Conservation of Endangered Freshwater Fish in Europe
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Endangered freshwater fish of Spain

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Summary. Conservation status of Spanish freshwater fishes has been recently reviewed in a Red Data List (1986) and in a Red Data Book (1992). Whilst the Red List catalogued 20 threatened fishes (including four exotic species!), the updated red book listed 28 native taxa (26 species and two subspecies). The actual catalogue consists of one species "presumably extinct", six species "endangered" (E), 12 species "vulnerable" (V), six species and two subspecies "rare" (R), and one species "insufficiently known" (K). Some notable facts are that all diadromous fishes (eight species) are threatened at present, and also 12 of the 19 Iberian endemic species are now considered endangered. Similarly, 27 native Spanish fishes were registered in the Bern Convention, while 25 species are included in the EU Council Directive on the Conservation of Natural Habitats in 1992. Nevertheless, Spanish conservation laws are still insufficient since only seven species are protected by the National Catalogue of Threatened Species in 1990.

Introduction

Conservation status of Spanish freshwater fishes was firstly reviewed in a Red Data List of the vertebrates from Spain (ICONA, 1986). The status of freshwater fish was further discussed (Elvira et al.,1988; Lobón–Cerviá and Elvira, 1989). Recently, many scientific efforts have been undertaken to investigate the actual conservation problems of Spanish freshwater fish fauna (Elvira, 1990, 1995a). Additionally, threats resulting from exotic fish introductions or building of dams are described by Elvira (1995b, in press) and Nicola et al. (1994). Research has been carried out on some extremely rare species, such as *Acipenser sturio* and *Valencia hispanica* (Elvira et al., 1991a; Elvira and Almodóvar, 1993; Planelles, 1993).

The Spanish Red Data Book of Vertebrates (Blanco and González, 1992) provides additional aspects to the knowledge of freshwater fish conservation missing in the former Red List (ICONA, 1986). The present report compares both fish catalogues from 1986 and 1992, and points out the main current threats to endangered species. In addition the status of the fishes under different national and international conservation and management laws are assessed.

Results and discussion

Categories of IUCN were used to indicate the conservation status (IUCN, 1988). Table 1 shows an updated list of endangered freshwater fish in Spain according to the last Red Data Book (Blanco and González, 1992). An additional species, *Cobitis haasi*, considered "indeterminate" by Blanco and González (1992) is included here under the synonym of *Cobitis paludica* (Perdices et al., in press), as it is otherwise excluded from the catalogue. Further information on the biology and distribution of vanishing fish in Spain can be found (Doadrio et al., 1991; Blanco and González, 1992).

During the short period 1986–1992, 16 taxa have become endangered or have changed to a higher IUCN category. Eleven fish species remain at the same threat level, while four exotic species formerly considered "rare", *Hucho hucho*, *Salvelinus fontinalis*, *Scardinius erythrophthalmus* and *Ictalurus melas* (ICONA, 1986) have been deleted in the catalogue (Blanco and González, 1992).

Figure 1 shows two pie charts with the percentages of fish considered threatened in the 1986 and 1992 lists. The percentages of fish included in all IUCN endangered category increased from 29% in 1986 to about 40% in 1992. The categories "vulnerable" and "rare" increased significantly in size, demonstrating the deterioration of the conservation status of several species.

