Eels

Is there more to eels than slime? An introduction to papers presented at the ICES Theme Session in September 2006

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The following 15 papers in this issue of the ICES Journal of Marine Science are based on presentations given at a Theme Session—"Is there more to Eels than Slime?"—at the ICES Annual Science Conference held in Maastricht, the Netherlands, during September 2006. International involvement in research on the European eel (*Anguilla anguilla*) started in 1968, when a draft synopsis of eel biology, fisheries, and aquaculture was prepared at the European Inland Fisheries Advisory Commission (EIFAC) session in Rome. By 1975, an ICES Eel Working Group had been set up (WGEEL), and it met in Copenhagen to document information on eel populations and fisheries and, for the first time, to note declining trends in catches. These were the subjects of a joint EIFAC/ICES symposium in Helsinki in 1976, where mitigation by restocking was first proposed, along with a call for further investigations of the species' unusual biology. By 1982, however, it had been recognized that eel catch data were incomplete and unreliable, and the collection of new data at an international level was given a lower priority than investigations of eel biology, because the absence of knowledge of basic processes such as age determination and sex differentiation was blocking progress.

At the 1985 meeting of WGEEL in Perpignan, France, the first real evidence of a rapid decline in recruitment was noted, based on common trends in a number of glass eel fisheries. The 1993 WG meeting was held in Olsztyn (Poland), by which time the decline in recruitment was well established, and it was recognized that more research would be needed to identify and address its causes. In 1996, the consequences of the continued decline in recruitment and observations of a rapid spread of the swimbladder parasite *Anguillicola* focused attention on the need to protect the European eel. This led to the ICES Advisory Committee on Fisheries Management in 1998 advising that the stock was at a historically low level, outside safe biological limits, and suffering a massive anthropogenic impact; it gave the precautionary advice (there was no quantitative assessment) that a protection plan and emergency measures were required urgently.

Meanwhile, ICES tried to develop eel assessments by encouraging national and local data collection (through country reports), along with international compilation of these data to conduct trend analyses of yields, stocks, and recruitment. The working group has identified potential causes of the downward trends, proposed precautionary management targets, and suggested mitigation measures in relation to conservation objectives. It was 2003, however, before the European Commission took up this advice in its proposal to introduce a Recovery Plan with Emergency Measures. A Regulation, initiated by the Commission and developed with input from all Member States, was finally accepted by the EU Parliament in July 2007.

Implementation of this regulation will depend greatly on scientific knowledge of the eel and its fisheries, and the Commission has held a number of meetings and commissioned studies to develop national eel management plans and associated data collection and analyses. These initiatives have generated new information on the biology, population genetics, demography and dynamics, life-history energetics, migratory behaviour, and reproductive studies of anguillid species that occupy oceanic, coastal and fresh-water environments, and the whole gamut of anthropogenic impacts on these processes, from chemical contamination, fishing, and habitat destruction, to climate change and parasites. The well-known result of all these impacts is that recruitment of glass eels to continental waters has fallen steeply in the past 30 years (Figure 1), and the associated decline in fresh-water populations of growing yellow eels and in the escapement of silver eels back to their oceanic spawning grounds is reflected in a decline in catches since the early 1960s (Figure 2).

The ICES Theme Session in 2006 provided a platform for exchange of information and ideas concerning these new research findings and their relevance to providing a scientific basis for conservation of eel stocks. Over two days, an audience of up to 100 scientists absorbed the contents of 26 verbal presentations and 11 posters that came largely from within Europe and concerned the European eel, but also contributions on other species of eel from Canada, Japan, Taiwan, and New Zealand.

Although much of the work presented is still at an early stage, it is clear that exploitation may be just one of the causes of eel population decline, although a reduction in fishing mortality may appear to be the most immediate solution to a growing lack of

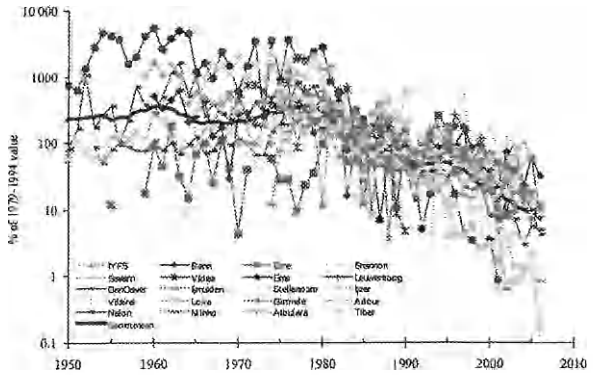

Figure 1. Trends in indices of European glass eel catch per unit effort (data from the joint EIFAC/ICES Working Group).

