

## LIPID CLASSES, FATTY ACIDS, STEROLS AND DIOL ETHERS IN A COLD OCEAN COASTAL FOOD WEB DURING THE SPRING DIATOM BLOOM

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Lipids were measured in plankton and settling particulate matter during the spring bloom in Conception Bay, Newfoundland, to determine the source and quality of material settling from the upper mixed layer. Lipids were also measured in 19 species of suprabenthic and benthic invertebrates from five phyla to determine nutritional content and trophic relationships in response to the sinking bloom. In Conception Bay, as in many areas of coastal Newfoundland, these species experience sub-zero temperatures year round.

Net-tow samples (20 µm mesh) and sediment trap samples (80 and 220 m depth) were taken in the deepest part of the bay (240 m) at about 16 day intervals from 27/3 - 9/7/96. Specimens of invertebrates were collected in Conception Bay with a dredge and a suprabenthic sled from 3/96 - 8/98. The sled, which had a 500 µm mesh net, was towed for 20 min at a depth of between 210 and 220 m.

Total lipid concentrations in plankton reached a maximum of  $6.3 \pm 2.5\%$  dry weight at the height of the bloom in April. Bacterial fatty acid markers were at their lowest during the bloom period (2.2-2.8% of total fatty acids), while polyunsaturated fatty acids (PUFA) were at their highest from the beginning of the bloom onwards (44-53%). The maximum fluxes of total lipids ( $75 \pm 0.7$  mg/m<sup>2</sup>/d) in non-poisoned 80 m traps occurred at the bloom maximum while those at 220 m ( $35 \pm 1.7$  mg/m<sup>2</sup>/d) occurred 16 days later. In April, zooplankton sterols accounted for 40-43% of sterols in plankton and settling matter, while sterols from algae were 50-53%, of which macroalgal sterols accounted for 9-12%. Higher plant sterols accounted for 6% of total sterols. In the deep traps, PUFA were maintained at high levels (34-35%) throughout the bloom period while bacterial markers were at their lowest (2.3-2.9%). A comparison of fluxes showed that over half the PUFA survived transit from 80 to 220 m during the bloom period. These data indicate a rapid transfer of highly nutritious material to the benthos during the spring bloom in Conception Bay.

In the benthos, the small, blind mysid *Erythrophtalma* contained, on average, the largest amount of lipid (6% wet weight), while a sea cucumber (order Apodida) contained the least (0.3%). In *E. erythrophtalma*, 73% of the lipids were in neutral (storage) lipids while in the sea cucumber, 68% were in polar (membrane) lipids. The euphausiid

*Thysanoessa raschii* had the highest proportions of essential omega-3 fatty acids (41% total fatty acids) while the sea cucumber had the lowest (21%). The small copepod *Pseudocalanus* spp. showed the highest mean value for the C<sub>16</sub> PUFA ratio indicative of lipids from newly formed diatoms. Sterol analyses revealed higher plant sterols to be significant contributors to sea cucumber sterols while macroalgae sterols contributed significantly to the sterols of the mysid *Pseudomma truncatum*. The asteroid, *Ctenodiscus crispatus* possessed an unusual series of lipids identified by mass spectrometry as saturated diol ethers with carbon numbers ranging from C<sub>16</sub>-C<sub>26</sub>.

The amphipods *Acanthostephia malmgreni* and *Anonyx* spp. responded immediately to each spring bloom by raising total and neutral lipid contents. The lipid and PUFA supply to the benthos was over 10 times that accumulated by *A. malmgreni* and *Mysis mixta*. Other species (e.g. *Pseudomma truncatum*) responded more slowly in these terms but the response continued over a long period. However, *P. truncatum* together with the decapod *Pandalus borealis*, *Mysis mixta*, and the polar bivalve *Yoldia hyperborea* did respond immediately by increasing the proportions of ω3 fatty acids, while others increased ω3 fatty acid contents later and over a longer period (e.g. *Ctenodiscus crispatus* and *Anonyx* spp.). The chaetognath *Parasagitta elegans* was different from most other species in that it maintained quite similar levels of total lipids, neutral lipids and ω3 fatty acids throughout the sampling period. Thus various strategies are used to sequester lipids in the suprabenthic and benthic invertebrate food webs to optimize use of sinking bloom and other plant material.