RED LISTING OF FRESHWATER FISHES AND LAMPREYS IN THE NETHERLANDS

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General introduction

The red list of fishes in the Netherlands was the last in a row which started with breeding birds, mammals, butterflies, reptiles and amphibians, fungi, lichens, dragonflies and grasshoppers. For all these organisms the same criteria were used to make them comparable among each other. Thee Dutch criteria have been based on the combination of rareness and trend (rate of decrease). Therefore rareness alone, without a marked decrease is not considered to be an argument to classify an organism in a red list category. The decrease in the case of freshwater fishes, is measured either as a decrease in the extent of occupancy (using 5 x 5 km squares) or as a decrease in certain parameters, like catch statistics, supposed to reflect the dynamics of the whole population (criteria A1 b and c, A2 b and c, IUCN 2001). However, in the Dutch system, the decrease over a period of 50 years is considered, in stead of the period of 10 years with the IUCN criteria. If we assume a smooth but exponential decrease in 50 years and compare the Dutch percentages (<25%, 25-50%, 50-75%, and >75%) with the percentages according to the IUCN criteria and categories (c & c), dealing with 10 years, this results in large differences Taking this into account, Ireformulate the Dutch criteria as percentages per 10 years as follows (see first column of Fig 1).

Occupancy Pop. size/area reduction	Very rare <1%*	Rare 1-5%	Fairly frequent 5-25%	Common >25%
<5.6%	Near Threatened	Least Concern	Least Concern	Least Concern
5.7 – 12.9%	Vulnerable	Vulnerable	Vulnerable	Least Concern
13 – 24.1%	**Endangered**	**Endangered**	Vulnerable	Near Threatened
>24.2%	**Crit. Endangered**	**Endangered**	Vulnerable	Near Threatened

Fig. 1. The Dutch criteria and categories for the red listing (reduction computed over 10 years).

According to the Dutch c & c, in total 24 species out of a list of 46 endemic species (sometimes subspecies in the case of brown trout and see trout) were listed (De Nie & van Ommering 1998).

