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A risk assessment for the introduction of African swine fever into the Cook Islands



(TCP/SAP/3805)

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Executive summary

This report describes a risk assessment mission in the Cook Islands, undertaken by the EpiCentre, School of Veterinary Sciences, Massey University, and the Food and Agriculture Organization of the United Nations (FAO) under FAO Technical Cooperation Programme (TCP/SAP/3805). The assessment aimed to evaluate the risk of introducing the African swine fever virus (ASFV) into the Cook Islands. The risk assessment results are then used to recommend measures to prevent or reduce the impacts of African swine fever (ASF) incursion in the Cook Islands.

ASF is a highly contagious viral disease that affects domestic and wild pigs. The virus was first reported in Africa and has spread to eastern Europe, China and Southeast Asia. Due to the recent ASF outbreaks in Asia and Papua New Guinea, Pacific Islands countries are now prioritizing steps to prevent the introduction of ASF. An important first step is to conduct an import risk assessment of ASFV to identify the main pathways for introduction and exposure. The knowledge informs decision making as to which measure to prevent or reduce the impact of ASF are likely to be most effective in the Cook Islands.

The assessment of risk was conducted using the WOAHP import risk analysis framework.

The most likely pathway for introducing ASFV into the Cook Islands was through contaminated pork products that international arrival passengers may bring in via airport. Should infected products enter the Cook Islands, there is a distinct pathway for exposure because pigs are routinely fed food scraps (swill) from households. The likelihood of transmission of ASFV to other susceptible pigs was considered extremely high due to the lack of farm biosecurity and the presence of feral pigs.

The assessment method was a systematic, qualitative import risk analysis of ASFV introduction to the Cook Islands. Results provide information about high-risk areas for ASF introduction, exposure and spread in the Cook Islands. They also identify gaps in control and prevention measures. The following steps are being proposed to minimize the likelihood of entry and exposure and the consequence of ASFV introduction.

Key recommendations are to:

1. Increase awareness of incoming passengers about meat products and fomites that can carry ASFV and instruct passengers to declare such materials or indicate whether they have visited any farms recently (30 days) to the biosecurity officer. Passengers can dispose of their food items in designated bins. Non-compliance shall be penalized.
2. Strengthen biosecurity procedures to ensure all baggage is scanned upon arrival and manual searches performed when suspect items are observed.
3. Ensure appropriate disposal of confiscated products through the incinerator.
4. Encourage households and restaurants to separate meat from vegetable waste and ban the supply of meat leftovers to pig owners.
5. Ensure sufficient cooking of swill (core temperature of 70°C for 30 minutes).
6. Increase awareness of pig owners and villagers about the ban on meat waste feeding, especially pork meat.

-
7. Educate stakeholders on ASF clinical signs and prompt reporting by pig owners/animal workers/public of signs of disease to the Ministry of Agriculture.
 8. Promote and strengthen farm biosecurity practices i.e., proper fencing of pigs, apply appropriate hygiene and sanitation measures.
 9. Regularly review the ASF status of countries where pork and pork products are being imported and do not accept products from countries with uncontrolled ASF outbreaks in commercial pigs.
 10. Prepare an emergency response plan for ASF with implementation and financial plan.
 11. Strengthen biosecurity legislations/regulations to include ASF and other TADs preventive and response measures, including the ability to fine companies/people who break these regulations where they exist.
 12. Encourage a multi-sectoral and multidisciplinary approach (One health) to address biosecurity threats of ASF and other TADs.

Acknowledgements

The authors wish to acknowledge the substantial contributions of the FAO Subregional Office for the Pacific Islands in Apia (Ms Xiangjun Yao, Ms Temwanoku Ioakim and Dr Kenneth Cokanasiga), FAO Regional Office for Asia and the Pacific in Bangkok (Dr Ian Dacre and Dr Scott Newman), the Ministry of Agriculture of the Cook Islands (Mrs Temarama Anguna-Kamana and Mr Pavai Taramai) and Dr Ahmed Fayaz (EpiCentre, Massey university). Outputs would not have been achieved without their support.

Abbreviations and acronyms

ASF	African swine fever
ASFV	African swine fever virus
FAO	Food and Agriculture Organization of the United Nations
GDP	gross domestic product
MOA	Ministry of Agriculture
PCR	polymerase chain reaction
PICs	Pacific Island Countries
FAO RAP	FAO Regional Office for Asia and the Pacific
FAO SAP	FAO Subregional Office for the Pacific Islands
SEA	Southeast Asia
TAD	transboundary animal disease
WAHIS	World Animal Health Information System
WOAH	World Organisation for animal health

1. Introduction

1.1.1 BACKGROUND

African swine fever (ASF) is a highly infectious transboundary animal disease affecting pigs (Costard *et al.*, 2013). ASFV-infected pigs develop severe lethargy, diarrhoea, or acute haemorrhagic fever, which typically results in death (Gabriel *et al.*, 2011; Gallardo *et al.*, 2017). After introducing ASF to Georgia in 2007, the disease has spread to nearly every Eastern European country (Rowlands *et al.*, 2008). The situation has been worse in 2018 as ASF was reported in China and rapidly spread to other adjacent Asian countries, causing the loss of more than 6.7 million pigs, mostly as pre-emptive culling (OIE, 2020). The movement of the ASFV into the Asia Pacific region poses a risk of ASF introduction to Pacific Island countries (PICs) such as Cook Islands. An outbreak of ASF in Cook Islands would result in high levels of pig mortality which would significantly affect food security in the country as most pigs are kept for subsistence. In addition, the costs associated with safely disposing of animals that die because of the disease and the slaughter and disposal of healthy animals to control the outbreak would be significant.

In 2020, a pilot project was initiated by the FAO Subregional Office for the Pacific Islands (FAO SAP) based in Apia, Samoa, in close collaboration with FAO Regional Office for Asia and the Pacific (FAO RAP) to assess the risk of ASF introduction to Samoa. The mission was completed by EpiCentre, Massey University, New Zealand. Two consultants visited the country to interview government agencies, farmers, and stakeholders and delivered a risk assessment report. Given the lack of import risk assessment of ASF in other Pacific countries, the project's scope was recently expanded to cover the risk for the Cook Islands.

