

CRAYFISH ON ATLANTIC ISLANDS - THREAT OR OPPORTUNITY

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ABSTRACT. This paper explores the threat posed by the deliberate or accidental introduction of the freshwater crayfish *Procambarus clarkii* to the Atlantic Islands in view of the degree of endemism which these islands possess. The threat to all the islands is made more immediate by the discovery in August 1993 of a large population of *Procambarus clarkii* in the Azores.

INTRODUCTION

Freshwater crayfish have a wide natural distribution through Europe, Western Asia, North America, Australasia, Madagascar and southern South America. They are naturally absent from much of Asia, all of Africa and most of South America (HOBBS, 1988). As the largest macro-invertebrate in temperate freshwater ecosystems, with some Australian species growing to several kilogrammes, the commercial prospects engendered by their anthropogenic spread, has assured their appearance in much of their non-endemic range (HOLDICH & LOWERY, 1988).

Until 1993 the mid-Atlantic Islands were free of crayfish introductions having been spared the bitter harvest being reaped by some islands as a result of alien invertebrate introductions. The plight of the Hawaiian Islands may serve as a warning. HOWARTH (1985) records some 2,000 alien arthropod species in the Hawaiian Islands with an extra 20 - 30 new ones arriving each year. Only one third of these have been intentionally released, mostly for pest control, pollination, food and other natural products. Hawaii has no native ant species but has 40 alien species which cause particular problems. Three predatory snail species were introduced in the 1950s in the hope of reducing populations of the giant African snail, *Achatina fulica*, a pest species, originally introduced for medicinal and gastronomic reasons, but instead they have caused the decline of native tree snail populations. Other Pacific Islands have experienced the extinction of some snail species for the same reasons. In New Zealand the culture of introduced *Cherax tenuimanus* has been banned and an existing marron farm

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owned by Kuru Aquaculture has been closed down, the stock destroyed and the company compensated following concern that the species might escape into the wild (MAF, 1992).

Crayfish such as *Procambarus clarkii* are highly prolific in suitable waters and the commercial temptation to import them to create a fishery is easy to appreciate when one looks at the production or export figures. In 1992, China exported 1300 - 2000 liveweight tonnes of crayfish, mainly *P. clarkii* to the U.S.A. (Louisiana Crawfish Production and Research Board, 1993) in the form of over 200 tonnes of tailmeat (HUNER, 1993). The 1993 Buyer's Guide for Aquaculture Magazine gives *P. clarkii* production in the USA as 53,000 metric tonnes, China 40,000 metric tonnes, Spain less than 300 metric tonnes and Kenya as under 500 metric tonnes. Chile is beginning to culture one of its own native species *Samastacus spinifrons* (RUDOLPH, 1993). HIPPEL (1993) briefly traces the spread of *P. clarkii* through east Africa. Originally introduced into Uganda by Israeli scientists in the 1960s it passed to Kenya producing massive populations and environmental problems in Lake Naivasha before being introduced into Zambia where it is now cultured (GRUBB, 1993). *P. clarkii* can now be found in countries as diverse as Iran, (HAY, 1992), Egypt (SOLIMAN, 1991), Argentina (LUCHINI, 1993), South Africa (SCHOONBEE, 1993), Thailand (TANGTRONGPIROS, 1991), Italy, Ecuador (ROMAIRE, 1993), Hawaiian Islands, India (NATH, 1993), Costa Rica (THOMAS, 1992), and Majorca (SLATER, 1992) to record but some of those reported in the Newsletter of the International Association of Astacologists over the last few years.

THE DILEMA

Crayfish such as *P. clarkii*, and to some extent some Australian *Cherax* species, are generally easy to grow and harvest, producing an extra cash crop with the minimum of effort, often in the poorer parts of the world where any extra income can significantly improve the native standard of living. As HUNER (1977) said, "The morality of *Procambarus clarkii* (crayfish) introductions can be disputed, but the species is now a great natural resource beyond its natural range and can be of great value especially in food-poor countries." Conversely, the very success of *P. clarkii* in particular creates real environmental problems when it is introduced or escapes into the wild. The problem has been well documented in Spain where it is regarded by many as a pest species (CARRAL *et al*, 1993).

THE ATLANTIC ISLANDS

Probably the ideal conditions for the culture of highly productive crayfish species such as *P. clarkii* are simply a warm climate and relatively unpolluted water with low acidity. The warm equable climate of Atlantic island groups such as The Azores, Madeira, Canary Islands and Cape Verde Islands combined with the varying amounts of open (e.g. stream fed lakes) and closed (e.g. water tanks) water bodies certainly give the potential for

crayfish culture.

Closed water bodies such as water storage tanks used, for example, on the southern sides of some of the Canary Islands, would probably be suitable for the culture of some *Cherax* species if the water quality was adequate. Many such tanks already support introduced species such as the fish *Gambusia*. The crayfish would be unable to survive for long if they escaped because of the generally episodic nature of the supplying water courses.

However, in open lakes or reservoirs with natural or semi-natural fauna and flora, the problem of crayfish introductions could be severe.

By its very nature, endemism is best exhibited within island systems. Many of these endemics are invertebrates, and the introduction of a large, prolific species such as *P. clarkii*, producing up to 300 eggs per female and with only 3 months from egg to maturity, during which time it will consume both living plant and animal material as well as detritus, poses a potentially uncontrollable threat to native species.

Prior to this conference I knew of no freshwater crayfish introductions to the Atlantic islands and the nature of this paper was a warning of a threat.

Subsequent to the conference CORREIA (1993) briefly reported the successful introduction of *P. clarkii* into the Azores. In more detail, the illegal introduction of the species into Sao Miguel Island took place in 1990/91 but its presence in one of the island's many lakes (Lagoa do Peixe) was only discovered by the public authorities in August 1993 when the population had reached very high levels and people had started to harvest them in large quantities. There are indications that people have already moved the crayfish to other lakes on the island. As a matter of urgency, The University of the Azores, led by Professor VASCO GARCIA and assisted by JOSE M. N. AZEVEDO, applied for research funding to the European Commission in Brussels in order to quantify the problem.

The balance between exploiting a potentially commercial species and protecting its very delicate environment is potentially fraught with conflict. On the negative side there is the damage that the species can do to macrophytes which might both influence the plants themselves and the fish populations using the macrophytes for food, shelter or spawning. The known predilection of crayfish for fish eggs may also have a negative impact. On the positive side, the fact that *P. clarkii* will eat some snails may help control the fascioliasis-transmitting snail *Lymnaea truncatula*, but conversely little is known of the invertebrate fauna of Azorean lakes and endemic gastropods are well known elsewhere.

As a commercial species the potential for crayfish production on Sao Miguel could be about 400 tonnes which would be about 2.5% of the value of the marine fish landings on the island.

From the Azorean experience my title, "Threat or Opportunity", has yet to be evaluated but now the door has been opened to the introduction of these species in to Atlantic islands. The lesson which must be heeded is that all such islands should have a policy in place to control such introductions before the introductory event occurs.

I believe that, although there may be places where introductions could safely take place, e.g. deep tanks on the southern side of islands, their introduction into open water bodies could spell environmental disaster. The situation is well summed up by HOLDICH (1988) "Despite the fact that it is known that the most widely introduced crayfish species, *Procambarus clarkii*, is nearly impossible to control or eliminate once it is introduced into a favourable environment, it still continues to be introduced into new areas. Economic benefits are often evident but at what cost to the environment!"

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