measures, Targeted Measures or MPI-Specified Measures*.
- b) regulatory status has changed
  - i) refer BORIC
- c) pest nomenclature has changed
- d) grammatical mistakes or spelling errors

(100) In order to minimise trade impacts, MPI will prioritise negotiation of *Export Plans* on pathways which have outstanding biosecurity risk including additional pests requiring *Targeted* or *MPI-Specified Measures*.

Australia – pumpkin

Additions to the pest list

(101) Cucumber Green Mottle Mosaic Virus (CGMMV) is added to the pest list for pumpkin from Australia because:
- a) it poses a new risk on the pathway.
  - i) Cucurbitaceae, including pumpkin, squash, and butternut (*Cucurbita pepo*, *C. maxima* and *C. moschata*) are known hosts of CGMMV (MPI, 2016b).

(102) *Targeted Measures* (in addition to *Basic Measures*) are justified to manage CGMMV for the following reasons:
- a) CGMMV is present in Australia (MPI, 2016b).
- b) CGMMV is not present in New Zealand (NZOR, 2017; NZFungi, 2017).

c) CGMMV has the potential to establish and spread in New Zealand because:
   i) CGMMV can remain viable in seed for long periods of time (MPI, 2016c).
   ii) The end use of fresh pumpkin, butternut and squash results in a high degree of waste, including a large number of viable seed which are not typically consumed or denatured before being discarded.
   iii) CGMMV can be transmitted via seed, pollen, and mechanically (MPI, 2016b, c). It is also persistent in soil.
   iv) Seed can germinate and grow into infected plants if they were disposed of into a suitable environment such as compost (MPI, 2016b, c).
   v) Infected plants grown from seed can transmit the virus, either through further seed production or mechanically (MPI, 2016b, c).
   vi) A variety of weed species from different families are hosts for CGMMV, which increases the chances of exposure to suitable hosts and ability to spread (MPI, 2016c). Many species identified as hosts were also asymptomatic (MPI, 2016c).
   vii) Some plants commonly grown in private gardens are hosts to CGMMV including squash, zuchinni and pumpkin and would therefore be exposed to discarded fruit and seed (MPI, 2016c).
   viii) The likelihood of exposure and establishment was assessed as high for the importation of cucurbitaceae seed (MPI, 2016c), and low for the importation of watermelon (with low levels of seed viability) (MPI, 2016b).

d) CGMMV is likely to have unacceptable economic consequences should it establish in New Zealand because:
   i) A number of commercial crops in New Zealand are affected by CGMMV including watermelon, *Cucurbita* spp., apricot. The sale value of cucurbitaceae grown in New Zealand is approximately $51 million and the establishment of CGMMV in New Zealand would likely have an impact of millions of dollars in the first year (MPI, 2016c).
   ii) Serious economic losses from CGMMV have been observed in several countries (MPI, 2016c).
   iii) Fruit quality can be adversely affected through visible symptoms on the fruit surface, and also interior deformation of the fruit (MPI 2016b).
   iv) CGMMV causes leaf mottling, mosaics, chlorosis, wilting and, in extreme cases, plant death (MPI 2016c).
   v) CGMMV prevents fruit growth entirely on apricot trees when combined with Strawberry Latent Ringspot Virus (present in New Zealand) (MPI 2016c).
   vi) CGMMV is difficult to eradicate and commonly reoccurs in countries where eradication has been considered successful (MPI, 2016c).
   vii) The potential economic consequence of CGMMV establishing in New Zealand is considered moderate.

e) *Targeted Measures* will effectively manage risk from CGMMV, either by excluding it, reducing populations to a negligible level, limiting its potential for establishment in the New Zealand environment, or removing or eliminating it from the pathway.

f) The following measures will manage CGMMV:
   i) Country freedom;
      - additional measures or an *Export Plan* are not required where 'country freedom' status is recognised by MPI for the export country.
   ii) Pest free area;
      - MPI will audit the management of pest free areas for compliance with ISPM 4: *Requirements for the establishment of pest free areas*.
   iii) Pest free place of production;
      - MPI will audit the management of pest free place of production for compliance with ISPM 10: *Requirements for the establishment of pests free places of production and pest free production sites*.

Deletions from pest list

(103) Three species are removed from the pest list for fresh pumpkin and from Australia because:
   a) they are not a risk on the pathway.

i) *Bemisia tabaci* was assessed as not associated with pumpkin fruits (assessed for Tonga, refer to Appendix 1).

ii) *Epilachna vigintioctopunctata* was detected in New Zealand in January 2010, and is now considered to be non-regulated under the Biosecurity Act 1993. This means that if it is intercepted in a consignment, it is an incidental organism under section 28(1A) of the Biosecurity Act 1993 (BRAD, 2017). It will therefore be removed from the pest list for fresh pumpkin from Australia.
Note: *Epilachna vigintioctopunctata* is still considered to be a new organism for the purposes of the Hazardous Substances and New Organisms Act 1996, meaning that this species cannot intentionally be imported into New Zealand.

iii) *Fusarium oxysporum* f. sp. *melonis* is present in New Zealand.

Nomenclature changes

(104) Three pests have names updated on the pest list because:

a) their names are no longer correct or preferred.

i) *Leptoglossus gonagra* is considered to be the preferred name of *Fabrictilis australis* (BORIC, 2017).

ii) *Henosepilachna vigintioctomaculata* is considered to be the preferred name for *Epilachna vigintioctomaculata* (BORIC, 2017).

iii) *Tetranychus kanzawai* had been misspelled.

New Caledonia – pumpkin and squash

(105) Unless otherwise stated, the following changes to the pest lists for New Caledonia are a result of the Tonga pumpkin IHS development process.

Additions to pest list

(106) *Dysmicoccus brevipes, Helicoverpa assulta* and *Planococcus minor* are added to the pest list for New Caledonia because:

a) they are a risk on the pathway.

b) they are now present in New Caledonia.

i) All three species have been intercepted at the New Zealand border on fresh produce from New Caledonia (Quancargo, 2017) and are assumed to now be present in New Caledonia. These species will be added to the pest list for New Caledonia and will require *Basic Measures.*

(107) *Pseudaulacaspis pentagona* and *Tetranychus neocaledonicus* are known to be present in New Caledonia (PIPLD, 2017). They will be added to the pest list for New Caledonia and will require *Basic Measures.*

Deletions from pest list

(108) Two species are removed from the pest list for fresh pumpkin and squash from New Caledonia because:

a) they are not a risk on the pathway.

i) *Epilachna vigintioctopunctata* was detected in New Zealand in January 2010, and is now considered to be non-regulated. This means that if it is intercepted in a consignment, it is an incidental organism under section 28(1A) of the Biosecurity Act 1993 (BRAD, 2017). It will therefore be removed from the pest list for fresh pumpkin from Australia.
Note: *Epilachna vigintioctopunctata* is still considered to be a new organism for the purposes of the Hazardous Substances and New Organisms Act 1996, meaning that this species cannot intentionally be imported into New Zealand.

ii) *Liriomyza sativae* is not associated with fruit of cucurbit species.

- Adults of *Liriomyza* species cause crop damage by puncturing the leaf surface to feed on leaf tissues and lay eggs (MPI, 2016a; EFSA, 2012).

