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Identification of introduced freshwater fish established in Europe and assessment of their geographical origin, current distribution, motivation for their introduction and type of impacts produced

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Introduction to the report

The present report builds on a previous survey undertaken by Dr Benigno Elvira, Department of Animal Biology I, Faculty of Biology, University Complutense of Madrid, on behalf of the Council of Europe and funded by the Waloon region.

Benigno Elvira's work, presented at the Standing Committee of the Bern Convention in November 2001, provided the basic data on all non-native freshwater fishes established in Europe, as well as an assessment of their potential threats to the biological diversity.

As a partner of the European Topic Centre on Nature Protection and Biodiversity, the « Museo Nacional de Ciencias Naturales » of Madrid has further worked on the development of indicators which can be used for reporting by the European Environment Agency on introduced species in freshwater ecosystems.

Madrid, 30 November 2001

**Identification of introduced freshwater fishes established in
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Introduction

Despite of the increasing knowledge during the last decade regarding the introduced freshwater fishes in Europe, nowadays, still remain unknown most of the questions related to origin, motivation, responsables and type of impacts of such introductions.

Many of the questions probably will remain unknown since the introduction phenomenon dates from Roman times and, of course, scarce documentation exist. Although some of the cited questions are less important from a conservation point of view, some others, like the origin of the exotic species and specially the ecological impacts that they could have provoked, are aspects that need to be resolved properly.

Hence, this report recover both the documented data and the unknown information with the aim that the lack of information from some introduced species in many European Countries could indicate where the research efforts must be applied. In this sense, the employment of molecular markers results rather useful to state routes of inmigration or the origin of exotic population, and the combination of genetic and ecology conform a strong tool to analyse, on native populations, the impact produced by the introduced species.

How many are and where they came from?

In this report it is compiled 103 introduced species that have been cited at least with incipient populations establishes in the wild. Two up to three of them come from other continents, specially from America (aprox. the 50%) and followed by Asia and Africa. The remaining species are European freshwater fishes that were introduced in regions where they were not indigenous, as for example, islands or peninsulas.

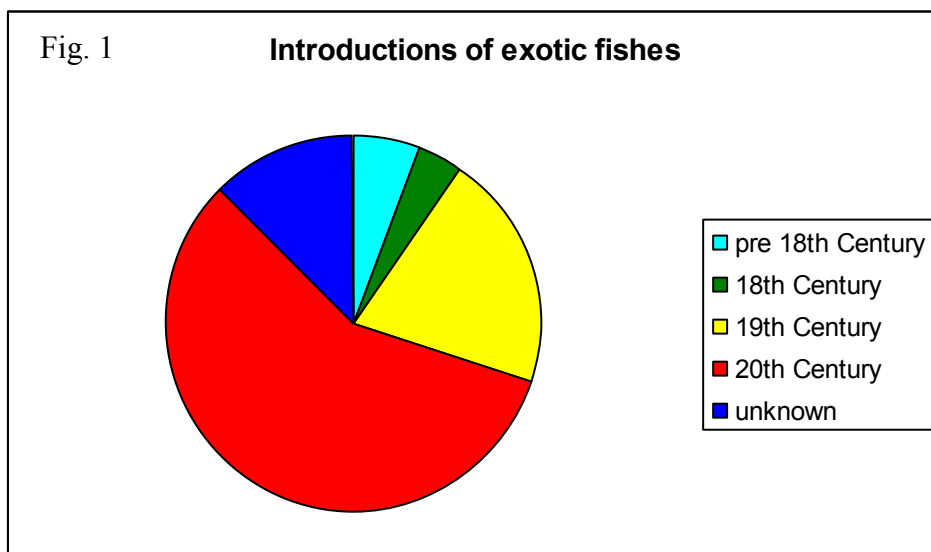
Nevertheless, some of these exotic species introduced in Europe are locally distributed and the size of their populations remains very low, so a more realistic analysis would indicate that no more than 40 exotic freshwater fishes are well established in European waters.