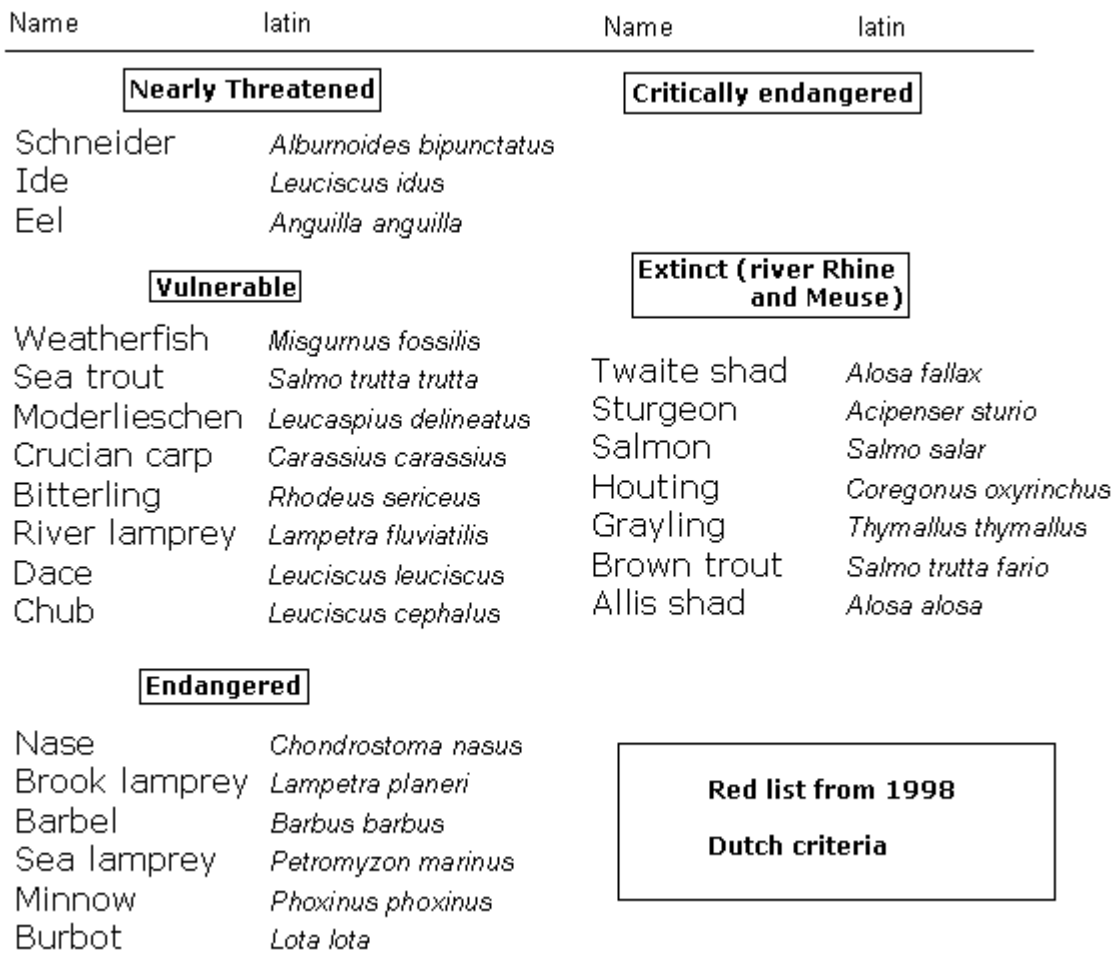

Fig.2 . The Dutch red list of freshwater fishes and lampreys, using the Dutch c & c.

Applying the IUCN criteria, seven species have to be expelled from the list, because their rate of decrease did not fit the IUCN criteria for red listing.. Three species have to move from Endangered to Vulnerable, while one species has to be moved from Near Threatened to Vulnerable, because no longer the actual extent of occupancy is relevant for being listed as a red list species.
On both lists most red list species are species from streaming water (rheophilic).

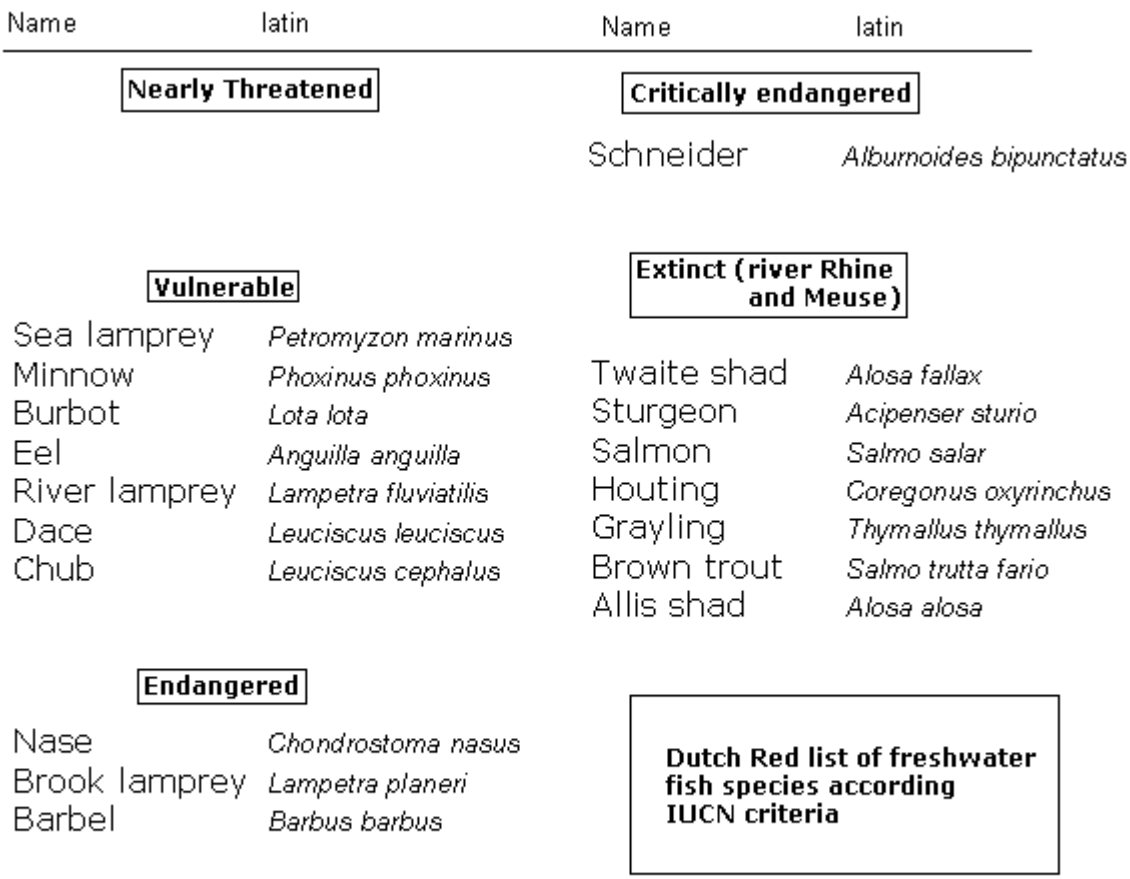

Fig. 3. The Dutch red list of freshwater fishes and lampreys after application of IUCN-criteria and categories.