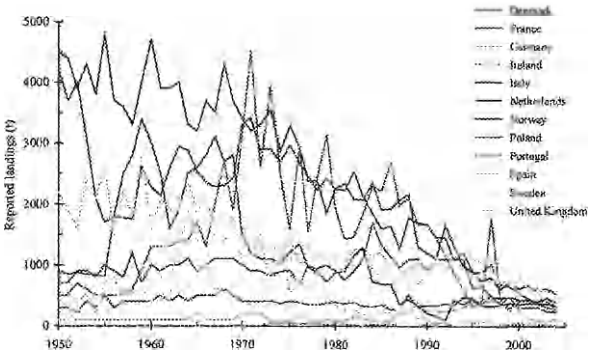

Figure 2. Trends in European eel landings data, as reported to the FAO. This graph shows all series that started in 1950 or before.

reproductive capacity. Although few presentations dwelt on this, some speakers described initiatives to assess directly or to model the status of eel populations (papers by Bark, by Breteler, by Jellyman, and by Simon, the first three with co-authors) and to elucidate and quantify both anthropogenic impacts and potential remedial measures in specific river catchments. Many of the models being developed within national research institutes for this purpose in response to the European Commission's proposed Eel Recovery Plan were evaluated at a recent EU-funded workshop (FP6 project 022488 SLIME, hence the title of the Theme Session), e.g. the papers by Aprahamian and by Bevacqua, and their respective co-authors.

The numerous environmental impacts on the eel include aspects related to its position in the ecosystem (as predator, and as prey), but the most worrying effects are related to its complex lifestyle and its vulnerability to barriers to migration, as well as to parasites and disease, to bio-accumulation of chemical contaminants that disrupt biological functions, and to changes to water quantity and quality brought about directly through industrial and agricultural developments or through the effects of climate change (including North Atlantic Oscillation and *El Niño* effects; e.g. the paper by Kim and his co-authors). Presentations were given that began to describe and quantify many of these issues, but it is clear that it is still not possible to apportion blame for the decline in any meaningful way. Several speakers stressed the important role that density-dependent regulation plays in eel population dynamics, possibly in both oceanic (depensatory) and continental (compensatory) phases (papers by Åström and by Aprahamian and their co-authors), but quantification of these crucial processes requires further investigation. Mitigation measures, such as fish passes for upstream migration and re-stocking with glass eels or elvers were discussed (e.g. the paper first-authored by Beaulaton), together with the potential for efficient deflection schemes at hydropower stations, tuned to river runs and peaks in silver eel migrations (papers by Jansen and by Winter and their co-authors). Apart from being a victim of environmental pollution, the eel has also been proposed as a useful bio-indicator of lipophilic pollutants, because water-phase concentrations below detection levels accumulate in the eel's fatty tissues and provide a good opportunity for monitoring (see the paper by Belpaire and his co-author).

Several of the presentations described new work on the movement and migratory behaviour of eels, through direct observation of glass eels in estuaries (e.g. the paper by Bult and his associates), the use of telemetry and data storage tags with silver eels (see the paper by Westerberg and his co-workers), and examination of environmental "signatures" in otolith chemistry, using Sr:Ca, for example (although no papers on this topic are published here). The presentations promised scope for new insights into population dynamics and stock assessments (including estimates of silver eel escapement), bottlenecks in production, and remedial measures. Additionally, otolith analysis permitted discrimination of natural recruits from trapped and transported animals, and the application of genetics in management was discussed by Maes and his associates.

The general conclusion was that the ICES Theme Session on eels achieved its goal in raising the profile of the multitude of issues surrounding the sustainability of the European eel (as a species, if not as an exploitable resource), informed those tasked with developing national management plans for stock recovery, and established personal and professional links between scientists working in many different disciplines and over a number of continents. We hope that the papers following this brief Introduction provide ample evidence of this.

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