

It has been discovered that in various boreal fishes the seasonal changes in their growth leave certain traces in all the osseous structures, such as vertebræ, gill-covers, otoliths, and scales, a difference being plainly seen between the parts formed during rapid growth (in summer), and the parts formed during feeble growth (in winter). In this way visible rings or zones are formed in the structures mentioned, varying according to summer and winter, thus enabling us to count the number of winters and summers passed by the fish in question, and to ascertain its growth in various phases of life. This was first discovered by Hoffbauer in the scales of the carp (1899), and has also been observed to hold good in the case of the otoliths of the plaice (Reibisch), and of the scales of gadoids (Stuart Thomson), while Heincke and others have proved various bones to be good indicators of growth. A voluminous literature<sup>1</sup> has accumulated as the result of these methods, which assumed greater importance when in 1904, upon the recommendation of Heincke, the international fishery investigators adopted them and applied them to many special and general problems. In recent years during the fishery investigations of several countries the growth and age of various commercial species have been subjected to analysis.

Age and growth of fishes denoted by their scales.

In Norwegian fishery work the scales have mostly been employed for age assessments, and in this way a number of species belonging to the cod family have been treated by Damas, while Sund has studied the age of the sprat, Broch, Dahl, and Lea the age and growth of the herring, and Dahl of the salmon and trout.<sup>2</sup>

Fig. 554 represents a series of scales of saithe, ranging from 17 to 67 cm. in length, taken on the west coast of Norway. They have been represented in proportion to the size of the

<sup>1</sup> See Knut Dahl, "The Assessment of Age and Growth in Fish," *Internationale Revue der ges. Hydrobiologie u. Hydrographie*, Bd. II., 1909, containing review of literature.

<sup>2</sup> Désiré Damas, "Contribution à la biologie des Gadides," *Rapp. et Proc.-verb. de la com. perm. pour l'expl. de la mer*, vol. x., Copenhagen, 1909.

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