When did they come?

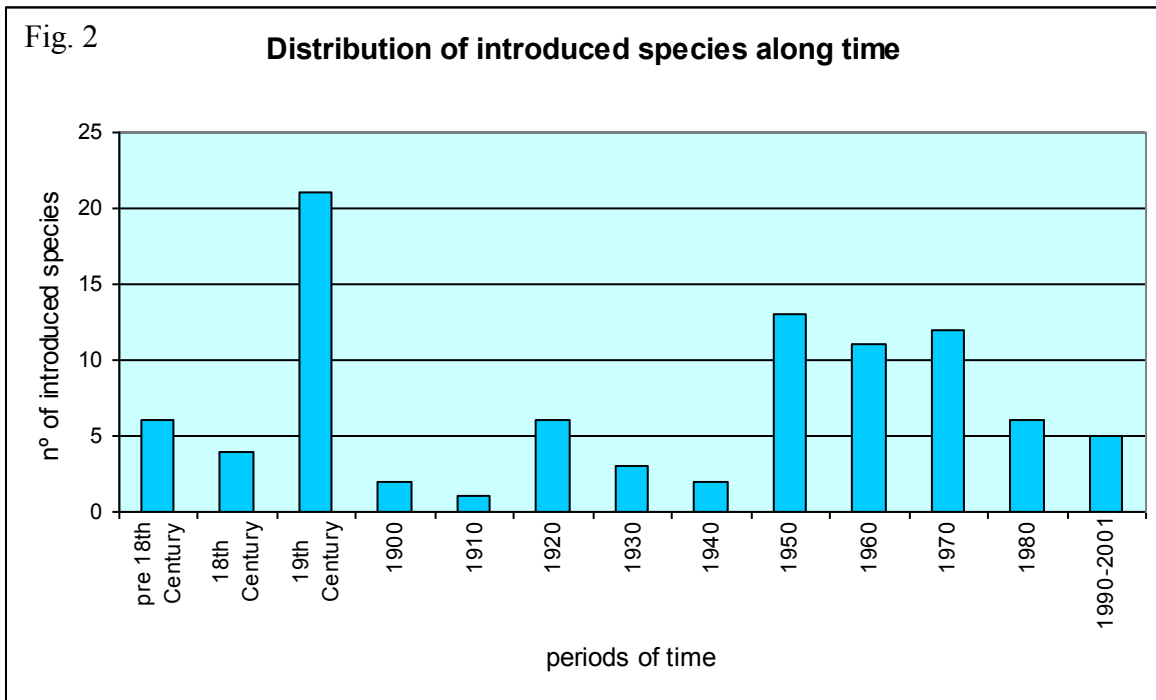
The arrival of each exotic species to the different European Countries where they currently live was highly variable and depended on their particular motivations (cultural, economic, political) and the responsables that induced such introductions.

In general, each species was introduced in different Countries at different years, decades or even centuries and in many cases the same species was stocked in the same Country several times. On the opposite, it is detected the simultaneous arrival of different exotic species to a single Country.

In spite of this difficulties, we can follow the history of the introductions of freshwater fishes in Europe considering the date of the first introduction in any European Country. As we can see in Figure 1, most that half of the introductions have occurred in the 20th Century (57%) while during the 19th Century, also characterised by numerous stockings, only the 20% took place.

