

FOOD AND FEEDING RELATIONSHIPS IN A COMMUNITY
OF FRESH-WATER FISHES

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(With 3 Figures in the Text)

1. INTRODUCTION

In the majority of researches upon the food of fishes attention has been fixed upon one species, and the other members of the community in which that species lives are considered chiefly as predators or as potential foods. Yet, it is generally realized that the factor of interspecific competition for supplies may be fully as rigorous as intraspecific competition in its limiting effects upon multiplication, growth and well-being. Nikolsky (1945) has named as the first problem in fish biology 'the study of the feeding habits of different species in order to understand the qualitative and quantitative connections between fishes and their food organisms. The results would be the knowledge of the dynamics of the food chains in a water body . . .'

Among others, Swynnerton & Worthington (1940) and Radforth (1940) in Great Britain; Alm (1917, 1921, 1922) in Sweden; Clemens, Dymond & Bigelow (1924) in Canada; Nurnberger (1930), Ewers (1933), Ewers & Boesel (1935), Boesel (1937) and Van Oosten & Deason (1937) in the United States; and Dobers (1922) and Stadel (1936) in Germany have published accounts of the foods of several species of fresh-water fish from one water. In some of these papers competition between species is not explicitly discussed, although information upon the subject is implicit. More recently, Frost (1946) has considered the food relationships of most of the species of fish in Windermere.

Between the end of 1938 and the beginning of 1941 the Freshwater Biological Association maintained a substation for the study of the biology of coarse (non-salmonid) fish at Bulbeck Mill, in the village of Barrington, Cambridgeshire. This laboratory was situated on the upper reaches of the River Cam, or Rhee, near the inflow of a small tributary, the Shepreth Brook. The fishing in a short length of the main river, and in nearly half a mile of the Shepreth Brook, was under the control of the Association. The Ouse and Cam Fishery Board kindly appointed the author, who was in charge of the investigations, an honorary bailiff, with powers to take fish by any method and at all seasons.

2. DESCRIPTION OF THE HABITAT

A map of the area from which all the fish investigated came is given in Fig. 1. The 'run' of the mill, from which the undershot wheel had been removed, is the upper limit on the main river. Below the mill the river widens into a pool about 40 ft. (13 m.) across and 6 ft. (2 m.) deep in the middle. The south bank of this pool is steep-to, with the remains of a system of revetments. The north shore is of gravelly chalk mud, steeply shelving and much grown up with *Epilobium* sp. After some 20 yd. (20 m.) the pool becomes shallower and the river thereafter flows over a bottom of gritty chalk mud in a channel 30 ft. (9 m.) wide and 2-4 ft. (c. 1 m.) deep. On the northern side there is a steep grass-grown bank, on the south there are grazing meadows which are under water in times of flood.

A dismantled eel-trap above the mill drains into a narrow dyke, much choked with reeds (*Phragmites communis*) and reed-mace (*Typha* sp.). This dyke curves round to join the main river at the foot of the pool below the mill.

The upper part of the Shepreth Brook runs between rows of pollard willows (*Salix* sp.) in a channel about 10 ft. (3 m.) wide, floored with clean gravel; the water is only a few inches deep. Half a mile from its junction with the river, the brook is joined by an almost stagnant creek which lies parallel to the main river among willow holts and orchards. The bottom of this creek is thickly covered with sodden leaves and fine mud. Below the mouth of this creek the brook is about 10 ft. (3 m.) wide and much overhung with willows. The water is 1-3 ft. (0.3-1 m.) deep, with a muddy bottom in the deeper stretches and a gravelly bottom in the shallows.

During the period of observation, the river rose and fell through a range of 37 in. (1 m.), the highest levels being in January and May 1939, and February and March 1940. In times of flood the north bank of the Cam and the slightly embanked south side of the Shepreth Brook were the shores of a wide, shallow lake. A gang of river cleaners cleared some of the mud