1.1.2 MISSION ACTIVITIES

Due to the travel restriction caused by the COVID-19 pandemic, EpiCentre consultants couldn't visit the Cook Islands. Therefore, instead of face-to-face interviews administered by EpiCentre consultants, questionnaires were developed (attached in Annex) and administered by the Ministry of Agriculture of the Cook Islands (Mrs Temarama Anguna-Kamana and Mr Pavai Taramai). The questionnaires were used to collect information from the following agencies:

- Ministry of Agriculture (MOA),
- Biosecurity services,
- Customs office,
- Ports authority/Marine office,
- Airport authority office.

The information collected aimed to aid our understanding of the roles and responsibilities of various government agencies and gather information on factors influencing the occurrence and spread of ASF for import risk analysis. For data relating to the introduction pathway, the focus was on what happened before the travel restrictions imposed due to the COVID-19 pandemic.

The survey also included pig farmers to understand the farming practices and biosecurity measures in commercial/subsistence pig farms and local pork supply. Visits were made to five representative pig farmers in the Cook Islands.

2. African swine fever (ASF)

2.1.1 ASF VIRUS

ASFV is a double-stranded DNA arbovirus of the family of *Asfarviridae*. ASFV isolates could be classified into eight serogroups, and recent genetic research has demonstrated that the virus can be categorized into 23 geographically related genotypes with numerous subgroups (Beltran-Alcrudo *et al.*, 2017). ASFV genotype is classified via the variability of a segment in the VP-72 gene. The phenotypic analysis is used to identify the source of outbreaks. No distinctive differences in the virulence between different genotypes have been reported.

ASFV can be isolated from the blood, faeces, urine, and nasal/ocular/vaginal excretions of infected pigs up to at least 70 days of infection (de Carvalho Ferreira *et al.*, 2012). Depending on the environmental conditions, the virus can still be isolated from the carcasses of infected pigs and the soil of the deathbed for up to several months (Fischer *et al.*, 2020; Zani *et al.*, 2020). In addition, the virus can survive in fresh, salted, dried, and frozen meat for months to years (Table 1).

Table 1. Expected survival time of African swine fever virus in various conditions

Product	Survival time (days)
Meat (boned, de-boned, ground)	105
Salted meat	182
Cooked or canned meat	0
Dried meat	300
Smoked meat	30
Chilled meat	110
Frozen meat	1 000
Fat or skin	300
Offal	105
Urine	15
Faeces	11

Source: adapted from Adkin, A., Coburn, H., England, T., Hall, S., Hartnett, E., Marooney, C. & Wooldridge, M. 2004. *Risk assessment for the illegal import of contaminated meat and meat products into Great Britain and the subsequent exposure of GB livestock (IIRA): foot and mouth disease (FMD), classical swine fever (CSF), African swine fever (ASF), swine vesicular disease (SVD)*. New Haw: Veterinary Laboratories Agency, Anonymous. 2010. *Scientific Opinion on African Swine Fever*. EFSA Journal, 8(3): 1556. <https://doi.org/10.2903/j.efsa.2010.1556> and Davies, K., Goatley, L.C., Guinat, C., Netherton, C.L., Gubbins, S., Dixon, L.K. & Reis, A.L. 2017. *Survival of African Swine Fever Virus in Excretions from Pigs Experimentally Infected with the Georgia 2007/1 Isolate*. *Transboundary and Emerging Diseases*, 64(2): 425–431. <https://doi.org/10.1111/tbed.12381>

Transmission of ASFV could occur via direct contact with infected animals, consumption of contaminated pork or material, fomites (e.g. cloths, trucks, feeds), and soft tick vectors of *Ornithodoros* spp. (Dixon *et al.*, 2020). In ASFV-free countries, the virus could be introduced through the movement of infected wild boars or contaminated pork products carried by passengers (Kim *et al.*, 2019; Sauter-Louis *et al.*, 2021).

There are no treatments for ASF or vaccines to prevent the spread of ASF. The only way to contain an outbreak of ASF is the immediate culling of pigs on infected farms and those near or in contact with infected farms (OIE, 2020). Therefore, rapid and reliable detection is required for the timely implementation of the control measures. Early detection relies on immediate reporting when pigs are observed to have clinical signs consistent with ASF (i.e. dermal haemorrhages, fever, diarrhoea, bleeding from orifices, high mortality) and rapid testing of dead pigs. A PCR based on the VP-72 gene is the test of

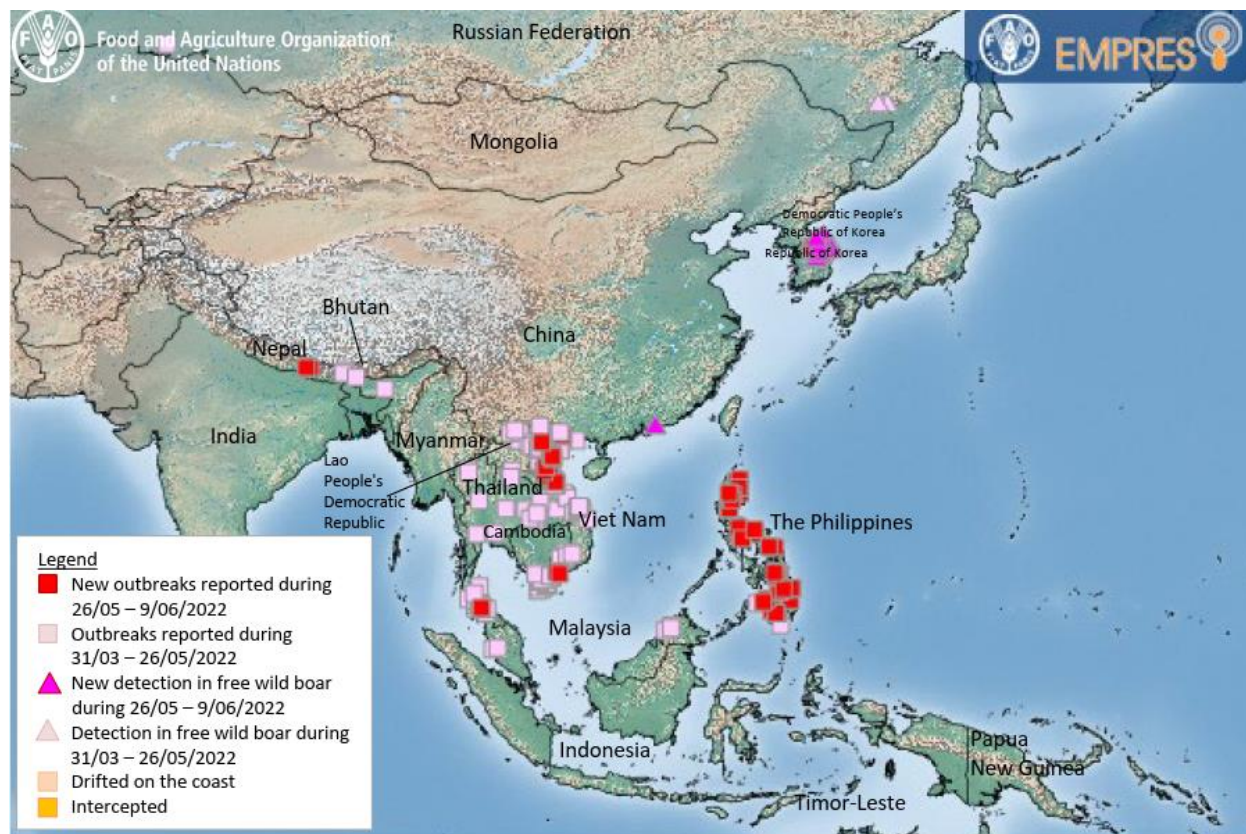
choice for early detection in peri-acute, acute or subacute ASF cases. However, PCR cannot confirm infectivity but can confirm the presence and quantitative information (Beltran-Alcrudo *et al.*, 2017).