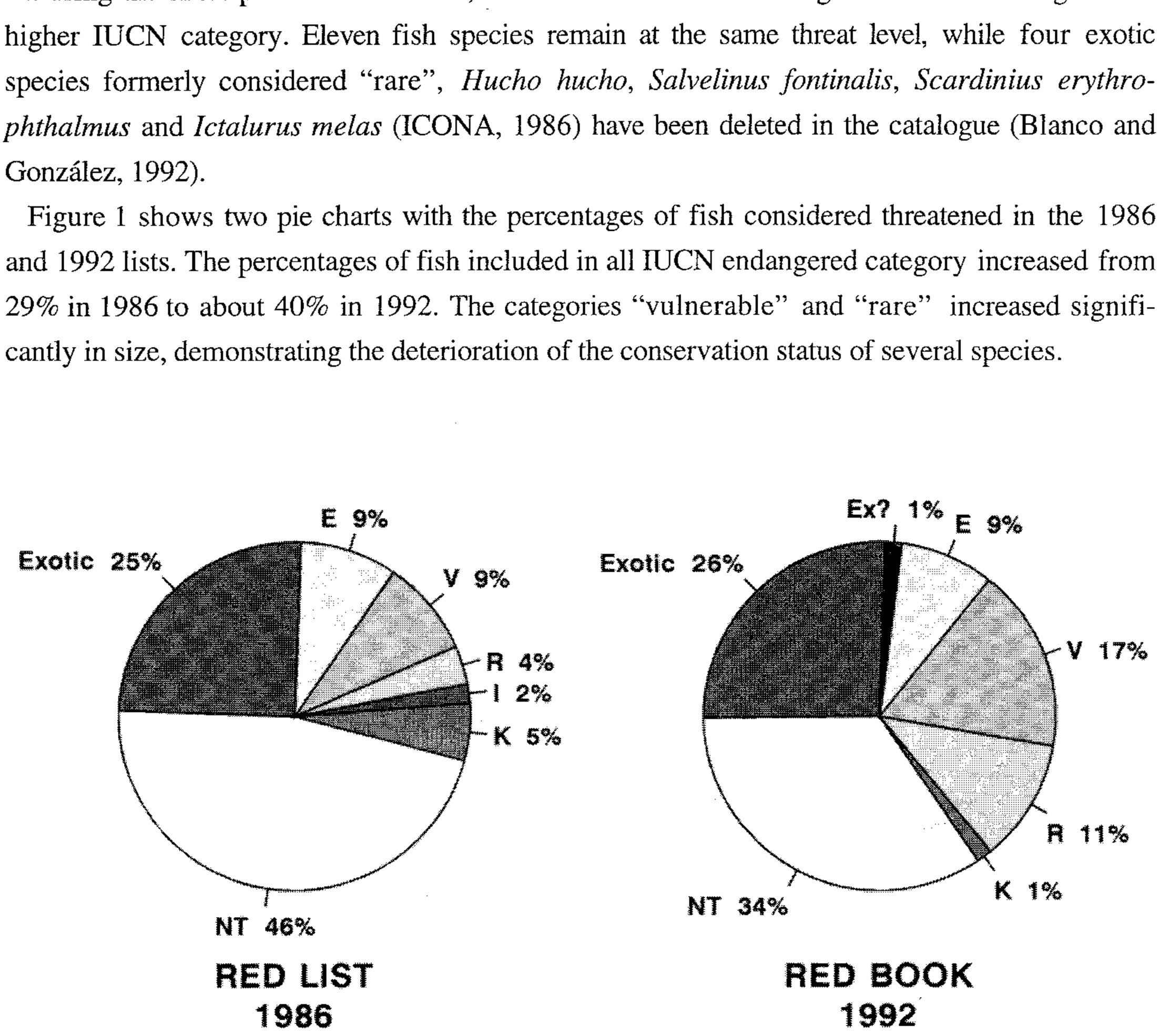

Figure 1. Percentages of endangered freshwater fish in Spain according to the Red Data List (ICONA, 1986) and the Red Data Book (Blanco and Gonzalez, 1992). Four exotic species (considered "R" in 1986) are included in left pie chart within the exotic sector. NT: not threatened.

