GROSS EXTERNAL ANATOMY

By way of introduction, basic diagnostic features of fish need to be identified.

1. Fishes are cold blooded/poikilothermic animals i.e. their body temperature varying passively in accordance with the ambient temperature (surrounding water temperature). Although, fishes as a group can tolerate wide range of temperature from just below O0C to 450C, individual species generally have a preferred or optimum as well as a more restricted temperature range. For example, salmonids inhabit water with temperature range from 0-200C. Any change within the optimum range can significant influence the biology as related to the anatomy.

2. The adoption of aquatic habit has other implications for the structure and physiology of fish. For instance, it makes the streamlining and shaping of the body an important pre-requisite for success in aquatic life. The shapes range from ovoid to torpedo-like or fusiform shape. This is due to the higher density of water than air.

3. Respiration assumes a greater important through the gills when compared to terrestrial animals because water contains 1/20th of 02 available in air. This proportion of 02 is still further reduced by an increase in temperature and/or ionic concentration. Fishes are exposed to much greater ionic and osmoregulatory challenges than land animals because their bodies are permanently immersed in water (a medium) which is not only the universal solvent but also the fluid in which gases must diffuse during respiration exchange. Microbial infection and multiplication are more likely to occur from the water medium.

Therefore, there is the need to consider the structural implication of fish to an aquatic existence. The gross external anatomy allows an individual especially the fisheries scientist to identify most species with a fair degree of accuracy. When doubt exists, other anatomical details may have to be examined. The body shape of fish is totally adapted to a free-swimming life in water and it is adapted to give maximum efficiency to its propulsion through the water.

Make a drawing each of body and cartilaginous fish. e.g tilapia as bony and *Scoliodon* (shark) as cartilaginous fish. Label each fully during class lecture.

There are basically two shapes of fish-round and flat fishes. Flat fish such as Skate, Rays, Plaice and Soles are adapted to life on the bottom of the water body. Round fish in general have evolved an efficient hydrodynamic shape to allow them to move through the water body with the minimum expenditure of energy. Body shapes of fishes can also be described based on the crosssections

of the body. These shapes include:

i Fusiform shape- Cross section fish is round e.g in tuna, mackerel. Draw.

3

ii Compressiform shape-Shows lateral compression e.g Tilapias, *Ilisha* etc. (Draw)

iii Anguilliform shape-compressed body form but are laterally long e.g *Gymnarchus.*(Draw)

iv Filliform shape- Round cross-section but with long body e.g eel, *Calamiochthys calabaricus.*(Draw)

v Teaniform shape- cross-section shows oval outlook e.g *Clarias, Heterobranchus*.(Draw)

vi Sagittiform- eound but with upper part flat e.g *Hepsetus odoe* (the African pike). (Draw)

vii Depressiform shape-cross section is dorso-ventrally compressed. e.g Soles,Skates and Rays. (Draw)

viii Globiform shape- Round cross-section and looks like a ball when viewed from the side. e.g globefish, sunfish (Draw)

The Skin: The external surface of the body of fish is the skin which is composed of two layers –

an outer epidermis and the inner dermis. It is from the underlying dermal layer that the characteristic scale covering of fish is produced. The epidermis is a thin, fragile layer which is constantly sloughed off and renewed. It contains mucous cells which secrete the sliming outer covering of fish. The slime on the epidermis is called mucus which makes the fish slippery to handle. The mucus protects the epidermal layer against abrasion and by lubrication makes the fish more streamlined and also difficult to hold. It also renders the skin less permeable and prevents entry of pollutant materials and microorganisms which would otherwise infect the fish. This is why fish are handled with care to avoid damage or injury to the skin or its protective coating. The lipoprotein properties of the slime also trap or bind heavy metals and bacteria which are then lost as the mucus is washed off the surface of the fish. Draw the TS of Skin. The scale
4
which are composed of bone and connective tissue growth in size in accord with other tissue in the body. Each scale overlaps the one behind producing a relatively impermeable but living cover. Growth rings or annuli are seen on the scale. Variations in thickness of these rings are produced by seasonal changes in diets or temperature or by spawning. The annuli can be used to determine age of fish. Note that these rings are more difficult to interprete with tropical fishes than the temperate fishes. The reason being that growth in tropical fishes is usually more rapid than it is in temperate water. Also, growth rings are not clearly seen in cultured fish because they are maintained under relatively stable conditions and feed at constant rates.

