

IMPACTS OF CLIMATE CHANGE ON SALINITY

Christine Gommenginger

National Oceanography Centre, Southampton

Executive Summary

Observational evidence for salinity changes and trends in the North Atlantic and UK waters is summarised annually in the International Council for the Exploration of the Sea ([ICES](#)) Report on Ocean Climate (IROC) (ICES, 2006). The Inter-Agency Committee on Marine Science and Technology ([IACMST](#)) published a comprehensive report in 2004 reviewing the status of various ocean parameters, including salinity, in UK Marine Waters (IACMST, 2004). The main points are:

- There are only few long-term time series of salinity measurements in UK waters and these do not indicate any overall long-term trend.
- Records from the Atlantic around the UK which are most influenced by in-flowing Atlantic waters reveal a general pattern of low salinity in the mid-late 1970s, followed by three decades of quite large inter-annual variability, probably closely associated with changes in the atmospheric circulation ([North Atlantic Oscillation](#)). Salinity records from the Faroe-Shetland Channel and the Ellett Line indicate a trend to high salinity since 1995.
- In the shallower areas of the North Sea and Irish Sea, the salinity is much more dependent on local runoff from land and local evaporation/precipitation changes, and hence is much more variable.
- Observational evidence suggests significant freshening of the mid-high North Atlantic between the 1950s and 1990s (Dickson *et al.*, 2002, Curry *et al.*, 2003; Josey and Marsh, 2005), which has been attributed to changes in atmospheric circulation. Recent observations in the North Atlantic show that the trend in the last decade (1995-2005) has been of warming and increasing salinity in the upper layers of the ocean (ICES, 2006)

Level of Confidence

Low

Key sources of Information

See Supporting Evidence

Supporting Evidence

The ICES Reports on Ocean Climate provide a view of environmental conditions in the North Atlantic by summarising results from long-term observations at standard sections and stations. The IROC (formerly known as the ICES Annual Ocean Climate Status Summary) is an annual publication by the ICES Working Group on Oceanic Hydrography (ICES, 2006).

The Inter-Agency Committee on Marine Science and Technology (IACMST) published a comprehensive report in 2004 on the status of various ocean parameters, including salinity, in UK Marine Waters (IACMST, 2004). The IACMST report included a review of the findings of the ICES group up to 2004.

Summary of changes and trends in salinity for UK waters (extracted from IACMST, 2004)

- Atlantic waters and adjacent shelf areas had low winter and summer sea surface salinity (SSS) in the mid-late 1970s (associated with the passage of the [Great Salinity Anomaly \(GSA\)](#)), followed by three decades of large inter-annual variability.
- Salinity records from the Faroe-Shetland Channel and the Ellett Line indicate a recent trend to high salinity.
- There is no discernible trend in mean SSS in the English Channel from 1900 to the early 1980s.
- SSS averaged over the Irish Sea from 1950 to 2002 shows a decrease in both winter and summer.

Please acknowledge this document as: Gommenginger, C. (2006). Impacts of Climate Change on Ocean Salinity in Marine Climate Change Impacts Annual Report Card 2006 (Eds. Buckley, P.J, Dye, S.R. and Baxter, J.M), Online Summary Reports, MCCIP, Lowestoft, www.mccip.org.uk

References

Curry, R., Dickson, B. and Yashayaev, I. (2003) A change in the freshwater balance of the Atlantic Ocean over the past four decades. *Nature* , 426, 826-829.

Dickson, R. R., I. Yashayaev, J. Meincke, W. Turrell, S. Dye and J. Holfort, (2002) Rapid freshening of the deep North Atlantic Ocean over the past four decades. *Nature*, 416, 832-837.

International Council for the Exploration of the Sea (ICES) (2006). The ICES Report on Ocean Climate 2005. ICES Cooperative Research Report No. 280, 47 pp. http://www.noc.soton.ac.uk/JRD/ICES_WGOH/iroc.php

Inter-Agency Committee on Marine Science and Technology (IACMST) report for UK Marine Waters 2004 - Marine Processes & Climate (2004). http://www.oceannet.org/medag/reports/IACMST_reports/MPCunres/MCP_report/ch_cover/MCPreport_cover.htm

Josey, S. A. and Marsh, R. (2005) Surface freshwater flux variability and recent freshening of the North Atlantic in the Eastern Subpolar Gyre, *J. Geophys. Res.*, 110, C05008, doi:10.1029/2004JC002521.