

Checklists



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

for **ships** travelling to Antarctica

for **aircraft** travelling to Antarctica

Action	Importance	✓
Rat guards in place on mooring lines	★★★	
Gang plank lifted at night or, if lowered, lit with flood lights	★★★	
External doors and windows closed whenever possible	★★★★	
Insect traps in place in food storage areas	★★★	
Old food removed from food storage areas at the end of each voyage	★★★	
Hold fumigated	★	
Inside watercraft cleaned	★★★	
Hulls of watercraft cleaned before loading	★	

Action	Importance	✓
Inside aircraft clean	★★★★	
Landing wheels or skids clean	★★★★	
Doors closed whenever possible	★★★	
Lighting minimised during night-time loading	★★★★	
Insecticide available in case insects etc. are discovered in flight	★★★	



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 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 introductions to the Antarctic region.

Globally, experience has shown that prevention of the 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. Recent work, including that of the 'Aliens in Antarctica' project undertaken during the International Polar Year, has identified the key pathways and vectors of non-native species introduction into the region.

Based on this research, and operator experience and consideration of what immediate actions can be taken by operators to reduce the risk of transfer of non-native species to the Antarctic, the checklists set out here have been developed. This document suggests actions that for many operators, can readily be taken, outlines why the actions are recommended, and provides 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.

It does not address however, the specific reduction of risk of introduction of microbiota, nor the reduction in risk of transfer of diseases. 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 measures for ships travelling to Antarctica

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 modern times. Ensuring there are no rodents present on board the ship, eliminates this introduction pathway, noting that Antarctic vessels often travel to the continent via sub-Antarctic islands.

Gang plank lifted at night or, if lowered, lit with flood lights

Rats and mice may board ships via the gang plank. To avoid this, the gangway 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.

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 and later become a source of infestation in the ships' stores or grey water systems. These insects can be transferred to Antarctic locations on food or by onshore winds when the vessel is at anchor or docked.

Insect traps in place in food storage areas

Insects will congregate in food storage areas that provide nutrients and suitable microclimatic conditions. To avoid infestation of ships' supplies and possible transfer to Antarctic locations, ultraviolet 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.

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

Insects and the like 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.

Hold fumigated

Insects, spiders and the like may have infested hold cargo during the packaging procedure especially if cargo was packed outdoors. Fumigating holds after cargo has been loaded and immediately before sailing could 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 cleaned using a biocide such as Virkon® 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 cleaned or treated before use in the Antarctic.

Rationale for suggested measures for aircraft travelling to Antarctica

Inside aircraft clean

Passengers and crew often inadvertently carry soil and seeds on their equipment, clothing and footwear which can dislodge in aircraft; aircraft should be cleaned thoroughly between flights. Particular attention should be paid to vacuuming carpeted or upholstered surfaces where soil could become engrained.

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.

Doors closed whenever possible

Insects are attracted to light sources at night and 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 or passengers' luggage.

Lighting minimised 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.

Insecticide available in case insects etc. are discovered in flight

A pyrethroid-based insecticide will kill insects and the like 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.

Rationale for suggested measures for stores supplying cargo to Antarctic destinations

Area surrounding stores free from weedy plants

The majority of seeds which become entrained in cargo come from areas immediately surrounding stores. Eliminating these populations of local weedy plants either by mechanical removal or use of, for example, a glyphosphate-based herbicide, will substantially reduce seed pressure.

for stores supplying **cargo** to Antarctic destinations

for stores supplying **food** to Antarctic destinations

for **expeditioners' gear** sent to Antarctic destinations

Action	Importance	✓
Area surrounding stores free from weedy plants	★ ★ ★	
Shipping containers washed inside and out	★ ★	
Loose and palletised cargo minimised	★ ★ ★	
Wooden crates and pallets meet International Plant Protection Commission standards	★ ★ ★	
Tracks and wheels of all vehicles clean	★ ★ ★	
Warehouse doors closed where possible	★ ★	
Cargo stored inside where possible	★ ★	

Action	Importance	✓
Designated clean area for packing food	★ ★	
Packing area is rodent-free, packaging is rodent-proof	★ ★ ★	
Flying and crawling insect traps in place	★ ★	
Produce is free of soil	★ ★ ★	
Quality checks on food to ensure no insect or fungal infestation before loading	★ ★ ★	
Refrigerate fresh produce	★ ★	
Avoid sourcing out of season produce	★	

Action	Importance	✓
Supply new clothing where possible	★ ★ ★	
Supply clothing and footwear not previously used in polar or alpine climates	★ ★	
Ensure all clothing and footwear is washed to remove organic material	★ ★	
Visually check all bags, footwear and clothing (particularly socks and over trousers) and remove entrained seeds	★ ★	
Pay particular attention to items with Velcro®	★	

An information video outlining cleaning procedures can be found at: http://academic.sun.ac.za/cib/video/Aliens_cleaning_video%202010.wmv

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, etc, have become entrained in containers while they have been standing empty in stores. Containers should be washed and stored on concrete or similar hard surfaces, rather than soil.

Loose and palletised cargo minimised
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 which is consigned in this way.

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. Ensuring that all wooden packaging materials meet the IPPC's International Standards for Phytosanitary Measures minimises this risk.

Tracks and wheels of all vehicles clean
In particular, tracks and wheels of vehicles, especially those which have been used previously, can harbour significant volumes of soil, seeds and live insects and the like which should be removed before shipping.

Warehouse doors closed where possible
Some seeds have dispersal mechanisms that allow them to travel on air currents and may blow through open doors and land on cargo.

Cargo stored inside where possible
Seed rain from the air, bird feathers and droppings and general detritus can fall on cargo which is stored outside, significantly increasing the number of propagules that can become entrained.

Rationale for suggested measures for stores supplying food to Antarctic destinations

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 etc. becoming entrained in food which is being packed.

Packing area is rodent-free, 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.

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.

Produce is free of soil
Soil can harbour micro-organisms and fungus and therefore only washed or brushed produce should be sent to Antarctica. Root vegetables such as potatoes and carrots and near-ground crops such as brassicas and pumpkins potentially harbour the greatest amount of soil and should therefore be targets of spot checks.

Quality checks on food to ensure no insect or fungal infestation before loading
Fresh produce, in particular leafy produce such as lettuce 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.

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

Avoid out-of season produce
Produce which has been in cold storage for long periods has a higher probability of containing fungal spores which under the correct conditions may grow and result in produce's spoilage during shipping.

Rationale for suggested measures for expeditioners' gear sent to Antarctic destinations

Supply new clothing where possible
The most effective way to ensure that seeds, soil and the like 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 which can be especially difficult to clean.

Supply clothing and footwear not previously used in polar or alpine climates
Equipment which has been used in cold climates for previous expeditions or field training may be entrained with seeds etc. adapted to those climatic conditions. Such species have a greater chance of successfully establishing in the Antarctic.

Ensure all clothing and footwear is washed to remove organic material
Washing 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 which may pose an invasion risk. However, washing at these temperatures is unlikely to kill seeds and these will need to be removed manually (see below).

Visually check all bags, footwear and clothing (particularly socks and over-trousers) and remove entrained 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.