- Eggs are laid inside leaves, and once hatched, larvae tunnel within the leaf feeding (on occasion they have been reported from leaf stalks or the plant stem), before leaving the leaf and pupating in soil (MPI, 2016a; EFSA, 2012).
- *Liriomyza sativae* adults are over 1mm long, and have a shiny black and yellow appearance (CPC, 2017), which would make any individuals present on a fruit, and not disturbed by harvest, visually distinct.

Nomenclature changes

(109) *Leptoglossus gonagra* has had its name updated from *L. australis* on the pest list because:

a) its name is no longer correct or preferred

i) *Leptoglossus gonagra* is considered to be the preferred name for *L. australis* (BORIC, 2017).

Tonga – squash and butternut

(110) Unless otherwise stated, the following changes to the pest lists for squash and butternut are a result of the Tonga pumpkin IHS development process.

(111) The Tonga pumpkin IHS development process found the pest lists for fresh pumpkin, squash and butternut for human consumption aligned well, resulting in the same pest list for all three commodities

Additions to pest list for squash and butternut

(112) *Aulacophora quadrimaculata, Bactrocera facialis, B. kirki, B.* sp. nr. *Passiflorae, B. xanthodes* and *Choanephora cucurbitarum* are added to the pest list for squash and butternut because:

a) they are associated with the squash and butternut hosts and pose a risk on these pathways.

i) *Aulacophora quadrimaculata* was assessed as requiring *Basic Measures* (refer paragraph 77). *A. quadrimaculata* is also associated with squash (*Cucurbita* sp.) (PIPLD, 2017), and is assumed to also be associated with butternut.

ii) *Bactrocera facialis, B. kirki, B.* sp. nr. *passiflorae* and *B. xanthodes* were assessed as requiring *MPI-Specified Measures* for pumpkin (refer paragraph 91), and it is assumed that squash and butternut are also hosts (Appendix 1).

Note: These fruit fly species will be managed under the existing *MPI-Specified Measure* (Conditional non-host status based on maturity).

iii) *Choanephora cucurbitarum* was assessed as requiring *Basic Measures* (refer paragraph 82). Squash and butternut (*C. maxima* and *C. moschata*) are also hosts of *C. cucurbitarum* (MAF, 2011).

Deletions from pest list

(113) Seven species are removed from the pest list for fresh squash and butternut from Tonga because:

(114) They are not associated with squash or butternut fruit, not present in Tonga or, do not vector regulated diseases or concern:

a) *Bemisia tabaci* and *Liriomyza trifolii* were assessed as not associated with pumpkin fruit (refer Appendix 1), and therefore assumed to not be associated with squash and butternut.

b) *Aphis craccivora, Aphis gossypii, Myzus persicae* and *Planococcus citri* were assessed as present in New Zealand and not vectors of any diseases of concern that are present in Tonga (refer Appendix 1).

c) *Achatina fulica* was assessed as not present in Tonga (refer Appendix 1).

Vanuatu – squash

(115) Unless otherwise stated, the following changes to the pest list for Vanuatu are a result of the Tonga pumpkin IHS development process.

Additions to pest list

(116) *Pseudaulacaspis pentagona* and *Tetranychus neocaledonicus* are include on the pest list for squash from Vanuatu because:

a) they are a risk on the pathway.

i) *Pseudaulacaspis pentagona* and *Tetranychus neocaledonicus* are now known to be present in Vanuatu (PIPLD, 2017) and will require *Basic Measures.*

ii) Refer Appendix 1.

Deletions from pest list

(117) Liriomyza trifolii and L. sativae are removed from the pest list for fresh squash from Vanuatu because:

a) they are not associated with squash.

i) Refer Appendix 1 for host association assessment.

ii) *Liriomyza sativae* was assessed as not associated with squash fruit (refer paragraph 108).

Nomenclature changes

(118) One pest has had their name changed on the pest list because:

a) they are no longer the preferred name.

i) *Leptoglossus gonagra* is considered to be the preferred name for *Fabrictilis australis* (BORIC, 2017)

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Appendix 1: Pest Categorisation

The pest categorisation process (table below) identifies all known major pests and diseases found to be associated with fresh pumpkin in Tonga, determines their presence (or absence) in New Zealand, and considers if they might be associated with fresh pumpkin at export. A summary of key conclusions from the risk analysis process is included where a pest has been identified as a potential quarantine pest. Pests associated with pumpkin, but not present in Tonga, are not included in the table.

The table below follows the risk analysis process and terminology identified in part 2 of the international standard, ISPM 11: *Pest risk analysis for quarantine pests*. The table includes:

- The identity of the pest. The table is organised by order, then family.
- Conclusions from the risk analysis, including the associated justification and evidence, for:
  - Step 1: Pest categorisation.
  - Step 2: Assessment of the probability of introduction and spread.
  - Step 3: Assessment of potential economic consequences.

  Note: if at any step there is insufficient information available to determine that the organism fulfils the criteria of a quarantine pest, then the organism is discounted from the pest list and the pest risk analysis process does not continue.
- Conclusion of the pest risk assessment ('Is a measure justified?').
  Note: the level of measure required, based on the outcome of the pest risk management assessment in Part 3 of this RMP, is included in the table.

It is assumed that if a species associated with fresh pumpkin (*C. pepo*) is of concern, then the reasons for this concern would be recorded internationally (with interception data (where available), any risk analysis, scientific studies, reports of significant economic impacts). Measures must be supported by technical justification, and measures cannot be applied because there is uncertainty or a lack of available information. MPI may review the pests associated with a pathway (or their management) if new information becomes available, including in the following circumstances:

a) a change in host status;
b) pest status prevalence;
c) frequent interception on arrival in New Zealand; or
d) a new or changed risk on imported fresh pumpkin is identified by MPI's Emerging Risks System.

Some organisms may not be included on the fresh pumpkin pest list, and therefore a measure (e.g. *Basic*, *Targeted*, or *MPI-Specified Measures*) has not been assigned to the pest. However, if regulated organisms are intercepted on the pathway an on-arrival remedial action is required (e.g. fumigation) prior to clearance for entry into New Zealand. If no suitable or approved treatment is available, the consignment will be reshipped or destroyed. Any pests intercepted on the pathway may be retrospectively added to the pest list and will be considered as part of the next review of the IHS.

ISPM 11 requires that "The identity of the pest should be clearly defined to ensure that the [risk] assessment is performed on a distinct organism, and that biological and other information used in the assessment is relevant to the organism in question." It is recognised that a pest may still be clearly defined at genus level, as not all species are described. In this case, genera that are present in Tonga but not in New Zealand would be considered as regulated as they still pose a potential hazard to New Zealand.

