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# This Week's Citation Classic

**Conover R J.** Oceanography of Long Island Sound, 1952-1954. VI. Biology of *Acartia clausi* and *A. tonsa*.
*Bull. Bingham Oceanogr. Coll.* **15**:156-233, 1956.
[Dept. Zoology and Bingham Oceanographic Lab., Yale Univ., New Haven, CT]

A study of population structure of two co-occurring species of copepods was supplemented by comparative physiological experiments at different temperatures and food concentrations within the range of their habitat to ascertain the differential effect of seasonal changes on their ability to compete for available resources. [The *SCI*® indicates that this paper has been cited in over 140 publications since 1961, making it the most-cited paper published in this journal.]

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"I arrived at Yale University in the fall of 1950 with a vague notion that I wanted to work with the aquatic environment for my PhD, although my only previous field experience had consisted of an amateurish limnological study of a small brook in Ohio. After a year of naive groping for a research topic, I met Gordon Riley, who had recently returned from a year at Scripps Institution of Oceanography. Gordon had just persuaded the Office of Naval Research to support an oceanographic study of Long Island Sound (LIS). Fortune smiled further when my wife, Shirley, became the field technician on that project. About then I also met Georgie Deevey, who had studied the zooplankton of several nearby neritic environments, and I was introduced to the 'ecological niche' by G. Evelyn Hutchinson in his ecology course.

"Earlier, Deevey had found that the copepods *Acartia clausi* (now *A. hudsonica* Pinhey[1]) and *A. tonsa* shared dominance in Tisbury Great Pond[2] with virtually no seasonal overlap, but in LIS it was a little different. There, *clausi*, the cold-water form, and *tonsa*, the summer species, co-occurred for weeks in spring or even months during the fall-winter transition. So there it was! I reasoned that twice a year the ecological niches of these closely related species coincided under the influence of a seasonally changing environment leading to direct competition for limited resources and elimination of the species least well adapted to prevailing conditions. Why not examine the metabolic and grazing rates of the two species under different temperatures at natural food levels at different seasons and compare their energy budgets?

"At that time, the experimental study of living zooplankton was just beginning, but papers by D.T. Gauld and J.E.G. Raymont[3,4] gave me confidence. I used a scaled-down version of the Winkler method to measure respiration and ran grazing experiments in the same size 35 ml glass-stoppered bottles. A set of five water baths was constructed to give the range of natural temperature variation in LIS. Each bath was also equipped with a miniature 'Ferris wheel' to keep plankton in suspension during grazing experiments. As it turned out, *A. clausi* acclimated both its respiration and feeding rates with changing environmental temperature but *A. tonsa* could not. Adult *clausi* should have outcompeted *tonsa* even in summer! However, detailed analysis of community structure during the twice yearly transition periods showed clearly that the younger developmental stages were most sensitive to changing conditions and the adults, the most tolerant. Thus, in summer, *clausi* nauplii became less abundant and *tonsa* nauplii began to increase several weeks before a trend could be observed for the later developmental stages.

"My paper appeared at a time of transition in zooplankton research from total dependence on examination of preserved material to the inclusion of the study of living animals and what they do. While it did not initiate the trend, it may have demonstrated a bit better than contemporary studies how traditional and newer methods could be used to attack the same problem. A recent symposium at Dartmouth College shows how far experimental ecology of zooplankton has come."[5]

1. **Bradford J M.** Partial revision of the *Acartia* subgenus *Acartiura* (Copepoda:Calanoida:Acartiidae). *NZ J. Mar. Freshwater Res.* **10**:159-202, 1976.
2. **Deevey G B.** The zooplankton of Tisbury Great Pond. *Bull. Bingham Oceanogr. Coll.* **12**:1-44, 1948.
3. **Raymont J E G & Gauld D T.** The respiration of some planktonic copepods. *J. Mar. Biol. Assn. UK* **29**:681-93, 1951.
4. **Gauld D T.** The grazing rate of planktonic copepods. *J. Mar. Biol. Assn. UK* **29**:695-706, 1951. (Cited over 85 times.)
5. **Kerfoot W C,** ed. *Evolution and ecology of zooplankton communities*. Hanover, NH: University Press of New England, 1980. 793 p.