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Short communication

Time-series data for a selection of forty fish species caught during the International Bottom Trawl Survey

Henk J. L. Heessen

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Relative abundance estimates of 40 fish species caught during the ICES coordinated International Bottom Trawl Survey are presented for the period 1970–1993. Trends in survey catches for eight commercial species are compared with total stock biomass estimates derived from stock assessment. In general, there is a remarkably good correspondence between these two independent parameters, suggesting that the survey is capable of registering significant changes in abundance. Among the 40 species, there are many more showing a positive trend during recent years than a negative one. However, the commercial species are all either declining or are stable. The most significant changes are observed in "southern" species, which is probably related to a period of relatively warm winters after 1990. In many resident species, however, that appear to be increasing over a prolonged period of time, this explanation does not seem to apply.

Key words: fish, long-term trends, North Sea, trawl survey.

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Introduction

The data from the ICES coordinated International Bottom Trawl Survey (IBTS) provide one of the longest time series available for demersal fish species in the North Sea. The survey has been carried out annually in February since 1965. Initially, herring (*Clupea harengus*) was the target species, and the survey coverage was restricted to the southern and central North Sea. Since 1969, the Skagerrak and Kattegat have been sampled and from 1974 onwards the entire North Sea area has been included in the survey area.

An overview of the distribution of all fish species caught during the IBTS, based on catches in the years 1985–1987, is given in Knijn *et al.* (1993). Time series for 10 of the most abundant non-commercial species caught are presented in Heessen and Daan (1996), and for 6 species of rays in Walker and Heessen (1996). This paper presents time series of average catch rates for a selection of 40 other species for the period 1970–1993, including 8 commercially important species. The survey catches of the latter are compared with estimates of total stock biomass (TSB) (from ICES, 1995a).

Materials and methods

Survey methods are summarized in Heessen and Daan (1996) and a full description is available in ICES (1992). All data are stored in the IBTS Database at the ICES Secretariat in Copenhagen. Data on by-catch species are incomplete for the period 1970–1982, because not all data have been computerized. For eight commercial species the survey catches are complete. Average catch rates in numbers per hour fishing have been calculated over all hauls made in the North Sea proper (cf. areas 1–7 in Fig. 1 of Heessen and Daan, 1996).

Results

Sharks (Fig. 1)

Except for spurdog (*Squalus acanthias*) (see Heessen and Daan, 1996), sharks are caught infrequently. Tope (*Galeorhinus galeus*) has only been reported since the 1980s. This species is probably mainly a summer visitor in the German Bight (Knijn *et al.*, 1993). Smooth hound (*Mustelus mustelus*) is caught in very low numbers.

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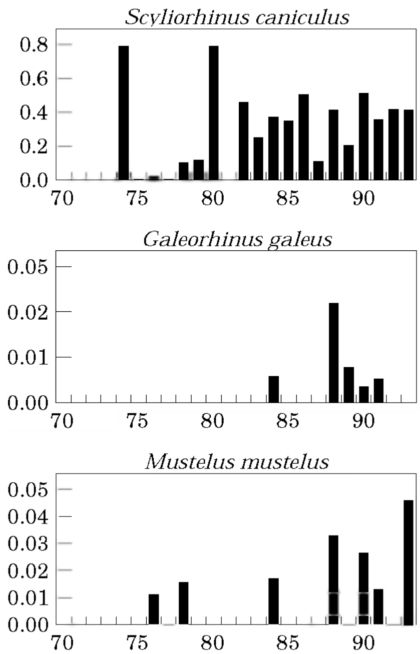

Figure 1. Average catch per one hour fishing for three shark species, 1970–1993.

Lesser-spotted dogfish (*Scyliorhinus caniculus*) is slightly more abundant, particularly in the north-western parts. Since the early 1980s the catches have been fairly stable.

Pelagic species (Fig. 2)

Both the survey catches and TSB clearly show the reduction in herring abundance in the late 1970s, and the recovery of the stock in the following 10 years. Catches of sprat (*Sprattus sprattus*) are rather variable. Anchovy (*Engraulis encrasicolus*), a southern species, was regularly caught in the 1970s. Over recent years numbers have been slightly increasing (see also Boddeke, 1996). The lesser argentine (*Argentina sphyraena*) dominate over the greater argentine (*A. silus*) in the catches, but both species appear to have increased over the last decade.