2.1.2 ASF SITUATION

ASF had been an endemic disease only in Africa until 1957, when the first transcontinental case occurred in Portugal (Boinas *et al.*, 2011). ASF then spread to other European and American countries. In 1995, except for Sardinia in Italy, the regions were declared free of ASF (Dixon *et al.*, 2020). Almost two decades later, another introduction of ASFV to Europe was reported from Georgia in June 2007 (Rowlands *et al.*, 2008). ASF quickly spread to the Caucasus region (Beltrán-Alcrudo *et al.*, 2009) and persisted in the continent mainly via the "wild boar–habitat cycle" that the transmission of ASF occurs directly between wild boars and indirectly through carcasses in the habitats (Chenais *et al.*, 2018). Since its re-introduction in 2007, ASF has transmitted to other European countries, including Ukraine, Belarus, Poland, Republic of Moldova, the Czech Republic, Romania, Hungary, Bulgaria, Belgium, Slovakia, Serbia, Greece, Lithuania, Estonia, Italy, Latvia, and Germany (OIE, 2020; Sauter-Louis *et al.*, 2021; Schulz *et al.*, 2019).

In 2019 ASFV was reported in China and has rapidly spread to other Asian countries, most likely via the illegal importation of pig meat from affected countries (Schulz *et al.*, 2019). Since ASFV was reported in China, outbreaks have been reported in 15 other countries in the Asian Pacific (see Figure 1; FAO, 2022). Affected countries implemented control measures, such as pre-emptive culling and movement restriction. Between 2018 and 2020, nearly 7 million Asian domestic pigs were culled to prevent the spread of ASF. The Ministry of Agriculture and Fisheries of Timor-Leste announced the culling of 100 000 pigs after the confirmation of ASF in September 2019. In January 2022, an outbreak of ASF was reported in Thailand, and the government allocated USD 17.3 million to control the disease spread. Due to the geographical proximity to Thailand, the Cambodian government restricted any importation of pigs from its neighbouring countries. In addition, Nepal reported its first cases of ASF in May 2022. ASF outbreaks and followed control measures have severely affected national food security and livelihood, especially in poor rural families in many Asian countries. However, ASF control was largely ineffective due to a lack of technical or financial resources.

Figure 1. Current situation of ASF in Asia as of June 2022; Source: FAO. (2022) ASF situation in Asia update. [http://www.fao.org/ag/againfo/programmes/en/empres/ASF/situation_update.html#Cook Islands](http://www.fao.org/ag/againfo/programmes/en/empres/ASF/situation_update.html#Cook%20Islands)



2.1.3 GENERAL PROFILE

The Cook Islands is a Polynesian island country in the South Pacific Ocean in free association with New Zealand. The country consists of 15 islands and two reefs with a combined land size of approximately 240 square kilometres (Figure 2). The islands are geographically divided into two distinct groups: the southern Cook Islands (e.g., Palmerston, Aitutaki, Manuae, Takutea, Mitiaro, Atiu, Mauke, Rarotonga, Mangaia) and the Northern Cook Islands (e.g. Penrhyn, Rakahanga, Manihiki, Pukapuka, Nassau, Suvarrow). The largest island is Rarotonga, where most of the population of the Cook Islands dwells. The islands are scattered between the latitude of 8° and 22° south and between the longitude of 156° and 166° west.

Figure 2. Location of the Cook Islands; Source: United Nations. 2022. Geospatial, location data for a better world. Cited 20 August 2022. <https://www.un.org/geospatial/mapsgeo/webservices>



The 2016 census reported that the total population was 17 434 and 4 593 households in the Cook Islands (Cook Islands statistics office, 2018). Much of the population, 13 007 people, or 74.6 percent of the population, live on Rarotonga. Nineteen percent of the population or 4 013 people live across the country's other southern islands, with the remaining 6 percent of the population residing across the northern islands. However, no people live on two of the southern islands (Manuae and Takutea and one northern island (Suvarrow) because conditions are not favourable.

The Cook Island's gross domestic product (GDP) is approximately USD 384 million (UNCTAD, 2022), with tourism and the service industry contributing more than 70 percent of the GDP (Tanimetua, 2021). In contrast, the primary industries, such as agriculture and fishing, contribute less than 3 percent of the national GDP. Despite agriculture contributing less than 5 percent to GDP across the country 50 percent of households engage in agricultural activities (Table 2). Most of the households engaging in agricultural activities do so at a minor or subsistence level, with less than 10 percent engaged in agricultural activities at a commercial level.

However, it is worth noting there were significant differences across the island groups. On the southern islands other than Rarotonga 75 percent of household engaged in agriculture and nearly 20 percent did so at a commercial level. While, on the North Islands nearly 90 percent of households engaged in agricultural activities and there were no operations classified as commercial.

