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# The Tropic Transfer of Fatty Acids in Boreal Lake Food Web and their Function in Zooplankton

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**ABSTRACT**

*Lake pelagic food webs generate fish that are significant human resources due to their high content of necessary Polyunsaturated Fatty Acids (PUFAs). These PUFAs are produced at the base of the food chain by phytoplankton and transported by zooplankton at high trophic levels. Water chemistry has been linked to zooplankton fatty acid composition, which most likely impacts phytoplankton community composition and therefore food for zooplankton.*

## INTRODUCTION

Determining the resources that sustain consumer output and how they impact the movement of energy and growth-limiting biochemicals from primary producers to upper trophic levels is a major problem in food web ecology. The origins, utilisation, transformation, storage, and transport of lipids in pelagic food webs are of special interest in aquatic systems [1,2]. Phytoplankton's autochthonous production is browsed by zooplankton, which is then consumed by fish larvae and planktivorous fish. In addition to providing energy to higher trophic levels directly or indirectly via the microbial loop, terrestrial Organic Matter (tOM) can give energy to higher trophic levels. Bacteria feed on Dissolved Organic Matter (DOM) from both terrestrial and autochthonous sources, which are browsed by heterotrophic nanoflagellates and ciliates. Zooplankton feed on terrestrial Particulate Organic Matter (tPOM), heterotrophicnanoflagellates and ciliates, and even bacteria in addition to phytoplankton, making the energy of the microbial food chain available to fish and other secondary consumers. The origins, utilisation, transformation, storage, and transport of lipids in pelagic food webs are of special interest in aquatic systems. Allochthonous sources with a high proportion of POM and almost all of DOM originating from terrestrial sources can dominate the standing pools of OM in boreal lakes [3]. The efficiency of energy transmission via the microbial food web is thought to be low since it takes several trophic stages, even though the pool of tDOM might be considerable. Algal-derived DOM, which has a much faster turnover rate than tDOM and supports greater bacterial growth efficiencies, can also help sustain the microbial loop. tDOM, on the other hand, is a heterogeneous mixture of molecules with widely variable bioavailability, and the labile portions (low molecular weight compounds) can sustain as high bacterial growth rates as phytoplankton-derived OM. As a result, consumers in boreal lakes may eat a dynamic mix of autochthonous and allochthonous foods [4,5].

The usual Fatty Acid (FA) profiles of the main probable components of aquaticherbivore diets (phytoplankton, bacteria, protozoa, and terrestrial carbon) differ significantly between and even within these categories. While certain FA molecules appear to be conservative in that they are absorbed into consumer tissues unchanged, others appear to be not so conservative in that consumers can convert them to other FA molecules, despite physiological restrictions. In addition, consumers can selectively metabolise energy (i.e. catabolism) particular FA molecules, or preferentially maintain their FA because they are key components or precursors to major hormones of the structure of cell membranes. The extent to which consumer FA profiles reflect their diets or are unique to the consumer provides a possible framework for building trophic pathways in aquatic food webs [6]. The important molecules that have an effect on both primary and minor food consumption [7,8] include certain Essential Fatty Acids (EFAs). These EFAs comprise Polyunsaturated Fatty Acids (PUFAs) and HUFAs; a subset of 20 and 22 carbohydrates PUFAs in the ω3 and ω6 moieties. The levels of these Essential Fatty Acids (EFAs) in algae in marine environments are very varied [9]. During a bloom, the LCn-3 PUFA concentration might be as low as 3%-7% of total phytoplankton fatty acids, rendering the nutritional value of such phytoplankton blooms suspect. There's also evidence that the amount of Docohexaenoic Acid (DHA) and Eicosapentaenoic Acid (EPA) in algae varies a lot between different taxonomic groupings. Cryptophytes, for example, contain significant EPA and DHA proportions, whereas chlorophytes lack or have negligible quantities of these fatty acids.

## CONCLUSION

The relevance of fatty acids in aquatic dynamics is increasingly acknowledged and field research in the last 15-20 years has advanced considerably. The relative relevance of various interactors including temperature, food amount and a host of food (e.g. fatty acids, sterols, amino acids, phosphorous, and the nitrogen) on growth of consumers still needs to be explained through a mix of field and laboratory research.

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