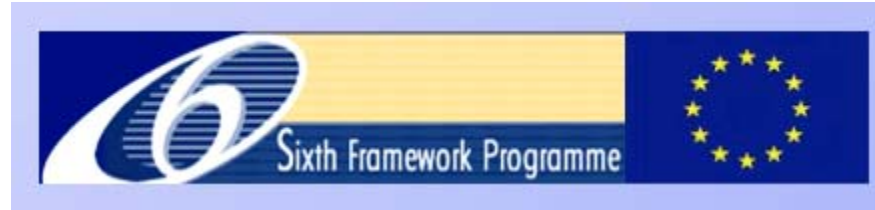


Impacts of Introduced Aquatic Alien Species in European Aquaculture Activities

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IMPASSE Project

- This presentation is based upon the results from Workpackage 2 of the EU-funded Project:

Environmental impacts of alien species in aquaculture
(IMPASSE)

- The project came to an end with an international conference:



WP2

Analysis of the impacts of alien species on aquatic ecosystems

- Overall objectives of WP2:
 - .1 analysis of the spread of novel pathogens and disease,
 - .2 analysis of ecological disruptions to ecosystem function caused by the introduction of alien species,
 - .3 analysis of the social and economic impacts of alien species introductions.

2.1 Analysis of the spread of novel pathogens and disease

- An analysis of the potential for spread of diseases was made and the introduction of new diseases through historical stocking and introduction records was assessed.
- Pathways by which diseases and parasites are spread were reviewed to establishing the guidelines for introduction and quantifying risk to natural populations and ecosystems arising from introductions.
- Detailed case histories of selected disease agents were prepared.

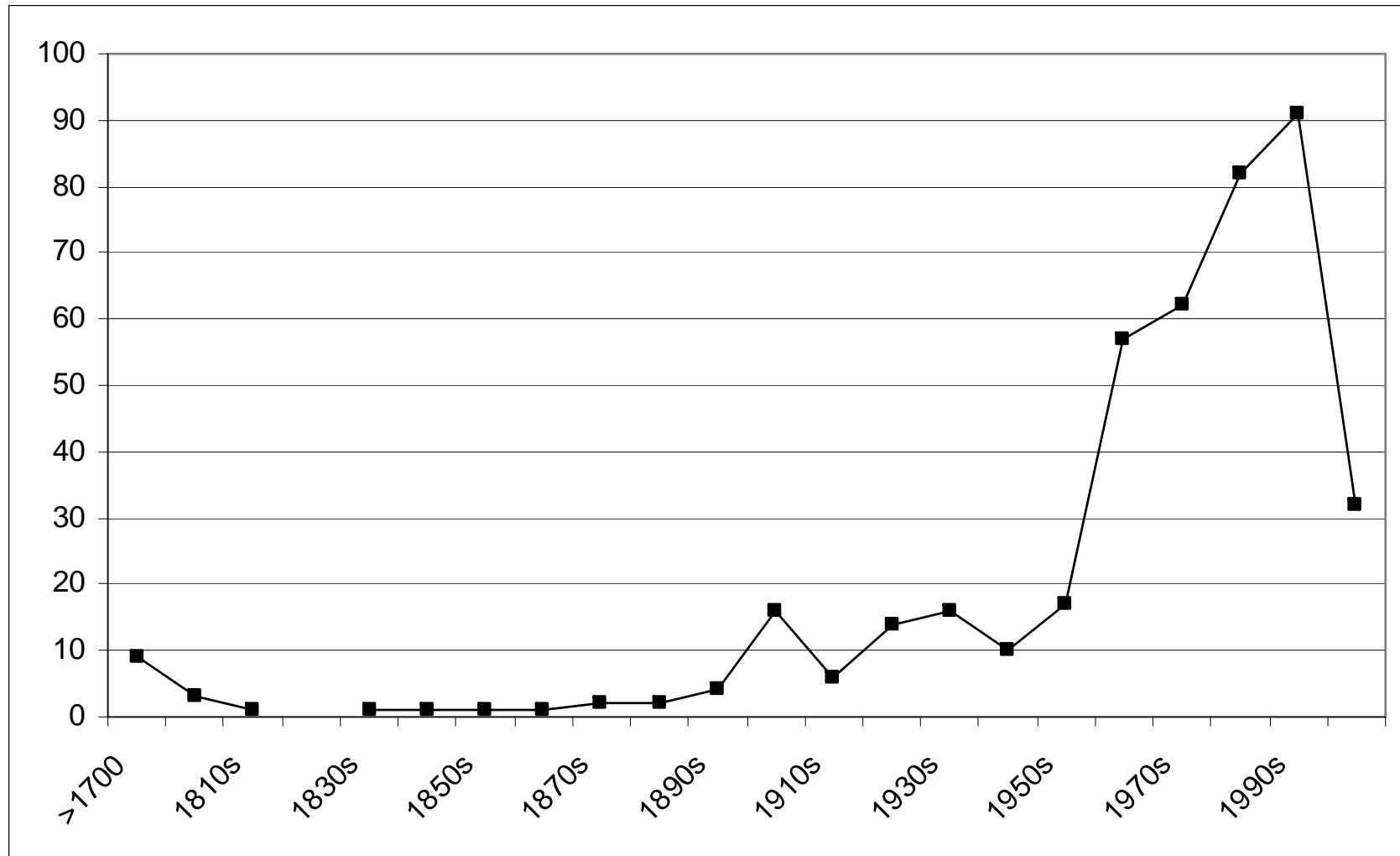
2.1 Analysis of the spread of novel pathogens and disease

