Angling for data: Recreational anglers' records of conger eel (*Conger conger)* landings from the English Channel between 1990-1991

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Abstract

Declines in commercial fish stocks have been well documented through government records of catches. Here we demonstrate that records from anglers, if appropriately interpreted, can be used to provide detailed retrospective data on population trends in fish species. We highlight this with reference to records of conger eel from the British Conger Club that show a decline in size and abundance of conger through the 1990s, during which time the commercial extraction of the species increased markedly. Anglers' records are a potentially important source of quantitative data on population trends of a number of poorly studied species.

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INTRODUCTION

Multi-species approaches to fisheries management

There has been an upsurge of interest in developing an understanding of impacts on or exploitation of marine species that occur parallel to or outside of commercial fisheries (Pitcher *et al.* 2002; Harrington 2005). It has been generally accepted that attempting to manage fisheries through single species modelling causes severe disruption of ecosystem structure (Hollowed *et al.* 2000; Walters *et al.* 2005). Pauly and colleagues (Watson & Pauly 2001; Pitcher *et al.* 2002; Zeller *et al.* 2005) have argued forcefully for a broader approach to modelling marine ecosystems and the need for a more comprehensive species list to be included in the tools used by fisheries managers. Unfortunately there are few long-term data series of unexploited or un-mandated (i.e. those for which there is or has not been a requirement to record catches or landings) species available from sources that a fisheries manager might traditionally use (Zeller *et al.* 2005). Consequently, current attempts to model complex systems such as the Northern European region on the basis of only those few species that are of commercial value (commercial species as a percentage of total numbers of fish) and have therefore been heavily exploited, are likely to be inadequate. Furthermore, an understanding of those species for which data have been collected is hampered by socio-economic factors such as variations in price, discard and the behaviour of fishermen (Schiermeier 2002). Fisheries managers then, would benefit from information on a broad range of species, but are unlikely ever to acquire this information through traditional means. The detailed knowledge of ecologies by local people is in many situations recognised as of value in resource management (Johannes *et al.* 2000; Crona and Bodin 2006) however in the case of fisheries many

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governments prefer to use institutions with a particularly narrow view of the marine environment and a single species approach (Charles 2001).

The conger eel.

The European conger eel (*Conger conger* {Linnaeus 1758}) is the largest member of the family Congridae (~150 species; Nelson, 1994). They have a complex lifecycle but in adulthood are often associated with shallow rocky areas or wrecks between 10-800 m (Moyle & Cech 2000). This long lived and slow growing species reaches maturity between 5 and 15 years and is targeted by both commercial and recreational fishers. Little is known of the biology of congers generally (Xavier et al, 2010) and an extensive literature search by O'Sullivan *et al.* (2003) demonstrated that there has been no significant investigation of the population dynamics of *C. conger*. Correia et al (2009) pointed out that there is little in the way of data relevant to fisheries management despite the fact that they have some commercial importance. Global landings of conger eel in 2009 were estimated by the FAO at 10893 Tonnes, most being landed by France and Spain (FAO, 2011). An understanding of the general biology and distribution of *C. conger* has been hampered by misidentification of *C. triporiceps* which has a distribution from Bermuda to Brazil (Kanazawa, 1958). It is now believed that the European conger is restricted to the Mediterranean and the Eastern North Atlantic (Wheeler 1969; McCleave and Miller 1994).

This study aims to investigate the utility of records from specialist anglers as a source of data to supplement the narrow range of species investigated and managed by governmental institutions. We attempt to show that with appropriate care, data from anglers can pick up long-term trends that are unlikely to be available from any other source.

METHOD

Records from the British Conger Club (BCC) were collated and analysed to identify trends in the conger population in the ten years from 1990 to 1999. Records were separated by line class (20, 30, 40, 50, 60, 80lb = 9.1-36.4kg) and by catch location (shore, wreck or reef). Data extracted from the BCC records contained the weight of each specimen and port at which it was landed. All record fish need to be weighed using certified and officially recognised scales when submitted to the British Conger Club, accompanied by a weighting certificate. Where a member of the British Conger Club makes an application for a line strength award they are required to submit some of the line used for the capture for testing (www.britishcongerclub.org.uk).

