Chapter 15
Impact of introduced fish on the native freshwater fish fauna of Spain

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Abstract At least 20 fish species in 10 families have been successfully introduced into Spanish fresh waters. Thus, about 38% of the present freshwater fish species (52 species, excluding the diadromous species) are exotic. The introduction of exotic predatory fish species and the dispersion of other non-endemic species which compete with the native fish species have had a marked impact on the survival of the latter. Preliminary data suggest allochthonous fishes such as pike, *Esox lucius* L., and largemouth bass, *Micropterus salmoides* (Lacépède), have a negative impact on the native fish fauna.

15.1 Introduction

The Iberian Peninsula has a freshwater fish fauna exhibiting low species diversity but a high degree of endemism (Doadrio *et al.* 1991). The native fish fauna is presently threatened by the introduction of many exotic fish species (Elvira 1990, 1995a,b,c, 1996). Likewise, stocking of new species has increased dramatically during the twentieth century, particularly over the past 20 years (Elvira 1995a). Many of the introduced species have a local distribution, but some have occupied extensive areas (Elvira 1995b). Although many introductions were administrative decisions (sport fishing was the most frequent purpose for introductions), impact studies were never carried out. To avoid future problems from species introductions and develop a protocol for controlling invading species, information on the potential disruption these species can cause is urgently needed. This chapter examines the status of introduced fish species in Spain and their impact on the endemic fish fauna.

15.2 Current status of introductions

The majority of the native fish fauna in Spain is presently threatened (Elvira 1990, 1995c, 1996). The conservation status of Spanish freshwater fishes has been reviewed in the Red Data List (ICONA 1986) and in the Red Data Book (Blanco & González 1992). The number of species included in the IUCN category of threatened increased significantly over the 6-year period between the two assessments (Elvira 1996).

Elvira (1995b) studied the spread of exotics throughout the Spanish river basins

and found that the number of introductions in all basins has increased over the last 40 years and many have now become successfully established over wide areas. At least 20 fish species have been successfully introduced into Spanish fresh waters (Table 15.1). These include the 19 species listed by Elvira (1995c) and the white bream, *Blicca bjoerkna* (L.), reported here for the first time from the Ebro River basin. Two other species were also found for the first time in 1995: the Siberian sturgeon, *Acipenser baeri* Brandt, and the channel catfish, *Ictalurus punctatus* (Rafinesque). Few specimens have been caught and their naturalisation has yet to be confirmed.

Most of the exotic species were brought into Spain, mainly for sport fishing purposes, during the 20th century (Elvira 1995a). Some species are potential competitors

Table 15.1 Exotic freshwater fish species introduced in Spain, including their current range of distribution and trend of spread (↑ increase, = stable, ↓ decline).

	Current range	Trend
Cyprinidae		
Alburnus alburnus (L.)	local	↑
Blicca bjoerkna (L.)	local	↑
Carassius auratus (L.)	wide	=
Cyprinus carpio L.	wide	=
Gobio gobio (L.)	wide	↑
Rutilus rutilus (L.)	local	↑
Scardinius erythrophthalmus (L.)	local	↑
Ictaluridae		
Ameiurus melas (Rafinesque)	local	↑
Siluridae		
Silurus glanis L.	local	=
Esocidae		
Esox lucius L.	wide	=/↓
Salmonidae		
Hucho hucho (L.)	local	=
Oncorhynchus mykiss (Walbaum)	wide	=
Salvelinus fontinalis (Mitchell)	local	=
Fundulidae		
Fundulus heteroclitus (L.)	local	↑
Poeciliidae		
Gambusia holbrookii (Girard)	wide	=
Percidae		
Perca fluviatilis L.	local	↑
Stizostedion lucioperca (L.)	local	↑
Centrarchidae		
Lepomis gibbosus (L.)	wide	↑
Micropterus salmoides (Lacépède)	wide	=
Cichlidae		
Cichlasoma facetum (Jenyns)	local	=

of native species. For instance, the exotic mosquito fish, *Gambusia holbrooki* (Girard), and killifish, *Fundulus heteroclitus* (L.), possibly compete with the endemic toothcarp, *Lebias ibera* (Valenciennes) and *Valencia hispanica* (Valenciennes), although there is no sound scientific information to support this supposition. In contrast, some of the exotic fish are predators on native species (Sostoa & Lobón-Cerviá 1989; Rincón *et al.* 1990). In a recent study of the evolution of the fish fauna in the National Park of Daimiel (Guadiana River basin, central Spain) (Elvira & Barrachina 1996), 11 fish species native to this wetland were found to have become extinct during the twentieth century. Pike, *Esox lucius* L., was reputed to be the principal cause of these extinctions. It was introduced into the Daimiel region in the 1950s and, probably through predation, eliminated the native fish fauna. In the absence of suitable prey foods the pike itself disappeared in 1986 (Elvira & Barrachina 1996). Nowadays the exotic carp, *Cyprinus carpio* L., and mosquitofish, *Gambusia holbrooki*, are the only common fish of the area.

A similar situation was found in the Natural Park of the Ruidera Lakes (also in the Guadiana River basin) (Elvira & García-Utrilla 1991; Almodóvar & Elvira 1994). Here, the original fish fauna (nine species, including eight Iberian endemisms) still survives, but it currently coexists with eight exotic species (Almodóvar & Elvira 1994). The area consists of 14 lakes joined by short streams, and Almodóvar and Elvira (1994) found that native species are now mainly restricted to the higher lakes and springs. Conversely, the exotics are very common and widespread throughout the middle and lower lakes and streams. The loss of the native fish and their replacement by exotics still appears to be in progress.

To ascertain the mechanisms by which the predators eliminate their prey, a study of the diet of fish predators in the lower areas of Ruidera was carried out. The aim was to determine the predator–prey interactions of the large predators, pike, *Esox lucius* L., and largemouth bass, *Micropterus salmoides* (Lacépède), with native species. Unfortunately, it became clear after the study was started that the native fish species were already on the verge of extinction from this area and another exotic species, the red swamp crayfish, *Procambarus clarkii* (Girard), was the most common prey for pike (Elvira *et al.* 1996). Nowadays, this exotic crayfish is the dominant prey in occurrence, number and biomass. It was inferred that pike initially fed on native fish, but when these stocks disappeared they switched their diet to crayfish (Elvira *et al.* 1996). The diet of largemouth bass, *Micropterus salmoides*, from the same area is similar (Nicola *et al.* 1996). Red swamp crayfish is also the dominant prey, but it does prey on other fish species.

15.3 Conclusions

Current information about the introduction of fish species into Spanish fresh waters allows the following conclusions to be made.

- At least 20 (perhaps 22) fish species have been successfully introduced in Spain.

- Stocking of new exotic fish has markedly increased during the latter part of the twentieth century.
- Some of the exotic species have spread quickly over extensive areas.
- Environmental impact studies were never conducted before or after the stocking.
- The native (mostly endemic) freshwater fish fauna is threatened by predation or competition with exotics.

In recent years, Spanish politics has become more environmentally conscious, and regulatory agencies are now playing a more active role in controlling the introduction and spread of exotic fish species. However, private interests (anglers, fish farmers) are frequently in favour of introductions, and so the prospects are that more exotic fish will arrive in Spain in the future, whilst those already established will probably become more widespread (Table 15.1).

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