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TITLE: Climate change and squid range expansion in the North Sea

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ABSTRACT:

Abstract Aim Studies focussing on long?term changes in squid populations are rare due to limited availability of fisheries?independent data. However, squid play an important role as predator and prey in marine food?webs and have also become an increasingly important target for fisheries. Their short life history is thought to make them particularly sensitive to changes in the environment, potentially leading to strong fluctuations in population size. Here, we investigate whether squid have increased in the North Sea, in terms of distribution and abundance, and whether these patterns are related to variability in environmental and climatic factors. Location North Sea, north?east Atlantic Ocean. Methods We extracted squid catches from a unique 35?year time series of bottom trawl survey data in the North Sea (1980?2014), collected during late summer (August?September). Changes in distribution and abundance were compared with climatic variables known to be linked with various ecosystem components in the area. Results We found that squid distribution across the North Sea increased over the 35?year time series. Loligo expanded southward from a predominantly north?easterly distribution, compared to northward expansions by Alloteuthis and the Ommastrephidae from their core distributions in the southern and central North Sea respectively. In addition, all squid species studied here displayed an overall increase in biomass over the time series and there were large annual fluctuations. Significantly positive relationships were found between this increase and climate variables for each of the dominant individual taxa studied and when all species were combined. Main conclusions The results suggest a strong causal relationship between climate variability, notably warming sea temperatures, and squid populations. At least for the last 35 years, climate change appears to have been largely favourable for squid and with changes in climate set to continue, squid may end up beneficiaries where many finfish struggle.

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