Examples

The burbot *Lota lota* (Linnaeus)

This is a freshwater species from a family of mainly marine species. This family is part of the well known order Gadiformes, cods and haddocks. The extent of occupancy from 1900-1950 compared with the occupancy in 5 x 5 km squares during 1980-1995 is given in figure 4. The decrease in occupancy is 28%, calculated by interpolation over a period of 10 years , hardly good enough to qualify for "Vulnerable".

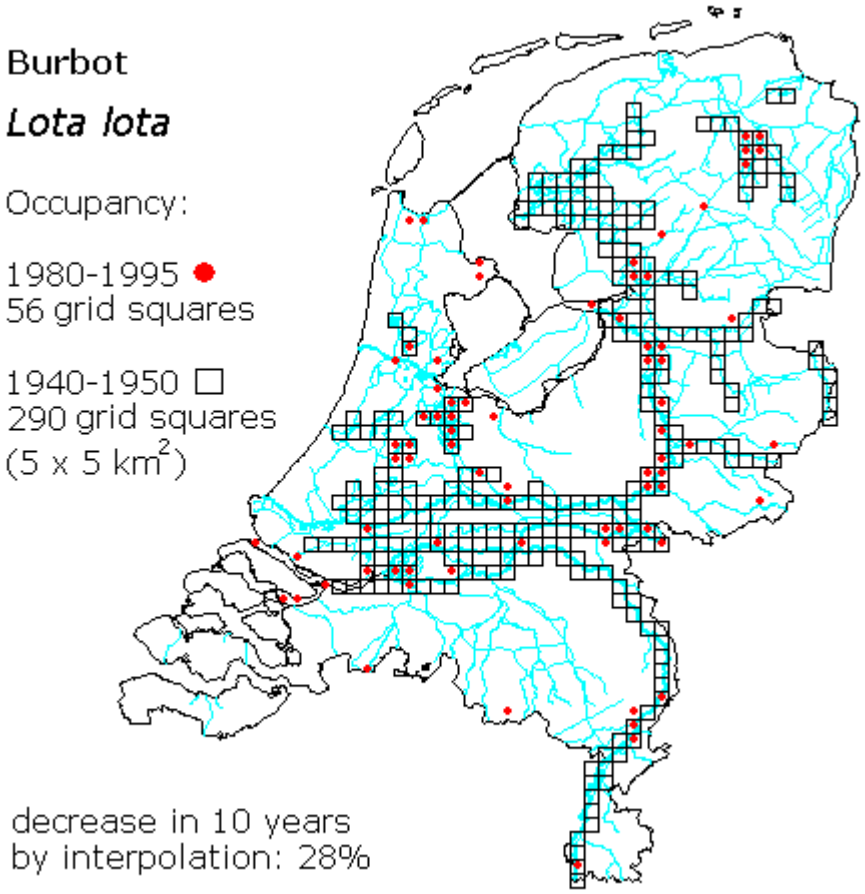

Fig. 4. The extent of occupancy of the Burbot (*Lota lota*) based on observations from 1900-1950 and 1980-1995 (De Nie 1997a and b).

The Schneider *Alburnoides bipunctatus* (Bloch)
The Schneider was supposed to be lost for the Dutch ichtyofauna. There were unconfirmed observations from the 19th and early 20th century. The only confirmed observation was an individual caught in 1931 in the River Meuse near Roermond. Just during the preparation of the Dutch red listing, members of the Natuurhistorsich Genootschap in Limburg (Limburg Naturalists' Society) caught several Schneiders in a tributary of the river Meuse, a stream called De Geul, one of the very few unspoiled streams in The Netherlands. Maybe the fishes caught are individuals coming from streams in Belgium. There are no indications for reproduction. Thus, likely there are no streams where the Schneider can complete its whole life cycle (De Nie 1997b). However, potential habitat maybe present if attempts to improve the Geul show to be successful. The minimal extent of proper habitat will be only a few hectares.This species is listed a critically endangered.