Gadoids (Fig. 3)

The gadoid catch is largely dominated by the four commercial species cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), whiting (*Merlangius merlangus*), and Norway pout (*Trisopterus esmarki*). After a number of strong year classes in the 1970s the abundance of cod gradually decreased. Since around 1975, both survey catches and TSB show the same downward trend. Catches of haddock and whiting

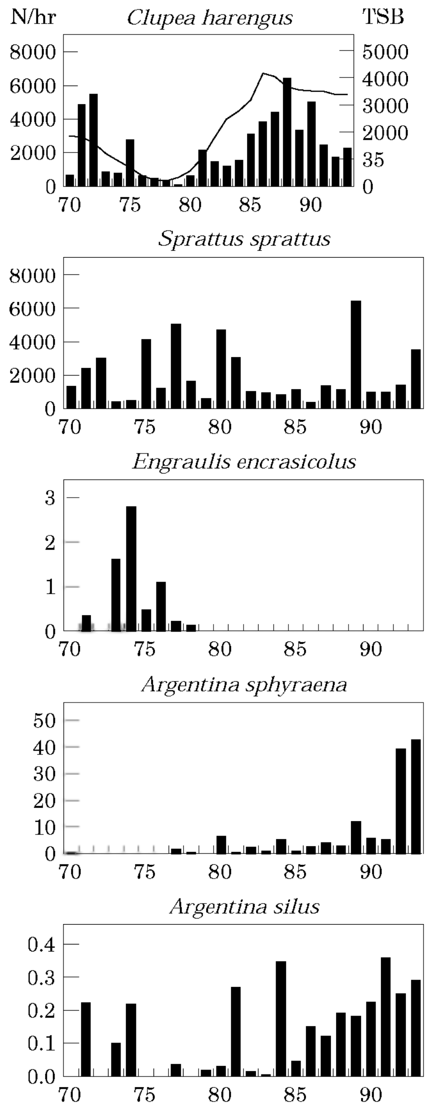

Figure 2. Average catch per one hour fishing for five pelagic species. For herring, the drawn line represents estimated TSB (Total Stock Biomass in ’000 t; right-hand axis; Anon., 1995a).

varied considerably over the 24-year period, but recent numbers per hour were at the same level as in the 1970s. For haddock, survey catches and TSB follow the same pattern. For whiting, however, there is no agreement between the two. Since the mid-1980s, the IBTS data show a gradual increase, whereas according to the assessment TSB remains stable (ICES, 1995b). For both saithe (*Pollachius virens*) and Norway pout (*Trisopterus esmarki*) there is little resemblance between the survey catches and TSB. Pollack (*Pollachius pollachius*), tusk (*Brosme brosme*), ling (*Molva molva*), and hake (*Merluccius merluccius*) are caught irregularly without clear trends.