RESULTS

The records from the British Conger Club provide annual data of dates and weights of medal fish caught between 1990 and 1999. The data show that eel capture by recreational anglers has a regular summer season in both activity and the size of eels caught (Figure 1). The fact that larger eels are captured during the summer is likely to be a reflection of the higher levels of effort at this time combined with the fact that the figures reflect "medal" fish. Most eels (68% of those recorded) were caught on wrecks using 50lb (22.68Kg) line, and all these specimens were landed at English Channel ports. These data were therefore used to analyse population trends for the species in the Channel over a ten year period.

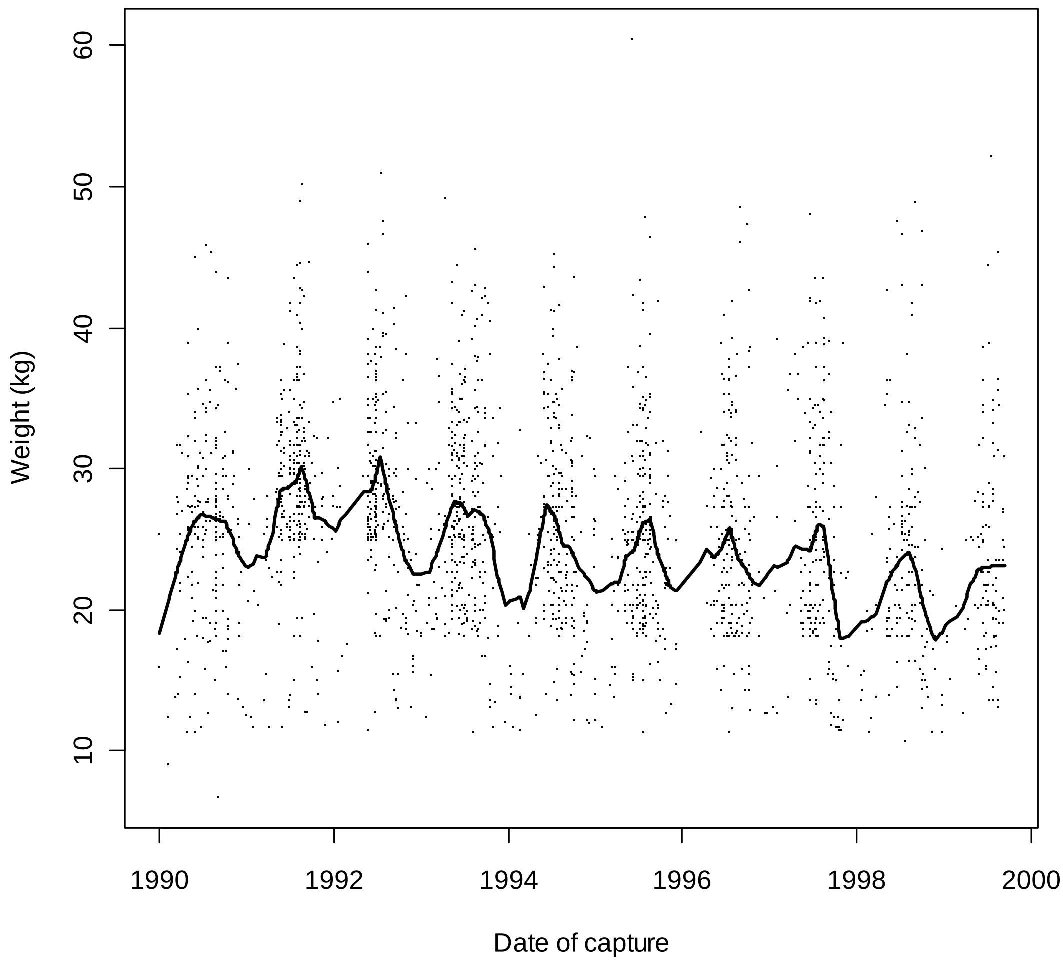

Figure 1: A summary representation of the data on dates of capture and weight of eels provided by the British Conger Club (1990-1999). The line represents a running average of weights with 5% of points used to dictate the value for each date.

