

Inter-continental Checklists

For supply chain managers of the National Antarctic Programmes for the reduction in risk of transfer of non-native species

Background

Non-native species are one of several major threats to biodiversity globally. They have already profoundly transformed the biodiversity of many sub-Antarctic islands, and are increasing in their prevalence in the Antarctic. Indeed, the threat of non-native species introductions has been identified as a priority Antarctic conservation concern by the Committee for Environmental Protection (CEP) within the Antarctic Treaty System. The CEP Non-Native Species Manual (https://www.ats.aq/documents/ATCM40/att/atcm40_att056_e.pdf) provides guidance and resources to address risks posed by non-native species. The Scientific Committee on Antarctic Research (SCAR) and the Council of Managers of National Antarctic Programmes (COMNAP) are working with the CEP to reduce the threats posed by non-native species introductions.

Globally, experience has shown that prevention of unintended or accidental introduction of non-native species is the most appropriate means of reducing the risks posed by them: if the species are not introduced they cannot go on to colonize an area and have an impact.

These guidelines provide details on actions that can be undertaken to address the key pathways and vectors of non-native species introductions into the region, outline why the actions are recommended (the “rationales”), and provide guidance on the relative importance of each action in terms of practicability and reduction of risk of non-native species transfer. The importance ranking, from one star being the lowest to three stars being the highest, is a general guide. Given the range of environments that exist in the Antarctic region, the high importance of an action may not necessarily apply to all areas of the Antarctic. As further information becomes available and as the practicability of procedures to reduce the risks of introduction of non-native species improves, so these checklists will evolve.

Rationale for suggested actions for **ships** travelling to Antarctica

External doors and windows closed whenever possible ***

Insects are attracted to lights such as those used to illuminate ships at night for security purposes and may subsequently establish populations on the vessel that later become a source of infestation in the ships’ stores or grey water systems. These insects can be transferred to Antarctic locations by passengers, on food, or by onshore winds when the vessel is at anchor or docked. Keeping external doors and windows closed while the ship is docked is recommended.

Rat guards in place on mooring lines **

Rats and mice are known to have devastating effects on the sub-Antarctic islands where they have been accidentally introduced, including in recent times. Ensuring there are no rodents present on board the ship eliminates this introduction pathway.

Gang plank lifted at night or, if lowered, lit with flood lights, particularly at dawn and dusk **

Rats and mice may board ships via the gang plank. To avoid this, the gang plank should be raised at night, and bright lights should illuminate the area between the ship and wharf. However, although illumination deters rats, lights on the ship tend to attract insects and therefore it is critical that insect traps are in place.

Insect traps in place in food storage areas **

Insects will congregate in food storage areas that provide nutrients and suitable microclimate conditions. To avoid infestation of ships' supplies and possible transfer to Antarctic locations, ultra-violet electric fly killers, insect sticky traps and crawling insect traps should be used to reduce numbers of individuals and slow or halt population growth within the stores.

Old food removed from food storage areas at the end of each voyage **

Insects and other invertebrates are commonly found amongst stored goods. Populations of invertebrates can reach considerable numbers over the duration of a voyage and fungus can grow on rotting food and act as a source pool to infect new supplies - thus perpetuating the cycle of infestation. Cleaning storage areas and removing old food is recommended at the end of each voyage.

Hold fumigated **

Insects, spiders and other invertebrates may have infested hold cargo during packing, especially if cargo was packed outdoors. Fumigating holds after cargo has been loaded and immediately before sailing can significantly reduce the risk of introduction via this pathway.

Inside watercraft cleaned **

Passengers and crew often carry soil and seeds on their equipment, clothing and footwear, which can dislodge during small boat operations. To avoid cross-contamination between voyages and/ or sites, watercraft should be brushed or vacuumed to remove organic matter, and washed using a biocide such as Virkon® F10 or dilute bleach.

Hulls of watercraft cleaned before loading **

If zodiacs, barges, ships' tenders and other small watercraft have spent extensive periods in the water, they may have become fouled. Watercraft should be drained and cleaned or treated before use in the Antarctic and between sites where practical.

Footwear disinfection systems available *

The availability of trays, brushes, and pressure washing equipment on the ship will provide the ability to clean footwear before each embarkation and disembarkation.

Rationale for suggested actions for aircraft travelling to Antarctica

Inside aircraft clean ***

Passengers and crew often inadvertently carry soil and seeds on their equipment, clothing and footwear that can dislodge in aircraft; aircraft should be cleaned thoroughly between flights. Particular attention should be paid to vacuuming carpeted or upholstered surfaces where soil or propagules could become engrained. Footwear cleaning pads are suggested for passengers and crew disembarking aircraft.

