Physical characteristics and ocean acidification

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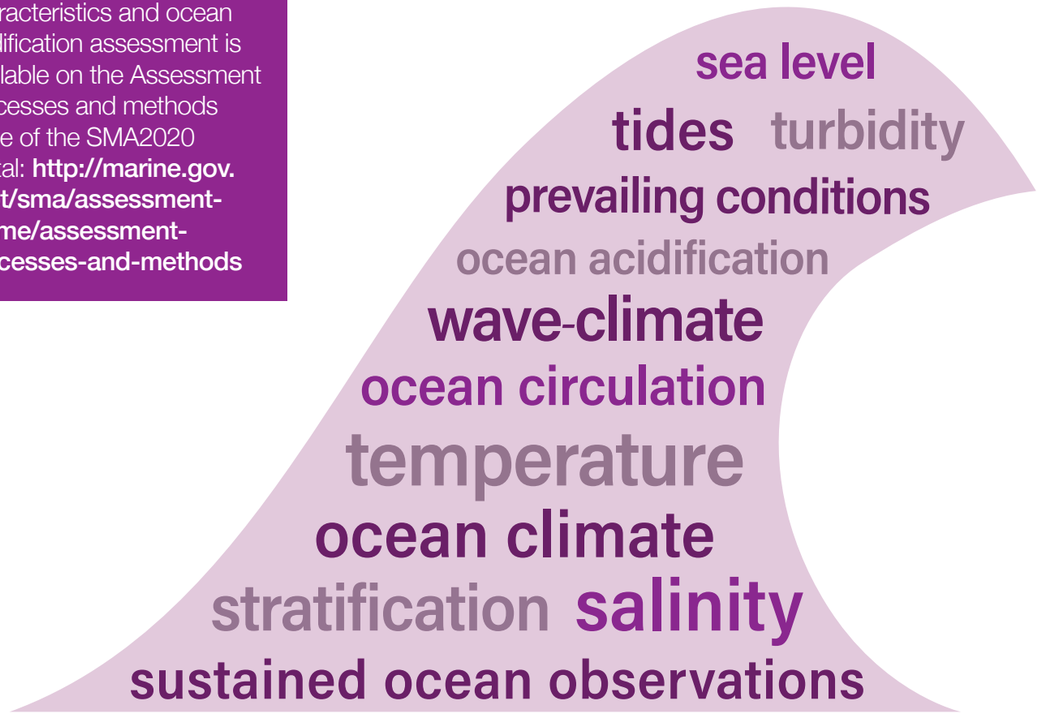
More information on the regions used in the Physical characteristics and ocean acidification assessment is available on the Assessment processes and methods page of the SMA2020 portal: **http://marine.gov.scot/sma/assessment-theme/assessment-processes-and-methods**