The European Eel (*Anguilla anguilla*)
The eel is still common in The Netherlands; the fish is widely distributed throughout the country. This is a catadromous species, spawning in the Atlantic ocean, after a larval phase in salt water, elvers (juvenile eels, or glass eels) migrate to freshwater. This immigration is monitored since 1938 by standardized catches in the sluices of the IJsselmeer. The immigration of elvers is very erratic. During the 1940s there was a period with a very low influx, followed by periods with high influx. However since the late 1980s recovering holds off. This does not only apply for the situation in The Netherlands, but also in other countries of North and South Europe. The present levels are about 10% of the average level during the period before 1980, implying more than 60% decrease in 10 years (Dekker 2002).

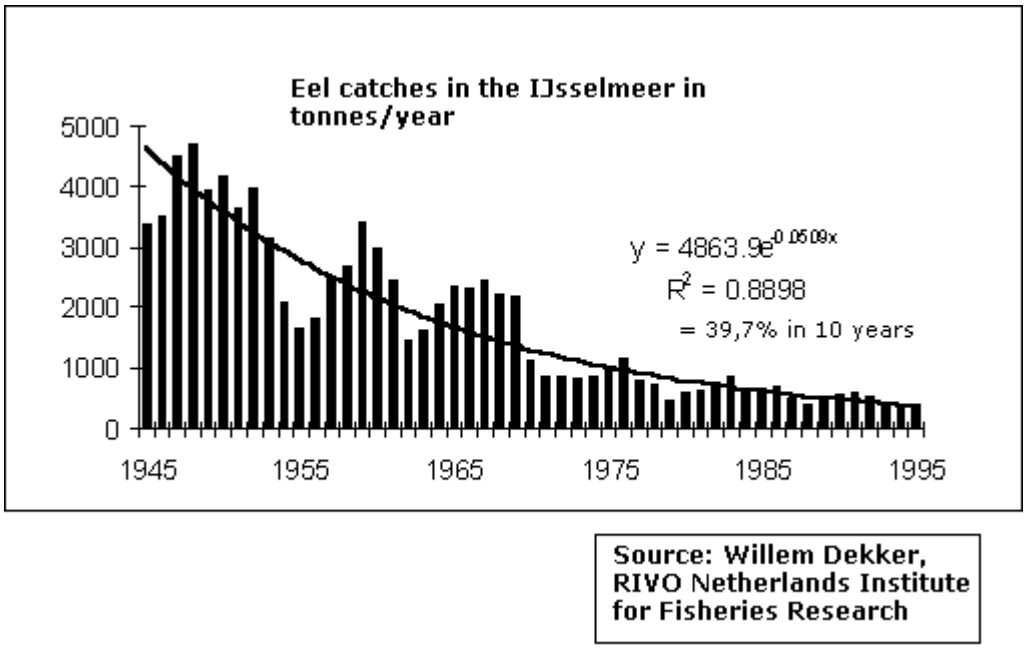

Fig. 5. Eel catch statistics 1945 – 1995 in the IJsselmeer.

The amount of eel caught in the IJsselmeer (Lake IJssel) decreased since 1945, interpolating with a simple exponential function yields a decrease of 39.7% in 10 years. (De Nie 1997b). The red list status Vulnerable for this species is important, also because the cause of this decrease is unclear.

Sea trout *Salmo trutta trutta* Linnaeus and **Salmon** *Salmo salar* Linnaeus
Other remarkable species are salmon and sea trout. The sea trout may be considered as an anadromous form of the brown trout (*Salmo trutta fario*) which is extinct in the Netherlands. The catch statistics of the sea trout in the lower stretches of the river Rhine and Meuse do not show a clear decrease. Supposing that individuals, off spring from (often artificially "improved") populations in the upper stretches of the river Rhine and Meuse (and tributaries) develop as sea migrating form (induced by habitat deterioration!). This sea going fishes stay more in coastal waters, while salmons migrate over long distances in the Atlantic. On the other hand, sea trout lack the strong homing ability of salmons, so they can travel up stream in any river. Therefore, in spite of the poor water quality of the rivers Rhine and Meuse, sea trout did not evidently decrease in the lower stretches of these rivers.
In higher stretches of the river Rhine (river Waal near Nijmegen) and also according to German sources the sea trout was supposed to be extinct as a self reproducing population in the river Rhine (Steinberg & Lubieniecki 1991) However this decrease in The Netherlands was poorly documented and tentatively estimated as more than 50% in 50 years. This may be 13% in 10 years, not enough to qualify for a red list status.
The same is true for the salmon, which became extinct in the river Rhine and Meuse. Because the salmon fishery was an important activity in the 19th century and beginning of the 20th century, we have accurate catch statistics. If we analyze these statistics with a very simple model of decrease (exponential), in retrospect we can conclude that the mean rate of decrease was about 6.6% per year and 49% per 10 years.