Table 1. List of Spanish endangered freshwater fish

	Red List 1986	Red Book 1992	Bern 1988	Thr. spp. 1990	Hab. Dir. 1992	Fishery 1989	Market 1989
Petromyzontidae							
Lampetra fluviatilis		Ex?	III		II,V		
Lampetra planeri	R	R	III		II		
Petromyzon marinus	I	V	III		II	■	■
Acipenseridae							
Acipenser sturio	E	E	III	II	II*,IV		
Clupeidae							
Alosa alosa	V	V	III		II,V	■	
Alosa fallax	V	V	III		II,V	■	
Anguillidae							
Anguilla anguilla	V	V				■	■
Salmonidae							
Salmo salar	V	V	III		II,V	■	■
Salmo trutta		V				■	■
Cyprinidae							
Anaecypris hispanica	R	E	III	II	II,IV		
Barbus comiza		V	III		II,V	■	■
Barbus guiraonis		R			V	■	
Barbus haasi		R			V	■	
Barbus meridionalis		V	III		II,V	■	
Barbus microcephalus	K	R	III		V	■	
Chondrostoma toxostoma arrigonis		R	III		II	■	■
Chondrostoma toxostoma turiensis		R	III		II	■	■
Iberocypris palaciosi	K	K		II	II		
Leuciscus carolitertii		R				■	
Leuciscus cephalus		V				■	
Rutilus lemmingii		R	III		II		
Cobitidae							
Cobitis calderoni	K	V	III				
Cobitis paludica		V	III				
Cyprinodontidae							
Aphanius iberus	E	E	III	I	II		
Valencia hispanica	E	E	II	I	II*,IV		
Gasterosteidae							
Gasterosteus aculeatus	V	V					
Cottidae							
Cottus gobio	E	E		II	II		
Blenniidae							
Blennius fluviatilis	E	E	III	II			

Red List (ICONA, 1986) and Red Book (Blanco and González, 1992): past and present IUCN categories (Ex?: probably extinct, E: endangered, V: vulnerable, R: rare, I: indeterminate, K: insufficiently known). Bern 1988: Annexes to the Bern Convention (II: Annex II, "species strictly protected"; III: Annex III, "protected species"). Thr. spp. 1990: Spanish Catalogue of Threatened Species (I: Annex I, species catalogued "in danger of extinction"; II: Annex II, species catalogued "of special interest"). Hab. Dir. 1992: Council Directive of the EU on the Conservation of Natural Habitats and of Wild Fauna and Flora (II: Annex II, "species of general interest whose conservation requires the designation of special areas of conservation"; II*: priority species included in Annex II; IV: Annex IV, "species of general interest in need of strict protection"; V: Annex V, "species of general interest whose presence in the wild may be subject to management measures"). Fishery 1989: species subject to commercial fishing in Spain. Market 1989: marketable species in Spain.

Table 1 also shows the status of endangered fishes in regard to some national and international regulations on preservation and management. In addition, one fish species, *Acipenser sturio*, is listed in Appendix I of CITES (Washington Convention on International Trade in Endangered Species of Fauna and Flora) ratified by Spain in 1986.

One freshwater fish species is included in Annex II and a further18 taxa are listed in Annex III of the Bern Convention (Tab. 1). In addition, the following nine species not mentioned in the Red Data Book are listed in Annex III: *Barbus bocagei*, *Barbus sclateri*, *Chondrostoma polylepis*, *Leuciscus pyrenaicus*, *Rutilus arcasii*, *Tropidophoxinellus alburnoides*, *Syngnathus abaster*, *Pomatoschistus microps* and *Pomatoschistus minutus*.

Of the 28 taxa threatened in Spain, only seven are protected at a national level in the Spanish Catalogue of Threatened Species from 1990 (Tab. 1).

The Council Directive of the EU on the Conservation of Natural Habitats and Wild Fauna and Flora in 1992 includes many of the endangered fish under the various annexes (Tab. 1). For example, *Chondrostoma polylepis*, *Rutilus arcasii* and *Tropidophoxinellus alburnoides* are listed in Annex II, while *Barbus bocagei*, *B. graellsii* and *B. sclateri* are noted in Annex V.

Finally, two Royal Orders from 1989 list Spanish fish subject to commercial fishing and marketing (Tab. 1). Some contradictions are evident, as several endangered species can be caught and sold in Spain, even though they are protected by international regulations.

The main detrimental factors effecting the endangered fish

Construction of dams

In Spanish rivers, there are about 11 000 large dams, in addition to numerous smaller artificial barriers. The prevention of upstream and downstream fish movements by dams is one of the most negative impacts on the migratory species (Nicola et al., 1994), all of which are, at present, classified as "vulnerable", "endangered" or "presumably extinct" (Tab. 2). Even now, fish ladders are absent from most Spanish dams. In fact, species such as *Acipenser sturio* are at the present time in grave danger of extinction namely due to these dams (Elvira et al., 1991b).