The number of eels caught fluctuated, increasing from 1990 to1993 and then declining to 1999. During the same period, the mean body mass of recorded eels declined from 28-29kg in the beginning of the decade to 25-26kg in the second half of the decade (Table 1).

Table 1. Number and body mass of conger eels caught on 50lb line on wrecks in the 1990s recorded by the British Conger Club.

Year	Number Caught	Mean Body Mass (kg)
1990	68	28.3
1991	180	29.5
1992	156	28.8
1993	261	27.6
1994	190	26.9
1995	191	25.6
1996	159	26.4
1997	141	27.3
1998	117	25.8
1999	78	25.8
Mean	154	27.3

Moreover, the size (and presumably age) structure of the population changed.

Weights of eels caught on 50lb lines showed a distinct decrease from a modal value of 25-30 kg in the early 1990s to 20-25kg by the end of the decade (Figure 2).

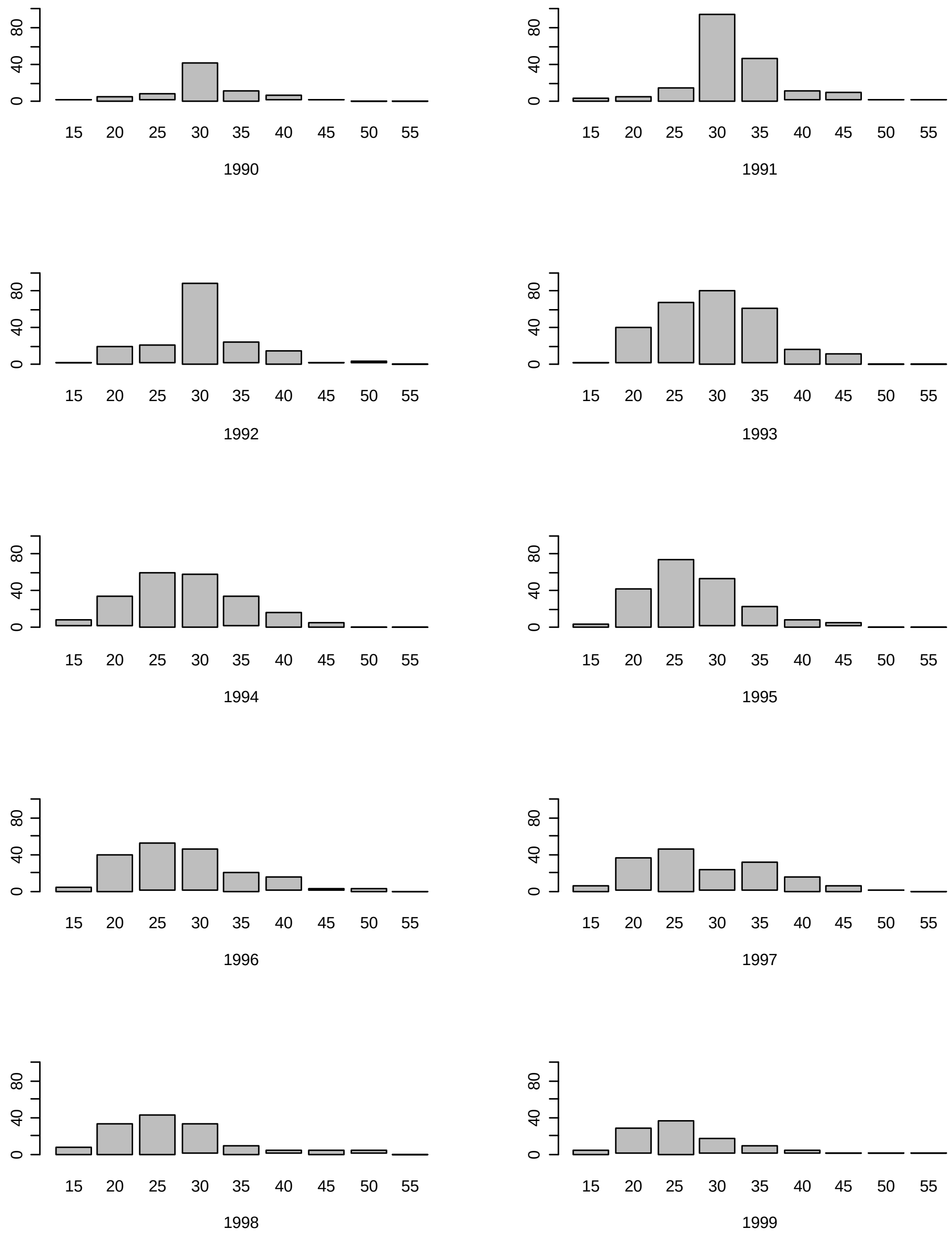

Figure 2: Percentage frequency histograms of eel weight classes for years 1990 to 1999. The figures represent eels captured by anglers using 50 lb (22.7 kg) line. This is the most popular line weight used by eel anglers. Weight classes are in kg.

During the same period there was also a dramatic decline in the number of individuals caught on 60-80lb (27.2 – 36.3 Kg) lines (Figure 3).

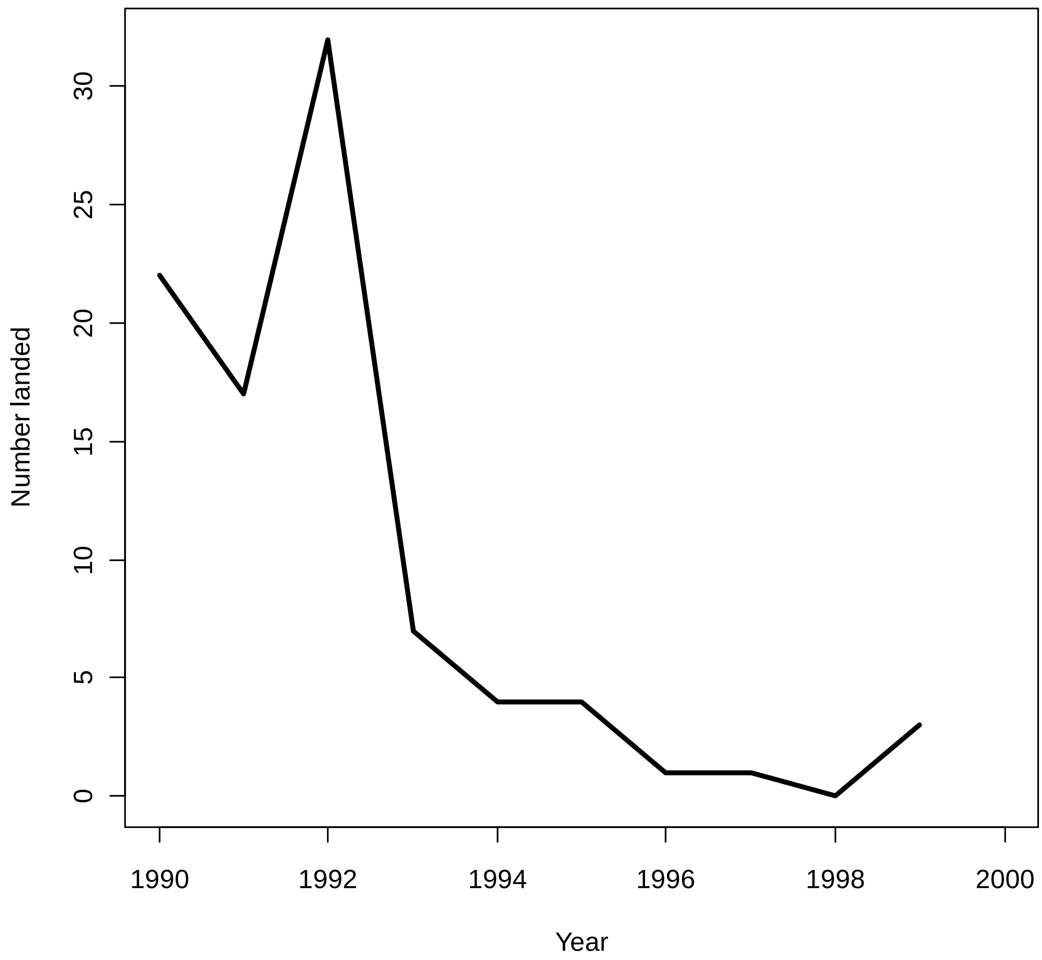

Figure 3: Number of eels landed each year by anglers using 60-80lb (27-36 kg) line.