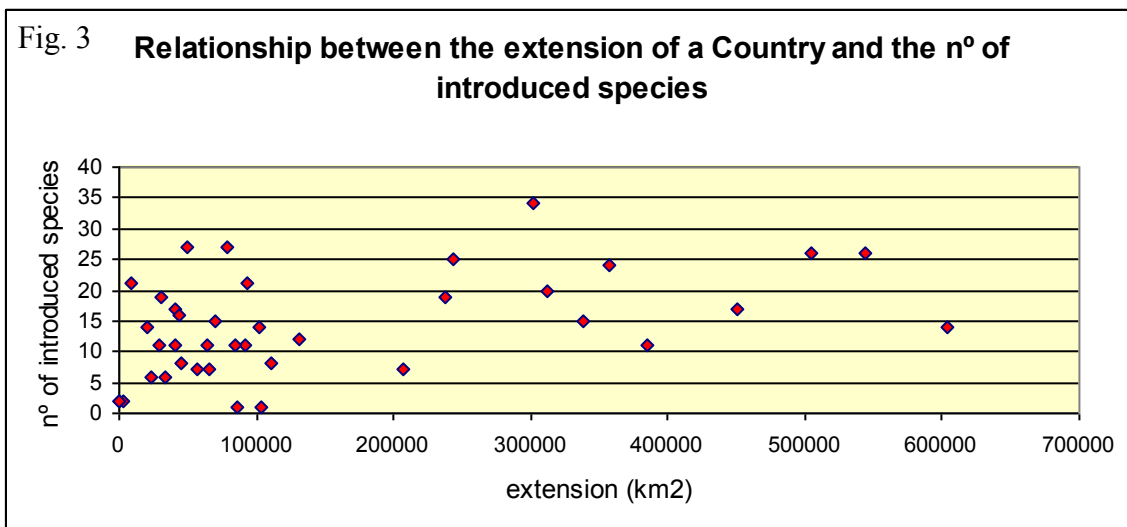


Within the 20th Century, results evident that introductions were promoted in its second half (Figure 2), interestingly after the Second World War. At the end of the century the introductions tend to decay. Obviously, the pattern of introductions long time in several Countries do not fit to that showed for the whole Europe, and hence, for example, Spain has suffered the introduction of at least 8 species during the 1990s.