- Almost 400 non-target species introduction events included in the database
- Of those, approx. 50% are unintentional introductions of disease agents and pathogens
- Secondary spread between aquaculture sites in Europe is also of serious concern as non-target species were frequently moved unintentionally
- For 217 events it is not indicated and for 27 events it is unknown whether or not it was a target or non-target species introduction

2.1 Analysis of the spread of novel pathogens and disease

- The most impacting disease agents and pathogens include:
 - crayfish plague *Aphanomyces astaci*, large scale mortalities amongst indigenous European crayfish species
 - Infectious Haematopoietic Necrosis Virus, IHNV (1987, impact on salmonids)
 - Viral Haemorrhagic Septicaemia Virus, VHSV (1930s, impact on salmonids, turbot)
 - Spring Viraemia of Carp Virus, SVCV (1727, cyprinids)
 - *Bonamia ostreae*, Bonamiosis (1979, oysters, up to 90% infested)
 - Withering Syndrome (1992, Abalone)
 - *Anguillicola crassus*, Eel nematode (1980s, eels)

2.1 Analysis of the spread of novel pathogens and diseases



New findings of alien pathogens and diseases in Europe including secondary spread.

For 139 new findings the decade of first record is unknown.

2.2 Analysis of ecological disruptions to ecosystem function caused by the introduction of alien species

- The impact of introduced species on ecosystem dynamics was examined in different environments/habitats (marine, estuaries, rivers, and still waters):
 - disturbance of the local environment;
 - intra- and inter-specific interactions;
 - predation;
 - species extinction.
- These data were used to support the risk assessment analysis (WP3) and development of protocols / guidelines (WP4)

2.2 Analysis of ecological disruptions to ecosystem function caused by the introduction of alien species

- Ecological impacts range from single predator-prey interactions to complete shifts in ecosystem functioning:
 - habitat modification
 - nutrient dynamics
 - competition
 - interference with reproductive activities
- Shifts in ecosystem functioning (ecosystem engineers):
 - significant modification in food web structure
 - change from energy-rich to energy-poor system
 - change from fast to slow cycling of nutrients

2.2 Analysis of ecological disruptions to ecosystem function caused by the introduction of alien species

- Case histories were prepared for:
 - Silver Carp (*Hypophthalmichthys molitrix*)
 - the fourth most introduced fish in the world (FAO)
 - target species for fisheries, control of phytoplankton
 - Common Carp (*Cyprinus carpio*)
 - habitat modification (disturbs sediment, disrupts macrophytes and impairs invertebrate reproduction)
 - target species, food and ornamental fish
 - Rainbow Trout (*Oncorhynchus mykiss*)
 - target species
 - alters fish community structure (smaller fish)