Note: ISPM 5 defines 'quarantine pest' as "*a pest of potential economic importance to [New Zealand] and not yet present there, or present but not widely distributed and under official control.*

Scientific name		Conclusion	Reason	Evidence to support	Is a measure justified?
Acari	*Tetranychus neocaledonicus* André [Tetranychidae]	Has the potential to be a quarantine pest on this pathway.	*Tetranychus neocaledonicus* is associated with the pathway.	- *T. neocaledonicus* is present in Tonga (Migeon and Dorkeld 2006-2017). - Is not recorded in New Zealand (MAF, 2008; not recorded in PPIN 2017). - Pumpkin (*Cucurbita pepo*) is a host of *T. neocaledonicus* (Migeon and Dorkeld 2017; MAF 2008).	**Is considered a quarantine pest on this pathway.** **Measures are justified (*Basic Measures*).**
		And has the potential to establish and spread if it entered NZ.	*T. neocaledonicus* has the potential to enter New Zealand and be exposed to suitable hosts.	<u>Entry:</u> - The small size (~0.5mm) (MAF, 2008) of *T. neocaledonicus* means that the pre-export grading and packing process and phytosanitary inspection could miss low level infestation, especially on ridged pumpkin varieties. - *T. neocaledonicus* is a distinct carmine red colour (MAF, 2008), which would be visually obvious on inspection. - *Tetranychus* sp. mites have been intercepted on fresh pumpkin from Australia and butternut from Tonga arriving in New Zealand (QuanCargo, 2017). <u>Exposure:</u> - -Decorative pumpkins may be displayed outdoors, providing a substrate for mite development and exposure to a suitable environment/hosts. - Waste may be disposed of to compost or home gardens. - *T. neocaledonicus* is relatively mobile and can disperse via air currents and crawling (MAF, 2008). <u>Establishment and spread:</u> - *T. neocaledonicus* is highly polyphagous, with economically important hosts including clover, eucalypts, cucurbits, citrus, peach, beans and potato (MAF, 2008). Ornamental hosts include rose, chrysanthemum and hibiscus (MAF, 2008). Suitable host species are common in home gardens and commercial production throughout New Zealand. - Reproduction is both parthenogenic and sexual (MAF, 2008). Fertilised females overwinter on secondary hosts, move to cultivated hosts (usually cucurbits) and breed rapidly (MAF, 2008). - The optimal temperature for development for *T. neocaledonicus* is 30°C and established populations would be restricted to distinct areas (MAF, 2008). Females can enter diapause in adverse conditions until exposed to more suitable conditions (MAF, 2008). As the conditions are not optimal in New Zealand, it is unlikely that there would be rapid population increases and establishment would be limited to warmer regions (MAF, 2008).	
		And has the potential to cause negative economic consequences which are sufficient to justify phytosanitary measures on this pathway.	*T. neocaledonicus* is capable of causing medium level economic impacts and possibly environmental impacts if it established in New Zealand.	- Establishment of *T. neocaledonicus* would increase pest control costs and decrease productivity of economically important agricultural species (clover) as well as impacting production crops (cucurbits, citrus, peach, beans and potato) and forestry (eucalypts) (MAF, 2008). - The economic impact of *T. neocaledonicus* establishing is considered to be low to moderate (MAF, 2008; D. Anthony, personal communication, 2017). Infestations would affect agricultural, forestry, horticultural and nursery sectors (MAF, 2008). - Clover is a major pasture species for wider agricultural production in New Zealand, and even small productivity decreases could have significant economic impact.	

				- Iconic native species (*Leptospermum*, *Metrosideros* and *Lophomyrtus*) are potential hosts, however conditions are unlikely to be favourable for rapid population growth, and impact is uncertain (MAF, 2008).	
Coleoptera	*Aulacophora indica* (Gmelin) [Chrysomelidae] (Syn: *Aulacophora similis*) *Aulacophora quadrimaculata* Fabricius, 1781 [Chrysomelidae]	Have the potential to be quarantine pests on this pathway.	*Aulacophora indica* and *A. quadrimaculata* are associated with the pathway.	- *A. indica* and *A. quadrimaculata,* are present in Tonga (MAFFF, 2012). - Are not recorded from New Zealand (Gordon, 2010; NZOR, 2017; PPIN, 2017). - Are associated with *Cucurbita pepo* (varieties unclear) (Kimoto et al, 1984; MPI, 2015a).	**Are considered quarantine pests on this pathway.** **Measures are justified (*Basic Measures*).**
		And have the potential to establish and spread if they entered NZ.	*A. indica* and *A. quadrimaculata* have the potential to enter New Zealand and be exposed to suitable hosts.	<u>Entry:</u> - Larval damage should, but may not always be detected by visual inspection (MPI, 2015a). - *A. indica* larvae are up to 10mm long and 0.8mm wide (CPC, 2017). - Primarily root feeders, *A. indica* and *A. quadrimaculata* could be carried across international borders as they sometimes tunnel under the skin (MPI, 2015a). - Adults should be visually detectable due to their large size and conspicuous colouring. - Adults of *A. indica* (red wing cases) and *A. quadrimaculata* (yellow wing cases with large black marks) are 6-8mm long (MAF, 2008). - Adults are likely to be disturbed by harvest (DOA, 2013). - Eggs are laid on dead leaves and in soil (MAF, 2008), and not associated with pumpkin fruit. <u>Exposure:</u> - Decorative pumpkins may be displayed outdoors, providing opportunity for development and exposure to the environment. - *A. indica* and *A. quadrimaculata* are likely to be strong fliers (MPI, 2015a). Other reported hosts of *A. indica* include melons, cucumber, Brassicaceae, maize, spinach, sweet potato, and broad beans (CPC, 2017). <u>Establishment and spread:</u> - *A. indica* has a wide distribution in tropical (Pacific and S.E. Asia) and colder (most of China, Afghanistan, Mongolia, Pakistan, Nepal, Japan, Siberia) climates (MPI, 2015a). - The climatic preferences of *A. quadrimaculata* are unclear, however it is present in Australia (DOA, 2013). - The likelihood of establishment has been assessed as low to moderate in areas of New Zealand where *C. pepo* is grown (MPI, 2015a).	
		And have the potential to cause negative economic consequences which are sufficient to justify phytosanitary measures on this pathway.	*A. indica* and *A. quadrimaculata* are capable of causing low level economic impacts if they established in New Zealand.	- The economic consequences of establishment of *A. indica* and *A. quadrimaculata* have previously been assessed as low (MPI, 2015a).	
	Platysimus insularis (Boheman, 1843) [Curculionidae]	Have the potential to be quarantine pests on this pathway.	*Platysimus insularis* and *Sphaerorhinus* spp. are associated with the pathway.	- *P. insularis* and *Sphaerorhinus spp.* are present in Tonga (PIPLD, 2017). - Are not recorded from New Zealand (not recorded in NZOR; Gordon, 2010 or PPIN). - Are associated with pumpkin (PIPLD, 2017), though it is unclear if there is an association with pumpkin fruit, or other plant parts.	**Do not fulfil the criteria of quarantine**