Types of scales: (i) Placoid scales – sometimes called dermal denticles. It has an ectodermal cusp made up of an enamel-like substance. Commonly found in shark (Elasmobranchii/cartilaginous fish).

(ii) Cosmoid scale – is another type of scale in this category. It resembles placoid but thinner and with harder water layer. It is made up of material known as virtrodentine. Found in the living and extinct lobefin fishes.

(iii) Ganoid is another type of scale in this category. It differs in having inorganic salt substance called ganoine. It has a diamond-shape flat, smooth enamel-like surface. Sometimes called rhombic scale because of its shape. Found in *Polypterus, Calamoichthys calabaricus.*

The other two types of scales commonly called bony ridge scales are found in many living fish species especially the Osteichthyes. These are:

(a) Cycloid scale which is characterized by its exposed surface being smoothly rounded. That is, its thin smooth disc-like surface edge has a more or less circular outline. Fishes having this type of scales are therefore smooth to touch e.g. tilapias, *Heterotis, niloticus* (Draw)
5
(b) Ctenoid scale has its posterior surface or margin toothed i.e. comb-like.

Therefore, fish is rough to touch e.g. *Ctenopoma kingsleyae*. It should be noted that there are fishes without scales. These are called Scaleless or 'naked' fishes. These fishes are usually covered with thick slime/mucus which make them more slippery to touch or handle e.g. *Malapterurus electricus, Clarius sp.*

Mouth positioning can be used to describe fish. Make diagrams of such which include:

(i) Terminal mouth e.g. in tilapias
(ii) Sub-terminal mouth e.g. in *Clarias*
(iii) Inferior mouth e.g. in Shark
(iv) Superior mouth e.g. in *Hemichromis*
(v) Retracted mouth e.g. in African barrel fish (*Hyperoglyphe*)
(vi) Protrusible/Protracted mouth e.g. Star gazer (*Uranoscopus*)

The mouth of fish is equipped with teeth are used in connection with feeding. Teeth are one of the structural adaptations to feeding habit. Based on location in the mouth, teeth could be described as:
(i) Premaxillary – teeth located on the front margin of the upper jaw.
(ii) Maxillary – teeth located on the sides of the upper jaw on separate bones
(iii) Mandibular teeth – these are located on the margin of the lower jaw
(iv) Vomerine – these are located on the front part of the roof of the buccal cavity.
6
(v) Pharyngeal teeth – these are located on the throat.
Based on the types cusps, there are 3 types:
Unicuspid teeth – Have one cusp each
Bicuspid teeth – Each tooth has two cusps
Tricuspid teeth – Each tooth has three cusps
Tricuspid teeth – Each tooth has three cusps.
Based on the form, there are
(i) Villiform teeth – these are numerous, short, fine and pointed teeth e.g. found in *Channa*, stargazer.
(ii) Incisor-like teeth – these are with sharp edges used for cutting. Highly characteristic of the carnivorous e.g. *Gymnarchus*
(iii) Canine-like teeth – these are relatively big pointed teeth used for piercing and holding prey. Found in piscivorous fish e.g. Barracuda, *Hepsetus odoe, Hydocynus*, Shark etc.
(iv) Molar-like teeth – these are flattened broad teeth used for cutting and crushing e.g. in benthic fishes feeding on shellfish and detritus e.g. Rays, Skates.
Note that in some fishes, teeth may remain vestigial e.g. the planktophagous feeding fishes – *Ilisha africana* and in Carps which are omnivorous.