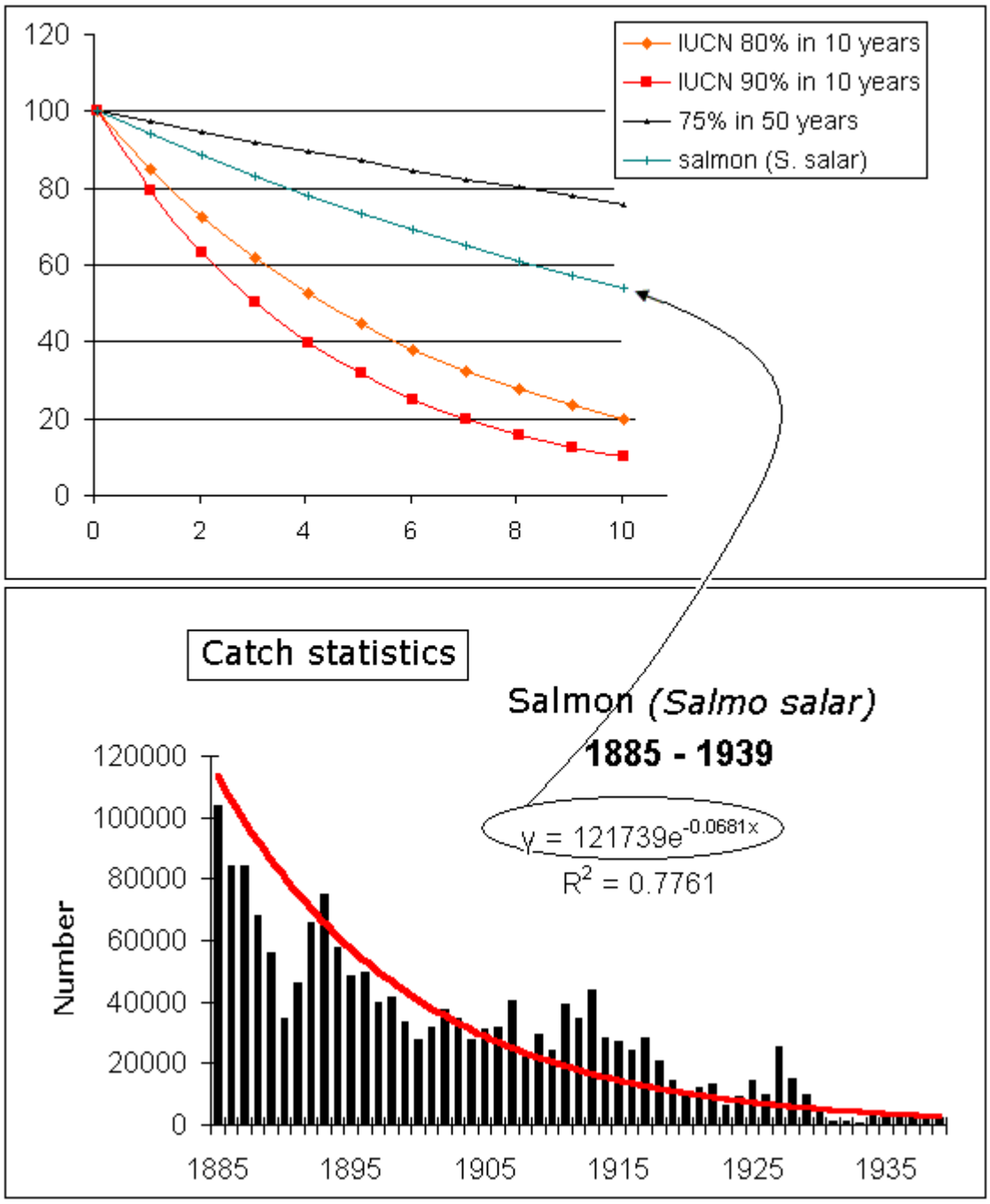

Fig. 7.

Not enough to qualify as an Endangered species, provided this was the only criterion.
A time-analysis model was applied on these data. *Auto Regressive Integrated Moving Average* using a moving average on log-transformed data over 10 years, supposing a 5 years cycle in the catches between 1885 tot 1930 and 1885 tot 1940 yielded promising results to predict the probability of extinction within a certain time range. However, with a very wide range of probabilities. Even an increase in population was possible within the 95% range. The results are strongly influenced by the choice of the model and the parameters used. The use of this kind of models may be helpful. Being not an expert on time series analysis, I cannot be more specific.

