

BONY FISH

Osteichthyes or "bony fish". This class has the largest number of vertebrates in it over



Reptiles

Examples: Sea turtles – marginally alligators and crocodiles



?	ALLIGATOR	?	CROCODILE
			
Residence: mainly freshwater habitats		Residence: freshwater and saltwater habitats	
Jaw: shaped like the letter 'U'		Jaw: shaped like the letter 'V'	
Teeth: upper teeth visible when mouth is closed		Teeth: upper and lower teeth visible when mouth is closed	
Skin: dermal pressure receptors located on the jaw		Skin: dermal pressure receptors located on the entire body	
<small>Photo: ©Luis Castaneda Inc./iStock/Getty</small>		<small>Photo: ©Raphael Van Butele/The Image Bank/Getty</small>	



While in early times, a number of huge reptiles dominated the oceans, most are now gone. Only the sea turtles are representing these animals at this time.

Crocodiles and alligators are more associated with rivers than the ocean, but in some cases, they may wander into the ocean near the shore.

While alligators can tolerate some salt water, they are largely fresh water animals. Some crocodiles are salt-water crocodiles but are not very good swimmers so they are usually close to the shore. There are reports of them far out to sea on occasion.

Mammals



Marine mammals are those that either live full time in the ocean like whales (Cetaceans) and manatees (Sirena). The whales are divided into 2 groups – those with teeth (odontoceti). This group includes several whales like the sperm whale and porpoises and dolphins). The other group are baleen whales (mysticeti) (the blue whale, the right whale). Baleen is a kind of “plastic” looking material (keratin that hangs down from the whale’s gums and acts as a kind of strainer for the plankton these whales eat. Others live in the water and

come on the land fairly easily – seals and sea lions (pinnipeds). Some are often on the land like sea otters and polar bears who are dependent largely on the ocean for food.