Coleoptera	*Sphaerorhinus* sp. Guérin-Méneville, 1841 [Curculionidae]	**However** they do not have the potential to establish and spread if they entered NZ.	*P. insularis* and *Sphaerorhinus* sp. do not have the potential to enter New Zealand, be exposed to suitable hosts, and establish and spread within New Zealand.	Entry: - There is not much literature available on these species. It is unclear which lifestages might be associated with pumpkin fruit. - *P. insularis* is a leaf feeder, defoliating plants (Zimmerman, 1964). - *Sphaerorhinus* sp. weevils are recorded as leaf feeders (note: this assessment was of a leaf commodity) (DOA, 2013). - no reports were identified of either of these genera feeding on fruit. - MPI interception data (pumpkin from Australia and New Caledonia, squash and butternut from Tonga) does not include any weevil interceptions (Quancargo, 2017). - *P. insularis* has spread within the Pacific Islands as a hitchhiker species (e.g. crawling into cargo) (Zimmerman, 1964). Exposure: - *Platysimus insularis* (Zimmerman, 1964) and *Spaeherorhinus* sp. (MPI, 2015a) are flightless, and therefore limited in movement. Adult weevils are capable of walking short distances to locate host plants (MPI, 2015a). - There is uncertainty regarding the host range of these weevils. - Known hosts of *P. insularis* include *Ipomoea*, *Lepidium* and *Scaevola* (Zimmerman 1964). - Known hosts of *Sphaerorhinus* sp. include pumpkin, watermelon and squash (PIPLD, 2017). Establishment and spread: - The climatic preferences of *P. insularis* and *Spaerorhinus* sp. are unknown, however it is assumed that they are unlikely to be able to establish in New Zealand conditions as they are only reported from tropical countries. - *P. insularis* is reported from Tonga Fiji and Cook Islands (PIPLD, 2017). Zimmerman (1964) also records presence as far northwest as the Marshall Islands and southwest as the Austral Islands. - PIPLD (2017) only reports *Sphaerorhinus* sp. as present in Tonga.	**pests on this pathway.**
Diptera	*Atherigona orientalis* Schiner [Muscidae]	Does not fulfil the criteria of a quarantine pest on this pathway.	*Atherigona orientalis* is not associated with the pathway.	- *Atherigona orientalis* is present in Tonga (CPC, 2017). - Is not recorded from New Zealand (not recorded in NZOR or Gordon, 2010; recorded as not in New Zealand in PPIN). - Although recorded as a saprophagous pest on marrow (MPI, 2015a; CPC, 2017), no evidence has been found of association with pumpkin. - *A. orientalis* is primarily saprophytic, mostly feeding on damaged or rotten plant tissues (MPI, 2008; CPC, 2017). - MAF (2008) considered that there was a low likelihood of association with commercial fruit [citrus] pathways. - As it is not associated with fruit at harvest, it does not have the potential to enter New Zealand on the pathway.	**Does not fulfil the criteria of a quarantine pest on this pathway.**
	Liriomyza trifolii (Burgess) [Agromyzidae]	Has the potential to be a quarantine pest on this pathway.	*Liriomyza trifolii* is associated with the pathway.	- *L. trifolii* is present in Tonga (MAFFF, 2012). - Is not recorded from New Zealand (not recorded in NZOR or Gordon, 2010; recorded as not in New Zealand in PPIN). - Pumpkin is a recorded host (MAFFF, 2012).	**Does not fulfil the criteria of a quarantine**

Diptera		**However** it does not have the potential to enter NZ.	*L. trifolii* does not have the potential to enter New Zealand.	Entry - While pumpkin is a recorded host of L. *trifolii* (MAFFF, 2012), this pest is associated with leaves (and possibly stems), rather than fruits of host plants. - Adults of *Liriomyza* species cause damage by puncturing the leaf surface to feed on leaf tissues and lay eggs (MPI, 2016a; EFSA, 2012). - Eggs are laid inside leaves, and once hatched, larvae tunnel within the leaf feeding (on occasion they have been reported from leaf stalks or the plant stem) before leaving the leaf and pupating in soil (MPI, 2016a, EFSA, 2012). - As it is not associated with fruit at harvest, it does not have the potential to enter New Zealand on the pathway.	**pest on this pathway.**
	Bactrocera facialis (Coquillett) [Tephritidae] *Bactrocera kirki* (Froggatt) [Tephritidae] *Bactrocera* sp. nr. *passiflorae* [Tephritidae] *Bactrocera xanthodes* (Broun) [Tephritidae]	Have the potential to be quarantine pests on this pathway.	*Bactrocera facialis, B. kirki, B.* sp. nr. *passiflorae and B. xanthodes* are associated with the pathway	- *B. facialis* (absent from Niuas), *B. kirki, B.* sp. nr. *passiflorae* (Niuas only) and *B. xanthodes* are present in Tonga (Pacifly, 2007). - *B. facialis, B. kirki, B.* sp. nr. *passiflorae* and *B. xanthodes* are not recorded in New Zealand (not recorded in NZOR or Gordon, 2010; recorded as not in New Zealand in PPIN). - Pumpkin (*C. pepo*) is assumed to be a conditional host of *B. facialis, B. kirki, B. passiflorae* and *B. xanthodes.* - While there is no evidence of these fruit flies feeding on undamaged mature pumpkin, it is assumed that damaged or soft lifestages of *C. pepo* are able to host these fruit flies. - Zucchini, a soft skinned variety of *C. pepo*, is a demonstrated host of these fruit flies in laboratory based host status tests (Heimoana et al, 1996). - Pumpkin is a known host of *B. cucurbitae*, *B. decipiens* and *B. tryoni* (note, none of these species are present in Tonga) (Leblanc et al, 2013; Leblanc et al, 2012; Leblanc and Putoa, 2000; Dhillon et al, 2005; Jessup and McCarthy, 1993). - Non-host status testing for pumpkin has not been carried out as part of research into fruit fly hosts (e.g. Heimoana et al, 1996).	**Are considered quarantine pests on this pathway.** **Measures are justified (*MPI-Specified Measures*).**
		And have the potential to establish and spread if they entered NZ.	*B. facialis, B. kirki, B.* sp. nr. *passiflorae and B. xanthodes* have the potential to enter New Zealand and be exposed to suitable hosts.	Entry: - Eggs and larvae of *Bactrocera* spp. fruit flies are internal to fruit (MPI, 2015a), and may go undetected during harvesting, handling, cleaning and packaging (MPI, 2012; MPI, 2016a). Exposure: - Whole (carved) pumpkins for decorative purposes are likely to be displayed outdoors. Some waste (seeds, flesh) will be disposed of, sometimes to compost. - Skin (with a small amount of flesh) and seeds from pumpkins for consumption may be disposed of, sometimes to compost. - Hatching larvae feed on the fruit flesh for 10-35 days, progressing through 3 instars before pupating in soil (MPI, 2012). Decorative pumpkins displayed outdoors and compost would provide suitable opportunities for larval development and pupation. - After hatching, adults fly to suitable hosts. Suitable hosts for these fruit flies vary between species, but include avocado, capsicum, citrus, eggplant, mango, papaya, passionfruit, and tomato (Pacifly, 2007). Many of these species are grown in home gardens and/or commercially in New Zealand.	