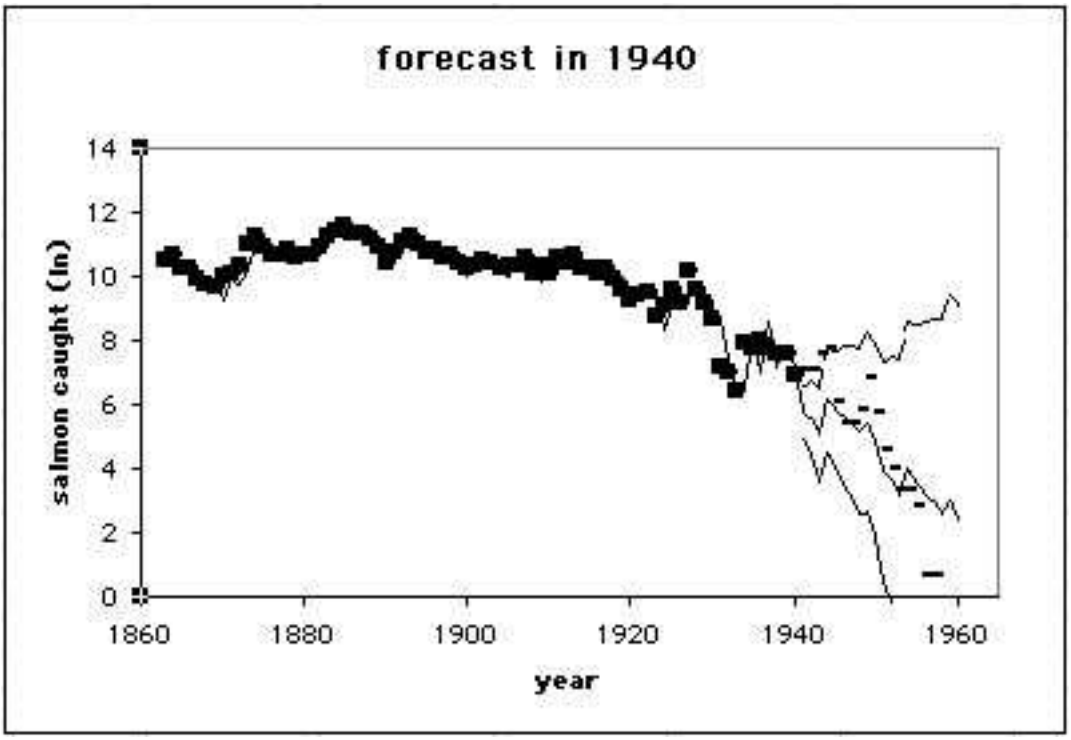

Fig. 8. Auto Regressive Integrated Moving Average with catch statistics on salmon (1885-1940) to predict extinction.

Bullhead *Cottus gobio* Linnaeus
This species is a fresh water species related to many marine fish species from the order of Scorpion fishes. This species is fairly common in the greater water bodies as lakes, canals and big rivers. Even in some of the smaller but non-streaming waters typically for The Netherlands. On the other hand, this species is rare in streams. Therefore, this species is not on the red list, but is classified as a "target species", according to Dutch nature conservation policy guidelines (Bal et al, 2001). Target species are selected species, typically for an ecosystem. The ecosystem quality is measured by monitoring a set of typical species. This method is similar to that of economic indicators, such as the retail price index, a representative selection of products monitored in a subset of stores. The quality of ecosystems, the loss or gain in biodiversity is measured in a parsimonious way, to make this procedure practical and affordable.

Conclusions

- According to Dutch criteria 24 species (53% of 45 species) have a red list status. When applying the IUCN c & c 18 species (40%) have a red list status. In both cases nearly all species were rheophilic.
- The rate of decrease to qualify for a IUCN red list status was too low for 7 species). The actual distribution alone (rareness) is not an argument (the Schneider had red list status Nearly Threatened). A rapid rate of decrease of a common species does not yield a red list status (Eel red list status Nearly Threatened).
- The rate of decrease chosen to obtain a red list status may be too high, other statistical mathematical techniques may be of use to estimate the probability of extinction (salmon)
- Monitoring the population of species with a near threatened species or carefully chosen species without a red list status is a means to measure ecosystem quality (concept: target species).

Acknowledgements
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