Of those nearly 2 220 households engaged in in agricultural activities 73 percent keep livestock and poultry. However, there was a variation across the island grouping. According to the 2011 Agricultural Census on Rarotonga, 57 percent of households engaged in agriculture keep livestock, while on the other southern Islands nearly 100 percent, or 690 of the 701 households engaged in agriculture kept livestock. In the North group, 207 of the 244 households, or 85 percent kept had livestock or poultry. The most common livestock

species was pigs with 31 percent of all households in the Cook Islands owning one or more pig (Table 3). The next most common chickens and poultry. For all livestock and poultry, the percentage of households with animals varied between the island groups.

Table 2. Number and percentage of households (HH) engaged with different levels of agricultural activities in the Cook Islands by island group (Ministry of agriculture, 2014).

Level of agricultural activities	Island group			Total (n = 4 372)
	Rarotonga (3 154 HH)	Other southern Islands (939 HH)	Northern Islands (279 HH)	
None	1 922 (61%)	238 (25%)	35 (13%)	2 195 (50%)
Minor	659 (21%)	77 (8%)	166 (59%)	902 (21%)
Subsistence	333 (11%)	450 (48%)	78 (28%)	861 (20%)
Commercial	240 (8%)	174 (19%)	- (%)	414 (9%)

Source: Ministry of Agriculture. 2014. Cook islands 2011 Census of agriculture & fisheries. Rarotonga, Cook Islands, Ministry of agriculture, Cook Islands.

Table 3. Number and percentage of households (HH) raising livestock in the Cook Islands.

Livestock status	Island group			Total (4 372 HH)
	Rarotonga (3 154 HH)	Other southern Islands (939 HH)	Northern Islands (279 HH)	
Any livestock or poultry	698 (22%)	690 (73%)	207 (74%)	1 595 (36%)
Type of livestock				
Pig	622 (20%)	559 (60%)	173 (62%)	1 354 (31%)
Chicken	83 (2.6%)	497 (53%)	114 (41%)	694 (16%)
Goat	223 (7%)	358 (38%)	0 (0%)	581 (13%)
Cattle	44 (1%)	19 (2%)	0 (0%)	63 (1%)
Duck	9 (0.3%)	7 (0.7%)	0 (0%)	16 (0.4%)

Source: Ministry of Agriculture. 2014. Cook islands 2011 Census of agriculture & fisheries. Rarotonga, Cook Islands, Ministry of agriculture, Cook Islands.

2.1.4 PIGS

The 2011 Agricultural census reported that across the nearly 1 400 households keeping pigs there were approximately nearly 14 000 pigs (Ministry of agriculture, 2014; Table 4). There are also feral pigs in the Cook Islands that have not been captured in these numbers. Exact numbers are not available; however, it does appear the numbers are increasing, especially in the southern islands (Government of the Cook Islands, 2016). Research suggests feral pigs are competing with people and domestic pigs for food resources (Clark et al., 2013). Therefore, the increase in population size indicates that may be entering into the villages and mixing with domestic pig.

Eighty-five percent of the pigs are located on Rarotonga and the other southern islands. Less than 6 percent keeping more than 30 pigs, and nearly 60 percent of households keeping less than ten animals (Table 5). Based on responses to the questionnaire none of the households with more than 30 pigs were running large scale industrial operations. Therefore, pig production appears to be predominately subsistence in the Cook Islands. The pigs are often tethered to a tree to prevent free-roaming (Government of the Cook Islands, 2016) or kept in enclosures or pens (Bakare *et al.*, 2020; Figure 3). However, up-to-date information about the type and proportion of pig housing systems in the households of the Cook Islands was not available.

Given a subsistence nature, household owners mainly use local feeds for pigs. According to four pig farmers surveyed for this mission, they all reported feeding coconut and swill to their pigs. Commercial feeding is somewhat less common and could be limited to commercial pig holdings, of which all the processed feeds are imported from other countries. However, the origin countries of the processed feeds are unknown. Based on the survey for this mission, two out of four farmers reported using commercial feed, with the cost of a commercial diet being approximately USD 25 and USD 30 per bag.

The MOA has introduced commercial pig breeds, such as Large white, Landrace, or Duroc, over the past decade as part of efforts to improve genetics (Government of the Cook Islands, 2016). The introduced breeds were sourced from New Zealand and since then no live pigs have been imported. There is no data on how common the commercial breeds are. Anecdotally, the local pig breeds are still dominant due to the robustness against the harsh climate and feed sources (e.g., coconut). Most households with pigs also have a sow. Interviews conducted as part of this mission indicate that the sows are mated naturally either using their own animals or those of a neighbor. Artificial insemination is believed to be quite limited for pig farmers in the Cook Islands and no semen appears to be imported for this purpose.

Figure 3. Pigs in building/cage of subsistence farms in the Cook Islands.



Table 4. Number and percentage of pigs/sows in each group of islands of the Cook Islands.

Number	Island group		
	Rarotonga	Other southern Islands	Northern Islands
Pigs (13 951 pigs)	5 219 (37%)	6 739 (48%)	1 993 (14%)
Sows (2 884 sows)	1 187 (41%)	1 396 (48%)	301 (10%)

Source: Ministry of Agriculture. 2014. Cook islands 2011 Census of agriculture & fisheries. Rarotonga, Cook Islands, Ministry of agriculture, Cook Islands.

Table 5. Number and percentage of households based on the number of pigs kept in each group of islands of the Cook Islands.

Island group	Herd size			
	< 10	10 - 19	20 - 29	≥ 30
Rarotonga (n =622 HH)	441 (71%)	128 (21%)	34 (6%)	19 (3%)
Other southern islands (559 HH)	315 (56%)	143 (26%)	57 (10 %)	44 (8%)
Northern islands (173 HH)	92 (53%)	51 (30%)	18 (10 %)	12 (7 %)
Total (1 354 HH)	848 (63%)	322 (24%)	109 (8%)	75 (6%)

Source: Ministry of Agriculture. 2014. Cook islands 2011 Census of agriculture & fisheries. Rarotonga, Cook Islands, Ministry of agriculture, Cook Islands; Due to rounding not all totals sum to 100

2.1.5 PORK AND PORK PRODUCTS

The 2011 agricultural census estimated that nearly 6 500 pigs were either slaughtered for self-consumption or sale or sold alive (Table 6). Nearly 80 percent of the pigs were slaughtered or sold as fatteners with live weights between 60 and 100 kilograms. There are no abattoir or commercial home kill services in the Cook Islands. Therefore, the pigs were slaughter by someone in the household near to where they were raised. Pigs and pork are sold directly rather than through a market and most sales are to neighbours for customary or social functions, including weddings, funerals, or feasts. A small proportion of product is sold to local restaurants (Figure 4). In 2011, the total revenue from selling, either slaughtered or live pigs, was estimated to be NZD 115 000.