Landing wheels or skids clean ***

Soil and plant material can become entrained in the wheels of aircraft. Particular attention should also be paid to the skids of helicopters that have been used to deploy field parties to or from ice-free areas, or aircraft that have landed on loose surfaces.

Lighting minimized during night-time loading ***

If it is necessary to have doors open at night for cargo loading operations, turn lights off where possible. If it is necessary to have lights on, flying insect traps should be installed.

Doors closed whenever possible **

Insects are attracted to CO₂, heat sources during the day, and light sources at night therefore they may become trapped in aircraft. These insects may be able to survive for long periods on the aircraft if suitable microclimatic conditions are found, such as amongst cargo, in the galley or passengers' luggage.

Insecticide spray available **

A pyrethroid-based insecticide will kill insects, spiders and most invertebrates that are accidentally carried on board, and prevent their escape and colonisation in Antarctica. This precaution is particularly important if the aircraft is carrying fresh produce and can be used pre-flight or in case insects are discovered in flight.

Rationale for suggested actions for handling cargo bound for Antarctic destinations**Area surrounding stores is clear of vegetation *****

The majority of seeds that become entrained in cargo come from areas immediately surrounding storage facilities. Removing vegetation and eliminating weeds from the surrounding area will substantially reduce seed pressure and lessen the likelihood of insects, rodents and birds congregating and contaminating cargo. It is important to keep the area clear year-round, but particularly in the months immediately before the start of supplying cargo to Antarctic destinations.

Loose and palletised cargo minimized. Cargo containers or storage bins with lids preferred ***

Cargo that is packed on pallets or is loose has a high surface area to volume ratio compared to containerised cargo. It therefore has more surface available for seeds and insects to become entrained. In addition, it is more difficult to clean cargo that is consigned in this way. If containers are not an available option, then closed, secured storage bins can be used.

Wooden crates and pallets meet International Plant Protection Convention (IPPC) Standards ***

A major potential pathway for the introduction of non-native fungi into Antarctica is on wood. It is recommended to consider as far as possible that all wooden packaging materials used meet the IPPC's International Standards for Phytosanitary Measures (2002), enacted to minimise this risk. If pallets are being used that have been in storage for a long period, ensure they are clean and have had recent or periodic fumigation treatment.

Tracks and wheels of all vehicles clean. Closed spaces (such as engine compartment) checked ***

Transported vehicles have the potential to act inadvertently as vectors that can carry biological organisms over large distances to areas where they are not normally found. Immediately before

being loaded onto the ship or aircraft for transportation, all vehicles should be checked by a designated person to ensure they are free of soil and biological material. If any soil or biological material is found, the contaminated vehicle should be cleaned and re-inspected before being transported. Where practical, hot washing with high pressure hoses or steam cleaning is recommended. Pay attention to wheels, wheel arches, tracks and areas underneath the vehicle and clean manually with a brush and water to remove all soil and debris. Also immediately before loading and where practicable, vehicles should have their engines started before loading, to ensure rats and mice are not living in the engine compartments.

Rodent and insect trapping in cargo facilities **

As for ships, the likelihood of cargo infestation can be reduced by the deployment of rodent traps, ultraviolet fly killers and insect traps.

Shipping containers washed inside and out **

Pressure washing the inside and outside of shipping containers is recommended in case seeds, insects, spiders, wind-blown soil, have become entrained in containers while they have been standing empty in storage facilities. Containers should be washed and stored on concrete or similar hard surfaces, rather than soil. If cargo is not containerised, loose or palleted cargo should be washed and stored inside or, if outside, then set on a clean, sealed surface and in a dry environment to avoid proliferation of fungi and bacteria. Inspect the storage area regularly.

Warehouse doors and windows closed where possible **

Some seeds have dispersal mechanisms that allow them to travel on air currents and may blow through open doors and windows and land on cargo. Closing doors reduces exposure. Where practicable, installation of insect nets can minimise entry of insects or wind-blown seeds.

Cargo sorted inside where possible *

Seed rain from the air, bird feathers and droppings and general detritus can fall on cargo that is stored outside, significantly increasing the number of propagules that can become entrained. Store cargo inside on clean, sealed surfaces.

Containers packed on a clean sealed surface *

Foreign materials can be easily identified if present on a sealed surface such as bitumen or concrete. Such surfaces are easily cleaned to ensure no weeds, rodents, soil and waste contaminates the containers.