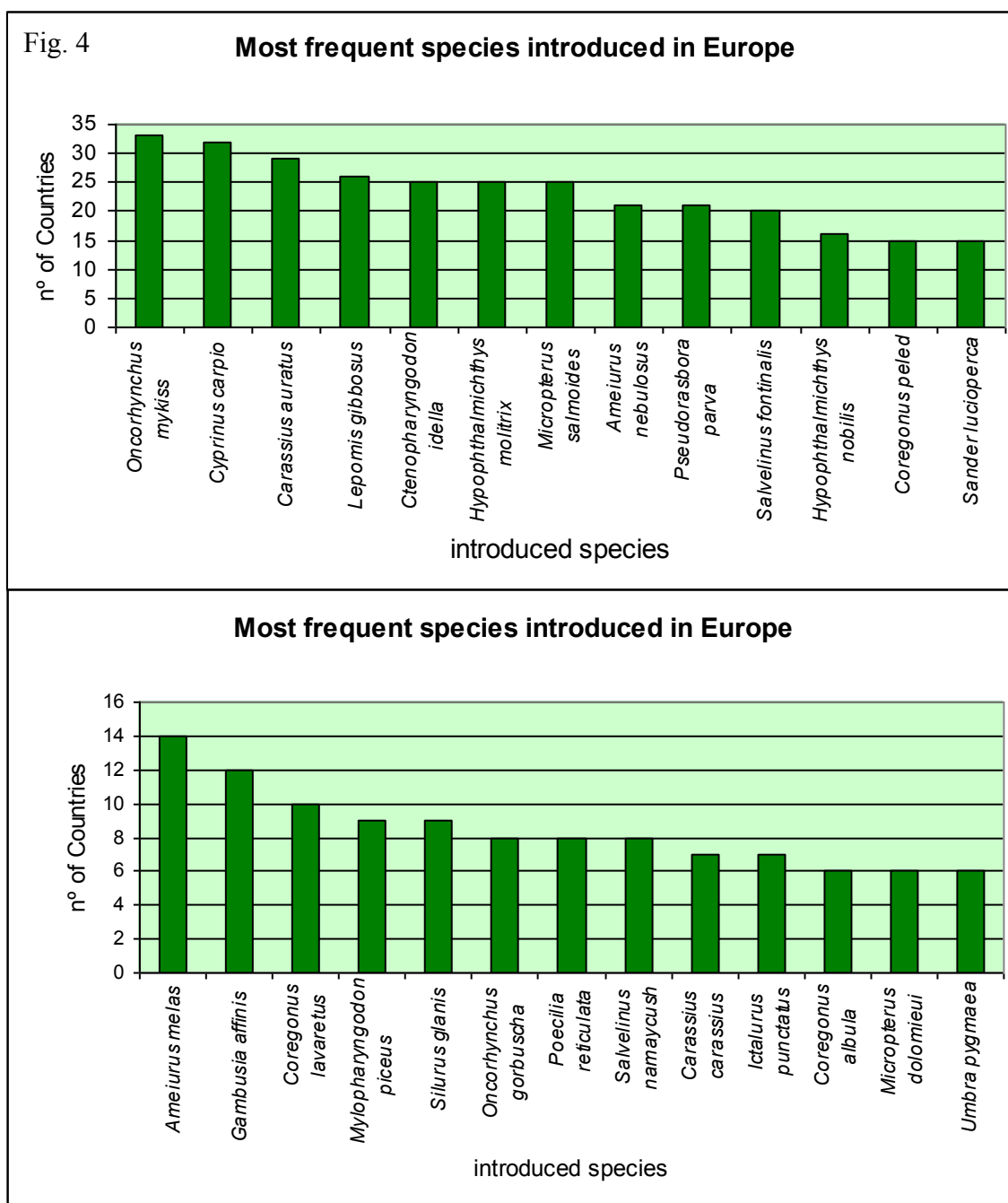


What is their distribution in Europe?

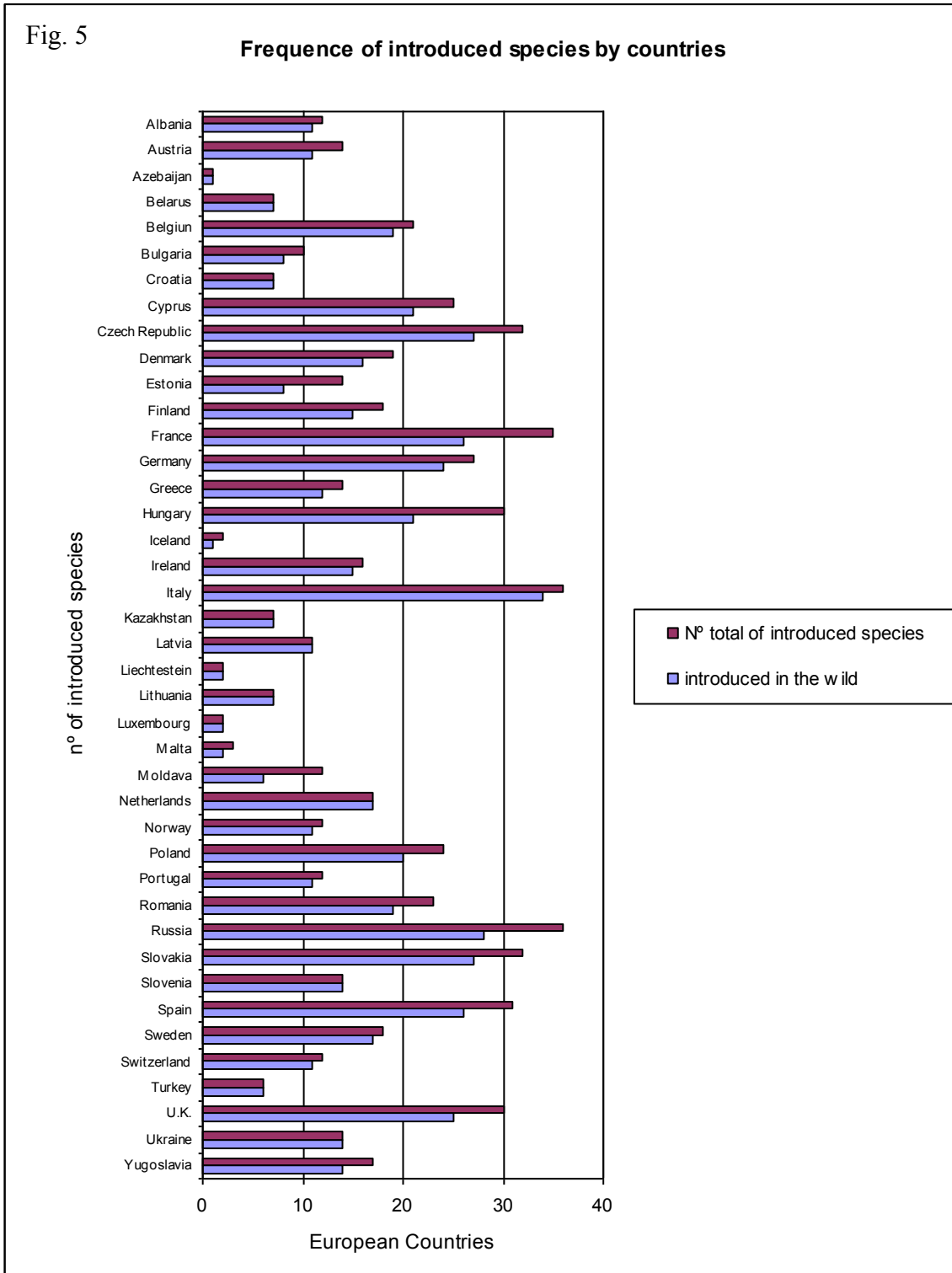
Interestingly, when we confront for each Country the extension of its territory versus the number of introduced species (Figure 3) we find that there is not any direct relationship between them. Hence, Countries like Cyprus, showing a relative small extension, housed 21 exotic species, much more than many bigger Countries in Europe.



