Construction of a food web based on the species located in the Clyde Sea.

Introduction

We will be sampling the waters of the Clyde Sea to attempt to create a food web of the plankton recorded. We will examine the relationship between key species and inorganic and organic mater found in the waters. The diversity of plankton in the Clyde Sea is immense. We will only select a few species to create our food web, as creating a food web for the entire recorded species will be next to impossible for us.

The Clyde Sea is situated on the South West coast of Scotland and is surrounded by the Shetland Islands mainland Scotland. The land masses that surround the Clyde sea offers great protection from strong prevailing winds and other whether fronts from the Atlantic to the wildlife located in the sea.

Materials and methods

Water samples were taken form the Clyde Sea using Zooplankton nets. We had a range of different mesh sizes. The first was a course net: 710µm. The second was a medium mesh: 335µm. The third was a fine mesh: 142µm and the last was a very fine mesh size: 90µm. These different mesh sizes would hopefully catch a range of plankton from Mesozooplankton to Picoplankton.

The water samples would be taken back to the lab where we would attempt to identify the individuals to species level. To do this we would use different microscopes, depending on the size of organism and identification guides. We had the option to either use a binocular microscope or a monocular microscope.

Discussion

Nutrients is vital for the survival and formation of a food web, it is essential for the growth of plankton. In the marine environment Nitrogen is usually the growth-limiting nutrient. Nitrogen exists in the marine environment as NO_3^-, NO_2^-, or NH_4^+. Organic compounds are found in the waters and also play a key role in maintaining the food web. Organisms feed on this as a food source. The most significant source of dissolved organic carbon is from phytoplankton. The main compounds of dissolved organic carbon are Carbohydrates, nitrogenous compounds, organic acids and lipids. The constant supply of organic compounds comes in the form of dead plankton. As plankton die they sink very slowly where microorganism feed on them. This is a key stage of the food web. Inorganic compounds have a very important role in food webs. Many organisms require this for living.

Hertotrophic nanoflagellates employ a wide range of feeding strategies. There are 3 main strategies adopted by Hertotrophic nanoflagellates for feeding, 1. the ingestion of whole cells, 2. use of a feeding tube called a peduncle and 3. use of a cytoplasmic veil e.g. pallium. Many Hertotrophic nanoflagellates compete with copeopods for ciliates and other microorganisms. Photosynthetic nanoflagellates only use light from the sun to produce energy. We found a great deal of mixotrophic ciliates in our sample. We focused our attention on *Flavella spp*. These mixotrophic ciliate photosynthesise, but also feed on live prey. Organisms like *Flavella spp* are extremely important, as they are hetrotrophic, which means they regenerate nutrients, thus they take Dissolved Inorganic Nitrogen and re introduce it to the cycle by a means that is possible to uptake by other organisms.

There were vast numbers of Dinoflagellate caught in our sample. Dinoflagellates tend to be more successful in stratified water columns, and adopt a diel vertical migration pattern to prolong their life span, where they feed near the surface at night and return to greater depths in the day to avoid visual predators. This means they have the ability to move around in the water column. There have been some recordings of some dinoflagellates being toxic. Half of dinoflagellates are hetrotrophic (Williams *et al*, 2005). Another type of primary producer we encountered was the diatom. Diatoms are the most common type of phytoplankton. These organisms are non-motile which is why they usually thrive in well-mixed areas. They have a high growth rate which is evident as spring blooms often occur.

Copepods were the highest member of our food web. Copepods are crustaceans and many species are planktonic. The play a key role in food webs, not only as predators on phytoplankton by prey for larger fish and whales. Many planktonic copepods adopt a diel vertical migration.

I concentrated on the dinoflagellate *Dinophysis c.f. acuta* as part of my primary producer in the food web. The *Dinophysis c.f. acuta* is a bigger more distinct species of dinoflagellate. One of its main prey is a ciliate. However some ciliates feed on *Dinophysis spp* (Williams *et al*, 2005). *Skeletonema costatum* was another phytoplankton that I placed as a primary producer in my food web. It is one of the most common diatom in our waters, particularly during spring bloom. It favours waters of high salinities (Williams *et al*, 2005). *Chaetoceros c.f. decipens* was the last primary producer I inserted in my food web. *Chaetoceros c.f. decipens* is one of the most wide spread *Chaetoceros spp* found around our waters. It is present all year round, and thrives during spring bloom. It can survive in coastal and estuarine environments (Rines & Hargraves, 1988).

Flavella spp is a small phytoplankton species, which is also mixotrophic. They are important predators of nanophytoplankton (Heinbokel & Beers, 1979) It requires dinoflagellate as food. *Flavella* can recognise between dinoflagellates of different size and shape from non-dinoflagellates (Stoecker *et al,* 1981). It can tolerate a wdie range of salinities (Williams *et al*, 2005). *Leptocylindrus danicus* is usually found in the North sea and in the Bristol channel (Newell & Newell, 1963). However we had many recordings of this species. It is usually co dominant with *Skeletonema costatum* in spring and fall blooms (Williams *et al*, 2005). *Helicostomella subulata* is a ciliate. It is a vital link between connecting bacteria and pico/nanoplankton to larger zooplankton. Up to 50% of bacterial and phytoplankton production may be taken up by ciliates. Copepods, decapod larvae and other larger organisms pray upon ciliates. Ciliates are capable of rapid growth with cell divisions every hour (Williams *et al*, 2005)

Temora longicornis is a copepod and is very common in coastal waters around the British Isles (Newell & Newell, 1963). They mainly feed during the night as they have adopted a diel vertical migration strategy (Head *et al*, 1984). It mainly feeds on phytoplankton such as diatoms, dinoflagellates, ciliates, and tintinnids. *Acartia c.f. clausi* is thought to be restricted to the North Atlantic, but studies have shown that they are to be found in the Mediterranean and the Black sea (Bradford, 1976).

The food web shows the interactions between key species of plankton and Inorganic and Organic Matter. Bacteria is key in this food web as it takes up dissolved organic mater and inorganic matter, this in turns allows Hetrotrophic nanoflagellates to ingest organic matter, which is extremely important for growth. The Hetrotrophic nanoflagellates is either taken up by *Helicostomella subulata*, or dies and converts into Organic and Inorganic matter by bacterial work. Dissolved inorganic matter is also taken up by *Chaetoceros c.f. decipens*, which is also fed on by *Helicostomella subulata*. *Skeletonema costatum* takes up dissolved inorganic matter, which is then prayed upon by *Flavella spp*. This *Flavella spp* is taken up by *Dinophysis c.f. acuta*, *Temora longicornis* and *Acartia c.f. clausi*. It also secrets dissolved organic matter. *Helicostomella subulata* takes up Hetrotrophic nanoflagellates, *Skeletonema costatum* and *Dinophysis c.f. acuta*. The top 2 predators excrete Dissolved and particulate organic matter. Thus completing the food web.

The mesh sizes we used did were not capable of catching smaller bacteria, nano/picoplankton. To do this we would have had to use smaller mesh sizes. To make the food web more quantitative we could have looked at rate of ingestion between species, include more species in the food web and see how concentration of specific species would alter the rate or life span of certain species.

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