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External Anatomy and Physiology of a Red Snapper Fish (*Lutjanus madras)*

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Abstract: ***Body elongate to moderately deep and laterally compressed. Head relatively small with pointed snout. Snout-forehead profile almost straight. Pair of small rounded nostrils on each side of snout with very low flap on outer edge of anterior nostril. Pair of canine teeth anteriorly in upper jaw, with smaller canine teeth between these and symphysis. Remaining lateral portion of upper jaw with series of embedded caniniform teeth. Lower jaw with about 6–8 small canine teeth on each side. Dorsal-fin outline slightly incised. Predorsal scales extending forward to vertical at posterior margin of pupil. Scale rows on back rising obliquely above lateral line. Lateral-line scales 49–51. Horizontal scale rows above lateral line 6–7. Scale rows on cheek 7–8. Scales absent on preopercular flange. Profile of soft dorsal-fin relatively low and weakly rounded. Pectoral fins pointed. Caudal fin emarginate. Colour. Pinkish-white base colour, becoming darker reddish-pink dorsally and down snout, and paler ventrally. Other external features were also discussed. The main objective of this present study is to create a dynamic experience to assist in understanding the external features and its Physiology of a red snapper fish (Lutjanus madras).***

Keywords: External Anatomy, Physiology and Fish

1. Introduction

Anatomy is the study of an organism's structures. Fishes come in a diverse array of forms, many with special modifications. The shape, size, and structure of body parts permit different fishes to live in different environments or in different parts of the same environment. The external anatomy of a fish can reveal a great deal about where and how it lives. Most fish have scales and breathe with gills. Approximately 22, 000 species of fish began evolving 480 million years ago. Fish, by definition and almost without exception, are cold-blooded vertebrates. This means that they remain at approximately the same temperature as the water surrounding them. In contrast to the mammals who are water-dwelling such as the Whale or Water Rat, which like ourselves, usually maintain a much higher internal temperature than the water that surrounds them even though the water may be a much colder temperature than a mammal could otherwise survive. When the water becomes too cold, or exposure to the cooler water becomes longer than the mammal's internal temperature control can keep up with, this is called hyperthermia and the mammal' internal core temperature cools and the mammal's heart slows and eventually, the mammal dies. All freshwater aquarium fish have, much like the mammal, an exact temperature range within which they can survive. If the temperature of the aquarium strays far out of this range, the fish have no type of internal temperature control and will simply die. Different fish species have different temperature needs based on the traditional temperatures of the waters of origin of those species. Aquarium fish share with Humans and other mammals the possession of a backbone, or vertebral column. Fish are built on the same fundamental plan, having the same basic system of bones and organs as mammals. Even more surprisingly, in many cases, some species of fish exhibit parental behavior, express a sense of family, show signs of recognition to specific humans and even exhibit signs of emotion. There is much we have yet to learn about aquarium fish, but they are not just decoration, they are pets that deserve our respect and care. All feature a sloped profile, medium-to-large scales, a spiny dorsal fin, and a laterally compressed body. Northern red snapper have short, sharp, needle-like teeth, but they lack the prominent upper canine teeth found on the mouth, dog, and mangrove snappers. They are rather large and are red in color. This snapper reaches maturity at a length of about 39 cm (15 in). The common adult length is 60 cm, but may reach 100 cm. The maximum published weight is 50 lb, and the oldest reported age is 100+ years. Coloration of the northern red snapper is light red, with more intense pigment on the back. It has 10 dorsal spines, 14 soft dorsal rays, three anal spines and eight to nine anal soft rays. Juvenile fish (shorter than 30–35 cm) can also have a dark spot on their sides, below the anterior soft dorsal rays, which fades with age.

2. Materials and Methods

Description of the experimental animal

Kingdom:	Animalia
Phylum:	Chordata
Class:	Actinopterygii
Order:	Perciformes
Family:	Lutjanidae
Subfamily:	Lutjaninae
Genus:	*Lutjanusmadras*

Lutjanus snappers have a circumtropical and subtropical distribution and are found in the Atlantic, Indian and Pacific Oceans

Size:
Maturity: Max Length: 30cm (Total length) TL, Commonly to 20cm TL.

Habitat and Ecology:
Inhabits coastal coral and rocky reefs and outer slopes (depth 5-90m). Forms large and small aggregations around outcrops. Diurnal carnivore. It is a broadcast spawner and tends to spawn in groups.

Fishery Status:
This species is not protected or subject to fishery regulations. It is caught in the fish trap fishery, but is a regular and sometimes numerous component of the catch.