Diptera				Establishment and spread: - It is not known how many eggs are laid into each fruit, however as females do not discriminate against fruit that already has eggs present it is assumed that any number of larvae of both sexes could be present in a single fruit entering New Zealand. - Limited evidence is available on the climatic preferences of these fruit flies, however it is generally assumed that tropical fruit flies could be capable of establishing permanent populations in Northern New Zealand (Northland, Auckland, Coromandel) and seasonal populations in other North Island and warmer South Island regions (MAF, 2008). - MPI (2012) assessed a very low likelihood of permanent establishment of *B. kirki* or *B. passiflorae,* with a low likelihood that seasonal populations could establish. - A range of hosts (varies between fruit fly species) are found in home gardens and grown commercially.	
		And have the potential to cause negative economic consequences which are sufficient to justify phytosanitary measures on this pathway.	*B. facialis, B. kirki, B.* sp. nr. *passiflorae and B. xanthodes* are capable of causing a high level economic and environmental impacts if they established in New Zealand.	- The host range for these fruit flies (varies between fruit fly species) includes important commercial crops such as avocado, tomato, capsicum, citrus, pumpkin, and passionfruit (Pacifly, 2007). - The annual combined domestic and export sales value of these crops is approximately $430 million (FreshFacts, 2016). - Establishment of even a seasonal population of one of these fruit flies has a potentially adverse impact on access to overseas markets. - Eradication of Queensland fruit fly (*Bactrocera tryoni*) populations from Auckland in 2015 cost over $13 million (MPI, 2015b).	
Hemiptera	*Bemisia tabaci* Gennadius, 1889 [Aleyrodidae]	Does not fulfil the criteria of a quarantine pest on this pathway.	*Bemisia tabaci* is not associated with the pathway.	- Some strains of *B. tabaci* are present in Tonga (MAFFF, 2012). - Some strains are present in New Zealand and is a potential vector (NZOR, 2017). - Is associated with pumpkin plants (MAFFF, 2012). However, eggs, larvae and adults are associated with leaves, not fruit (CPC, 2017). As it is not associated with fruit at harvest, it does not have the potential to enter New Zealand on the pathway. - No diseases of concern in Tonga are known to be vectored by *B. tabaci.*	**Does not fulfil the criteria of a quarantine pest on this pathway.**
	Aphis fabae Scopoli [Aphididae]	Has the potential to be a quarantine pest on this pathway.	*A. fabae is* associated with the pathway.	- *A. fabae* is present in Tonga (MAFFF, 2012). - *A. fabae* is not reported from New Zealand and is a potential vector (NZOR, 2017). - Is associated with pumpkin plants (MAFFF, 2012). However, eggs, larvae and adults are typically associated with leaves, and so would pest incidence on fruit would be low (CPC, 2017).	**Is considered a quarantine pest on this pathway.** **Measures are justified**

Hemiptera		**And** have the potential to establish and spread if they entered NZ.	*A. fabae* has the potential to enter New Zealand and be exposed to suitable hosts.	Entry: - Adults are visually noticeable and can be found during packhouse cleaning and grading procedures. *C. pepo* has a relatively simple structure and earlier life stages would not be difficult to find on fruit (Capinera, 2015; MAF, 2011). - *A. fabae* is visible with distinct colour that would be noticeable during inspection. Eggs are laid on barky tissues (eg. trees) as an overwintering lifestage; nymphs are sap suckers on leaves and stems, adults may be found on fruit in low numbers (MAF, 2011). - *A. fabae* is capable of surviving transit conditions to New Zealand (intercepted on fresh produce) (QuanCargo, 2017). Exposure: - Adults are highly mobile with dispersal mostly occurring from wind and winged lifestages (Capinera, 2015; MAF, 2011). - *A. fabae* is highly polyphagous with many suitable hosts in New Zealand, including plants that are common in NZ home gardens (Capinera, 2015; MAF, 2011). Therefore adults may come in contact with a suitable host. Establishment and spread: - *A. fabae* is likely to survive in the New Zealand climate (MAF, 2011) - *A. fabae* can reproduce asexually (give birth to nymphs) and sexually (lay eggs) (Capinera, 2015; Chinery, 1993). - *A. fabae* has a high potential to establish and spread through New Zealand (MAF, 2011).	**(*Basic Measures*).**
		And have the potential to cause negative economic consequences which are sufficient to justify phytosanitary measures on this pathway.	*A. fabae* is capable of causing moderate level economic and environmental impacts if they established in New Zealand.	- Economic impact of *A. fabae* should it establish is considered low to moderate A known pest of vegetable crops, particularly beans and beets (MAF, 2011). Feeding weakens plants and can cause plant death (MAF, 2011). *A. fabae* can be difficult to control once established (MAF, 2011). - *A. fabae* is a vector of Papaya ringspot virus-cucurbit affecting strain (PRSV-W) which is not known to be present in New Zealand (NZOR, 2017). Papaya ringspot virus-cucurbit affecting strain (PRSV-W) can be vectored by these aphids PRSV-W is associated with pumpkin and other cucurbits. PRSV-W is present in Tonga and not reported from NZ. This virus is transmitted in a non-persistent manner by these aphids and would not present a risk on this pathway (Van Emden and Harrington 2007). - All other viruses known to be vectored by these aphids and associated with cucurbits are either not present in Tonga or already present in New Zealand (Davis and Ruabete, 2010).	
	Aphis craccivora Koch, 1854 [Aphididae] *Aphis gossypii* Glover, 1877 [Aphididae]	Do not fulfil the criteria of quarantine pests on this pathway.	*A. craccivora* is not associated with the pathway	- *A. craccivora, A. gossypii* and *M. persicae* are present in Tonga (MAFFF, 2012). - Are present in New Zealand (Gordon, 2010; PPIN), but are potential vectors of a plant virus not known to be present in New Zealand (NZOR, 2017). Papaya ringspot virus-cucurbit affecting strain (PRSV-W) can be vectored by these aphids PRSV-W is associated with pumpkin and other cucurbits. PRSV-W is present in Tonga and not reported from NZ.	**Do not fulfil the criteria of quarantine pests on this pathway**

	Myzus persicae Sulzer, 1776 [Aphididae]			This virus is transmitted in a non-persistent manner by these aphids and would not present a risk on this pathway (Van Emden and Harrington 2007). - All other viruses known to be vectored by these aphids and associated with cucurbits are either not present in Tonga or already present in New Zealand (Davis and Ruabete, 2010).	
Hemiptera	*Leptoglossus gonagra* Fabricius 1775 [Coreidae] (Syn: *Fabrictilis australis* / *Fabrictilis gonagra*)	Has the potential to be a quarantine pest on this pathway.	*L. gonagra* is associated with the pathway	- *L. gonagra* is present in Tonga (MAFFF, 2012). - Is not recorded in New Zealand (not recorded in NZOR or Gordon (2010), or PPIN). - Is associated with pumpkin (MAFFF, 2012).	**Is considered a quarantine pest on this pathway.** **Measures are justified (*Basic Measures*).**
		And has the potential to establish and spread if it entered NZ.	*L. gonagra* has the potential to enter New Zealand and be exposed to suitable hosts.	<u>Entry:</u> - Adults may be associated with pumpkin fruit (Baldin et al, 2002). - Eggs are laid on leaves and stems, but not fruit (Baldin et al, 2002). Nymphs may feed on leaves, stems and developing fruit, however antibiotic components from cucurbits are harmful to the biological development of *L. gonagra* (100% nymph mortality was observed in no choice tests) (Baldin et al, 2002). - Adults are large (15mm) (MAF, 2008) and would be visually obvious during production and inspection. - MAF (2008) assessed the likelihood of entry on citrus fruit from Samoa as very low. As *L. gonagra* primarily uses cucurbit leaves to lay eggs, it is assumed that *L. gonagra* will be present in cucurbit growing areas, however the hard skin of undamaged pumpkin fruits means that feeding is unlikely. <u>Exposure:</u> - Wide host range including cucurbits, citrus, beans, kumara, tomatoes, potatoes and passionfruit (MAF, 2008). - Adults are winged, and it is assumed that they are capable of sufficient flight to find host plants (MAF, 2008). <u>Establishment and spread:</u> - MAF (2008) considered the likelihood of establishment to be low, based on localised populations establishing in warmer parts of the North Island (permanent establishment limited by wet and cold winter conditions).	
		And has the potential to cause negative economic consequences which are sufficient to justify phytosanitary measures on this pathway.	*L. gonagra* is capable of causing low level economic and environmental impacts if it established in New Zealand.	- In Florida, L. *gonagra* attacks citrus as part of a pest complex including *L. phyllopus* and the stink bug *Nezara viridula* (present in New Zealand) (MAF, 2008). On its own, *L. gonagra* is considered a minor pest (on citrus) (MAF, 2008). - MAF (2008) considered that the economic impact of establishment would be low. - Environmental impacts are uncertain, but likely to be very low (MAF, 2008).	
	Pinnaspis strachani (Cooley 1899) [Diaspididae]	Has the potential to be a quarantine pest on this pathway.	*A. destructor* and *P. strachani* are associated with the pathway.	- *A. destructor* and *P. strachani* are present in Tonga (MAFFF, 2012). - Are not recorded in New Zealand (not recorded in NZOR or Gordon (2010), recorded as not present in PPIN). - Are known to be associated with *C. pepo* (MAFFF, 2012).	**Is considered a quarantine pest on this pathway.**

