Task

Create your own fish. Be creative. Think biologically about the links between structure and function and function and survival in a specific habitat.

Procedure

Habitat. Select a habitat in which your fish will exist. Is it a deep sea fish, a pelagic fish, a coral reef fish, or a fish found on the fringes of an estuary where fresh and salt water mix?
Niche. Select a lifestyle of niche for your fish. Is it a filter feeder or a predator? Does it eat coral or graze on sponges? Does it cruise the open waters or seek the shelter of a island reef? What is the micro-habitat based on; food, space, shelter, temperature, currents, etc.?
Basic body form. Think about body size, shape, and length. Long streamline fish are great sprinters, but lousy at distance. Short, round, pan shaped fish have great mobility and often inhabit coral reefs and kelp forests.
Size and shape of its fins. Fin size and shape will determine how fast your fish swims, how it accelerates, as well as how well it maneuvers. Fins with rays are often there as defensive weapons as well as maneuverability control. The fins of a tuna give it terrific top speed, but don't ask it to navigate the crack's and crevices of a reef. The sharp spines coming out of the fins of a lion fish may defend it against predators, but they come at a cost of slow swimming speed.
Feeding and defensive. The ocean can be a brutal place to live, how does you fish feed? On what does it feed? Is it a filter feeder or is it a predator? What is its mouth like, and what other adaptations does it have to allow it to feed. In addition, how does your fish avoid being someone else lunch? If an organism is going to survive it must have a strategy. Does it seek the shelter of a school, or the shelter of a reef or the shelter of another organism? Is it armed to the teeth or just plain fast?
Reproduction. A fish that has its choice of prey and can avoid being eaten still has the daunting task of attracting a mate. Without attracting a partner to create the next generation, a fish is as good as dead. What strategy does your fish use to find a mate, and care for its young? Does it have billions of eggs or does it care a lot for just few? Does it build nests or show any migratory pattern?
Internal Anatomy. What is the internal anatomy of your fish like? Does it have any special features for digestion, temperature control, or breathing? If your fish migrates between fresh and salt water you must discuss some of the internal changes that occurs when that happens.
Classification. Now that you know something about your fish, use the resources provided and describe the classification for your fish. All fish belong to kingdom animalia, phylum chordata, but you will provide the class, order, and family. You may not make these up, these must be real families and your fish must meet its requirements.

Helpful Hints:

Habitat: Think about where you want your fish to live. Where it lives, what zone, will help you to define the other characteristics of your fish.
Niche: For some species how a fish "makes a living" is obvious. A tuna swims the ocean currents constantly looking for prey. It eats as much as it can, and once it reaches adult size there is very little that will eat it (aside from us.) For other fish, things may be much more complex and interesting. Many fish have developed symbiotic relationships with other species. Their survival, feeding, and defensive strategies may be closely linked to this other species.

Sometimes, these links are completely independent of another species. The Harlequin snake eel (for example) is a nearly harmless fish that very closely mimics the appearance of the highly poisonous banded sea snake.

Body From and Fins: The size, shape, and placement of fins on a variety of basic body forms has everything to do with how fast, how quick, how far, and how maneuverable a fish can swim. Some fish are well adapted generalists (salmon), others are highly specialized (sea horses). Do keep in mind a few things. Getting bigger requires eating a lot more. There is always a forced compromise between speed and maneuverability. Its nearly impossible to do both well.

Feeding and Defense: These two often go hand in hand. They both depend a great deal on habitat and lifestyle. Large size, big teeth, or sharp spines may be "sexy", but the single most common defensive and feeding adaptation among bony fish is schooling. It has a variety of benefits both for avoiding predators and finding food. A small fish, all alone is just to easy of a target for a wandering predator. Coloration is also very important, especially in the mesopelagic and coral reef communities. Being nearly invisible is an advantage to both predator and prey. In the deep sea the production of light can serve similar functions in making a fish less visible. As for attracting or finding prey, the adaptations seem almost limitless.