Specimen collection and deposition: Fish specimens were collected from Kasimedu fishing harbours landing centre (Lat.13.1280° N; Long. 80.2969° E) and brought to the laboratory by using plastic container, during October, 2018 to April, 2019 visiting five times. Local fishermen catch these fishes using gear named small berjal, hooks and lines. All specimens were collected in full observance of local government regulation, and in obedience to appropriate animal care standards. Most specimens were photographed after collection. Fresh fish, fixed preparations of fish (10–20 numbers). "The external structure of fish", "Fish body shape", "Location and types of fish mouth". Tools: tweezers, dissecting needles, cuvettes. The size of sample containers required was determined from the study plan. Meador and others (1993), and Walsh and Meador (1998) present additional useful information on the collection of fish; the latter also provide a list of suppliers and vendors of equipment and supplies. Pre-filled the 125-mL bottles with about 85 mL of fixative. 10% neutral-buffered formalin is the preferred fixative because it can be shipped via ground transport. Handled safely (that is, in accordance with the MSDS). Containers were filled under a hood or outdoors, and followed by wearing protective clothing (lab coat or long sleeves and pants; latex or vinyl gloves; and safety glasses, goggles, or face shield) to prevent eye and skin contact was strictly followed Some preservatives and fixatives are also flammable, as are acetone and ethanol. Consult the MSDS for these materials, and avoided extreme heat and ignition sources (that is, sparks and flames). All equipment were cleaned when it was taken into the field. Fish samples were collected for its external investigation. Than specimens were transported with ice box and kept in –20ºC within deepfreeze till for further study.

3. Results and Discussion

The body of fish consists of three parts: head, trunk and tail. The head part is the distance from the mouth to the back edge of the gill cover. Body elongate to moderately deep and laterally compressed. Head relatively small with pointed snout. Snout-forehead profile almost straight as it was observed by (Saha et al., 2018) in Lutjanus fish species. Head large and triangular, as it was observed by (Saha et al., 2018) in Lutjanus fish species. The trunk part is the distance from the end of head to the anus or to the beginning of the anal fin. Dorsal profile convex, large in size as it was demonstrated by (Saha et al., 2018) in Lutjanus fish species. The tail part is the distance from the anus (from the beginning of the anal fin) to the end of the tail fin as it was observed by (Menke2011 and Robert 2001) in zebra fish and teleostat fish. There are mouth, eyes, nose and gill openings, spiracles on the head of the fish (fig 1).

Figure 1

The head part has the following: the snout which is the distance from the head to the front vertical of eye; the space behind eyes is from the back vertical of the eye to the distal end of the gill cover; cheek is part of the rear vertical of the eye to the rear edge preopercular bone; forehead is the space between the eyes as it was mentioned by (Tembhre and Kumar, 1996) in fishes. At the bottom part of the head there are placed: chin which is the part of the head from the beginning of the mandible to the place of connection or attachment of gill membranes; throat is the distance from the gill membranes to the base of the pectoral finsymphysis is the place of joining of the bones of the lower jaw as it was reported by (Densmore, 2019) in fishes.

Eyes
Fish eyes are similar to terrestrial vertebrates like birds and mammals, but have a more spherical lens. Fish can detect color reported by (Densmore, 2019) in fishes. Fish eyes are more round than in mammals because of the refractive index of water and focus is achieved by moving the lens in and out not distorting it as in mammals. Eyes of fish resemble human eyes, (fig 2) eye not at mid-level of head rather behind tip of snout (fig 1) as it was reported by (Saha et al., 2018) in Lutjanus fish species.

Figure 2

At the front of each eye is a lens, held in place by a suspensory ligament. The lens focuses images of objects on the retina. To bring near and far objects into focus, the lens retractor muscle moves the lens back and front. Fish eyes are usually placed just dorsal of and above the mouth (fig 1) as it was observed by (Menke, 2011) in fishes, just like the mouth of a fish, the size, shape and position of eyes can provide information about where a fish lives and what it feeds on. Unlike animals, fish normally adjust focus by moving the lens closer to or further from the retina.

Nostrils

Each nostril in a fish actually consists of two openings which is located in the dorsal to the mouth as it was observed by (Menke, 2011) in zebra fish (fig 3)Posterior nostril is elliptical type.

Figure 3

Pair of small rounded nostrils on each side of snout with very low flap on outer edge of anterior nostril. Paired nostrils or snares in fish are used to detect odours in water and can be quite sensitive. Sense of smell is well developed in fishes. Water circulates through the opening in the head called nostrils. Unlike animals fish nostrils were not connected to any air passages. Fish nostril serves no rule in respiration. They are completely sensory. The largest part of a fish brain is the olfactory lobe, which is responsible for the sense of smell as it was reported by (Robert, 2001) in teleostat fish.