2.2 Analysis of ecological disruptions to ecosystem function caused by the introduction of alien species

- Conclusions
 - limit the introduction of top predators, especially to ecosystems with high conservation value
 - limit escapees from aquaculture facilities
 - enforce more stringent quarantine guidelines to reduce „fellow travellers“
 - apply more care when selecting new target species for aquaculture (ban species/families of high risk)
 - increase public awareness (hobby aquarists and pond fishes)

2.3 Analysis of the social and economic impacts of alien species introductions

- Review of the socio-economic importance and impacts
- Analysis of the potential economic costs of impacts arising from transfers of disease and pathogens, disruption of ecosystem functioning and ecological interactions and genetic interactions with wild populations
- A cost benefit analyses to provide input into the risk assessment protocols for helping decision-making procedures of introductions

2.3 Analysis of the social and economic impacts of alien species introductions

- Key general problems are
 - very little data exist on (monetary) socio-economic impacts of alien species in Europe
 - when data are given, it is mostly unclear what estimation method and factors were used
 - EU-funded project „*Technical support to EU strategy on invasive alien species (IAS)*“ coordinated by Institute for European Environmental Policy (IEEP)
 - One key objective is to assess the monetary impact of IAS in Europe, tentatively the
 - documented costs 11.4 billion €/year (1.8 control, 9.6 damage)
 - fisheries & aquaculture >150 million/year including lost revenue

2.3 Analysis of the social and economic impacts of alien species introductions

Evaluation of Total Economic Value

- Use values (market impacts)
 - industry directly affected (e.g. aquaculture)
 - relatively easy to assess
 - industry indirectly affected (e.g. tourism)
- Non-use values
 - non-market goods and services
 - changes in ecosystem functioning
 - species extinctions

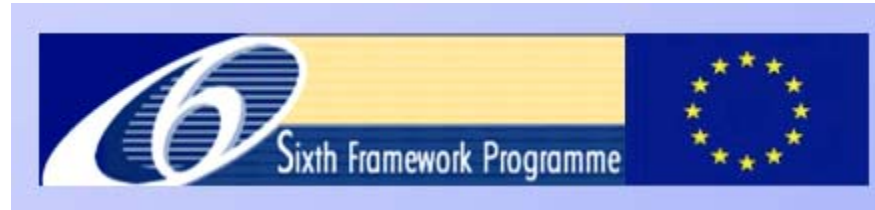
2.3 Analysis of the social and economic impacts of alien species introductions

- Cost Benefit Analysis (CBA)
 - identify all alternative options
 - identify benefits and costs to be considered
 - identify impact of each alternative and selection of indicators
 - prediction of quantitative costs over time
 - assess monetary impacts
 - calculate all benefits and costs
 - evaluate net present value
 - sensitivity analysis
 - results in recommendations

Summary

- Increasing rate of pathogens and diseases during the last century
 - ca. 400 non-target species introduction events known
 - ca. 50% are unintentional introductions of diseases & pathogens
- Documented costs (tentative calculation) of alien species in Europe:
11.4 billion €/year (1.8 control, 9.6 damage)
 - fisheries & aquaculture >150 million/year incl. lost revenue
- Recommendations
 - avoid the introduction of top predators, especially to ecosystems with high conservation value
 - limit escapees from aquaculture facilities
 - enforce more stringent quarantine guidelines to reduce „fellow travellers“
 - increase public awareness (hobby aquarists and pond fishes)

Acknowledgements



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- Data were provided by the EU Programmes DAISIE and DIPNET
- Reports of the ICES Working Group on Introductions and Transfers of Marine Organisms (WGITMO) were consulted
- Additional data were extracted from the NOBANIS and CIESM databases
- Monetary information from EU-funded project „*Technical support to EU strategy on invasive alien species (IAS)*“ coordinated by the Institute for European Environmental Policy (IEEP)