A CONSERVATION PROGRAMME FOR THE PARTULID TREE SNAILS OF THE PACIFIC REGION

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Abstract


Throughout the Pacific numerous endemic molluse species have either become extinct in the wild or are currently facing the threat of extinction as a result of introduction of the predatory snail *Euglandina rosea* and the New Guinea flatworm *Platydembus manokwari*. Without determined conservation efforts, including the establishment of *ex situ* breeding programmes, much of the region’s endemic snail fauna will be lost. Since 1986 a collaborative international conservation programme has been in place for partulid tree snails. The participating institutions currently maintain a total of 33 taxa in culture (comprising >12,000 snails). The conservation status of all 117 partulid species has been assessed using the Conservation Action Management Plan (CAMP) process. Target *ex situ* population sizes required to maintain 90% of starting heterozygosity over 100 years have been calculated using the analytical model programme CAPACITY (Pearce-Kelly et al., 1994) The genetic management requirements of the breeding programme have necessitated the development of a colony management computer database enabling demographic management and analysis of the populations. The ability of long term captive-bred snails to adapt to natural field conditions was investigated using a trial release and monitoring experiment at Kew Gardens. Field introduction trials via the construction of predator-proof forest reserves were commenced in 1994.

Introduction

An ill-conceived attempt at biological control of the African land snail *Achatina fulica* (using the snail predator *Euglandina rosea* and the New Guinea flatworm *Platydembus manokwari*) has resulted in large numbers of endemic mollusc species becoming extinct, or facing the threat of extinction throughout the Pacific region. Without the establishment of *ex situ* breeding programmes many of these endemic species will face extinction.

The 117 species of Polynesian tree snails of the family Partulidae once spread over a wide group of volcanic islands of the west, central and south Pacific. Each island had its own endemic species, which were often further restricted to individual valleys. The product of extraordinary selective pressures, *Partula* (the largest and most studied genus of the Partulidae) has provided researchers with an invaluable insight to the mechanisms behind speciation (Johnson et al., 1995). In addition to their scientific importance many species of Partulidae are valued elements of the region’s rich cultural heritage.

The introduction of *Euglandina* has had a disastrous effect on the region’s species of Partulidae. *Euglandina* paid scant attention to its intended *Achatina* target preferring to prey on the smaller endemic snails. Extensive field surveys have determined that many partulid species have been preyed to extinction throughout their natural range (Murray and Clarke, 1984; Pearce-Kelly et al., 1994).

In 1986 the international zoo community, in association with IUCN’s Captive Breeding Specialist Group, devised an international conservation programme to establish viable *ex situ* populations of as many endangered partulid species as possible. The programme is currently maintaining in culture 33 taxa (totalling >12,000 individuals) in 18 collections in Europe and North America.

A workshop in 1994 used the Conservation Action Management Plan (CAMP) process (Seal et al., 1994) to assess the conservation status of every species within the Partulidae. This review determined that no species could be considered as being less than endangered and identified 53 species as being in need of urgent captive-breeding assistance (Pearce-Kelly et al., 1994). Because of the intensive culture requirements associated with the Partulidae, together with the large number of species requiring captive-
breeding assistance, the workshop calculated the
target population sizes required to maintain
90% of starting heterozygosity over 100 years
using the analytical model programme
CAPACITY (Flesness and Mace, 1988; Soule et al.,
1986) The results of this exercise suggested
that a minimum of 250 adults, together with
their associated young, need to be maintained
for each species in the breeding programme.

The demographic labyrinth
Maintaining healthy genetic populations of any
species over successive generations requires a
management protocol that takes account of the
major factors that lead to loss of genetic diversity.
These factors are genetic drift (the random
process which results when a limited sample of
genes from one generation is transmitted to the
next), inbreeding depression (mating between
relatives which can result in reduced characters
such as fertility and growth rate), artificial selec-
tion (the disproportionate survival of individu-
als adapted to the prevailing environmental
conditions — in captivity selective pressures
may differ from those in the wild) and disease.
In order to balance these considerations the snail
cultures are maintained along inbred and out-
bred lines with genetic drift and inbreeding
depression being minimised in the outbred lines
while the inbred lines best reduce the risks of
selection pressures and disease.

The taxa in the Partulidae programme derive
not only from different islands but from differ-
ent valleys and collection sites within valleys.
Each of the >100 collection sites represents a
genetically unique population which needs to be
maintained as a separate breeding line. The need
for generation separation and monitoring of the
four developmental stages (defined as new born,
juvenile, subadult and adult) are further manage-
ment complications. These considera-
tions are compounded by the need to maintain
populations as colonies of up to 200 snails, of
mixed age structure. The development of a com-
puterized colony database (CERC1) has, for the
first time, enabled the detailed monitoring and
analysis of demographic trends, and environ-
mental and genealogical data in colony popula-
tions.

Re-establishment
The effectiveness of the breeding programme in
maintaining viable populations was tested in
1994 when a group of zoo-bred Partula tae-
niata was released on to Polynesian plants growing at
Kew Gardens. This 16 month trial suggested
that long term captive-bred Partula populations
have retained their ability to readapt to a natural
environment and diet (Pearce-Kelly et al.,
1995). The latest development has been the
commencement of re-establishment on the
French Polynesian island of Moorea (Murray,
1995). Because of continued predator threat,
this aspect of the programme has involved the
construction of a predator-proof reserve, 20 m
× 20 m, built with cheap locally available
materials, and containing three species of cap-
tive-bred Partula snails (Murray, 1995).

For the foreseeable future, it is not possible to
progress beyond the predator-proof reserve
strategy due to the high numbers of surviving
Euglandina in the habitat. These Euglandina are
feeding on native micro-snails in the leaf litter
and will continue to prevent the full re-establish-
ment of Partula into the wild until effective
predator control measures are developed.

To ensure that the captive snails do not
become diseased, lose their natural resilience to
demic micro-organisms, or introduce alien
microbes when returned to their native habitat,
an extensive screening exercise is in place to
determine the nature and levels of enteric gut
fauna and flora in both the wild and captive
Partula populations.

Other conservation initiatives
Educational material is being produced to help
raise public awareness of the ecological disaster
facing the indigenous snail fauna throughout the
Pacific and, to illustrate how Polynesians can
help prevent further extinctions of endemic moll-
suscs, legislation is being formulated to prohibit
further introduction of alien species into French
Polynesia. These two initiatives are the most
effective conservation action that can be taken
to reduce the likelihood of alien predators being
introduced to islands that have thus far escaped
such disastrous importations.

Conclusion
The extinction of endemic species of mollusc
throughout the Pacific is continuing. Without
concerted in situ and ex situ action, of the nature
outlined above, it can only escalate. The signifi-
cance for conservation of such action is high-
lighted by the number of species currently
afforded a second chance of survival through
captive-breeding programmes. In addition to
benefiting the individual target species, such
programmes are potential conservation models
for many of the more than 1000 IUCN-listed threatened mollusc species.

References