FLATFISHES AND SKATES

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Summary

Flatfishes and skates have the body flattened. Their bodies are respectively compressed and depressed, and with anatomical, and physiological modifications. The biology and the annual catches of the more important commercial species are described.

1. Introduction

These are ground-living fishes. Their body is extremely flattened. Their flat form is admirably adapted to the mode of the life on the ground. The body of flatfishes, Pleuronecteformes, which are flattened from side to side, is generally described as "compressed." The body of skates or Rajidae, electric rays or Torpedinidae, stingrays or Dasyatidae and eagle rays or Myliobatidae, which are flattened from top to bottom, is generally described as "depressed." This form, but less flattened, also exists in some sharks such as the carpet or nurse sharks or Orectolobidae, and the angel sharks or Squatinidae, but also in other bony fishes like the anglerfish or Lophiidae, and the batfish or Ogcocephalidae. There are other ground-living adaptations: the body can be very elongated with reduced fins, particularly in fishes with burrowing habits such as Anguilliformes or sound lances or Ammodytidae. Alternatively the pelvic fins have united to form an adhesive or sucking disc, as in lump fishes or Cyclopteridae, gobies or Gobiidae and clingfishes or Gobiesocidae, or the three lower pectoral rays can be enlarged and free, and used for detection, as in sea robins or Triglidae.

Because of the flatness of the body, there are anatomical, and physiological modifications. In the skates, electric rays, stingrays and eagle rays, the mouth and gill-openings are on the under side of the head. When the skate swims, it is able to breathe like other fishes: with the mouth open, water is drawn in and after a short interval is

expelled from under the gill-cover, and the cycle is then repeated. When resting on the bottom, however, it inhales water by way of two spiracles, comparatively large openings situated immediately behind the eye. The spiracles are provided with a movable valve to avoid the danger of introducing sand with the stream of water and this clogging up the delicate gill filaments. The water is expelled through the gill-openings under the head.

In the Pleuronectiformes there are greater anatomical and physiological modifications. The newly hatched larvae are quite symmetrical with an eye on each side of the head, as for most other fishes. They swim at or near the surface of the sea. After a time with metamorphoses in the later stage of larval life, the typical asymmetry becomes obvious. One eye moves round to the upper edge of the head and round to the opposite side. At the same time, the dorsal fin is prolonged forward and after the eye has moved round, the fin extends along the edge of the head above it. In some species the migration of the eye is when the dorsal fin has grown forward on to the head. The eye is then obliged to push its way through between the base of the fin and the head. Associated with the migration of the eye is one involving the nostril of the same side and a twisting of the mouth. There is also a greater or lesser degeneration of the pectoral and pelvic fins on the blind side. The modification of the anatomy of the head including the cranial and head bones, and innervations of the eyes.

Fish with a compressed or depressed body generally have the lower surface un-pigmented. The upper surface of many of the skate (*Raia*) and flatfishes (Pleuronectiformes) is often colored in harmony with the ground on which they are lying. The general appearance of a goosefish (*Lophius*) with its series of branched membranous appendages tends to give it a general resemblance to a weed-covered rock. It is, however, in the flatfishes that the capacity for changing the coloration in harmony with the surroundings reaches its height. The turbot (*Scophthalmus maximus*) living on dirty mud or sand on the sea bottom is a dull-grayish fish. Placed on a background of coarse gravel, the coloration becomes an excellent match for the seabed. The ground fish often lie partially buried. They are mostly inactive by day, lying quietly on bottom, often deeply buried in sand up to the eyes, and to the spiracles in skates. Skates are strictly carnivorous and feed mostly at night. Some skates and flatfishes also carry out feeding migrations on a considerable scale.

The catches of ground-living fish are less than 2% of total worldwide catches, with, in 1996, 920 000 mt of flatfishes, about 220 000 mt of skates, 260 000 mt of congers, and about 110 000 mt of anglers (Lophiidae). However this relatively low catch is compensated by the high market value of some species which are very much appreciated in gastronomy for their dense fine meat. This is particularly the case with the sole *Solea solea* and many other species of Soleidae and Cynoglossidae, the turbot *Scophthalmus maximus*, brill *Scophthalmus rhombus*, Atlantic and Pacific halibut *Hippoglossus hippoglossus* and *H. stenolepis,* and anglerfishes *Lophius* spp.