Body mass of eels landed at different ports was analysed. There was a positive relationship between the number of conger caught in a port on 50 lb line and the mean body mass of fish caught over the ten years (Figure 4; Spearman's correlation, n=49, ρ=0.388, p=0.006).

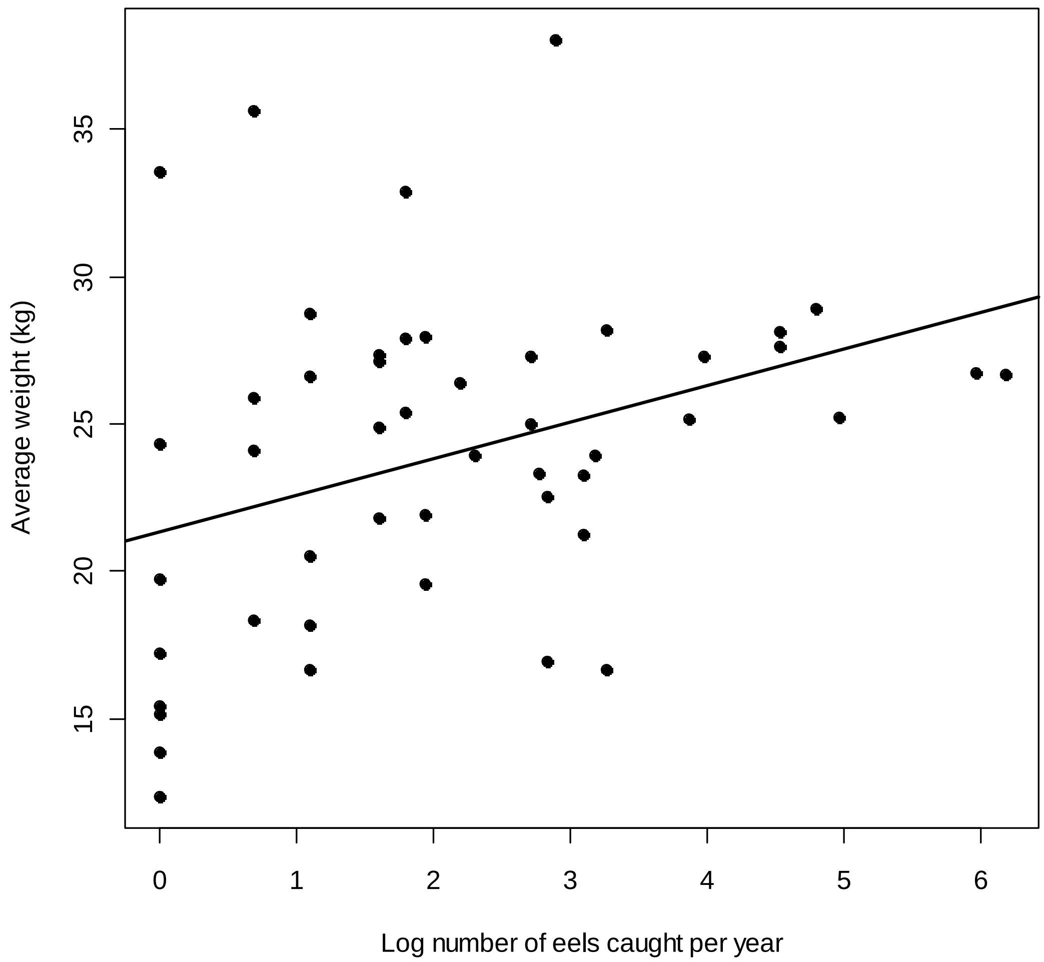

Figure 4: Average weights of conger eels caught using 50 lb (22.7 kg) line for each port plotted against the log of number of eels landed. The data suggest that there is a positive and significant correlation between the two with larger eels being landed in ports where the total number captured each year is highest.

