Long Term Change in the Western English Channel

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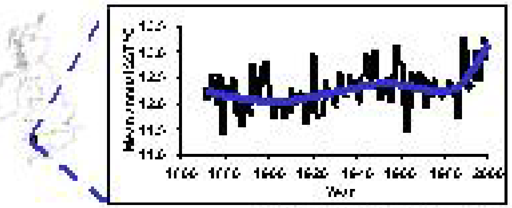
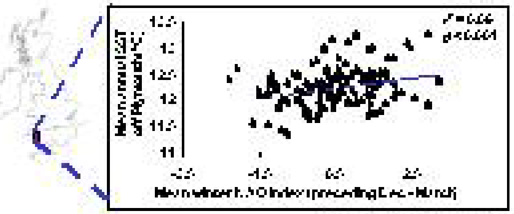
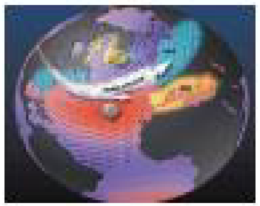
Climate Related Changes in the Western English Channel

- There have been substantial fluctuations in sea temperature over the course of the 20th century
- Mean annual sea surface temperatures are weakly correlated with the intensity of North Atlantic Oscillation
- A high NAO index leads to more westerly warmer and wetter weather in Northern Europe, a low NAO index leads to cool and dry periods
- Predicted global sea surface temperature warming scenarios of 1.4 - 5.8 °C over the next 100 years

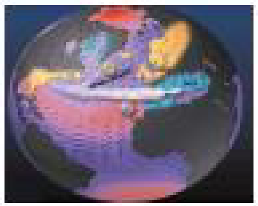




North Atlantic Oscillation



Positive Index



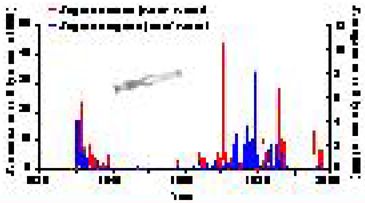
Negative Index

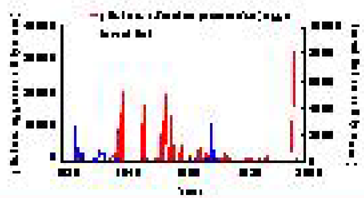
Climatic Influences on Marine Organisms

- Major changes identified in pelagic, demersal and intertidal assemblages
- Temperature change may affect physiology and/or behaviour directly, in addition to density-dependent predator-prey and competitive interactions
- Future change may have significant socio-economic consequences (e.g. for fisheries)

Plankton Assemblages

- Cold water plankton became more abundant off Plymouth during a period of cooler sea surface temperatures in the 1970s replacing warm water species



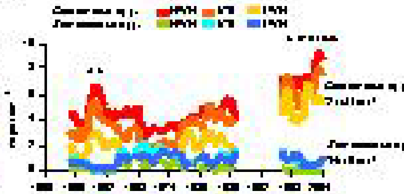


Rocky Shore Intertidal Organisms

- Rocky shore organisms represent excellent indicators of climate-induced change in the marine environment
- For example, during the cool period of the 1970s and early 1980s substantial increases were observed in the proportions of 'northern' species within barnacle and limpet assemblages
- Resurveys show that in the 1950s southern species were more common than in the 1980s (last warm period)
- There are inexpensive to survey, and extended time series are available

Intertidal Barnacles

Abundance on South Devon & Cornwall shores (1954-1997, 1997-data)

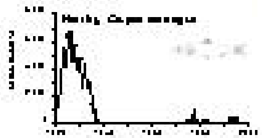


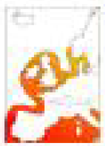
Patella depressa

A 'southern' species

Pelagic Fisheries

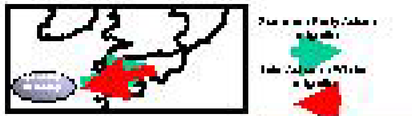
- During the warming of 1930s, stocks of herring, a cold water species, collapsed in the Channel
- Herring never returned in such abundance and were 'replaced' during the warmer 1950s by pilchard, a 'southern' species
- Over the last 20 years as mean annual sea temperatures have escalated, pilchard catches have increased dramatically

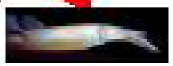


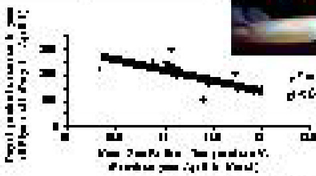


Squid Migration

- European squid (*Loligo forbesi*) have an annual life-cycle. Eggs hatch during winter in the Western Approaches. During Summer squid start to migrate into the English Channel, before returning in late Autumn / Winter to spawn and die.
- The timing of this annual migration (day of peak abundance off Plymouth) is highly correlated with sea temperature and the Winter NAO index







Overview

- Ecosystem-wide changes have been observed
- Variability in species abundance, recruitment and the timing of life-history events closely linked to hydrography, which is in turn climate regulated
- Changes over the past century have been in response to 0.5 - 1.5°C sea surface temperature fluctuations. Model predictions suggest more substantial change in future with unknown consequences for marine biodiversity
- In view of global change predictions, there is a pressing need for long-term monitoring to continue to provide baselines on which to assess scale of future change, and predict potential consequences for biodiversity and users of marine environments
- MBA led MarClim (Marine Biodiversity and Climate Change) initiative has recently resumed annual surveys on British and Irish rocky shores. The project will predict changes of inshore assemblages using UK Climate Impact Programme scenarios
- MBA time-series of offshore plankton and hydrography were restarted in 2001