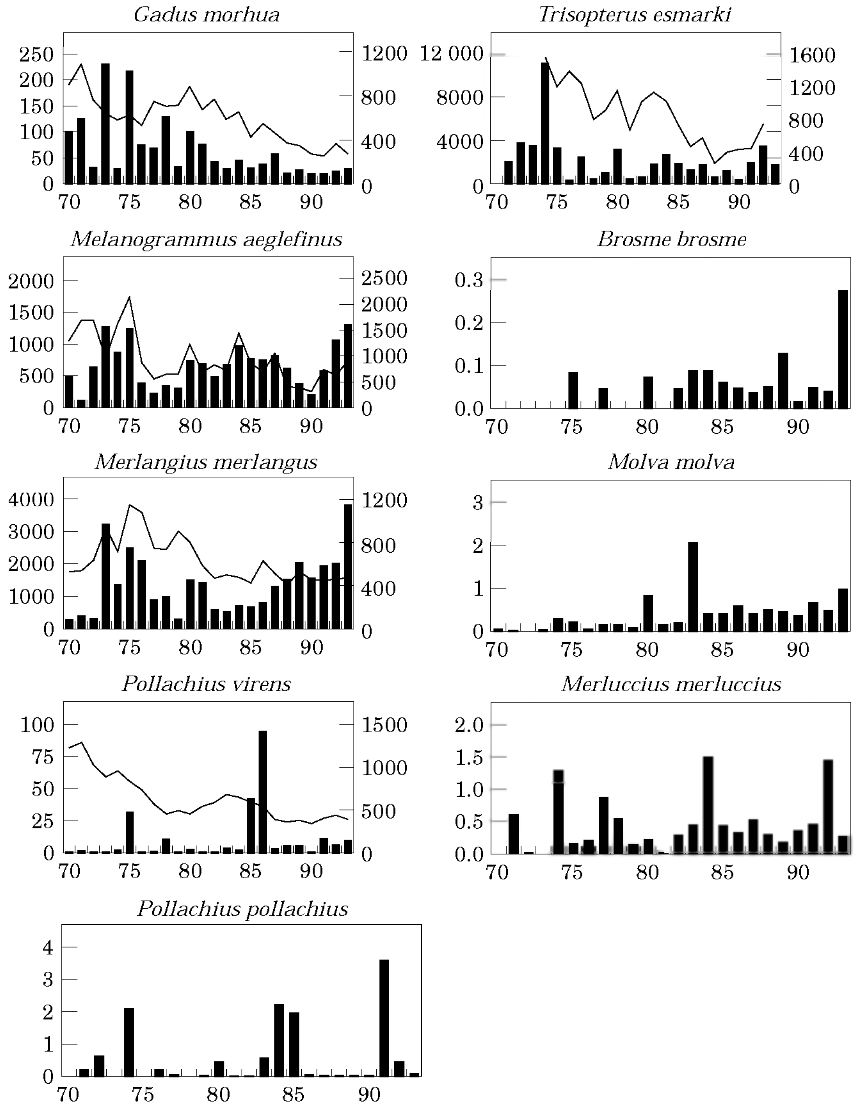

Figure 3. Average catch per one hour fishing for nine gadoid species. For cod, haddock, whiting, saithe, and Norway pout, see also legend to Figure 2.

"Southern" species (Fig. 4)

The four "southern" species presented here show a remarkable increase in the most recent period (see also Corten and van de Kamp, 1996). Lesser weever (*Echiichthys vipera*) is a resident species on sandy bottoms. John Dory (*Zeus faber*) and mullet (*Mullus surmuletus*) have been caught incidentally in earlier years, whereas boar-fish (*Capros aper*) and blue-mouth (*Helicolenus dactylopterus*) are newcomers. The catches of blue-mouth, a deep-sea species, have been traced to one single year class that invaded the northern North Sea in the winter of 1990/1991 (Heessen *et al.*, 1996).

Flatfishes (Fig. 5)

Seventeen flatfish species have been reported in the IBTS (see also Heessen and Daan, 1996), of which 11 are shown here. Compared to many other species, catches of most flatfish species are remarkably stable. Although the gear used in the survey is certainly not very efficient for catching flatfish, the trends in catch rates in numbers and in TSB (weights) from stock assessment for plaice and sole are in remarkably good agreement, indicating both decreases in plaice (*Pleuronectes platessa*) in recent years and recent maxima in sole (*Solea solea*). Turbot (*Psetta maxima*),

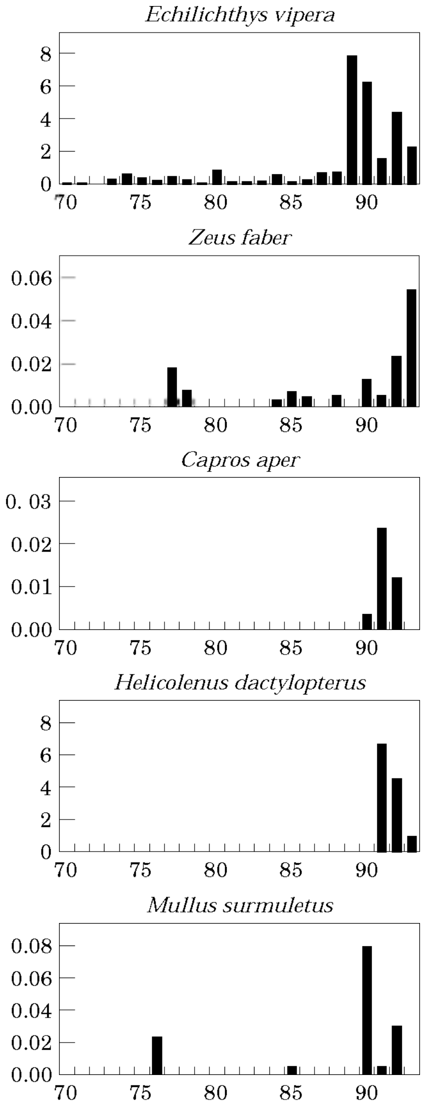

Figure 4. Average catch per one hour fishing, for five southern species.