Close to the half of the introduced species in Europe are present only in one or a couple of Countries and, therefore, their relevance in an European context is little. On the contrary, some other species (fortunately no more than 26) are widely distributed across Europe (Figure 4). Apparently, there are not families more popular than others since salmonids, cyprinids, centrarchids and ictalurids show the wider distribution ranges.



When the introductions are analysed by Countries (Figure 5), firstly we must take into account that the real number of exotic species present usually is higher than that of the



species established in the wild since some of them are maintained in aquaculture pools. Accidentally, they can arrive to natural conditions and become establish.

Eight Countries (Czech Republic, France, Italy, Russia, Slovaquia, Spain and U. K.) showed 25 or more exotic species established in the wild, but the worst situation is found in Italy where 34 introduced species inhabit.

Why were they introduced?

As commented above the motivations that induced the introduction of an exotic species depends on the Country where it occurs. We have classified the causes for introductions in 11 principal categories that comprises the stoching of fishes for angling/sport fishing, the release of aquarium species, the usage of baitfish or the release of them after fishing, the growing of ornamental species, the aquaculture and fisheries and some aspects of the environmental management like the pests control or the weed control and the purpose to fill a supposed empty ecological niche. Human intentions are absent in the cases of accidents or when the exotic species arrive by diffusion from a neighbour country (Figure 6).