Pig meat is available at local supermarkets (Figure 5) but none of it comes from domestic production. The pork meat and meat products (i.e. pork cuts, ham, shoulder and pork luncheon meat) in supermarkets are imported mainly from the United States of America, New Zealand, and Spain (up to 141 tonnes per year), and to date, been no ASF outbreak reported from the country.

Figure 4. The value chain of pork products in the Cook Islands; Source: elaborated by the authors.

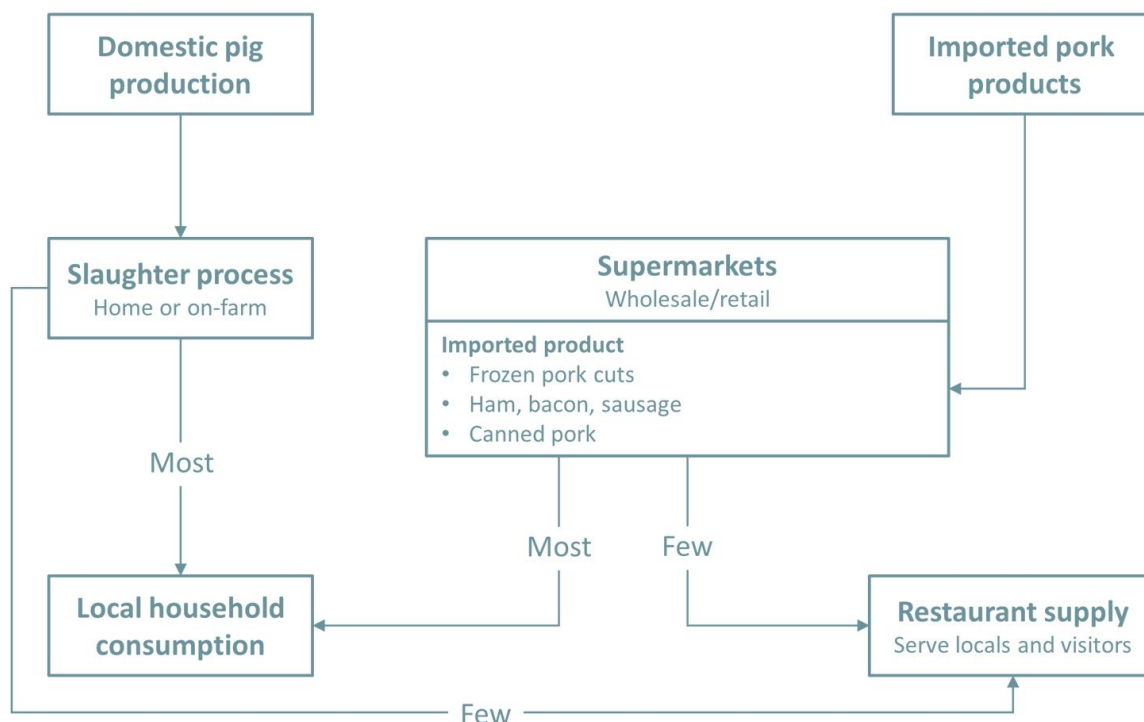


Table 6. Number of disposed pigs and per the revenue (NZD) of pig/pork meat selling in the Cook Islands.

Pig category	Number slaughter or traded alive	Slaughtered		Sold live	Total Revenue (NZD)
		Self-consumption	Sold		
Weaner	286	77 (27%)	167 (58%)	42 (15%)	7 700
Fattener	5 175	2 281 (44.1%)	1 802 (35%)	1 092 (21%)	93 662
Sow	626	245 (39%)	202 (32%)	179 (29%)	9 430
Boar	430	228 (53%)	100 (23%)	102 (24%)	4 430
Total	6 517	2 831 (43%)	2 271 (35%)	1 415 (22%)	115 222

Source: Ministry of Agriculture. 2014. Cook islands 2011 Census of agriculture & fisheries. Rarotonga, Cook Islands, Ministry of agriculture, Cook Islands.

Figure 5. Imported pork product examples.



2.1.6 ROLES OF AGENCIES FOR PREVENTING AND RESPONDING TO AN ASF OUTBREAK

Securing the border of the Cook Islands against invasive pathogens is a task of the Biosecurity services under the Ministry of Agriculture (MOA). The Biosecurity services liaise with Customs, Airport authority and Port authority/Marine offices. They are responsible for preventing the introduction of all harmful insects, pests, and diseases through passenger arrival, cargo, and post. The importation of live animals or meat products to the Cook Islands requires a Biosecurity Import Permit. Also, before arrival, any imported live animals must undergo a pre-departure health treatment specified in the Import Health Standard. When found, illegally imported animal or animal products, including those without the permit, are confiscated for incineration and burial. However, during interviews, customs and biosecurity officers reported that they manually conduct the screening of baggage/cargo for those who declared to detect prohibited items. They also applied x-ray inspection of random passengers.

No qualified veterinarians are operating in the Cook Islands. Also, there are no veterinary services from the government. Currently, simple treatments, such as deworming or diagnosis of minor diseases, are routinely done by extension officers of MOA. It was narrated that a couple of extension officers have completed the requirements for the qualification of para-veterinarians.

In an animal disease emergency, such as ASF, the MOA sanctions provisional measures to verify the outbreak and control its spread. The legal basis for declaring a biosecurity emergency is the Biosecurity Act 2008. Should an ASF outbreak occur, the MOA has the legal powers to coordinate the response involving several government agencies. The Biosecurity Act 2008 allows other parties, such as Police, to exercise reasonable force to ensure compliance. However, there is no standard of procedure prepared against an outbreak of ASF in the Cook Islands.

During an ASF response, the Secretary of MOA would declare a biosecurity emergency under the Biosecurity Act 2008 and require the Director of MOA to undertake the most appropriate measures. The Director can require the Biosecurity officers to conduct the following activities:

- Surveillance of animal populations for ASF outbreaks;
- Responding to public enquiries about sick animals, investigation and organization of property access for sample submission and submission of samples for laboratory testing;

- Raising awareness amongst communities on the impacts of ASF outbreaks on livelihoods;
- Risk reduction and management of outbreaks;
- Prohibition of animal movements;
- Prohibition of the distribution, sale or use of any animals, animal products or animal-related items;
- Slaughter of animals for disease control purposes to prevent the spread of ASF, instructions for the disposal of animal carcasses;
- Implementation of official control programmes, including disinfection and eradication measures.

