

Selective Feeding by Marine Zooplankton

Gilbert, J.J. 1990. Differential Effects of *Anabaena affinis* on Cladocerans and Rotifers: Mechanisms and Implications. Ecology Vol. 71 (5): 1727-1740.

Gilbert used laboratory variations to prove how this toxic, filamentous cyanobacterium affects its herbivores. His thorough procedures, limited variables, and a well-controlled experiment give rise to definitive results. This paper is a good reference for laboratory manipulated responses of zooplankton.

Irigoien, X., Head, R.N., Harris, R.P., Cummings, D. & D. Harbour. 2000. Feeding Selectivity and Egg Production of *Calanus helgolandicus* in the English Channel. Limnol Oceanogr Vol. 45(1): 44-54.

HPLC is used to determine which phytoplankton was selected for or against, with no conclusive results. Although the procedure is worth referencing the results for selection are not. On the other hand, worthy results did come from statistical data on copepod egg production, which is influenced by what they ingest. Depending on what you are researching, this paper could be a waste of time (selective feeding) or well worth your time (egg production).

Kamiyama, T. 2000. Application of a Vital Staining Method to Measure Feeding Rates of Field Ciliate Assemblages on a Harmful Alga. Mar Ecol Prog Ser Vol. 197: 299-303.

Fluorescently labeled algae (FLA) technique using a vital green fluorescent stain was applied to investigate the feeding activities of ciliates on a harmful alga. This particular technique seems to be reliable and trivial, with the possibility of even some gorgeous microscopic images. Red and green glowing cells under transmitted and blue light excitation, respectively, can give obvious results. May be tedious to count if prey is in high concentration, but worth the work in the end for dependable conclusions.

Kamiyama, T. & S. Arima. 2001. Feeding Characteristics of Two Tintinnid Ciliate Species on Phytoplankton Including Harmful Species: Effects of Prey Size on Ingestion Rates and Selectivity. J Exp Mar Biol and Ecol Vol. 257: 281- 296.

The use of auto-fluorescent particles was used to accurately determine ingestion rates. They referenced the use of latex beads and starch particles which clearly determined size differentiation and therefore did not have to redo in this experiment but did conclude that prey size is the most influential in ciliate feeding. This was a good use of alternate methods to get definitive results.

Kirk, K.L. & J.J. Gilbert. 1992. Variation in Herbivore Response to Chemical Defenses: Zooplankton Foraging on Toxic Cyanobacteria. Ecology Vol. 73 (6): 2208-2217.

This paper summarizes the response of four cladoceran, two rotifer, and one copepod species on non-toxic (*Cryptomonas*) and toxic and filamentous (*Anabaena affinis*)

phytoplankton. Radiotracer methods using ^{14}C and ^{32}P label the respective phytoplankters and showed selection against *A. affinis* by copepod and rotifer subjects, with varying results by cladocerans. This clearly showed the radiotracer method to be successful, and opened up opportunities for further research. Criticisms: They provide three hypotheses of why zooplankton select for certain phytoplankton, but only directly address two; of those two hypotheses they assume tolerance to toxins but do not manipulate toxic amounts in the laboratory and study responses by zooplankton.

Meyer-Harms, B., Irigoien X., Head, R. & R. Harris. 1999. Selective Feeding on Natural Phytoplankton by *Calanus finmarchicus* Before, During, and After the 1997 Spring Bloom in the Norwegian Sea. *Limnol Oceanogr* Vol. 44(1): 154-165.

This investigation uses trivial yet dependable methods. *In situ* collections with immediate pigment analysis and fecal investigations, followed by simulated *in situ* incubations, gather data to make for good results. There were a lot of variables taken into account including phytoplankton biomass, standing stock and distribution, pigment abundances, and ingestion and clearance rates to come to final conclusions. I thought this was a thorough and well-rounded paper with dependable results.

Meyer-Harms, B., Reckermann, M., Voss, M., Siegmund, H. & B. von Bodungen. 1999. Food Selection by Calanoid Copepods in the Euphotic Layer of the Gotland Sea (Baltic Proper) During Mass Occurrence of N_2 -fixing Cyanobacteria. *Mar Ecol Prog Ser* Vol. 191: 243-250.

This was an excellent example of two thorough experiments complimenting each other in order to get accurate rates of selective feeding by copepods on cyanobacteria. Carotenoids present in cyanobacteria were measured within the gut of the grazers using high performance liquid chromatography (HPLC). This cannot be solely dependent upon because there are residual carotenoids taken up from the water column or differing amounts per unit prey. In order to correct for this, $\delta^{15}\text{N}$ (dell) was calculated using mass spectroscopy (MS). This is where “you are what you eat” comes into perspective: all organisms have distinct dell values and, dependent upon what you ingest, you will have those corresponding dell values.

Schmidt, K., Koski, M., Engström-Öst, J. & A. Atkinson. 2002. Development of Baltic Sea Zooplankton in the Presence of a Toxic Cyanobacterium: A Mesocosm Approach. *J Plank Res* Vol. 24 (10): 979-992.

With mesocosms as long term as this one (15 days) one must wonder how processes are altered in an enclosed system. Nutrient decline, toxin build-up, gas exchange and population dynamics (with the removal of all herbivores 100 μm and above) may have significant affect on key players in the system. They blame rejecting their hypothesis on the fact that there are only short term experiments to refer to but may need to reevaluate why there is a lack of long term experiments.

Teegarden, G.J., Campbell, R.G. & E.G. Durbin. 2001. Zooplankton Feeding Behavior and Particle Selection in Natural Plankton Assemblages Containing Toxic *Alexandrium* spp.. *Mar Ecol Prog Ser* Vol. 218: 213-226.

Ingestion and clearance rates were determined using microscopic methods. This experimental method is a good way to get a general sense of what grazers are feeding upon and results can be more accurate using complimentary methods. This paper refuses to use complimentary methods so may not be a complete example of selective feeding.