Mouth

Mouth shape and size is good clue to what fish eat. The mouth is at the front, or anterior end, of the fish (fig 4). It has a terminal mouth and generally feed on other fish as it was reported by (Densmore, 2019).

Figure 4

Small conical teeth on vomer, and both jaws have caniniform teeth with pair of dagger like canine in upper jaw anteriorly. Preopercle serrated as it was reported by (Saha et al., 2018) in Lutjanus fish species. Pair of canine teeth anteriorly in upper jaw, with smaller canine teeth between these and symphysis. Remaining lateral portion of upper jaw with series of embedded caniniform teeth. Lower jaw with about 6–8 small canine teeth on each side. Fish have a sense of taste and may sample items to taste them before swallowing if they are not obvious prey items. Mostly fresh water are omnivorous. Some are primarily piscivorous which means eating mostly other fish. Almost all fish have teeth as it was observed by (Robert., 2001) in fishes. Some have teeth that extend deep into their pharynx (called pharyngeal teeth). The esophagus of a fish usually can distend considerably to accommodate large prey.

Gills

Gills are the breathing apparatus of fish and are highly vascularized, which gives them their bright red colour (fig 5) Large operculum with flap and large opening included 2 spines at the end of operculum. One rounded serrated bone above operculum as it was mentioned by (Saha et al., 2018) in lutjanus fish species.

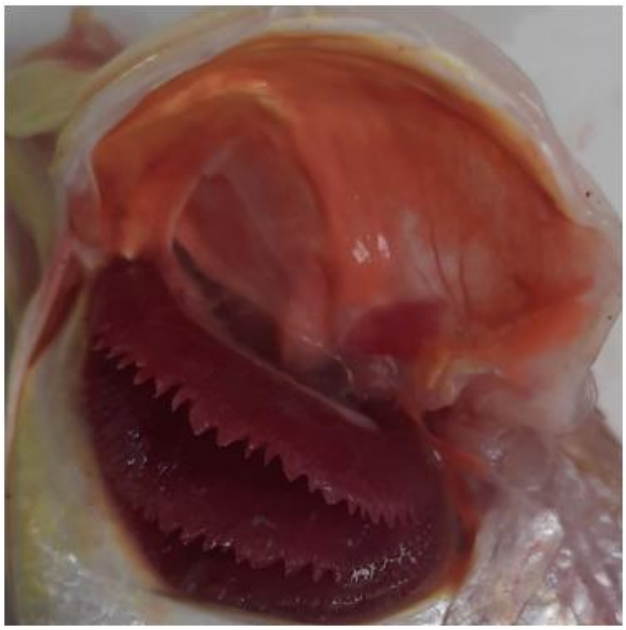

Figure 5

An operculum (gill cover) is a flexible bony plate that protects the sensitive gills as it was reported by (Wedemeyer, 1996) in fish. The bony operculum often has another bony flap, called the preoperculum, overlaying it, water is inhaled through the mouth, passes over the gills and is exhaled from beneath the operculum.

Lateral line

The lateral line is a sensory organ consisting of fluid filled sacs with hair like- sensory apparatus that are open to the water through a series of pores (fig 6).

Figure 6

The lateral line system consists of a long canal that runs along each side of the body, as shown in Figure below**,** and contains a series of sensory organs that can detect small pressure changes and vibrations from water currents. This helps fish sense movements nearby, alerting them to prey or predator activity as it was mentioned by (Densmore., 2019) in fishes. Creating a line along the side of the fish. The lateral line primarily senses water currents, pressure and movement in the water. Lateral line runs the length of the body from just behind the head to the causal peduncle as it was mentioned by (Robert, 2001) in teleostat fish. The lateral line is used to help fish to sense vibration in the water. Lateral line sense is useful in hunting prey, escaping predators and schooling.

Scales

Scales in fishes have ctenoid scales composed of connective tissues covered with calcium; also have a very important mucus layer covering the body that helps prevent infection (fig 7) Scale rows on back rising obliquely above lateral line. scale of rows has on cheek. Pre-dorsal scales extending forward to about the middle of inter-orbital space as it was mentioned by (saha et al., 2018) in Lutjanus fish species.

Figure 7

as it was observed by (Menke et al., 2011) in fish. Lateral-line scales 49–51. Horizontal scale rows above lateral line 6–7. Scale rows on cheek 7–8. Scales absent on preopercular flange. Cycloid and Ctenoid scales are found in the vast majority of bony fishes. These types of scales can overlap like shingles on a roof, which gives more flexibility to the fish. These scales also form growth rings like trees that can be used for determining age.