3. Import Risk Analysis

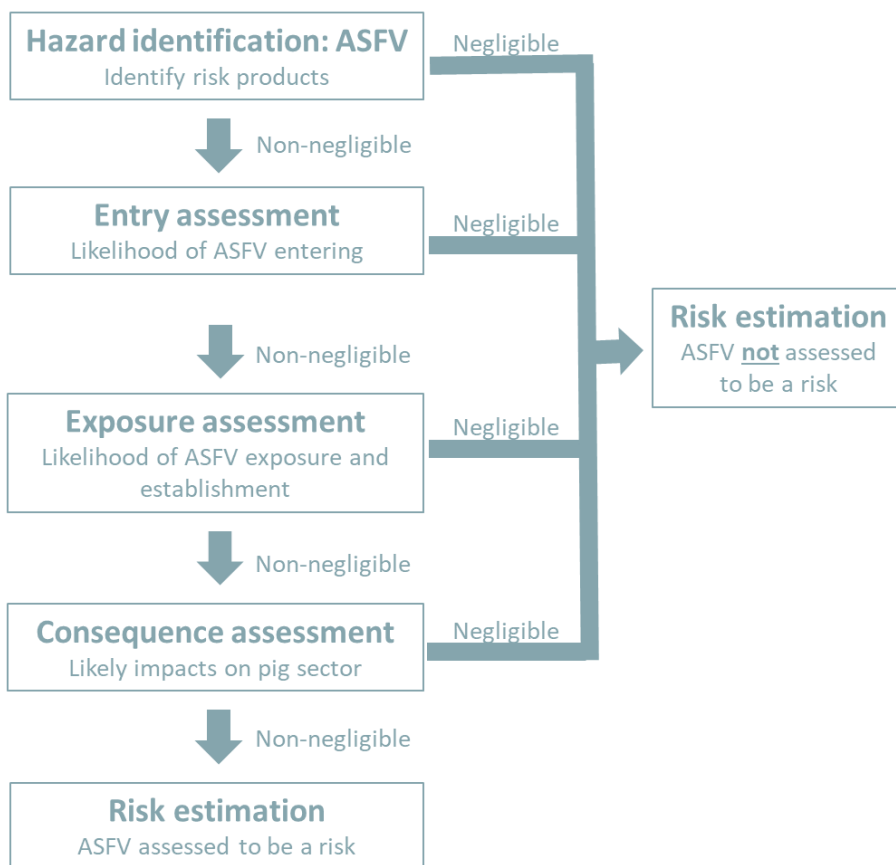
The methodology used in this mission follows the WOAHA (formerly known as OIE) import risk analysis framework (OIE, 2010) and the New Zealand Biosecurity Risk Analysis guidelines (Biosecurity New Zealand, 2006). The terminology used for risk attributes and descriptors is provided in Table 7. The import risk analysis process is shown in Figure 6.

Table 7. Terminology for Risk Attributes and Descriptors (Biosecurity New Zealand, 2006)

Risk Attributes	
- Negligible	Not worth considering; insignificant
- Non-negligible	Worth considering; significant
Risk Descriptors	
- Very Low	Close to insignificant
- Low	Less than normal level
- Medium	Around normal level
- High	Extending above normal level
- Very high	Well above normal level

Source: Biosecurity New Zealand. 2006. Risk Analysis Procedures, Version 1. Cited 31 May 2022. www.mpi.govt.nz/dmsdocument/2032/direct

Figure 4. Import risk analysis process; Source: elaborated by the authors.



3.1.1 HAZARD IDENTIFICATION

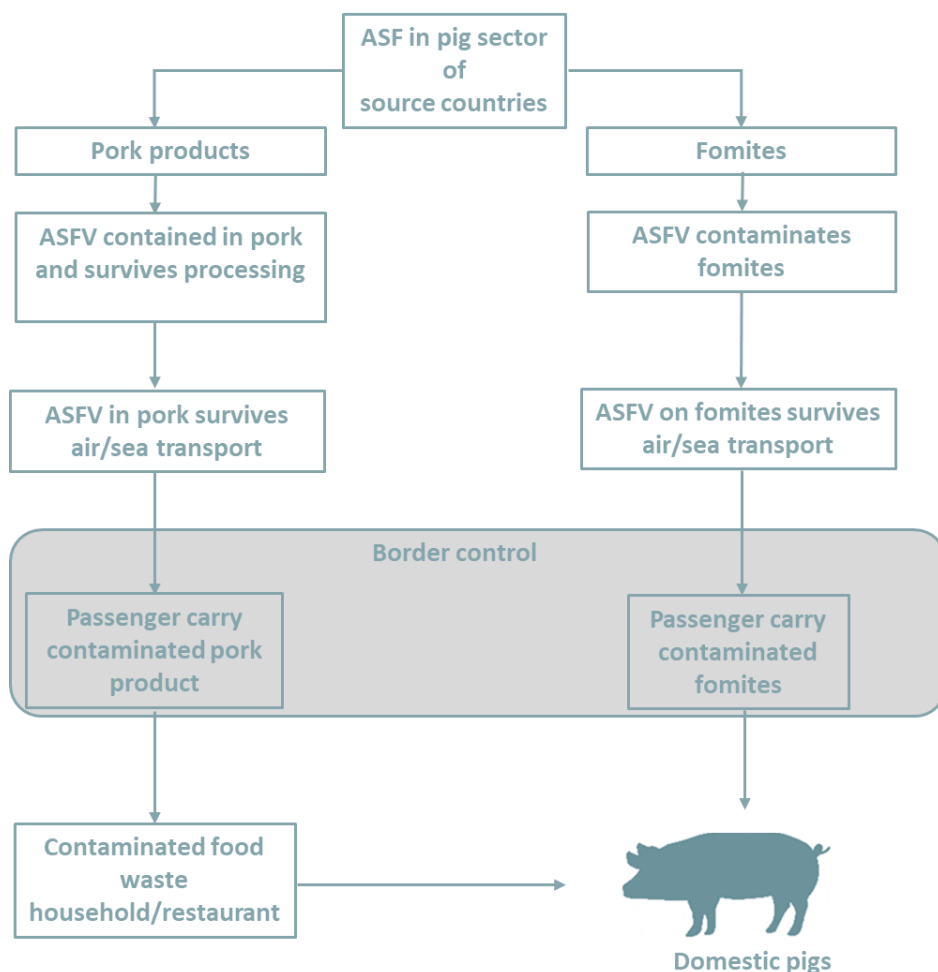
ASFV is known to be exotic to the Cook Islands and identified as a potential hazard. Thus, the main goal for this step is to identify risk products/items from ASF affected countries that could be contaminated with ASFV and enter any state of the Cook Islands. According to the latest WOAHS World Animal Health Information System (WAHIS), ASF was reported in Africa, the Eastern part of Europe, Russian Federation and 17 countries in Asia, including China, Mongolia, Viet Nam, Cambodia, Democratic People’s Republic of Korea and Republic of Korea, Myanmar, The Philippines, Timor-Leste, Indonesia, Papua New Guinea, India, Malaysia, Bhutan, Thailand and Nepal (FAO, 2022; OIE, 2020). ASFV can be transmitted directly or indirectly via pig-to-pig, feed-to-pig and fomites-to-pig (Guinat *et al.*, 2016). It was assumed that pork meat products, pig feed, and contaminated fomites from these regions would pose a non-negligible risk of ASF introduction into the Cook Islands.

