



XXXIII Antarctic Treaty Consultative Meeting
3rd to 14th May, 2010

Punta del Este - Uruguay

WP 4

Agenda Item: CEP 8a

Presented by: SCAR

Original: English

Preliminary Results from the International Polar Year Programme: Aliens in Antarctica

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Introduction

Non-native species have rapidly risen to the fore as one of the major concerns facing conservation in the Antarctic Treaty area, and have been well recognized as such by the CEP (reviewed in Rogan-Finnemore 2008 and ATCM XXXII SP11).

Further to assess propagule pressure (e.g. numbers of seeds, spores, reproductive adult organisms) and the vectors (e.g. baggage, clothing, containers) and pathways (e.g. Australia to Antarctica via air or via sea), in as integrated a fashion as possible, across the region, an international consortium of researchers undertook the *Aliens in Antarctica* project as part of the International Polar Year (see ATCM XXX IP 49).

Consortium members, with the assistance of national operators, COMNAP, IAATO members, other participants, and a range of volunteers undertook standardized sampling using methods developed from scientific best practise and accepted in the published scientific literature (e.g. Whinam et al. 2005; Lee & Chown 2009; Hughes et al. 2010).

This paper reports on the preliminary analyses of data on vascular plant seeds carried by visitors to the region. This forms a major part of the IPY *Aliens in Antarctica* project.

In summary the following sampling was undertaken:

- a) Most categories of Antarctic visitors: ship's or aircraft crew, tourist, tourist support personnel, field-based scientist, station- or ship-based scientist, field-based national programme support personnel, and station- or ship-based national programme support personnel.
- b) Different classes of vessels/aircraft: aircraft, national programme ship, small tourist ship (40-80 passengers), medium-sized tourist ship (81-200 passengers), large tourist ship (> 200 passengers).
- c) Different routes/pathways: that is, departing from South America, South Africa, Australia and New Zealand, and from elsewhere.
- d) Different categories of personal gear (e.g. clothing, bags).
- e) Questionnaires established from visitors the geographic areas and major ecosystems they had visited prior to the Antarctic voyage, previous use of clothing and other items, and information on the date and port of departure.

Outcomes

A total of 850 people, travelling on 23 different ships and aircraft, from many different voyages, was sampled. Approximately half of the sampled people were involved in national Antarctic programmes (11 ships/aircraft and 40 voyages), and half from tourist operations (12 ships and 37 voyages). Five thousand questionnaires were completed further to assess patterns of travel history.

Approximately 30% of the visitors sampled carried plant seeds. Initial analyses indicated that the categories 'ships crew' and aircraft crew' and 'tourists' had the lowest proportion of visitors carrying seeds, whereas 'field-based scientist' and 'tourist support personnel' had the highest proportion of visitors with seeds present (Table 1).

Table 1 – Proportion of members carrying seeds in each of the visitor categories sampled.

Category	Number of visitors sampled	Seeds present (%)	No seeds present (%)
Ship's or aircraft crew	18	11	89
Tourists	361	21	79
Tourist support personnel	26	54	46
Field-based scientist	120	53	47
Station- or ship-based scientist	87	43	57
Field-based national programme support personnel	39	46	54
Station- or ship-based national programme support personnel	147	41	59

Using habitats visited (national parks/nature reserves, rural/agricultural areas, parklands/botanical gardens, Arctic areas, alpine/high altitude areas, and sub-Antarctic/Antarctic areas) as explanatory variables, statistical modelling demonstrated that a higher proportion of visitors who had been to national parks/nature reserves and/or to the Antarctic in the year before their Antarctic voyage carried seeds than those who had visited other habitats. For visitors who **had not** visited national parks/nature reserves or sub-Antarctic/Antarctic areas, the estimated proportion with seeds was 20%. For those who had visited national parks/nature reserves this proportion was 33%, for those who had been to the sub-Antarctic/Antarctic it was 32%, and for those who had visited both kinds of sites the proportion was 46%.

In terms of previous visits to the world's biogeographic regions undertaken by visitors prior to them travelling to the Antarctic in the current survey, those who had visited the Neotropics (South America) and/or the north-eastern or south-western Palaearctic carried seeds less frequently than on average, while those that had been to the Antarctic, the north-western Palaearctic (NW Europe), Australasia and/or the southern Afrotropics carried seeds more frequently than on average. That Antarctic visitors who had previously visited the Neotropics had a lower proportion carrying seeds than others may well have to do with the fact that the majority of the tourists surveyed for this study – who, as already shown, carried seeds less often than most other visitor categories – travelled to Antarctica via this region.

Port or area of departure also had an influence on proportion of individuals carrying seeds. The statistical modelling showed that visitors departing from Japan and South America were less likely to carry seeds than those departing from other areas. For South America (estimated proportion = 11%) the outcome is likely a consequence of the high proportion of tourists departing from this area. Those departing from Japan (estimated proportion carrying seeds = 0%) represented a single group. Visitors departing from Reunion had the highest proportion of visitors with seeds (estimated proportion = 71%). No significant difference in the incidence of seed-carrying visitors was found between departures from Australia, New Zealand or South Africa (estimated proportion with seeds = 52%). The difference between visitors departing from these regions, and those departing from South America, may well be explained by the fact that in the current survey the latter are mainly tourists, and the former nearly all national programme personnel.

Using season (date of departure, in four periods) as explanatory variables, statistical modelling showed that visitors departing in the austral spring and/or in autumn carried seeds more frequently than those departing in the austral summer, with estimated proportions of visitors with seeds of 58% and 65% for spring and autumn, respectively, and 27% for both summer periods. Unfortunately, these outcomes are confounded by differences in departure areas and visitor types among seasons, and further analyses are underway to explore the complexities of the seasonal effects.

With type of vessel as explanatory variables, statistical analysis showed that visitors on medium-sized and large tourist vessels were relatively unlikely to carry seeds (estimated proportions of 9% and 5%, respectively). On small tourist vessels a much larger proportion of tourists carry seeds (estimate = 37%), while tourists travelling on national programme ships or aircraft were very likely to carry seeds (estimated

proportion = 71%). In our survey, the latter all represented tourists departing from Australia, New Zealand or Reunion.

Preliminary, though far from complete, analyses of baggage and clothing items indicate that camera bags, back packs, and footwear showed a higher frequency of seeds than did other items of clothing or personal equipment. This finding is in line with previous work undertaken within the South African and Australian national Antarctic programmes (Whinam et al. 2005; Lee & Chown 2009).

Conclusions

The IPY *Aliens in Antarctica* project is providing empirical information that can be used to refine management approaches to reduce propagule pressure to the Antarctic. The differentiated form of the information (by visitor type, region, previous visits, departure area, vessel type) will prove especially useful for improving methods to reduce risks of non-native species transfer.

These preliminary analyses suggest that the personnel posing the highest risks of non-native species propagule transfer (specifically plant seeds) are those from national Antarctic programmes, tourist support personnel, and tourists travelling with national Antarctic programmes or on small vessels.

Final analyses of the data collected will emerge over the next few years, with much of the original data and images of propagules being made available via the databases managed by the Australian Antarctic Data Centre.

Acknowledgments

The members of the IPY *Aliens in Antarctica* consortium represent a wide range of nations and organizations. Collectively, and through SCAR, the consortium thanks its supporting institutions, as well as the national programme operators, COMNAP, IAATO, and other participants for their patience and support during this project. The consortium is especially grateful to all of the visitors to Antarctica who agreed to take part, in whatever way, in the survey, and to the many volunteers who assisted with data collection.

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