2. Plaice, *Pleuronectes platessa*, Linnaeus, 1758

Plaice of the Pleuronectidae family (eyes normally on the right side, pre-opercular margin free; mouth terminal) are distinguished by the ocular side being a warm brown

color, with a number of rather large red or orange spots and a series of four to seven bony tubercles behind the eyes. It grows to about 100 cm SL, but more commonly between 25 and 45 cm SL. Plaice is the most important flatfish for fisheries with 154 000 mt in 1996. It is a ground-living fish, mostly on sandy ground but also on mud and gravel. It is found near the coast—the first year old specimens on the shoreline, then, at less than -5 m the second year old specimens, then on and after the third year old specimens, mostly between -15 and -80 m, to about -120 m. It penetrates estuaries but not far up because it is not very tolerant of fresh water.

There are several populations, each with its own spawning ground. The plaice reaches sexual maturity between two and six years old in females, and between three and seven years old in males. Spawning takes place in the cold months in the French Atlantic coast, the Channel and the North Sea: from December to March on the –20 to –40 m grounds; in the Western Baltic from November to June in the -60 to -90 m grounds; in the South-West Iceland from March-April, in the Barents Sea from March to May. Plaice spawns over all its distribution area, but mostly in the Southern North Sea and the Channel grounds. According to size, females produce from 50 000 to 500 000 eggs. Plaice are very abundant, but have low fecundity. For example, females of 37 cm SL have from 80 000 to 100 000 eggs in the North Sea, 160 000 on the French Atlantic coast (Baie de Douarnenez), more than 300 000 in the Baltic. The eggs at spawning are 1.9 mm mean diameter (1.6 to 2.1 mm). They are pelagic, floating near the surface at first but gradually sinking as development proceeds. The eggs float only if the salinity is more than 10‰ to 12‰. In the Baltic only the deep waters have an adequate salinity for good spawning. Hatching takes place in 18 to 21 days when the temperature is 5 to 6 °C, and up to one month in the Barents Sea where the temperature is 2 to 2.5 °C. At hatching the larva is about 6 to 6.5 mm in length. Pelagic life lasts for forty days and metamorphosis is reached at a length of 10 to 13 mm, sometimes up to 17 mm. After metamorphosis the young live on the bottom, reaching the shoreline about five days later.

The average growth rate is of about 10 cm in the first year, decreasing in the following years to about 6 cm in the second year, 5 cm from the third to the ninth year, and 1.5 cm beyond. The length of plaice is 6 to 12 cm in their first winter, 11 to 23 cm in their second winter, 23 to 41 cm in the fifth winter, 27 to 52 cm in the seventh winter, and 47 to 62 cm in the tenth winter. Females have a faster growth than males. Females also live longer (24 years) than males (only 11 to 12 years). At first, the larvae do not eat; but this begins once the yolk is absorbed. Often before they have completely absorbed the yolk, they eat first mostly tintinnids, dinoflagellates, copepod larvae, then mostly copepods, eggs of invertebrates, larvae of mollusks, diatoms, and larvae of polychaete worms. Beyond 8 mm, they eat more and more copepods and cumaceans. The young eat small polychaete worms, harpacticoid copepods, small crustaceans, amphipods, mysids, cumaceans, other small worms, and mollusks. From 20 to 30 cm, plaice eat polychaete worms and mollusks, and from 30 to 40 cm, large worms such as *Arenicola*. Beyond 40 cm they eat mollusks (*Donax, Macoma, Tellina, Solen, Venus,* and *Mytilus),* coelentera, crustaceans (amphipods and small crabs), echinoderms (brittle stars), and small fishes (*Ammodytes*). Plaice eat mostly during daylight hours. In the littoral area, they feed mostly after the flood tide.

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Biographical Sketch

Jean-ClaudeQuero has occupied the position of Ichthyologist/taxonomist at ISTPM/IFREMER (France) at the Laboratory of La Rochelle, since 1966. He was a co-author in Clofnam (UNESCO), 1973; Clofnam (UNESCO), 1984–1986 and editor of Clofeta (UNESCO), 1990; co-author of FAO species identification sheets for fishing areas 34 and 47, and French reviser of text for OECD 1990. He is the author of a popular treatise on commercial French fishes and editor of one on other commercial marine products. He is also the author of many scientific notes.