Hemiptera	*Aspidiotus destructor* Signoret 1869 [Diaspididae]	**And** has the potential to establish and spread if it entered NZ.	*A. destructor* and *P. strachani* has the potential to enter New Zealand and be exposed to suitable hosts.	Entry: - *A. destructor* and *P. strachani* are visually noticeable and may be found during packhouse cleaning and grading procedures. - Adult *A. destructor* are1.5-2mm in diameter and adult *P. strachani* are 1mm in diameter, both covered with a scale cover which is white to grey in colour. Eggs are laid underneath the scale cover (CPC, 2017; Din and Arthurs, 2015; MAF, 2009). - *C. pepo* has a relatively simple structure, however there are some areas of the pumpkin that could make detection of *A. destructor* and *P. strachani* difficult (e.g. where the peduncle meets the stem). - Diaspididae are capable of surviving transit conditions to New Zealand (intercepted on fresh produce) (QuanCargo, 2017). Exposure: - Due to their specialised biology, exposure of Diaspididae is limited. - Only crawler (male and female; crawling/wind dispersal) and adult male Diaspididae are mobile (MPI, 2014), restricting the ability of these species to leave the host and find a suitable host. - Crawlers are susceptible to extremes of temperatures, desiccation, rain and predation (Beardsley and Gonzalez, 1975; MPI, 2014). - No part of the pumpkin will be consumed, providing a higher level of unavoidable waste and a higher exposure risk (MPI, 2014). - Pumpkin is a robust host that could support viable Diaspididae for long periods of time. - *A. destructor* and *P. strachani* are highly polyphagous with many suitable hosts in commercial production and home gardens throughout New Zealand (CPC, 2017; Din and Arthurs, 2015; MAF, 2009). - MPI (2014) assessed the exposure of Diaspididae on fresh produce for consumption pathways as varying between negligible and low. Considering the factors in their conclusion, pumpkin for decorative purposes would fit at the high end, but within this range. - (e.g. quantity and exposure of material, robustness of host, proximity to hosts, temperature). Establishment and spread: - *A. destructor* and *P. strachani* are highly polyphagous with many suitable hosts in commercial production and home gardens throughout New Zealand (CPC, 2017; Din and Arthurs, 2015; MAF, 2009). - *A. destructor* and *P. strachani* currently have a broad tropical distribution (CPC, 2017; Din and Arthurs, 2015; MAF, 2008). MAF (2008) notes that while there is insufficient information to assess its ability to establish in New Zealand, it is likely *P. strachani* could survive Northland summers and year round in glasshouses. - MAF (2009) notes *P. strachani* is established in glasshouses in Hungary and the former USSR.	**Measures are justified (*Basic Measures*).**
		And has the potential to cause negative economic consequences which are sufficient to justify phytosanitary measures on this pathway.	*P. strachani* is capable of causing low level economic and environmental impacts if it established in New Zealand.	- The ability for *A. destructor* and *P. strachani* to establish in New Zealand is limited (probably to glasshouses) (Din and Arthurs, 2015; MAF, 2009,), limiting potential impacts. MAF (2009) did not assess the economic impacts of *P. strachani* as it was considered to be a negligible likelihood of establishment on the pear pathway.	

Hemiptera	*Pseudaulacaspis pentagona* (Targioni Tozzeti) [Diaspididae]	Has the potential to be a quarantine pest on this pathway.	*P. pentagona* is associated with the pathway.	- *P. pentagona* is present in Tonga (MAFFF, 2012). - Is not recorded in New Zealand (not recorded in NZOR or Gordon (2010), recorded as not present in PPIN). - Is known to be associated with *C. pepo* (MAFFF, 2012).	**Is considered a quarantine pest on this pathway.** **Measures are justified** **(Human consumption = *Basic Measures*)** **(Decorative purposes = *Targeted Measures*).**
		And has the potential to establish and spread if it entered NZ.	*P. pentagona* has the potential to enter New Zealand and be exposed to suitable hosts.	Entry: - *P. pentagona* is visually noticeable and may be found during packhouse cleaning and grading procedures. - Adult *P. pentagona* are 1.5-3mm in diameter and covered with a scale cover which is pale in colour. Eggs are laid underneath the scale cover (; MPI, 2014). - *C. pepo* has a relatively simple structure, however there are some areas of the pumpkin that could make detection of *P. pentagona* difficult (e.g. where the peduncle meets the stem). - Diaspididae are capable of surviving transit conditions to New Zealand (intercepted on fresh produce) (QuanCargo, 2017). Exposure: - Due to their specialised biology, exposure of Diaspididae is limited. - Only crawler (male and female; crawling/wind dispersal) and adult male Diaspididae are mobile (MPI, 2014), restricting the ability of these species to leave the host and find a suitable host. - Crawlers are susceptible to extremes of temperatures, desiccation, rain and predation (Beardsley and Gonzalez, 1975; MPI, 2014). - *P. pentagona* is highly polyphagous with many suitable hosts in commercial production and home gardens throughout New Zealand (CPC, 2017; MPI, 2014). - MPI (2014) assessed the exposure of Diaspididae on fresh produce for consumption pathways as varying between negligible and low. - Pumpkins used for decorative purposes have a higher risk of exposure than those consumed: - Carved pumpkin is a robust host that could support viable Diaspididae for long periods of time. - Wind dispersal of crawlers from decorative pumpkins would increase the level of exposure compared to waste disposed of to compost. - Considering the factors in the conclusion reached by MPI (2014), the exposure of Diaspididae on decorative pumpkin is going to be higher than pumpkins used for consumption. Establishment and spread: - *P. pentagona* is highly polyphagous with many suitable hosts in commercial production and home gardens throughout New Zealand (CPC, 2017; MPI, 2014). - *P. pentagona* is known to occur in temperate regions and may be able to establish in at least in warmer northern parts of New Zealand, or in sheltered habitats or in greenhouses (MPI, 2014). - Mated females are known to overwinter in cold climates (eggs may over-winter in warmer climates) (MPI, 2014).	
		And has the potential to cause negative economic consequences which are sufficient to justify phytosanitary measures on this pathway.	*P. pentagona* is capable of causing moderate level economic and environmental impacts if they established in New Zealand.	- Economic consequences of establishment of *P. pentagona* in New Zealand have been assessed as moderate (MPI, 2014). - Feeding activities on hosts causes early leaf drop, and may on occasion kill plants (MPI, 2014). - Kiwifruit and grapes are among reported hosts; and damage is likely to reduce marketable yields (e.g. 20% yield reduction observed on kiwifruit in Italy) (MPI, 2014). - Increased production costs may occur (e.g. additional pest control activities). - *P. pentagona* is already present in many important export markets (MPI, 2014), however there may be some impact on access to export markets.	

