

THE DISTRIBUTION AND GROWTH OF EELS  
OF THE GENUS *ANGUILLA* SHAW, 1830,  
IN THE WESTERN INDIAN OCEAN

par

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*RESUME*

*Les prix de commercialisation des anguilles (Anguilla ssp.) sont parmi les plus élevés du monde. La demande excède l'offre de beaucoup, notamment au Japon, où sont importées chaque année de grandes quantités de civelles, qui sont élevées jusqu'à une taille où les anguilles sont commercialisables. Les anguilles écloses dans l'Océan Indien occidental pénètrent dans tous les fleuves de la côte orientale d'Afrique. Mais, alors que leur vie en eaux douces a été bien étudiée, les périodes où elles séjournent en mer et en estuaire sont très mal connues. On admet, comme une évidence, que les civelles, qui après avoir pénétré dans les estuaires, remontent le cours des fleuves, appartiennent à une seule classe d'âge. Cependant des mélanges de classes d'âge se produisent. Ils sont le fait de poissons qui attendent en estuaire des conditions favorables de remontée des fleuves et sont alors susceptibles d'émigrer d'un estuaire à l'autre. L'auteur réclame du matériel et la communication des observations faites sur les phases marines, dans l'Océan Indien, des espèces du genre Anguilla.*

Of all fish which breed in the western Indian Ocean the eels of the genus *Anguilla* have, probably, the highest economic value per unit weight of fish. The demand for eels is world-wide and growing, and is even now by no means met by the supply. As a result the present price of eels is extremely high, and the fish are probably equal to, and certainly second only to, salmon in commercial value. The price of live seed eels in Taiwan in 1970 had increased to U.S. \$ 150 per kilogramme (FAO 1971) from less than U.S. 50 c fifteen years earlier, but a year later (in 1971) it had increased so much that seed eels of average weight were costing 15 U.S. cents *each* (FAO 1972).

An almost unique feature of the trade in eels for the market is that not only are the bulk of the product grown to marketable size in artificial ponds (rather

than captured as wild fish) but that most of the juveniles, or elvers, captured in rivers or estuaries at the start of their catadromic riverine migration are transported by air to the cultivation ponds in other countries a very considerable distance away.

Japan is the main importer of elvers from all parts of the world. The excess elvers unable to be cultivated in Japan are sold to Taiwan. Japan then buys back the adult eels for local consumption. At the present time elvers for pond cultivation in these countries are imported from France, Italy, Spain, Morocco, England, the Philippines, Indonesia and Sabah (Borneo) (Dr T.P. CHEN, personal communication 1973). Despite the large quantity of elvers thus imported from many countries, the demand for this valuable commodity is so high that there is a serious shortage of young eels.

No eels from the western Indian Ocean are as yet exploited commercially, with the exception of the traditional fisheries that have long been operated in Madagascar where traps are used to capture migrating adult eels (KIENER, 1959). Yet four important species are present in the western Indian Ocean (JUBB 1961), namely *A. marmorata* Quoy and Gaimard, 1824, *A. labiata* Peters, 1852, *A. mossambica* Peters, 1852 and *A. bicolor* McClelland, 1844. All of these are of potentially great commercial value, and populations of them in the freshwater phase of the life cycle are to be found in Africa in virtually all the eastward flowing rivers. The number of elvers which enter these rivers annually from the sea are probably reckonable in millions. Practically nothing is known of the available, exploitable stocks.

In view of the commercial value of these species, and the very large number of them that enter African rivers, it is surprising that they are as yet so little exploited and also that so little is known of their breeding biology, particularly in the marine phase. The main purpose of this paper therefore is to plead for further research into the life history especially of the breeding adults and of the leptocephalus larvae and immediately metamorphosed elvers.