Fins

Fins are appendages used by the fish to maintain position, move steer and stop. Has two kind of fins median and paired. Median fin are single running down the midline of the body. Dorsal-fin outline slightly incised. Dorsal fin is a median fin located on the dorsal side of the fish. Profile of soft dorsal-fin relatively low and weakly rounded. Pectoral fins pointed. Caudal fin emarginate. The anal fin and caudal fin are median fin. Caudal peduncle is the base of the caudal fin, were the strong swimming muscles of the tail are found. Caudal fin act like a propeller for the fish and caudal peduncle act like a motor. The paired fin are arranged in pair, the pelvic and pectoral fin. Pectoral fins are vertical and are located on the sides of fish usually just part the operculum. Pelvic fin is horizontally on the ventral side of the fish part the pectoral fins (fig 8) as it was observed by (Densmore., 2019) in fish. spines: 10; Dorsal rays: 13; Anal spines: 3; Anal rays: 9.

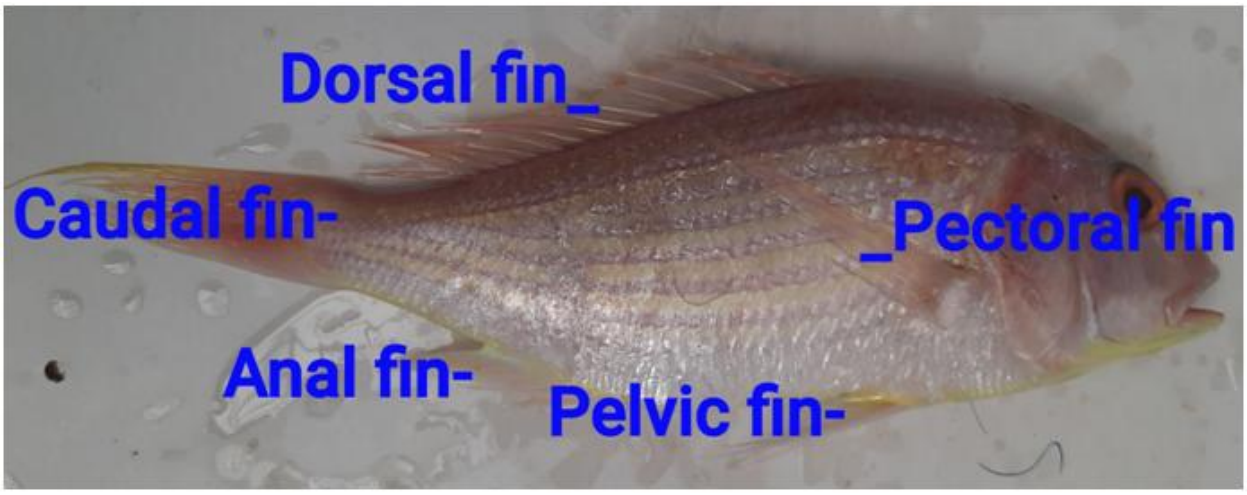

Figure 8

Pectoral fins are similar to animal arms which are found near the pectoral muscles. Pelvic fins are similar to legs.

Colour

Thin pinkish stripes on the body. Body pinkish dorsally with pinkish oblique lines, light pinkish yellow ventrally. Head

light pinkish, fine pinkish stripes horizontally, scale of row below the lateral line. Dorsal, pectoral, pelvic, anal and caudal fin pinkis has it was reported by (Saha., 2018) in Lutjanus fish species (fig 9). Colour. Pinkish-white base colour, becoming darker reddish-pink dorsally and down snout, and paler ventrally. A series of narrow yellow horizontal stripes (one per scale row) on lower sides of body below the lateral line. The mid-lateral stripe originating at the mid-eye distinctly more prominent and wider, 1.5–3 scale rows wide. Similar thin yellow to brownish yellow lines above lateral line, but run obliquely upward and along oblique scale rows. Dorsal, caudal, anal, and pectoral fins yellow (caudal fin frequently dusky when fresh). Pelvic fins whitish with yellow tinge. Iris reddish to golden yellow as it was mentioned by (Tembhre., 1996).

Figure 9

Vent

Vent is a small opening in the skin, has anal, genital, and urinary pores located anterior of the anal fin. The analpore is where faeces exits the fish body. The anus is the largest and most anterior of the pores (Fig 10)

Figure 10

as it was reported by (Tembhre., 1996). The genital pore is where eggs or sperm are released. The urinarypore is where urine exits the body. Often the genital and urinary pores are combined into a single urogenital pore. These pores are situated on a small papilla, or bump, just behind the anus as it was mentioned by (Tembhre., 1996).

4. Conclusion

While fish initially may appear to be difficult exotic patients due to their unfamiliar environment, this article points out how basic understanding of the fish anatomy and physiology make it easy for the clinician to start understanding the concepts of aquatic medicine. Once familiar with the basics, fish medicine offers a great opportunity to expand ones clinical expertise.

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