Hemiptera	*Maconellicoccus hirsutus* (Green,1908) [Pseudococcidae] *Dysmicoccus brevipes* (Cockerell, 1893) [Pseudococcidae] *Planococcus minor* (Maskel) [Pseudococcidae] *Ferrisia virgata* (Cockerell, 1893) [Pseudococcidae]	Have the potential to be quarantine pests on this pathway.	*Maconellicoccus hursutus*, *Dysmicoccus brevipes* and *Ferrisia virgata* are associated with the pathway	- *M. hirsustus, D. brevipes,* and *F. virgata* are present in Tonga (MAFFF, 2012). - Are not recorded in New Zealand (not recorded in NZOR or Gordon (2010); *M. hirsutus* not recorded in PPIN; *D. brevipes* and *F. virgata* recorded as not in NZ in PPIN). - Are known to be associated with *C. pepo* (PIPLD, 2017).	**Are considered quarantine pests on this pathway.** **Measures are justified (*Basic Measures*).**
		And have the potential to establish and spread if it entered NZ.	*M. hirsutus*, *D. brevipes* and *F. virgata* have the potential to enter New Zealand and be exposed to suitable hosts.	<u>Entry:</u> - Adults are small, however adults (and the associated black sooty mould (MPI, 2007)) are considered to be relatively easy to detect by inspection (MPI, 2014). Mealybugs tend to reside in cryptic locations, increasing the likelihood that they may be missed during visual inspection (MPI, 2014; MAF, 2008). - Pumpkin is typically smooth and would make the distinct adult mealybugs and eggs (MPI, 2008; MPI, 2014) detectable during pre-export inspection, although there are some cryptic locations around the peduncle that could make inspection more difficult. - Crawlers would be removed during packhouse brushing and processing as they are fragile and easily dislodged (MPI, 2014). - Likelihood of entry for mealybugs was assessed to range from negligible to moderate dependent on the commodity, and medium for citrus as the calyx and peduncle provide refuge and make them hard to find during inspection (MAF, 2008; MPI, 2014). <u>Exposure:</u> - These mealybugs are highly polyphagous with many suitable hosts present in NZ, including plants that are common in home gardens (MPI, 2014; MAF, 2008). - Pumpkin skin may allow exposure to the environment. - The skin is not consumed, and may be disposed of to compost (or to landfill, etc.) with some flesh attached. - Whole decorative pumpkins may be carved and displayed outdoors. - Pumpkin is a robust host, and the exposed flesh could provide a medium for mealybug development. - Nymphs, crawlers and adults are all mobile to some extent although the most mobile stage is the crawler stage (MPI, 2014; MAF, 2008). <u>Establishment and spread:</u> - These mealybugs are highly polyphagous with a wide variety of potential commercial and wild hosts (MPI, 2014; CPC, 2017). Host species are also commonly found in home gardens. - Suitable temperatures for establishment of at least seasonal populations can be found in northern parts of New Zealand. - *M. hirsutus* currently has a tropical to subtropical distribution, but is believed to be capable of establishment in the northern North Island (MPI, 2014). - *F. virgata* currently has a tropical to temperate distribution, including presence in Australia, USA, and South America, and is believed to be capable of establishment in the northern North Island (MAF, 2008). - *D. brevipes* and *P. minor* currently have a tropical to subtropical distribution, but is believed to be capable of establishment in the northern North Island (MAF, 2008).	

		And have the potential to cause negative economic consequences which are sufficient to justify phytosanitary measures on this pathway.	*M. hirsutus*, *D. brevipes* and *F. virgata* are capable of causing economic and environmental impacts if they established in New Zealand.	- These mealybugs are a threat to a number of significant crops in New Zealand such as grapes, passionfruit, citrus and squash. - Mealybugs can cause serious damage to host plants although the most significant damage usually occurs in regions warmer than New Zealand. - Mealybugs can be difficult to control with herbicide due to their polyphagous nature allowing them to establish on a range of weed species (MPI, 2014). - Economic and environmental impacts of these mealybugs have been considered by MPI: - The potential economic and environmental impacts *M. hirsutus* are considered 'low' (MPI, 2014). - MAF (2008) considered the potential economic and environmental impacts of *D. brevipes and F. virgata* to be medium.	
	Planococcus citri (Risso, 1813) [Pseudococcidae] *Pseudococcus longispinus* (Targioni-Tozzetti) [Pseudococcidae]	Do not fulfil the criteria of quarantine pests on this pathway.	*Pseudococcus citri* and *Pseudococcus longispinus* do not vector any diseases of concern.	- *P. citri* and *P. longispinus* are present in Tonga (MAFFF, 2012; QuanCargo, 2017). - *P. citri* and *P. longispinus* are present in New Zealand – but are potential vectors of plant pathogens. - *P. citri* and *P. longispinus* are not known to vector any viruses associated with cucurbits in Tonga and therefore do not require regulation on this import pathway.	**Do not fulfil the criteria of quarantine pests on this pathway.**
Lepidoptera	*Diaphania indica* Saunders, 1851 [Crambidae] *Tiracola plagiata* Walker, 1857 [Noctuidae]	Have the potential to be quarantine pests on this pathway.	*D. indica,* and *T. plagiata* are associated with the pathway.	- *D. indica,* and *T. plagiata* are present in Tonga (MAFFF, 2012, PIPLD, 2017). - Are not recorded from New Zealand (*T. plagiata* is recorded from the Kermadec Islands) (not recorded (except T. plagiata in the Kermadecs) in NZOR or Gordon, 2010; recorded as not in New Zealand in PPIN). - Are associated with pumpkin (MAFFF, 2012).	**Are considered quarantine pests on this pathway.** **Measures are justified (*Basic Measures*).**
		And have the potential to establish and spread if it entered NZ.	*D. indica,* and *T. plagiata* have the potential to enter New Zealand and be exposed to suitable hosts.	- Entry: - Larvae and adults of *T. plagiata* are visually obvious external feeders, which would be detected during production and inspection. - *D. indica* larvae 18-25mm; adult wingspan 25mm (MPI, 2015a). - *T. plagiata* mature larvae 60mm; adult wingspan 50mm (MAF, 2008). - *D. indica* and *T. plagiata* larvae are external feeders (MAF, 2008; MPI, 2015a). - *D. indica* and *T. plagiata* eggs and larvae are primarily associated with leaves. - *D. indica* eggs are laid on leaves while *T. plagiata* eggs are laid on leaves or young fruit (MAF, 2008; MPI, 2015a). - *D.indica* and *T. plagiata* can survive transit to New Zealand. - Both have been intercepted on consignments of fresh produce at the border (Quancargo, 2017). - Exposure: - *D. indica* and *T. plagiata* are polyphagous with many suitable hosts present in NZ, including plants that are common in home gardens (MAF, 2008; MPI, 2015a). - However, larvae of both species feed on young fruit (MAF, 2008; MPI, 2015a). - Larvae are mobile to an extent and could travel to a suitable host when pumpkin waste is disposed into a garden or compost. - Adults are highly mobile but are likely only to be found as hitchhikers as they are not typically associated with fruit (MAF, 2008; MPI, 2015a). - A *T. plagiata* adult (moth) was intercepted on a consignment of zucchini in 2010 (Quancargo, 2017).	