This is likely to be a reflection on numerous factors such as greater levels of experience amongst charter skippers and fishers in ports where it is a popular target species and the improved likelihood of large fish being landed in ports where more conger fishing takes place (see Figure 1). The median body mass of eels in the final five years of the decade at each of the 6 ports that had over 50 records (i.e. averaging more than 5 records per year) was subtracted from that in the first five years of the decade and compared to the number of eels landed at that port. There was no significant relationship between the two (Spearman's Correlation $R = 0.0.257$, $p = 0.658$) suggesting that excessive angling from these ports was not the direct cause of decline in eel body mass.

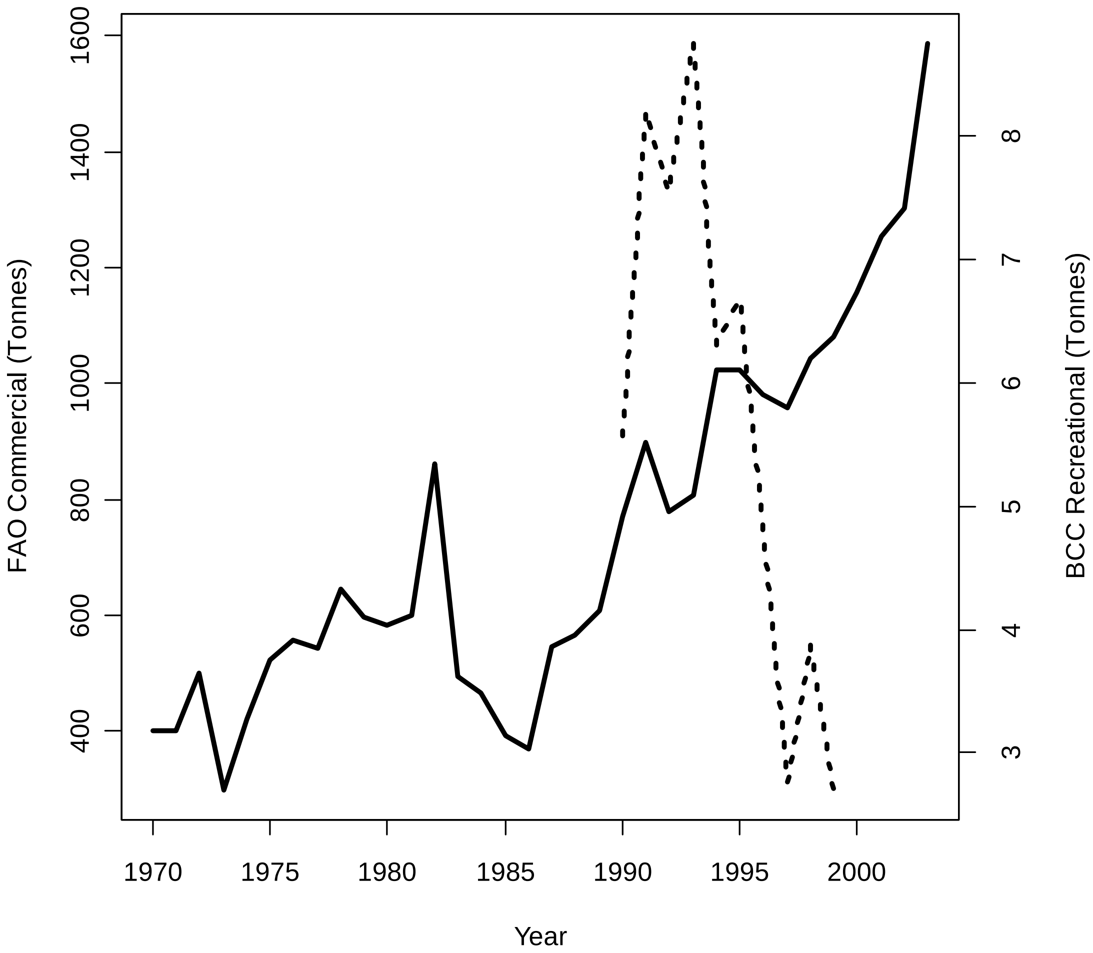

Figure 5: Total mass of conger eels landed by British commercial vessels (black line) and recorded by the British Conger Club (dashed line). Sources: FAO statistics and British Conger Club records.

