solving algebraic equations, making Fourier synthesis, etc., gives very little information and leaves one unsatisfied. The digital machines, both mechanical and electronic, are treated particularly well and Prof. Hartree has given the readers the benefit of his rich experience in the form of a fine analytical account of their working. The book is warmly recommended both to designers and to users of computing machines.

HILSA INVESTIGATIONS IN THE NARBADA*

TWO of the most important families of fish as food for mankind are the Clupeoids (Herring family) and Gadide (Cod family). The latter family is practically unrepresented in Indian water, but the Clupeoids are abundant. Quite a number of members of the Salmon and Herring families live parts of their lives in the sea, ascending rivers to a greater or less distance to spawn. Some spawn near the termination of the tidal rise, others ascend the rivers for vast distances. The striking result of this is that these fish, when overfishing takes place, are more amenable to depletion than fish which spend all their lives in the open sea. Consequently, information as to the spawning habits of these fish is of direct economic importance, and Dr. Kulkarni in these researches is to be congratulated on extending our knowledge of the spawning of the Hilsa, certainly one of the most important, if not the most important, of Indian fish.

It has long been known that the Hilsa ascend certain Indian rivers, *e.g.*, the Ganges to considerable distances and it was reasonable to assume that this migration was for spawning purposes. In June and July 1909, the writer of this review attempted to locate spawning ground of Hilsa in the Ganges without success, though ripe males and females which had evidently recently spawned were obtained at Sara Ghat, Rajmahal and Monghyr. In spite of the most careful search no eggs or larval fish were obtained. Late in September ripe males were obtained at Monghyr. So the mystery of the spawning grounds of the Hilsa remained unsolved until Dr. Hora in 1938 discovered spawning grounds at Pulta.

Now we have, thanks to Dr. Kulkarni, a detailed account of the spawning habits, eggs and young Hilsa from the Narbada. It appears that many, if not most, shoals of Hilsa in that river spawn at or about tidal limits in this respect resembling the Smelt (Salmon family) of English rivers. The author gives an excellent, lucid and detailed account of the eggs and young of the Hilsa with illustrations. There is also a map showing the positions where the eggs were obtained. All this information is most valuable, and should overfishing occur, as it may well do, the author's paper will be reliable as a source of any regulations that have to be made. The excessive preponderance of ripe males to females corresponds with our experience on the Ganges. A more detailed account of the extent of the spawning grounds in the Narbada River and also the fate of those shoals which ascend the river to Garudeshwar will be quite useful.

Dr. Kulkarni rightly draws our attention to the fact that while the Hilsa spawns relatively near the tidal limits on the west coast, it does ascend to considerable distances in the Ganges and Indus, even though a spawning was discovered by Dr. Hora at Pulta. We know that in the case of the two European Shads, one ascends rivers to a considerable distance whereas the other spawns near tidal limits. Can it be that there are two varieties of Hilsa, one the same as the above, while the other spawns immediately on reaching fresh water? There is also the question of the development and location of what may be termed the post-larval stages of the Hilsa. My own experience was that little or nothing was known of these stages. The duration of the spawning period should also be investigated.

J. T. JENKINS.

• *Breeding Habits, Eggs and Early Life-History of the Indian Shad, Hilsa ilisha (Ham.), in the Narbada River.* By Dr. C. V. Kulkarni, (*Proc. Nat. Inst. of Sciences of India*, 1950, **16**).