Key words



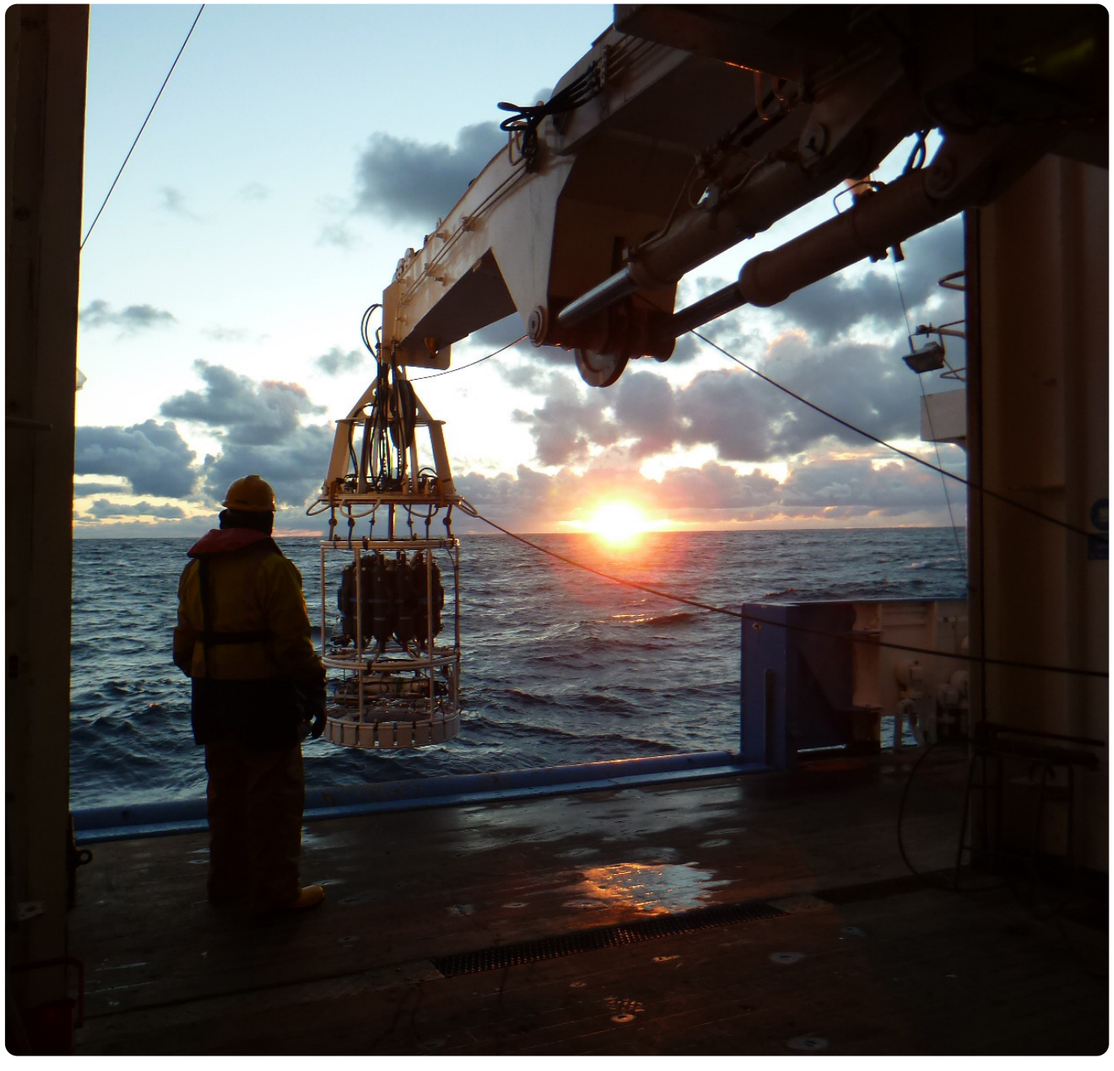
What is covered

The physical characteristics of the marine environment are important for the fauna and flora living in the sea. Productivity of the marine ecosystem is in part governed by the ocean climate. These assessments provide information on:

- The temperature and salinity of Scotland's seas.
- The ocean circulation, tides, sea level and wave-climate.
- The stratification of the water column.
- Ocean acidification.

The basis of the assessment

The assessments of these physical characteristics are based on trend analyses in each of the SMRs and OMRs, using a range of observational data and computer model outputs from Scottish and international monitoring programmes.



