NMPi and future Scotland's Seas assessments

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Are you a student? (Delete as appropriate): No

Scotland's Marine Atlas: Information for the National Marine Plan, published in March 2011, fulfilled the obligations of the Marine (Scotland) Act 2010 to 'prepare an assessment of the condition of the Scottish marine area' as part of the process of preparing a National Marine Plan. A key part of the Atlas was its Overall Assessment and wealth of supporting data and information. Marine Scotland is providing access to this Atlas information and assessment, with many updated maps, on its web based GIS platform, National Marine Plan interactive (NMPi). Marine Scotland works with SEPA, SNH, JNCC and MASTS to oversee NMPi content.

The main source of Atlas data was the statutory monitoring programmes and government statistics supplemented by other sources that had been available.

Looking forward to the next required 'assessment of the condition of the Scottish marine area', Marine Scotland wishes to identify any suitable scientific data or contextual information within the MASTS community that could provide additional or supplementary information.

The purpose of the presentation is to make the MASTS community aware of Scotland's Marine Atlas, outline the scope of the existing overall assessment, highlight the ongoing work to maintain NMPi as the 'go to' portal for information about the state of Scotland's seas and sources of data for marine planning, whilst identifying possible opportunities for the community to offer appropriate data and information that might be useful for the next overall assessment.

Scotland's Marine Atlas: Information for the National Marine Plan – www.gov.scot/marineatlas
Marine (Scotland) Act 2010 www.legislation.gov.uk/asp/2010/5/pdfs/asp_20100005_en.pdf
National Marine Plan www.gov.scot/Publications/2015/03/6517
National Marine Plan interactive www.gov.scot/nmpi

First assessment of microplastic contamination in intertidal sediments of Orkney

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Microplastics are defined as fibrous or particulate pieces of plastic smaller than 5mm and are commonly found in seawater, intertidal sediments, and other coastal environments. These plastics can enter the marine environment from the breakdown of macroplastics discarded at sea or coastline as well as from consumer products containing microbead technologies. They have recently become an area of interest because of potential health risks they may pose to marine organisms (Hartl et al., 2015). Microplastics have been shown to absorb toxic and persistent bioaccumulative compounds from seawater, including metals and persistent organic pollutants (POPs), which can be taken up and biomagnified up the food chain.

In recent years the UK has taken a stronger stance on reducing plastic pollution around the coast with more focus put on recycling plastics. Microplastics need to be monitored in order to evaluate the effectiveness of the Scottish Government's initiatives to reduce plastic debris in the environment. In 2014 we initiated the development of a baseline microplastic database for Scottish intertidal sediments. Our previous work has focused on the Firth of Forth. However, we have recorded microplastics in sediments from several locations around the Scottish mainland (Hartl et al, unpublished) and work to extend the initial database coverage is ongoing. In this context the aim of the present study was to conduct an exploratory survey in Orkney to establish preliminary microplastic concentrations in preparation for a more extensive survey.

This was done by taking sediment samples (glass cores) from the Scapa Flow area around the islands of Mainland, South Ronalsay and Hoy in the Orkney Archipelago. Microplastics were extracted through a process of precipitation/floatation in a supersaturated sodium chloride solution and by filtering the supernatant, with two washes per sample. The material retained on the filters was examined and sorted using a high powered dissecting microscope. Plastic particles or fibres were counted, classified by colour, and representative particles/fibres were removed for polymer identification using Fourier Transform Infrared Spectroscopy (FTIR). The results from both washes were pooled. Using ArcGIS quantitative and qualitative distribution maps were generated. The highest particle and fibre concentrations were found at Dead Sands (HY 28285 10506) and Congesquoy (HY 27648 10392), respectively, both on Mainland. With the exception of Dead Sands, all sites had higher concentrations of fibres than particles. Initial analysis suggests the microplastic distribution patterns are strongly correlated with the predominant metereological and hydrographic conditions at Scapa Flow. We are currently evaluating the FTIR data to determine the most common polymer types. The results from this pilot study confirm the presence of microplastics in the intertidal sediments in Orkney. A more extensive survey with increased site resolution is justified in order to add to the developing Scottish microplastics baseline database.

Hartl, M.G.J., E. Gubbins, T. Gutierrez, and T.F. Fernandes (2015) *Review of existing knowledge – emerging contaminant. Focus on nanomaterials and microplastics in the aquatic environment*. CREW. 20 pp.

Spatially and temporally variable oxygen conditions as determinant of microbial processes in and around Irish sponges

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Sponges are an ubiquitous component of marine communities and make pelagic nitrogen available to other benthic community organisms through the "sponge loop". The fate of sponge-produced ammonium will depend on the activity of sponge-associated microbes[1]. Under well-aerated conditions sponge-associated microbes have been shown to produce nitrogen through nitrification. Under anoxic conditions within the sponge, sponge-associated microbes have been shown, in some species, to produce N_2 gas, through anammox thereby creating a loss of nitrogen for that system. The level of oxygenation in and around sponges can also determine the level of sulfate reduction, a microbial process that happens in oxygen-depleted conditions. In corals, sediments residing on the coral surface were shown to lead to an decrease in oxygen at the coral surface, which led to subsequent sulfate reduction between the sediment layer and the coral tissue, and ultimately to tissue lesions.

To investigate oxygen concentrations as pre-cursor of microbial processes in 2 species of Irish sponges (*Dysidea fragilis* and *Pachymatisma Johnstonii*) oxygen micro-electrodes were used in laboratory conditions to measure oxygen concentrations in and around sponges covered with or devoid of sediments. Oxygen concentrations varied strongly spatially and temporally. Oxygen depletion was a common occurrence and occurred more readily at the surface of sediment-covered sponges than of those devoid of sediments. Sulfate reduction was below detection level when measured with a microsensor and no sponge tissue lesions were noted in sponges exposed to sediments naturally present in the unfiltered aquarium system for 3 weeks. The highly variable oxygen concentrations within and around *Dysidea fragilis* and *Pachymatisma Johnstonii* indicate that microbial processes occurring under oxic and oxygen depletion are possible, (e.g. nitrification, anammox, sulphate reduction) and that they are likely to be driven by sponge oxygenation. Further investigations using an alternative method to H_2S microsensors is necessary to determine the presence/level of sulfate reduction at the surface of sponges that have been exposed to natural levels of sediments for several weeks.

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