An increase in snake pipefish (*Entelurus aequoreus*) in the northeast Atlantic: possible causes and effects

David Johns[1] and Nick Halliday[2]
[1]SAHFOS, Plymouth, UK (djoh@sahfos.ac.uk)
[2]Marine Biological Association, Plymouth, UK (ncha@sahfos.ac.uk)

Climate induced changes in the planktonic community have been reported in the North Atlantic in recent years (Beaugrand *et al.*, 2002), and similar responses have been seen at higher trophic levels such as fish (Brander *et al.*, 2003). Many of these responses have been identified by the use of the Continuous Plankton Recorder (CPR), and here we discuss recent results from the survey concerning pipefish, numbers of which have increased dramatically around the UK in recent years. This has also been reported in both the scientific and popular press, and anecdotally by many divers. Pipefish are easily recognised, being vermiform with a long slender 'snout' and an armoured outer layer, much like an elongated seahorse. This increase has raised many questions, why has it happened and what affects will it have on the ecosystem?

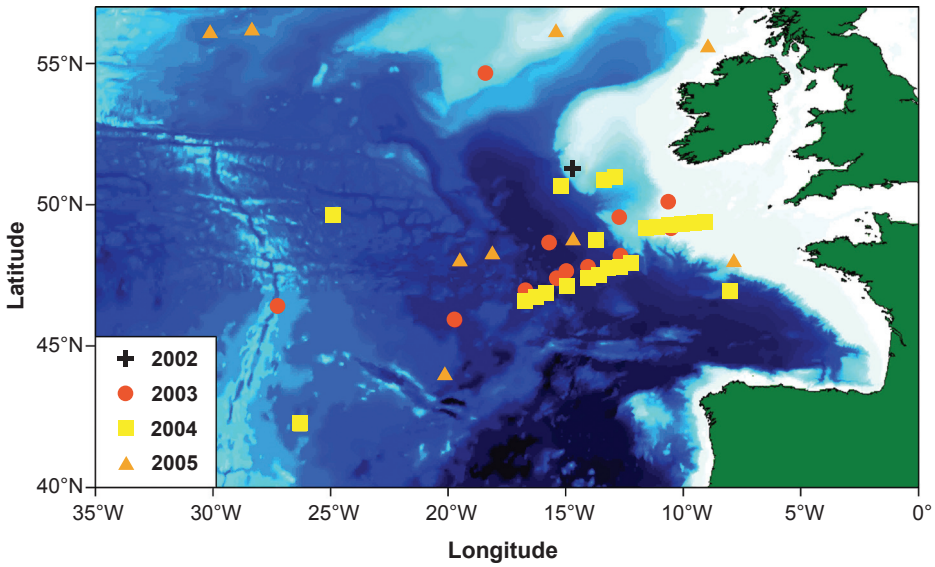

Figure 1. Pipefish records in the CPR survey.

The Continuous Plankton Recorder Survey has sampled the North Atlantic extensively for over 70 years, routinely recording over 300 zooplankton and over 200 phytoplankton taxa. The CPR samples at a depth of 7-10 metres, and is towed behind merchant vessels on their regular monthly routes. One of the initial objectives of the CPR survey was to aid understanding of fish stock variability, and for the potential prediction of fish distribution using plankton abundance and distribution data for the North Sea and the north-eastern Atlantic. Fish eggs and larvae are recorded in the routine analysis of CPR plankton samples however with the exception of isolated studies fish larvae have not been specifically identified since the late 1970s/early 1980s, when reduced funding resulted in a change in research priorities. Fish larvae are among the largest organisms sampled by the CPR and due to their nature are often damaged during sampling, however they can be generally be assigned to genus, family or to more homogeneous groups. One type of larval fish that is easily identified, and is therefore routinely noted in the records, is the pipefish. They have a tough exterior, like other members of the Sygnathidae (such as seahorses), and this allows them to remain intact when they enter the CPR. The use of genetic techniques has identified the species as the snake pipefish, *Entelurus aequoreus*, the most oceanic member of the family.

Prior to 2002, pipefish were rarely recorded in the CPR survey. In 2002, unprecedented numbers of pipefish were recorded in the north east Atlantic, and this has continued up to the present day. They have been recorded as far west as the mid-Atlantic Ridge, and throughout their natural range from the Azores to Iceland (Fig. 1). The species has, so far, been generally absent from the North Sea in CPR samples (although for two successive years individuals have been recorded on the Shetland to Aberdeen route). CPRs from west of Ireland have returned with large adult specimens caught on outside protuberances (for example the shock absorber at the front of the mechanism), suggesting very high abundances in the area. Harris *et al.* (in press) report the increase in snake pipefish over a wide geographic area, from the southern North Sea northwards towards Spitsbergen and the Barents Sea.

The reason for the increase could be due to a rise in sea surface temperatures (SST), affecting the animal's physiology. Male *E. aequoreus* brood the eggs on their abdomen, where they are laid by the females in an incubation area. Whilst the eggs are in position, the males are unable to mate with the females, who are batch spawners. It is thought that *E. aequoreus* responds to a rise in temperature similarly to the related *Sygnathus typhle*, where an increase in sea temperature from 10 to 15°C can reduce egg incubation time by approximately 23 days. This would allow the males to breed more frequently (Kirby *et al.*, 2006). Another possible reason for the increase could be due to changes in the

plankton prey of the pipefish. These changes could be in abundance or distribution of prey species, both of which may have altered due to increased SST. For example, there has been a decrease in the abundance of *Calanus* around the UK (Edwards *et al.*, 2006), and a northward shift in calanoid copepods (Beaugrand *et al.*, 2002).

The affects of this increase in the species are as yet not fully understood, but it is already apparent that seabirds are feeding snake pipefish to their young, with disastrous results (Harris *et al.*, in press). The bony nature of the species has led to chicks choking, and the apparent poor nutritional content of snake pipefish has contributed to chicks in some colonies starving to death. Prior to 2004, snake pipefish had not been recorded in the diet of seabirds, but a shift to their inclusion may prove to have a detrimental effect on seabird colonies that are already under stress from the decline in sandeel populations.

References

Beaugrand G., P.C. Reid, F. Ibanéz, J.A. Lindley and M. Edwards. 2002. Reorganization of North Atlantic marine copepod biodiversity and climate. Science 296: 1692–1694.

Brander K.M., G. Blom, M.F. Borges, K. Erzini, G. Henderson, B.R. MacKenzie, H. Mendes, J. Ribeiro, A.M.P. Santos and R. Toresen. 2003. Changes in fish distribution in the eastern North Atlantic: Are we seeing a coherent response to changing temperature? ICES Marine Science Symposia 219: 261-270.

Edwards M., D.G. Johns, P. Licandro, A.W.G. John and D.P. Stevens. 2006. Ecological Status Report: results from the CPR survey 2004/2005. SAHFOS Technical Report 3: 1-8.. ISSN 1744-0750.

Harris M.P., D. Beare, R. Toresen, L. Nøttestad, M. Kloppmann, H. Dörner, K. Peach, D.R.A. Rushton, J. Foster-Smith and S. Wanless. In press. A major increase in snake pipefish (*Entelurus aequoreus*) in northern European seas since 2003: potential implications for seabird breeding success. Marine Biology doi:10.1007/s00227-006-0534-7.

Kirby R.R., D.G. Johns and J.A. Lindley. 2006 Fathers in hot water: rising sea temperatures and a Northeastern Atlantic pipefish baby boom. Biology Letters 2: 597-600. doi: 10.1098/rsbl.2006.0530.