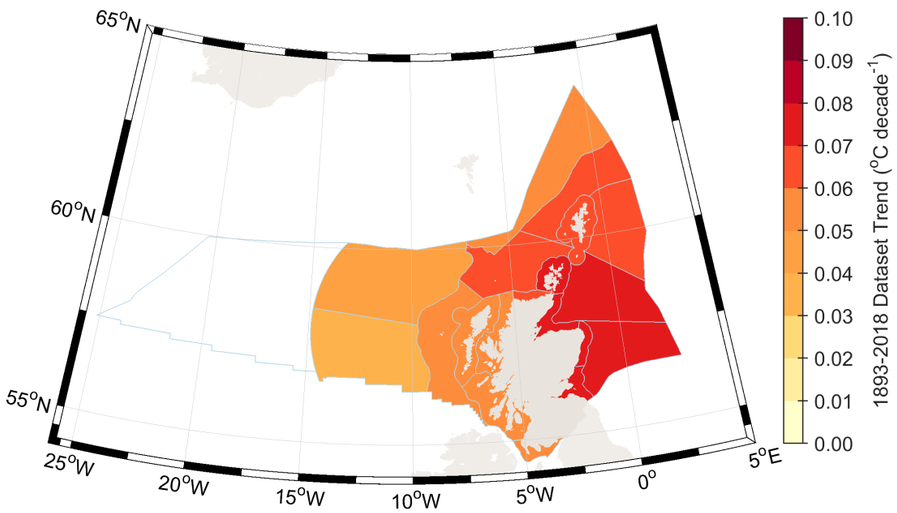
Summary of key messages

Sea surface temperatures have increased in all regions over the last 100 years. In the most recent decade, year-to-year variability has been high, and no significant trend has been seen. Salinities have recently decreased due to a freshening of source waters in the north Atlantic Ocean. These changes have also been observed in the coastal regions, although year-to-year variability is higher here due to the influence of freshwater run-off.

Sea level around the Scottish coast is rising due to global warming, although the rate of increase differs across regions. The wave climate in the most recent five years has been close to the long-term average conditions. The assessments of ocean circulation and stratification provide an overview of prevailing conditions as there is insufficient evidence to support trend assessments.

The Scottish ocean acidification dataset consists of five years of measurements, which is insufficient to calculate accurate trends in ocean acidification. The data are consistent with both UK and global data for coastal/shelf sea areas with the carbonate system having a strong seasonal cycle linked to biological activity.

- Sea surface temperatures are increasing over long time scales due to global climate change. Year-to-year variability has been high in recent years, masking this underlying trend.
- Salinity has been below average in recent years due to a reduction in salinity (freshening) of source waters in the Atlantic Ocean.
- New observational programmes to measure important parameters such as ocean acidification are being established.
- For some assessments, there are limited data or an absence of assessment criteria which prevents a full status assessment being undertaken, especially at the scale of an SMR.



SST trend from the HadISST 1.1 data product for the entire observational period (1893 - 2018) averaged by SMR and OMR. Note the colour scale ranges from 0 to 0.10 °C per decade. The trend in the Hatton OMR is statistically not significant, and has therefore not been included.

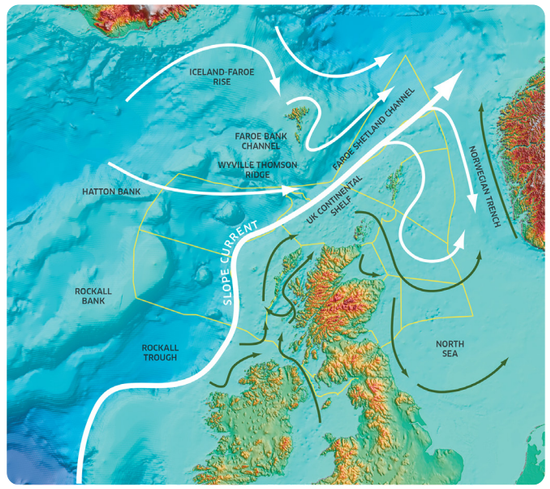
Summary of knowledge gaps

The signals of global warming due to anthropogenic greenhouse gas emissions are evident in some of the physical characteristics of Scotland's marine environment. However, to improve the understanding will require continued investment in ocean observing programmes. Emerging technologies, satellite observations and computer simulations could help address some of the gaps in the monitoring network. The following knowledge gaps have been identified:

1. Sustained ocean observations to collect data of essential ocean variables, such as ocean temperature, salinity, currents, turbidity, ocean acidification, dissolved oxygen, stratification and waves.

2. A lack of spatial extent, resolution and frequency in the data obtained from observational programmes that rely on *in situ* sampling.

3. The dynamics governing year-to-year variability and the links to the marine ecosystem, particularly for parameters such as ocean acidification, stratification, turbidity, waves and ocean currents.



> "Knowledge of changes in the physical and chemical environment of Scotland's seas is important to provide context to changes seen across the ecosystem."
>
> Bee Berx, Topic lead