The period of observation of British Conger Club records was concurrent with an ongoing increase in the total mass of conger landed by British (and other European) commercial fisheries in the north east Atlantic. In the 1990s, conger eel landings by

British commercial fishers increased from 770 tonnes in 1990 to 1081 tonnes in 1999 – a 40% increase in catch (Figure 5).

DISCUSSION

Dynamics of the conger population

This study has demonstrated that over a 10 year period the conger eel declined in abundance and body size in the English Channel. Moreover this decline occurred relatively rapidly, with clear changes observable from year to year. The size structure of the population shifted such that the modal body mass of individuals caught on 50lb line decreased. The chance of landing an individual eel must depend on the density of eels of a certain body mass in the population, the susceptibility to capture of these individuals and the chance that they will, once hooked, be landed without breaking the line. A decline in body mass of eels caught on 50lb line might be explained by an increase in large eels being caught on stronger lines. However the crash in numbers of eels caught on 60-80lb line suggests a decline in the largest eels to the point that there are either very few to catch or anglers ceased fishing with these lines.

At the same time as angling records demonstrated a decline in body size of conger eels, commercial fishery records showed a substantial increase in conger landings which are greater by over two orders of magnitude than recorded angling takes. The obvious conclusion is that increases in commercial takes of the species caused a decline in body size and abundance. While the angling data presented here provide circumstantial, correlative evidence and are by no means conclusive, they highlight potential issues with conger eels in the English Channel (and possibly elsewhere) and allow retrospective inspection of the nature of the fish population from a species for which there are no detailed government records.

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The use of angling records

While care must be taken when using data not collected specifically for scientific purposes, there is much valuable information to be gained from records of non-scientists. Organised associations of enthusiasts often endure for many years, and while the precision of the data may be relatively poor, its volume and longevity allow formal analysis. Elton and Nicholson (1942)'s classic analysis of the ten year cycle in fur trapping data was an early example of this. Wheeler (2002) used local naturalists' records to highlight causes of population fluctuation in mountain hares over a 30 year period. The more meticulously records are collated and kept, the more useful they may be to scientists; organised clubs or societies are often very careful recorders, and where participants are vetted (e.g. the BTO bird ringing scheme) much detailed, high quality information can be obtained (e.g. Gergory and Baillie, 1998; Toms and Newson, 2006).

Angling records are usually accompanied by data on equipment used, location and site of capture which are invaluable in interpreting trends in the data. The BCC conger eel data demonstrate this well. Records of line and catch site type allow some of the inherent variation in the data to be removed, and the fortuitous fact that large numbers of eels were caught on wrecks with 50lb line allow a detailed picture of the ten year time-series trends to be presented based on these data alone. However, a closer alliance between fisheries scientists and anglers might reasonably see the collection of other important information.

There have been previous suggestions for greater inclusion of the angling community into fisheries management, e.g. through rights based management (Sutinene and Johnston 2003) with the implication that anglers should pay for the right to fish.

There are many problems associated with this including the difficulty and cost of policing individuals. If anglers could be used to monitor their target species better perhaps this could serve as a mechanism for them to 'pay' for access to the fishery. Inclusion of fishers in scientific investigations can lead to changes in attitude towards their species. Drake *et al.* (2002) demonstrated that by providing anglers with simple tools such as length-girth-weight tables and streamer tagging equipment a subtle shift in attitude from predator to owner could be engendered. Data from anglers may be particularly useful in the case of charismatic surrogate species (Caro and O'Doherty 1999) such as conger and tope shark (*Galeorhinus galeus*) that may be indicators of ecosystem health but which are too large to be of interest as food to individual anglers.

Conclusion

The analysis of conger eel angling records here demonstrates there was certainly a marked decline in body size of the species in the English Channel through the 1990s, and possibly a decline in abundance through the same period. This serves to highlight the potential for angling records to provide long term data on species that are not of major commercial importance but may, nevertheless, be impacted by commercial fisheries. Moreover, it demonstrates a source of data on poorly studied species that could be incorporated into current models for a more holistic management of the marine ecosystem. Anglers could be to fisheries managers what garden bird watchers are to ornithologists, an enthusiastic, abundant source of data that serves to connect citizens with the science that is used to manage their environment.

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