3.1.2 ENTRY ASSESSMENT

The Cook Islands is an island country located some distance from its nearest neighbour. Therefore, ASFV entry into the Cook Islands would be limited to the international air and seaports. The ASFV could enter the country through contaminated pork meat products and fomites from the passenger. Figure 7 summarises the pathway by which ASFV might enter the Cook Islands.

According to information from government agencies, live pigs are rarely imported to the Cook Islands and so the pathways was not examined. Also, a pre-departure health treatment specified on the Import Health Standard is required for all the imported animals to the Cook Islands. Pork meat and meat products (i.e. pork cuts, ham, shoulder and pork luncheon meat) are imported mainly from the United States of America, New Zealand, and Spain (up to 141 tonnes per year), and to date, there has been no ASF outbreak reported from Therefore, it is less likely for ASFV to be introduced to the Cook Islands via pork products importation through the legal channel.

Figure 5. The risk pathway of African Swine Fever virus into the Cook Islands; Source: elaborated by the authors.



As there is no importation of pork or pork products directly from ASF infected countries, ASFV could be introduced into the Cook Islands via passengers illegally brings infected pork products at international arrival. All passengers must fill in arrival cards and declare whether they carry food items. While manually searching arriving passengers' luggage for declared passengers and X-ray inspection of random passenger were prescribed, the process could miss pork products. A Biosecurity officer narrated that they confiscated up to 14 kg of pork meat from passengers during 2019. Unconstrained imports of pork products, either accidentally by tourists from affected countries or intentionally by smuggling the products for personal or commercial use, presents a continuous threat for ASF introduction (Wooldridge *et al.*, 2006).

The ASFV can also be carried on clothing or footwear that could have contact pigs in the source country. Such risky fomites are not being cleaned and disinfected at arrival. In addition, the virus can persist for several days on fomites, particularly if protected by organic matter (Bellini, Rutili and Guberti, 2016). Therefore, anyone who had contact with an infected area, such as walkers, hunters or farmworkers visiting/returning to the Cook Islands, could bring contaminated fomites into the country. According to the Biosecurity offices, before the COVID-19 pandemic, more than 100 000 passengers arrived in the Cook Islands each year. Most passengers were returning residents or travellers, mostly from New Zealand followed by Australia and the United States of America. However, it is uncertain how many passengers are from Asia or Europe, where ASF is currently endemic in some parts. Given the possibility that passengers arriving from ASF endemic regions cannot be ruled out, international travellers could carry infected pork products or contaminated fomites into the Cook Islands.

International waste originating from aeroplanes and ships arriving from endemic countries is another important pathway of ASF introduction (Costard *et al.*, 2009). Different maritime transport vessels arrive in the Cook Islands, such as commercial ships with cargo and fishing vessels. Crews and passengers may carry and not declare pork products; containers may be contaminated with viruses, and catering waste may contain contaminated pig meat. However, disposal of catering waste to the Cook Islands from any foreign aircraft and vessel is strictly prohibited by the Biosecurity Act 2008, and the implementation of such regulation was confirmed from the narration of the Biosecurity officer as well as Aviation and Marine officers.

In conclusion, the likelihood of ASFV entry through arrival passengers is non-negligible. It was impossible to quantify the risk because of the limited data on pork meat and products (i.e. type of products, volume) ceased from arriving passengers. Interestingly, some of surveyed government officials (e.g. biosecurity and customs officers) narrated that they had detected pork products a couple of times per year from arrival passengers (before the COVID-19 restriction), whereas other officials (e.g. Airport authority and Port authorities/Marine officers) reported not to have detected such products. The results are unsurprising given that Biosecurity is a key function of all officials.

3.1.3 EXPOSURE ASSESSMENT

Pigs could be exposed to ASFV via feeding of leftover pork meat products or through contact with contaminated fomites from ASF affected countries. From the surveyed farmers, it was narrated that swill feeding without any treatment of heat is quite common in the Cook Islands. As a result, household scraps or food wastes could be contaminated with infected pork meat. Although some pig farmers may cook waste materials before feeding them to pigs, it is difficult to ensure that the traditional cooking over an open fire is sufficient to inactivate the virus. Thermal inactivation at a core temperature of 70°C for a minimum of 30 minutes is required to destroy ASFV (Beltran-Alcrudo *et al.*, 2017).

Feral pigs may play a key role in ASFV exposure. Feral pigs could be exposed to food waste by scavenging food waste with contaminated pork meat products or fomites contaminated by villagers. The growing feral pig numbers suggest they are quite apt at competing for food resources, including scraps. It also suggests that there might be more contacts between domestic and feral pigs for the food waste, which will contribute the spread of ASFV if the virus is introduced to the country. Accordingly, the likelihood of ASFV exposure is non-negligible.

3.1.4 CONSEQUENCE ASSESSMENT

The spread of ASFV in the pig population depends on the speed of transmission and its economic impact. Once established, ASFV spreads rapidly among pig populations. Pig farms in the Cook Islands generally have no or very low levels of biosecurity, a lack of which is recognized as a risk factor for ASF transmission (Sanchez-Vizcaino *et al.*, 2015). Given the trade of pigs as well as crossbreeding with neighbouring farms is common practice in the Cook Islands, the lack of basic biosecurity would enhance the horizontal and local spreading of ASF via pig-to-pig contact opportunities. Local traders could also spread ASFV by travelling between villages and collecting live or slaughtered pigs contaminated with ASFV.

