

Bio-invasions on the Balearic Islands

The Balearic Islands were populated by humans sometime between the second and fourth millennium BC. Palaeontology research shows that most of the current terrestrial vertebrates have been introduced and that almost all non-flying pre-human vertebrates have gone extinct, either through human predation or, in most cases, through impacts from introduced fauna. All terrestrial mammals (a small endemic bovid with continuously growing incisors, *Myotragus* – a giant dormouse *Hypnomys* and a giant shrew *Nesiotites*) disappeared a few centuries after the arrival of humans. **Very few other vertebrates have survived:** The endemic lizard from Mallorca and Minorca, *Podarcis lilfordi*, has been extirpated from the main islands and only survives on islets that have remained free of snakes and carnivores. In addition, the Mallorcan midwife toad, *Alytes muletensis* **only** survives in the **few** karst canyons.

The list of species that were introduced in prehistoric or historic times is very long and includes: snakes, green toad, green frog, geckos, turtles, tortoises, hedgehog, rodents, rabbit and hare, goats, genet, pine marten, weasel, etc. Many of these species have been on the Balearic Islands since centuries or even millennia, and form the present ecosystems – as a result, it would be impossible to reconstitute the original (pre-introductions) biodiversity. What is more, some introduced species have developed endemic subspecies that without doubt are of scientific (genetic) interest. Other species, for instance tortoises, green toad or hedgehog, have a conservation value because of their emblematic and popular appeal.

The problem of bio-invasions presents itself differently in the islands with very ancient human presence where there are introduced species that have been integrated into island ecosystems and that have evolutionary value, compared to islands where introductions are relatively more recent and where it is still possible to completely or partially restore local biodiversity. Oceanic islands, inhabited by Europeans since only a few centuries are currently suffering from the same processes that affected the Mediterranean islands during the Greek or Phoenician times. Where the logbooks of Captain Cook or of the Spanish and Portuguese navigators record then introduction of goats on the discovered islands, for the Mediterranean the story of a similar process, often irreversible by now is told by the toponymy of Mediterranean islands – names related to these herbivores (goats) or to rabbits are repeated over and over in this Sea.

However, bio-invasion on the Mediterranean islands should not be considered as nothing but an ancient and irreversible process in all

cases! Species that have been introduced on the islands, even in ancient times, can continue to pose serious threats that must be addressed. This is the case for instance of the viperine grass snake (*Natrix maura*), probably introduced in Roman times in Majorca and Minorca, which constitutes a threat of extinction to the Mallorcan midwife toad in those islands. The restoration plan for this species includes systematic control of the snake.. Equally serious is the threat posed by rats or cats to the colonies of the Balearic shearwater, *Puffinus mauretanicus*. In this case eradication is carried out, especially on the non-inhabited islets where the possibility for restoration of the original biota is higher. In some cases public opinion can be an major issue: for instance in the case of the eradication of the genet from the Cabrera national park (where they were introduced in 1902 and where they prey on endemic lizards and contributed to the extirpation of local shearwater colonies): the project has to be carried out as a live-capture of genets followed by translocation to Mallorca (where they are also introduced but don't seem to cause such serious problems).

It goes without saying that the introduction of species is a continuing and present problem, and not just a historical one. A dramatic example of this is the pine procession moth, *Thaumetopoea pityocampa*, which reached the Balearic islands in the 1950ies and which requires very large resources for control. Another example is the seaweed *Caulerpa taxifolia*, which colonised the Mallorca east coast - it has not been possible to eradicate it in spite of 500,000 Euro spent on this between 1992 and 2002. With regards to other species, there is concern about the proliferation of the monk parakeet *Myiopsitta monachus*., introduced fish, South African plants like *Carpobrotus*, the butterfly *Carcyreu marshalli*, etc. To face bio-invasion, it is crucial that a number of legal, prevention and rapid response measures are implemented, the importance of which has only recently started to be recognised. It is to be hoped that efforts and resources will be sufficient in the future, and will result in successes with regards to this serious problem which is particularly insidious on islands.

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