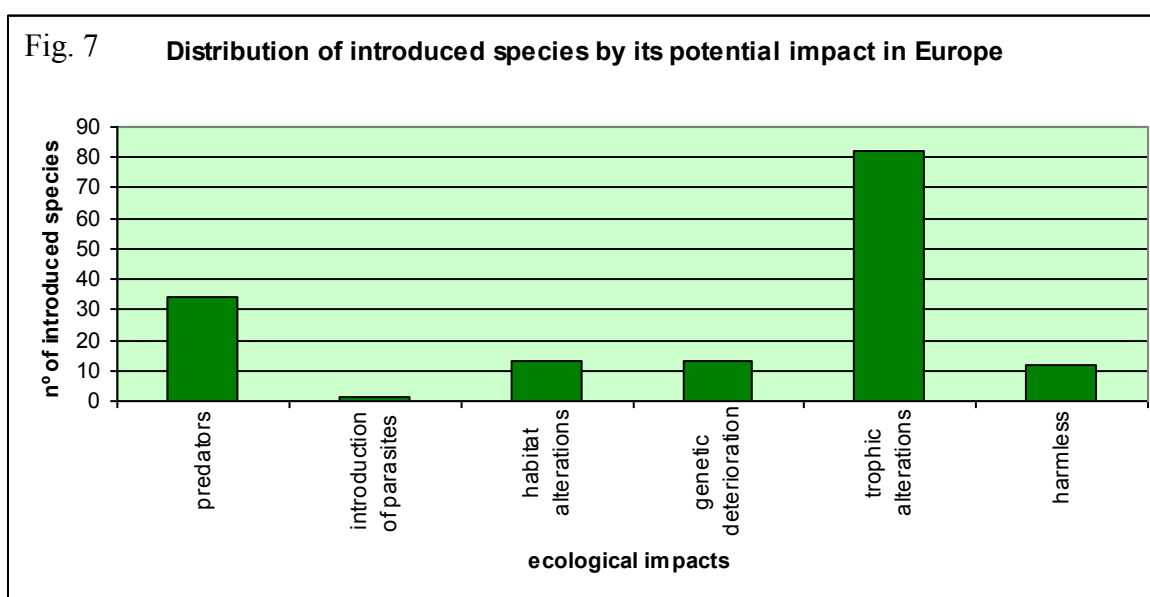
The reasons for introductions usually are unknown for many species although human activities seem to be in the basis.

In most of the Countries the aquaculture and the angling/sport were the two principal reasons, indicating an economic motivation. Besides, the employment of exotic species for animal and weed control was widely used in the second half of the 20th Century.

Finally, we can appreciate that those Countries with larger lists of introduced species also showed the higher variety of motivations.

Which are the impacts that they produce?