Reproduction: There are three basic strategies.

Ovoparity - 90% of bony fish lay eggs that are fertilized externally. It may be boring but it works. Fish may lay a few and give them a lot of attention or spread a million eggs into the currents never to be scene again.

Ovoviviparity - Eggs develop internally, and are born "live" as larvae.

Viviparity - Eggs develop internally and are directly nourished by the mother (rare in bony fishes and remarkably similar to mammals).

Hermaphroditic fish - Some fish may be both male and female, some fish may be males first and then females as they grow larger. As "Nemo's" father got older and larger he would most likely have become a mother.

The timing of spawning can be very important. Many broadcast spawners will spawn all at the same time, so that anything eating its eggs will quickly be satiated allowing many eggs to escape. For some fish, especially deep sea fish, spawning may happen when every they bump into a member of the same species. In some fish species, the timing of a spawn is based on the peak in food availability for newly hatched larvae. In many of these fish species, the males may change color in order to attack mates during a breeding season. Other males may build nests in order to coax females to lay eggs in them.

Internal Anatomy:

Kidneys: Freshwater fish have to deal with the constant influx of water into their cells. Their kidneys are constantly removing water from the body of the fish. They urinate almost constantly and almost pure freshwater. Saltwater fish have to deal with the constant outflow of water from their cells. The osmotic balance has a higher concentration of salt (and hence a lower concentration of water) outside of the cells. As a result they drink large amounts of water, and their kidneys work very hard to conserve water and pump out salt. Their urine is highly concentrated.

Gills: In a bony fish, the breathing process begins when the gill covers close and the mouth opens. At the same time, the walls of the mouth expand outward, drawing water into the mouth. The walls of the mouth then move inward, the mouth closes, and the gill covers open. This action forces the water from the mouth into the gill chambers. In each chamber, the water passes over the gill filaments which absorb oxygen from the water and replace it with carbon dioxide formed during the breathing process. Salt and other ions can also be lost or absorbed through the gills. The size and shape of the gill rakers is largely dependent upon what type of food the fish eats. A planktivore will have much finer and longer fill rakers than a piscivore.

Air Bladders: Found in most, but not all bony fish, air bladders are how fish adjust their buoyancy. Many bottom fish (like halibut) do not have these and will sink if they are not actively swimming.

Stomach and Intestines: The size of the stomach and the length of the intestines says a lot about what a fish eats. Fish that are piscivores (they eat other fish) eat a diet that is high in protein. They tend to have larger stomachs and shorter intestines. Fish that eat plankton or algae will have much smaller stomachs and longer intestines (for the digestion of cellulose and lipids).

Special Organs for Light and Electricity: Many fish have organs that produce light or electricity. But these organs are simply adaptations of structures found in all or most fish. For example, many deep-sea fish have light-producing organs developed from parts of their skin or digestive tract. Some species use these organs to attract prey or possibly to communicate with others of their species. Various other fish have electricity-producing organs developed from muscles in their eyes, gills, or trunk. Some species use these organs to stun or kill enemies or prey.

Scoring Guide	Points Possible	Points Earned (peer)	Points Earned (teacher)
Project pays attention to details, the organism created is believable and will clearly thrive in its chosen environment. The fish may be creative, but it still follows the "un-written rules" of its niche and habitat. The project shows a clear effort in research and learning on the topic of structure-function connections.	20		
A written summary of the decisions you made about your fish for each of the eight procedure steps is included. It should be free of typos and spelling errors and it includes the important details we need to know about your fish. Classification is accurate to family. Five points for each of the eight sections.	40		
Any artistic portion has integrity (written description of the fish matches the image) and it is aesthetically attractive.	30		
Student has included an annotated bibliography. This is a list of at least four sources (websites included) that also describes what information or inspiration you got from each of the sources you used.	10		
Totals	100		