While earlier workers, e.g. EGE (1939), FROST (1954), VAN SOMEREN and WHITEHEAD (1959) have reported on the occurrence of eels in various African rivers, it was the valuable work of JUBB (1961), (1964), that contributed most of our knowledge of eel biology during the freshwater period. As a result of this work the taxonomy, relative distribution of species, feeding habits, etc, of eel species, at least in Southern Africa, is now fairly well known, and we now have a good idea of the duration of the freshwater phase. In general, the two predominate species of future potential commercial importance are *Anguilla mossambica* south of latitude 21° S, and *Anguilla n. labiata* north of this latitude, (JUBB 1964).

Additional evidence indicates that elvers enter rivers at a definite, seasonal time of the year and that the waves of migration are of individuals of the same age-group. However this picture is later complicated by differential movements as discussed below. On January 26, 1973, a pool in the Great Fish River, Cape Province, South Africa, about 18 km from the river mouth, was treated with

rotenone. At this time the river was, due to prolonged drought, scarcely flowing at all, and progress upstream from the pool was effectively barred by a weir built for the purpose of measuring the river flow. 101 young eels were captured, which, as can be seen from the length-frequency histogram (fig. 1) were all juveniles of one compact age-group, with a mode of approximately 90 mm total length. A single individual of 133 mm total length was taken (see fig. 1) but no eels of any other size were present in the pool. These fish were approaching the post-elver stage, and had probably grown somewhat since they entered the estuary 18 km away. However, they clearly represent a single year-class which had migrated to this point together.

The length of time that young eels wait, either in the estuaries or in the lower reaches of the rivers, probably varies with conditions prevailing in any particular year. Upstream migration, in this part of Africa where rainfall is erratic, probably takes place more rapidly in a season of good summer rains than in one of drought with poor river flow. While more work remains to be done on elver behaviour in estuaries, there is some possibility (R.A. JUBB, personal communication) that elvers may enter one estuary, wait there a while and then if no freshwater arrives to make river migration possible, leave and travel along the coast to another estuary in the hope that conditions for river travel may be more favourable there. Also, it is probable that individual eels may decide to remain in a pool or other favourable water near the sea longer than others, to migrate only at a later date, perhaps in company with more recently arrived, and therefore smaller, specimens. This kind of differential movement often complicates the picture of a migratory wave of elvers all of the same year-class, and SKEAD (1959) has shown that post-elvers between 100 mm and 180 mm were found to be ascending a dam wall on the Buffalo River, South Africa, during the summer. The single 133 mm specimen in fig. 1 may thus represent a late traveller of the previous year-class.

In contrast to this freshwater work, which in itself is by no means complete, our knowledge of the biology, breeding and distribution of the Anguillidae in the Indian Ocean remains most inadequate and is still based on collections made by the Danish research vessel "Dana" in the western Indian Ocean in December, 1929, and January, 1930. The eel material from this cruise was worked on by Jespersen (1942) who was able to identify the leptocephalus larvae of the four Indian Ocean species of *Anguilla* and have led to the conclusion that a likely breeding area lies east of northern Madagascar within 10° to 20° S. and 60° to 65° E. From this conclusion and taking into account the prevailing ocean currents of this region, JUBB (1964) has shown how larvae of the species *A. mossambica* and *A. labiata* could drift to the coast in each of those areas where the species as adults are predominately found in the rivers.

However, much more research at sea remains to be done, more leptocephali (particularly of the early stages) collected, and the relative abundance of each of the species determined. It is to be hoped that the obtaining of such data as these will be placed high on the priorities of research programmes. The J.L.B. Smith Institute of Ichthyology would gladly welcome all materials of *Anguilla*, whether leptocephali or migrating adults and elvers, taken in the Indian Ocean.

As the late Professor J.L.B. SMITH after whom the Institute is named once wrote : "The discovery of the life history of the eel of the Northern Atlantic was a classic of modern scientific investigation ; its equivalent in the Indian Ocean still dangles tantalizingly before those who plan to investigate this large sheet of mysterious blue water".

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