Inadequate home slaughter facilities sewage and waste disposal could be potential infection sources. The guts and trim wastes were normally buried or composted. They could be directly accessible by feral pigs. Due to ASF being absent from the Cook Islands, farmers are entirely unaware of the disease and its transmission mechanisms. Lack of awareness could increase the time from introduction to detection, which would increase the size of the epidemic. It is unlikely that a disease outbreak will be promptly reported to MOA if farmers are unaware of it. Moreover, vehicles for the transport of pigs, pig feed, and equipment may be shared.

Due to the absence of vaccination, rapid detection and timely implementation of control measures, such as pre-emptive culling or fencing, could be one of the most effective ways to prevent the spread of ASF (OIE 2019; Han *et al.*, 2021). In the Cook Islands, in the case of an ASF outbreak, it is speculated that a timely response to prevent the spread of ASF may not occur. A survey from MOA narrated that there is currently no active/passive surveillance system for animal diseases. Also, it was reported that there is no capacity to manage/control/contain an animal disease outbreak in the Cook Islands. In addition, feral pigs are known to be a risk factor for ASF sustainability (Mur *et al.*, 2016) as these animals are at high risk of contact with household food waste and wild pigs. Therefore, feral pigs could pose an additional risk of ASF spread in the Cook Islands.

The domestic pig population of the Cook Islands consists of approximately 14 000 animals reared on more than 1 300 properties, mostly backyard piggeries (Ministry of agriculture, 2014). Pigs are an integral component of the agriculture of the Cook Islands. They have cultural values and provide food security, high-protein nutrition, and financial assets. The socio-economic consequences of introducing and establishing ASF for the Cook Islands pig sector must be regarded as extreme. In the event of an ASF outbreak, the rapid slaughter of pigs and proper disposal of pig carcasses are required to control the disease (OIE, 2019). The mortality and mass culling could substantially reduce pig numbers and limit pig meat supply to the local restaurant. Destruction of large numbers of pigs would cause significant socio-economic losses to threaten food security, culture, and livelihood in the Cook Islands.

In conclusion, the socio-economic consequences of an ASFV introduction were assessed to be very high, thus non-negligible.

3.1.5 OVERALL RISK ESTIMATION

The likelihood of an ASFV introduction and its exposure were both regarded to be non-negligible. The consequences of ASFV spread and its economic impact are considered very high and non-negligible. Therefore, ASF is considered to pose a risk to the Cook Islands.

4. Recommendations

4.1.1 REDUCING THE LIKELIHOOD OF ASF ENTRY

The main pathways for entry of ASFV into the Cook Islands are pork products. The less likely but non-negligible pathway was through contaminated fomites (boots, gears). These could enter via cargo, package and passenger's luggage. To reduce the likelihood of entry, we recommend:

- Passengers should be instructed to declare food products to the biosecurity officer on arrival or dispose of the product in the designated bins in the arrival hall.
- Passengers should be instructed to declare to the biosecurity officer if they have visited any farms recently (30 days). The Biosecurity services should inspect any clothing or footwear they have with them that was worn on the farm. Dirty clothing or footwear should be disinfected or confiscated.
- To improve compliance, passengers found to not be truthful on their declaration form should be fined.
- Promotional material should be placed in highly visible locations in arrival halls and at baggage carousels of airports to increase awareness of incoming passengers about pork products that can carry ASF and the importance of ASF to the Cook Islands.
- Ensure the practice of disposing of confiscated products in high-temperature incinerators.
- Increase awareness and provide training on ASF prevention, including the importance of biosecurity measures and penalties for non-compliance to relevant stakeholders (Farmers, businesses, the public, Biosecurity services, Customs, Airport Authority and Ports Authority).
- Strengthen biosecurity procedures and infrastructure to ensure that all baggage is x-rayed and manually searched if suspect items are visible on x-ray.

4.1.2 REDUCING THE LIKELIHOOD OF ASF EXPOSURE

From risk analysis, pigs raised in the Cook Islands would primarily be exposed to ASFV via waste feeding of meat scraps with ASFV present. The consultants recommend a public awareness campaign focused on the negative impacts of ASF and highlighting the need to 1) avoid feeding meat waste to pigs and 2) cook waste for food waste should be thoroughly cooked to reach the core temperature of 70°C for 30 minutes. While it would be preferable to avoid swill feeding altogether, that is not realistic given the cost and availability of commercial feed. Public awareness, including social media, TV, radio, printed materials, posters and organize meetings for those who raise pigs as well as the public should focus on encouraging the separation of meat from vegetable waste. Consideration should be given to implementing a ban on the feeding of meat.

4.1.3 REDUCING THE SIZE OF AN OUTBREAK

In the event of an ASF outbreak, the key to preventing further spread is early detection. Effective prevention requires a monitoring and surveillance system, facilitating early detection and timely intervention. Sufficient budget and personnel resources must be allocated to motivate early reporting,

implement active disease investigation, and control, and organize access to laboratories capable of diagnosing ASF. MOA should provide information for veterinary paraprofessionals and livestock owners to recognize ASF and report promptly. Those who care for pigs need to be aware of the signs of ASF and be given clear information as to who they need to notify if suspicious. Ways to raise awareness include social media, TV, radio, printed materials, posters and organize meetings with those responsible for caring for pigs.

Once infected with ASF, all animals on the infected property, whether affected or unaffected, must be destroyed and disposed of correctly to prevent further spread. The Cook Islands government need to train and equip sufficient personnel for rapid culling and carcass disposal and cleaning and disinfection in the event of an outbreak. Such an action plan to mitigate the impact of ASF infection would require compliance from pig owners. Therefore, there needs to be a compensation strategy and allocate financial resources to ensure adequate compensation for the removal and disposal of affected pig herds as part of disease control measures.

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Annex 1. Questionnaires and data items

Following data items are submitted in electronic format

1. ASF Import Risk Assessment Questionnaires
2. GEMP questionnaire completed by MOA
3. ESRI shapefile of the Cook Islands administrative division (GADM)
4. ESRI shapefile of the Cook Islands OpenStreetMap (OSM)

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