

This Week's Citation Classic

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Le Cren E D. The length-weight relationship and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis*). *J. Anim. Ecol.* 20:201-19, 1951.
[Freshwater Biological Association, Ambleside, Westmorland, England]

Methods for analysing length-weight data from fish are reviewed. Length-weight relationships for six size, sex, and maturity groups of perch were analysed by covariance. Differences between their seasonal cycles in condition are ascribed to gonad weights. [The *SCI*[®] indicates that this paper has been cited over 130 times since 1961.]

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"I began to study the population ecology of the perch in Windermere in 1943 soon after the start of an experimental fishery. The perch were caught in traps while spawning and then canned and sold as 'Perchines'; though tasteless, they were acceptable as part of a wartime diet. Samples of the catches were measured and I soon needed to convert lengths into weights, so I began to explore the literature on the length-weight relationships of fish. In the review that opens the paper, I tried to clarify the connection between the length-weight relationship and the 'condition factor' or 'ponderal index.' Although Weatherley and others have rejected my introduction of a 'relative condition factor' derived from an empirical length-weight relationship, others have used it and found the review useful; perhaps this is one reason why the paper has become a *Citation Classic*. I know of no general review of the topic that has superseded it.

"I then plotted lengths and weights of perch on double logarithmic graph paper and it became clear that regressions of log weight on log length would describe the length-weight relationships well for each sex-maturity group of perch. About this time, Charlotte Kipling joined our small staff at Wray Castle (a Victorian folly on the shore of the lake). She had just taken a course in statistics and skillfully devised a suitable analysis of covariance and set about calculating regressions. Nowadays these would be done in a few hours on a computer but Charlotte had only a small Monroe calculator (still in good working order!); logarithms were looked up in tables. We could not have interpreted the data properly if I had not first plotted out most of them. This visual inspection was an essential step, and I would be wary of carrying out a similar analysis 'blind' using a computer package. I believe that this may have been the first time that an analysis of covariance had been carried out on data of this kind.

"The second half of the paper described the seasonal cycle in relative condition and how this is related to changes in gonad weight. I suspect that this, too, may have been the first time such an analysis had been done in this way. The pattern of presentation has been copied by several subsequent authors and the final summary figure of the paper was the basis for the dustcover of Weatherley's 1972 book.¹ This may be another reason for the paper's frequent citation. Problems of the relative growth of parts of animals have interested biologists since D'Arcy Thompson published his classic book.² I believe that the study of such problems, including the ponderal and gonadosomatic indexes of fish, requires very careful and rigorous analysis.

"This study was really only one of the preliminaries to what I regard as more important long-term work on the growth and population dynamics of perch."^{3,4}

1. Weatherley A H. *Growth and ecology of fish populations*. London: Academic Press, 1972. 293 p.

2. Thompson D W. *On growth and form*. Cambridge: University Press, 1917. 793 p.

3. Le Cren E D. Observations on the growth of perch (*Perca fluviatilis* L.) over twenty-two years with special reference to the effects of temperature and changes in population density. *J. Anim. Ecol.* 27:287-334, 1958.

4. Craig J F, Kipling C, Le Cren E D & McCormack J C. Estimates of the numbers, biomass and year-class strengths of perch (*Perca fluviatilis* L.) in Windermere from 1967 to 1977 and some comparisons with earlier years. *J. Anim. Ecol.* 48:315-25, 1979.