Inside of vehicles cleaned *

Seeds, soil and the like could be entrained inside the vehicle; these are not easily removed by water. Therefore, vacuuming is needed to ensure any foreign materials are removed.

Rationale for suggested actions for handling food bound for Antarctic destinations

Packing area is rodent-free and packaging is rodent-proof ***

Rodents are attracted to areas of resource abundance such as food packing areas. To prevent their accidental transport to Antarctic destinations, it is essential to ensure that rodent traps are in place and packaging is rodent proof.

Produce is free of soil***

Soil can harbour micro-organisms and fungus and therefore only washed or brushed produce should be sent to Antarctica. Onions, root vegetables and near-ground crops such as brassicas and pumpkins potentially harbour the greatest amount of soil and should therefore be targets of spot checks. Dry or frozen produce may be an alternative in some cases.

Quality checks on food to ensure no insect or fungal infestation before loading ***

Fresh produce, in particular leafy produce such as lettuce, celery and cabbage, can be infested with many thousands of insects and may contain fungal infection. Produce is ideally inspected by quarantine officers or other appropriately trained personnel, before loading. If soil or viable biological organisms are found, the problem produce should be replaced, or rejected for transportation until cleaned/treated and re-inspected.

Remove decayed food before transportation to Antarctica ***

Decayed food contains microbes that could be potentially harmful to the environment. Therefore, only fresh produce should be sent to Antarctica. Anything that looks decayed should be removed and not sent to Antarctica. Instruct those in Antarctica, present when food arrives, that any decayed food should be incinerated if such facilities are available, or tightly sealed and sent back.

Flying and crawling insect traps in place **

Insects are at their highest abundances in food storage areas as they provide nutrients and suitable microclimatic conditions. To avoid infestation of warehouses and food stores, ultra-violet electric fly killers, insect sticky traps and crawling insect traps should be installed to reduce numbers of individuals and slow or halt population growth within the stores.

Refrigerate fresh produce **

At low temperatures entrained species will take longer to complete their life cycle than at higher temperatures. Refrigerating dry, fresh produce will therefore slow the development of any species that are present in the food and prevent populations reaching levels that pose a high invasion risk. Low food storage temperature will also inhibit the growth of fungi that spoils food for human consumption. Inspect refrigeration systems regularly to ensure they are working properly. Where long transit times for fresh produce are predicted, only fresh foods likely to remain unspoiled should be carried.

Designated clean area for packing food **

Pest species are attracted to areas of high resource abundance. Keeping the area around food packing clean and free from potential sources of infestation will reduce the probability of insects and spiders becoming entrained in food that is being packed.

Avoid out-of-season produce *

Produce that has been in cold storage for long periods has a higher probability of containing fungal spores that under the correct conditions may grow and result in produce's spoilage during shipping. Use of the high quality frozen foods that are now often available can greatly reduce non-native species threats.

Rationale for suggested actions for **expeditioner's gear** sent to Antarctic destinations

Supply new clothing where possible ***

The most effective way to ensure that seeds and soil do not enter the Antarctic with clothing is to issue expeditioners with new clothing for each trip. Where a complete new set of clothing cannot be issued for every trip operators should consider issuing new socks and over-trousers that can be especially difficult to clean.

Ensure all clothing and footwear is washed to remove organic material ***

Washing issued clothing according to manufacturers' instructions (typically low temperature and specialised detergent), and cleaning footwear with a brush and a biocide such as Virkon® or dilute bleach will remove some seeds and the majority of soil and organic material that may pose an invasion risk. However, washing at these temperatures is unlikely to kill seeds and these will need to be removed manually. Cleaning of equipment and tools carried by expeditioners is also important, especially if recently used in other polar environments and areas.

Ensure all other equipment is cleaned prior to packing ***

Expeditions should check their gear, including scientific equipment, prior to packing for transportation to Antarctica and between Antarctic locations. While out in the field, bags and other personal items, such as laptop cases, camera cases, backpacks, and tripods, can readily accumulate soil and organic matter, including seeds, that may then be transported to Antarctica.

Visually check all gear and remove seeds **

Washing alone does not remove all seeds from clothing. All outer clothing should be inspected and any seeds that are found should be removed with a vacuum cleaner or tweezers. Particular attention should be paid to socks and over-trousers as considerable numbers of seeds have been found in these items. Bags and footwear, especially those used previously should also be checked thoroughly.

Pay particular attention to items with Velcro® *

Items with Velcro® harbour greater numbers of seeds than those without Velcro®. Although these deeply entrained seeds may be unlikely to be expelled into the environment it is prudent to remove them.