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Mann K H. Energy transformations by a population of fish in the River Thames. *J. Anim. Ecol.* **34**:253-75, 1965.
[Department of Zoology, University of Reading, England]

Measurements of biomass, growth, and metabolism of five species of fish in the River Thames, England, were integrated to produce the first energy budget for a total fish community. From this were calculated the ecological efficiencies of each year class and each species population. [The *SCI*® indicates that this paper has been cited in over 110 publications. Only 17 papers from this journal have been cited over 100 times.]

Kenneth H. Mann
Marine Ecology Laboratory
Bedford Institute of Oceanography
Dartmouth, Nova Scotia B2Y 4A2
Canada

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"This study of the energetics of fish was part of a wider study of energy flow at all trophic levels in a freshwater section of the River Thames, about halfway between London and Oxford. After reading accounts of the pioneering work of the Odums,[1,2] John Teal,[3] and others, I was impressed with the possibility of getting a snapshot of the whole river ecosystem by charting the main pathways of energy flow. Financed at first by a small grant from the London Anglers' Association, we began with the energetics of fish populations, passing later to consideration of energy flow in the plants and invertebrates.[4] A useful review of metabolic rates and food requirements of fish had been published by the Russian scientist G.G. Winberg,[5] and in our study we brought together our own demographic and metabolic data on the fish stocks, American ideas on ecosystem energetics, and Russian expertise on fish metabolism, to produce a more detailed yet comprehensive account of the energetics of a fish community than anyone had achieved previously. This was our contribution to the International Biological Program.

"At the time of publication, the paper was controversial. Some questioned the energy flow approach to ecology, though in subsequent years many cited it as a kind of benchmark with which other energy flow studies could be compared. There was also a technical dispute about metabolic rates. There is no completely satisfactory way of determining empirically what is the metabolic rate of fish living freely in the natural environment. Using various indirect approaches, and following Winberg,[5] we assumed that when performing their essential activities of swimming, feeding, digestion, etc., the river fish had metabolic rates averaging twice the resting level. This was hotly disputed, but in a more recent review[6] it appeared that the assumption was justified.

"From the energy budget it was possible to calculate the growth efficiency of each year class of each species, show that efficiency declined with advancing age, and show that the overall ecological efficiency of the fish community was at the low end of the range predicted by theory, about six percent. This was probably because the natural top predator, pike, was scarce in the river and the fish studied were abundant and food-limited.

"The work was done on a shoestring budget. The University of Reading had acquired the riverside property known as 'The Dreadnought,' formerly a pub much frequented by the crews of horse-drawn barges in the eighteenth and nineteenth centuries. The mellow old brick building was shared between the biologists and the sailing club. Fish samples were taken with a big seine net paid out from the stern of a wooden punt that was so inadequate for the task that a student had to sit on the bow to prevent the stern from sinking under the weight of a wet net. Sometimes the river ran so fast that we lost our hold on the net and had to retrieve it from several miles downstream."

1. **Odum H T & Odum E P.** Trophic structure and productivity of a windward coral reef community on Eniwetok Atoll. *Ecol. Monogr.* **25**:291-320, 1955. (Cited 190 times since 1955.)
2. **Odum H T.** Trophic structure and productivity of Silver Springs, Florida. *Ecol. Monogr.* **27**:55-112, 1957. (Cited 195 times since 1957.)
3. **Teal J M.** Community metabolism in a temperate cold spring. *Ecol. Monogr.* **27**:283-302, 1957. (Cited 150 times since 1957.)
4. **Mann K H.** Case history: the River Thames. (Oglesby R, ed.) *River ecology and man.* New York: Academic Press, 1972. p. 215-32.
5. **Winberg G G.** Rate of metabolism and food requirements of fish. (Whole issue.) *Fish. Res. Board Can. Transl. Ser.* (194), 1960. 239 p. (Cited 315 times.) Translated from *Nauchnye trudy Belorusskogo Gosudarstvennogo Universiteta imeni V.I. Lenina*, 1956.
6. **Mann K H.** Estimating the food assumption of fish in nature. (Gerking S D, ed.) *Ecology of freshwater fish production.* Oxford: Blackwell Scientific, 1978. p. 250-73.