Habitat destruction

Loss of habitat is due to several causes, e.g., dam construction and the consequent establishment of large reservoirs and water-flow regulation, channelling of river courses, water withdrawal for extensive agricultural projects, and the drainage of coastal wetlands. The latter is an important factor for many fish, especially for riverine species living in middle and lower sections (Tab. 2). Degradation of fragile habitats such as the marshes in Mediterranean coastal areas has resulted in

Table 2. Major negative factors affecting endangered Spanish freshwater fish

	Dams	Habitat destruction	Pollution	Exotic introductions Predators	Exotic introductions Competitors	Overfishing
Petromyzontidae						
Lampetra fluviatilis	■					
Lampetra planeri			■			
Petromyzon marinus	■		■			
Acipenseridae						
Acipenser sturio	■	■				■
Clupeidae						
Alosa alosa	■		■			■
Alosa fallax	■		■			■
Anguillidae						
Anguilla anguilla	■		■			■
Salmonidae						
Salmo salar	■	■	■			
Salmo trutta	■	■	■		■	■
Cyprinidae						
Anaecypris hispanica		■	■	■		
Barbus comiza		■	■	■		
Barbus guiraonis		■	■	■		
Barbus haasi		■	■			
Barbus meridionalis		■	■			
Barbus microcephalus		■		■		
Chondrostoma toxostoma arrigoni		■	■	■		
Chondrostoma toxostoma turiensis		■	■	■		
Iberocypris palaciosi				■		
Leuciscus carolitertii		■	■	■		
Leuciscus cephalus		■	■	■		
Rutilus lemmingii		■	■	■		
Cobitidae						
Cobitis calderoni		■	■	■		
Cobitis paludica		■	■	■		
Cyprinodontidae						
Aphanius iberus		■	■		■	
Valencia hispanica		■	■		■	
Gasterosteidae						
Gasterosteus aculeatus		■	■			
Cottidae						
Cottus gobio		■	■			
Blenniidae						
Blennius fluviatilis		■	■			

the extinction of some local populations of the endemic toothcarps *Aphanius iberus* and *Valencia hispanica* (Elvira, 1990; García-Berthou and Moreno-Amich, 1991; Planelles, 1993). Similarly, the fragmentation of river courses and the lowering of water levels may favour the hybridisation of native *Chondrostoma* (Elvira et al., 1990).

Pollution of waters

When considering the general distribution of a species, pollution appears not to be an important factor at the moment. However, locally, pollution can greatly influence a particular site, population, or even a whole river system where rare species are involved, so in general nearly all taxa are assumed to be threatened by increasing water pollution (Tab. 2).

Introduction of exotic fishes

The recent spread of alien species has been studied by Elvira (1995b, in press). The occurrence of fish-predators, especially fish species earlier not present in Iberian fresh water, is probably one of the main detrimental factors influencing the survival of endemic species (mostly Cyprinidae and Cobitidae) (Elvira, 1990, 1995a) (Tab. 2). Also, some invaders can become direct competitors of native species, for example, the original populations of brown trout, *Salmo trutta*, are threatened by the introduction of *Oncorhynchus mykiss*, and by allochthonous stocks of *Salmo trutta* from central Europe. Similarly, exotic species such as *Gambusia holbrooki* and *Fundulus heteroclitus* are affecting the already scarce populations of endemic toothcarps (Tab. 2).

Overfishing

In Spain, freshwater commercial fishery is restricted to some selected migratory species. Overfishing was an important factor threatening the populations of *Acipenser sturio* (Elvira et al., 1991b) in the past while for fish such as *Alosa alosa*, *Alosa fallax* and *Anguilla anguilla* it is still a destructive factor at the present time (Tab. 2). The survival of the native brown trout populations *Salmo trutta*, is also threatened due to angling pressure (Almodóvar and Quirós, 1994).

The same factors also threaten the native freshwater fish faunas of neighbouring countries such as Portugal (SNPRCN, 1992) and France (Keith et al., 1992).

In recent years, Spanish politics has become more environment-conscious and supervising agencies are now playing a more active role in controlling threat factors. Nevertheless, legislation that protects fish and their habitats must be improved. Conservation programmes for certain endangered fishes like *Valencia hispanica* are already under way (Planelles, 1993), but many others should be initiated.

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