brill (*Scophthalmus rhombus*), witch (*Glyptocephalus cynoglossus*), and solenette (*Buglossidium luteum*) show similar patterns with a maximum in the late 1970s and an increase in recent years. Scaldfish (*Arnoglossus laterna*) and Norwegian topknot (*Phrynorhombus norvegicus*) have also increased. Flounder (*Platichthys flesus*), halibut (*Hippoglossus hippoglossus*), and megrim (*Lepidorhombus whiffiagonis*) appear to have remained stable over most of the period.

Mixed demersal species (Fig. 6)

The catches of angler (*Lophius piscatorius*) and red gurnard (*Aspitrigla cuculus*), a southern species, have recently increased. The tub gurnard (*Trigla lucerna*) shows no clear picture. The dragonet (*Callionymus lyra*) had a much higher abundance in the 1970s than in recent years. The spotted dragonet (*C. maculata*) is caught in low numbers, but recent catch rates have been relatively high. Catfish (*Anarhichas lupus*) and lumpsucker (*Cyclopterus lumpus*) show similar patterns with highest catches in the mid-1980s.

Discussion

The IBTS data represent a valuable source of information for studying changes in the North Sea fish fauna. Unfortunately, computerized data for the years prior to 1983 are still incomplete, and more data do exist in paper format in different laboratories that have participated in the past. The interpretation of the time-series data for the earlier years (1970–1973) is also hampered by the gradual increase of the survey area during that period. A more detailed analysis might show which effect the expansion has had on the time series, but such analyses must wait until all data hae been made available.

The catch rates in numbers show close agreement with the estimated trends in stock biomass based upon stock assessment for many of the commercial species, including flatfish. This seems remarkable, because the survey has been primarily aimed at estimating recruitment and the youngest year class makes up a much larger proportion of the total population in numbers than in weights. The agreement for flatfish is also not expected because the survey is not geared to these species. The conclusion might be drawn that the survey is well capable of registering changes in stock abundance in general.

The data show that, on a total North Sea scale, many of the southern species have done relatively well in recent years, corroborating the findings of Corten and van de Kamp (1996) that relative warm winters may have been a critical factor for this group. However, also many of the resident species appear to have become gradually more abundant over much longer periods, suggesting that another factor is involved. Relatively few species have decreased in abundance, but among these the commercially important species are noteworthy, suggesting effects of the fisheries. In general, a better understanding of the biology of the by-catch species appears to be a prerequisite for understanding what has caused all the observed changes in the North Sea fish fauna.