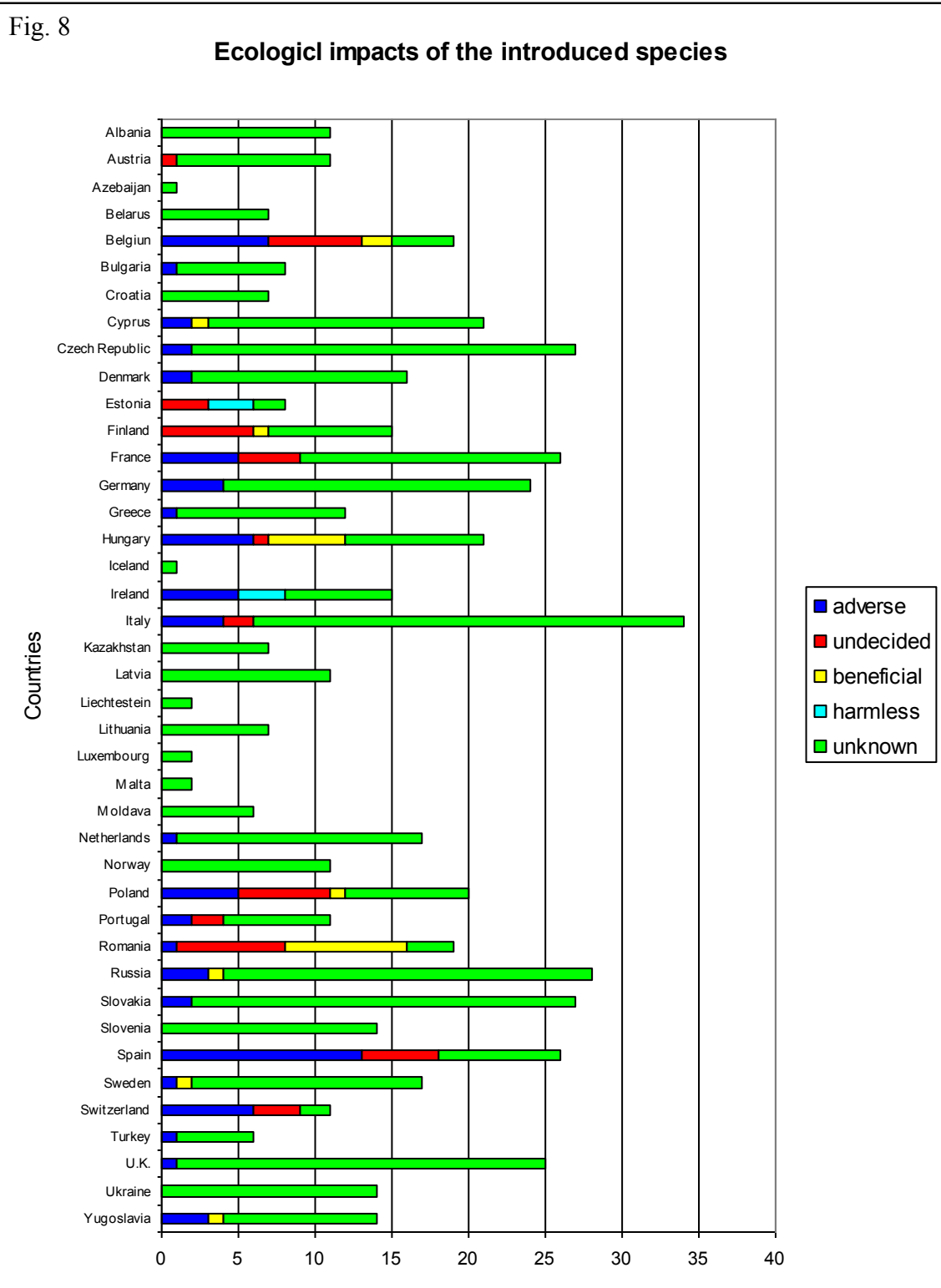
At this point we must state a clear differentiation between the potential impact that any establishes exotic species can produce and the real effect that this species is producing on native species. The potential impact (Figure 7) is deduced from the knowledge of the biology of the species and can also be inferred from previously analysed cases in which the species was put in contact with other faunas. Nevertheless, environmental conditions and species ensembles varies strongly from one Country to another or from one river to another and, therefore, each particular situation must be analysed independently.



From the potentiality point of view, only a dozen of the introduced species can be considered as harmless. The remaining can produce as serious impacts as the complete removal of the native species by predation.

The most frequent potential impact that the species introduced in Europe can produce is thought to be the trophic alterations. The reason is that the trophic alteration is normally correlated to other impacts like predation or habitat alteration. Hence, more than 80% of the introduced species are believed to alter the trophic structure of the natural ecosystems since they feed on fishes, compete for preys or are predated by other fishes.

When the impacts produced by the exotic fishes were analysed by Countries (Figure 8) only Belgium, Spain and Switzerland showed significant data regarding the sign of the



impact. Almost all the European Countries showed a high lack of information that is complete in some of them. When the information exist, the impact is described as adverse and in some cases a negative effect is known by intuition but in absence of specific analysis remains as undecided.

Who introduced them?

As in the preceding question, the unknown data are the most common situation. In this case the wide use of the aquaculture was the responsible of many introductions during the last centuries and that can be the cause of this lack of information.

The governments were the responsible of some of the more important programs for stocking exotic species, specially in those cases of animal or weed control, but also for "fill ecological niches" or for angling/sport purposes (Figure 9). The introduction promoted by governments is evident in some Countries like Estonia, Hungary, Poland and Romania but probably is also important in other Countries where there are no available information.

Fig. 9

Introductions responsibility