				Establishment and spread: - *D. indica* and *T. plagiata* are polyphagous with a variety of potential commercial and wild hosts (MAF, 2008; MPI, 2015a). - Suitable conditions for the establishment of populations can be found in New Zealand. - *D. indica* would be able to establish in most parts of New Zealand (MPI, 2015a). - *T. plagiata* currently has a tropical to temperate distribution, including presence in Australia, Asia, and many pacific islands, and would likely be capable of establishment in the northern North Island (MAF, 2008).	
		And have the potential to cause negative economic consequences which are sufficient to justify phytosanitary measures on this pathway.	*D. indica,* and *T. plagiata* are capable of causing economic and environmental impacts if they established in New Zealand.	- *D. indica* and *T. plagiata* are a threat to a number of significant crops in New Zealand such as cucurbits, beans, citrus and capsicum (MAF, 2008; MPI, 2015a). - Damage includes defoliation and damage to young fruit. - Potential economic impact from *D. indica* was assessed to be from negligible to moderate (MPI, 2015a). - Potential economic impact from *T. plagiata* is likely to be negligible to low as climate would restrict its distribution.	
	Setomorpha rutella Zeller [Tineidae]	Does not fulfil the criteria of a quarantine pest on this pathway.	*Setomorpha rutella* is not associated with the pathway.	- *S. rutella* was intercepted on squash from Tonga (QuanCargo, 2017) and is therefore assumed to be present in Tonga. - Is not recorded in New Zealand (not recorded in NZOR, or Gordon (2010); recorded as not present in New Zealand in PPIN). - Is recorded as intercepted on squash from Tonga (QuanCargo, 2017), but it is unclear if the interception was from the fruit or packaging. - *S. rutella* larvae feed on dry vegetable matter including dried goods, cereals, grain, rice, nuts and seeds (Zimmerman, 1978). No records have been identified of *S. rutella*, or members of *Setomorpha* feeding on fruit or Cucurbitaceae plants.	**Does not fulfil the criteria of a quarantine pest on this pathway.**
Fungi i	*Choanephora cucurbitarum* (Berkeley and Ravenel) Thaxter	Has the potential to be a quarantine pest on this pathway.	*C. cucurbitarum* is associated with the pathway.	- *C. cucurbitarum* is present in Tonga (MAF 2011, PIPLD, 2017; CPC, 2017). - Is not recorded in New Zealand (recorded as absent in NZOR (2017) and NZFungi, (2017); recorded as not in New Zealand in PPIN). - Is known to be associated with pumpkin (MAF 2011 (*C. moschata* pumpkin); APS, 2017).	**Is considered a quarantine pest on this pathway.** **Measures are justified (*Basic Measures*).**
		And has the potential to establish and spread if it entered NZ.	*C. cucurbitarum* has the potential to enter New Zealand and be exposed to suitable hosts.	Entry: - *C. cucurbitarum* first attacks blossom, progressing into the developing fruit, although it can also infect other tissues when damaged (MAF, 2011). - Advanced symptoms (fungal growth) would be obvious to visual inspection, however early stages of infection may be asymptomatic. - Infection can remain asymptomatic for ten days after infection (MAF, 2011). Exposure: - Hosts include pine, onion, brassicas, capsicum, melons, cucumbers, sweet potato, lettuce, eggplant, and corn. - Decorative pumpkins may be displayed outdoors in home gardens, providing exposure for spore distribution to other host plants. - Sporulation occurs after rainfall when the temperature exceeds 10°C (MPI, 2012), conditions likely to occur in New Zealand (especially in northern regions) during the summer months	

				Establishment and Spread: - *C. cucurbitarum* has a wide host range (including pine, onion, brassicas, capsicum, melons, cucumbers, sweet potato, lettuce, eggplant, and corn) (MAF, 2011). - Climatically the northern North Island is likely to be suitable for establishment in New Zealand (MPI, 2012).	
		And has the potential to cause negative economic consequences which are sufficient to justify phytosanitary measures on this pathway.	*C. cucurbitarum* is capable of causing economic and environmental impacts if it established in New Zealand.	- Crop losses of 30% have been reported from *C. cucurbitarum* (MPI, 2012). - *C. cucurbitarum* has a wide host range (including pine, onion, brassicas, capsicum, melons, cucumbers, sweet potato, lettuce, eggplant, and corn) (MPI, 2012).	
Virus	Papaya ringspot virus-W, cucurbit infecting strain [Potyvirus] *formerly Watermelon mosaic virus 1 (WMV-1*)	Has the potential to be a quarantine pest on this pathway.	Papaya ringspot virus-W is associated with the pathway.	- Papaya ringspot virus-W is present in Tonga (MAFFF, 2012). - Is not recorded in New Zealand (not recorded in NZOR or Verrakone et al (2015) or PPIN). - Is known to be associated with pumpkin (MAFFF, 2012).	**Does not fulfil the criteria of a quarantine pest on this pathway**
		However does not have the potential to establish and spread if it entered NZ.	Papaya ringspot virus-W does not have the potential to enter New Zealand and be exposed to suitable hosts.	Entry: - Early stages of this virus may be asymptomatic on host plants (CPC, 2017), and therefore not detected during harvest and packing processes. Exposure: - The likelihood of a vector present with the consignment infecting a host in New Zealand is considered to be negligible. - PRSV is non-persistent (Tripathi et al, 2008). In non-persistent viruses, inoculativity by the vector is retained for only a few seconds/minutes (Hogenhout 2008) or hours (Hohn 2007) after acquisition from plants. - The likelihood of an aphid vector present in New Zealand acquiring the virus from an infected pumpkin is uncertain but likely to be negligible. - Aphids are passive phloem feeders (they do not pump fluids from plants, it is the phloem sap pressure which allows this mode of feeding; Van Emden and Harrington 2007). - It is unlikely that discarded plant parts would be suitable for feeding, and they would be unlikely to attract aphids, particularly if there are living plants available. - Aphids are unlikely to be able to pierce the pumpkin skin to feed. - No information has been found suggesting that seed transmission takes place in cucurbits. - As the virus is non-persistent in aphid vectors, and there is no evidence of seed transmission, there is no opportunity for exposure to hosts in New Zealand.	