Acknowledgements

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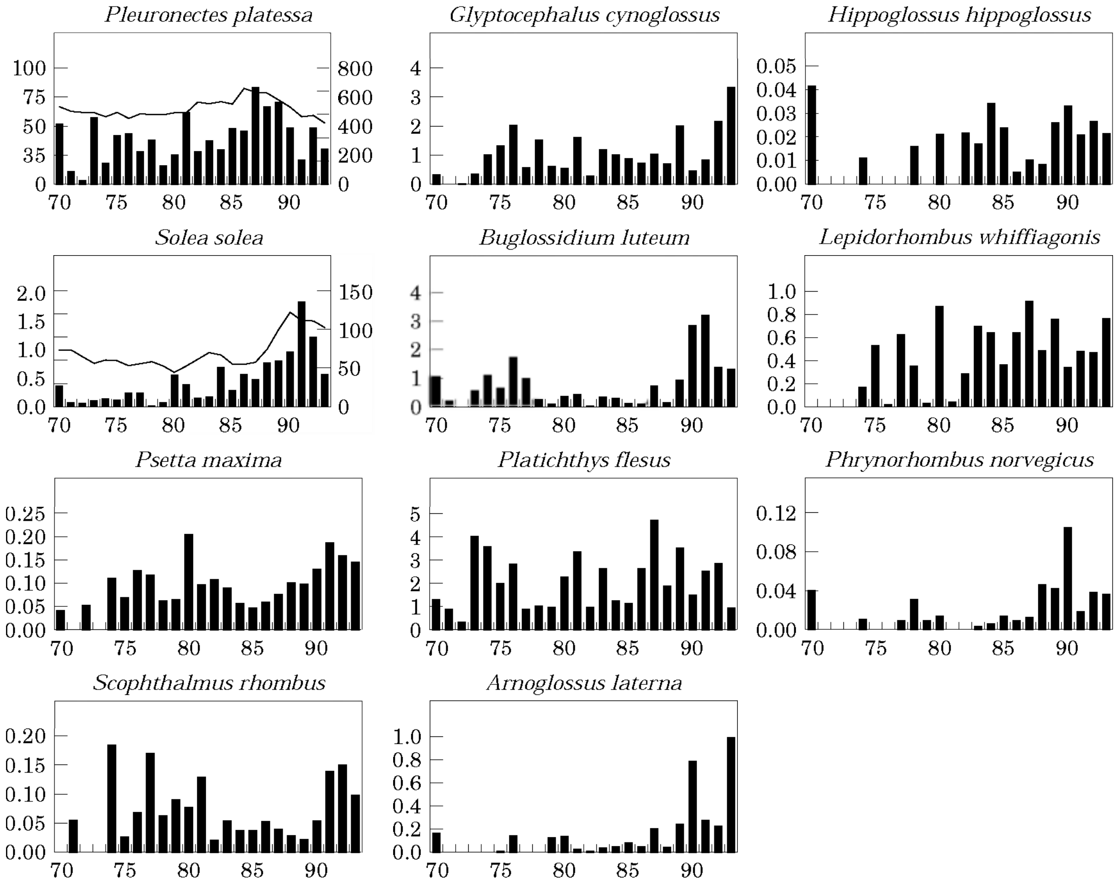

Figure 5. Average catch per one hour fishing, for 11 flatfish species. For plaice and sole, see also legend to Figure 2.

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Please note Figure 6 is on the following page.

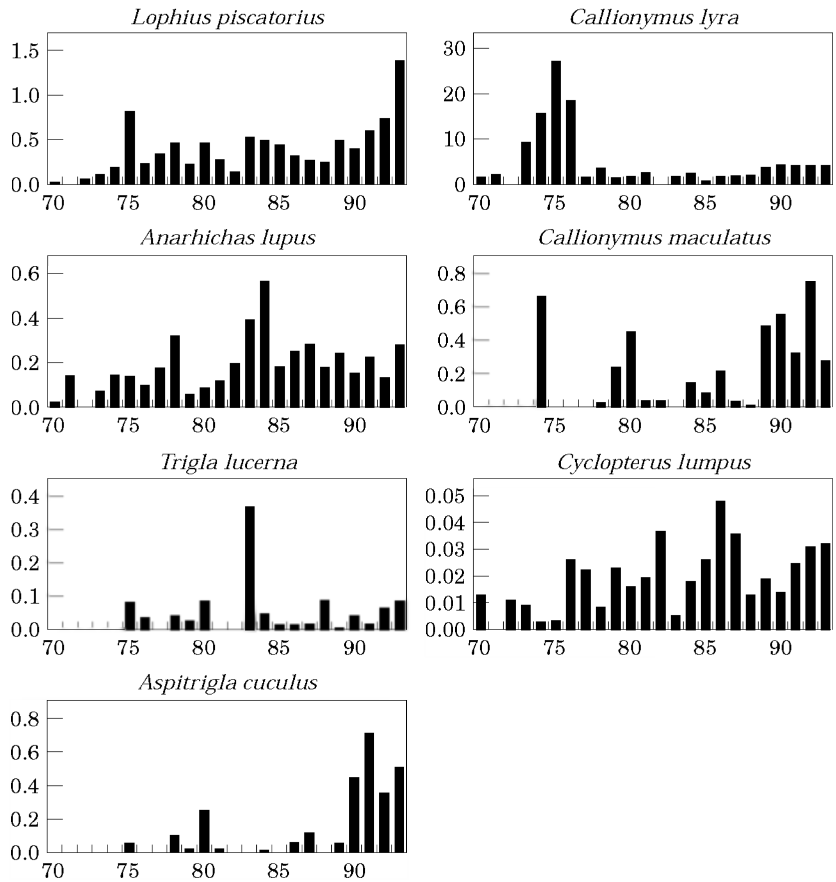

Figure 6. Time series, as average catch per one hour fishing, for a mixture of seven demersal species. Data from the ICES IBTS Database.