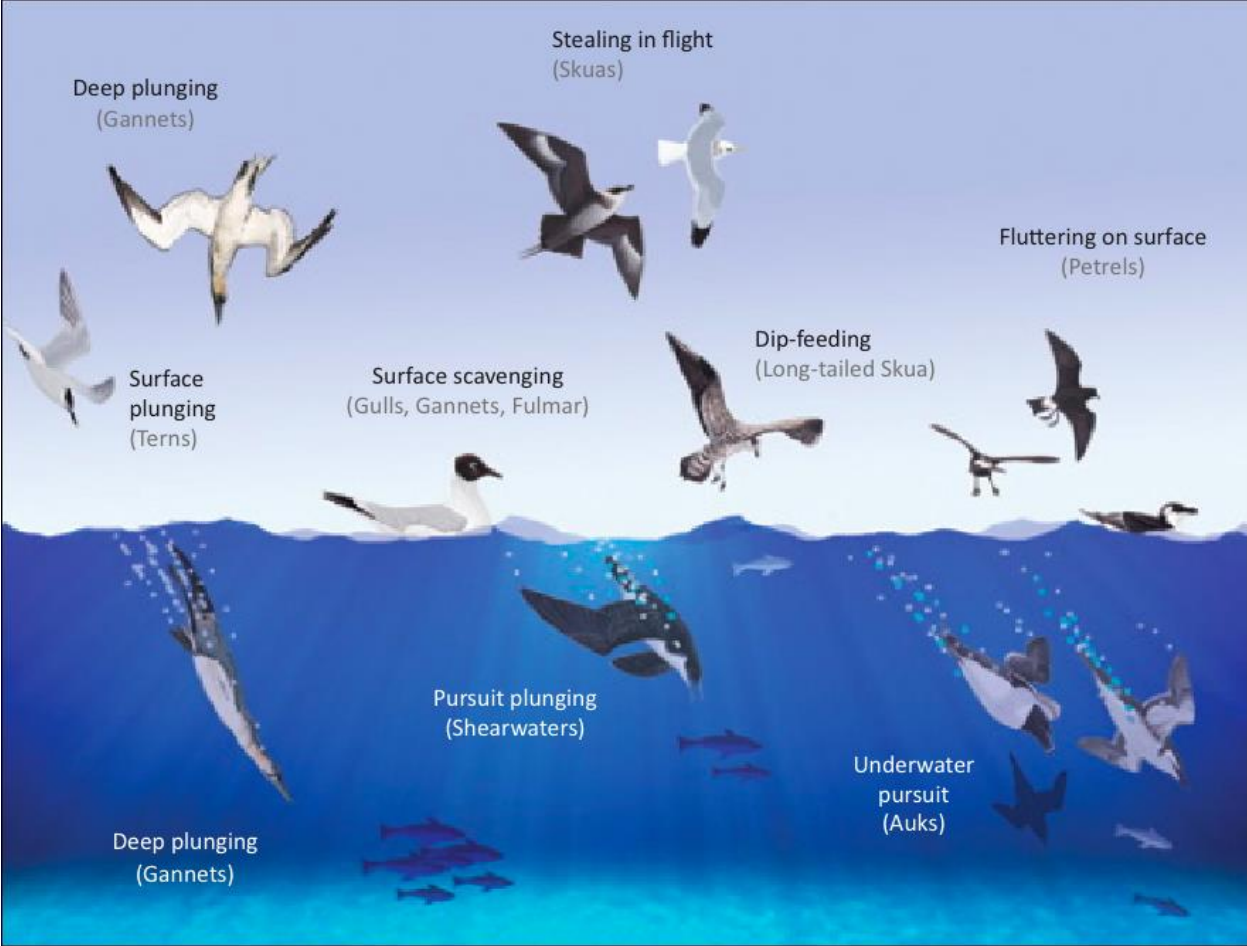
Birds

Although no birds spend their entire lives exclusively in the ocean, many do hunt fish and other sea life. Penguins are the most water adapted of all birds and seem far more graceful in the water than waddling around on the land.

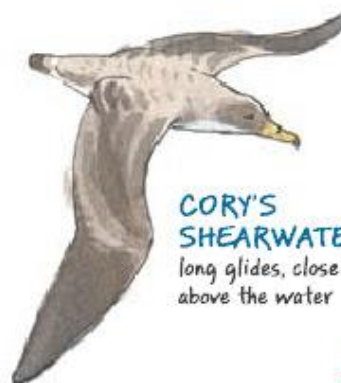




Many birds are highly specialized for the kinds of “fishing” they do.



Quick identification guide to Seabirds



CORY'S SHEARWATER
long glides, close above the water



STORM-PETREL
white rump like a swallow



YELLOW-LEGGED GULL
light-coloured bill, eyes and legs

dark grey mantle with white edge

tips of wing black, with large white spots



AUDOUIN'S GULL
dark-coloured bill, eyes and legs

light grey mantle without obvious white edge

dark above light below



MEDITERRANEAN SHEARWATER
quick wingbeats, usually flying in flocks

tips of wing black, with small white spots



angular hindcrown

strong bill

rounded crown and steep forehead

slender bill

CORMORANT



MEDITERRANEAN SHAG

By: 06.04.2016



thick kinked neck



thin straight neck



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Different Ecological Niches along the shore are important for many reasons. The Coral Reefs are found only along the shores of island volcanos or the remnants of such islands

What you need to remember are the following phyla and some of the reasons they are important in this class

1. Porifera: (sponges) simplest animals. Used by people largely for cleaning but also used by Romans to line helmets to make them more comfortable. Biological sponges are not much in use any more. We will talk about sponge divers later in the term

2. Cnidaria: One of the two radially symmetrical animal phyla. This one includes most jellyfish, anemones, and corals. They are typified by

their radial symmetry and their nematocysts or stinging cells. The coral, which form reefs, are an important ecological niche and serve as an example of relationship between the coral and dinoflagellates that live in the coral. The dinoflagellate is a primary producer that photosynthesizes. Hence, it gives off oxygen, which the coral itself can use. The coral gives off carbon dioxide, which the dinoflagellate needs to photosynthesize. The dinoflagellate gives the coral its color. When the coral is stressed (as for example the temperature rises (as say during an El Niño) the dinoflagellate is expelled (the coral turns white and the process is known as "bleaching") and may die if the a cooler temperature does not occur. If the stressing mechanism does vanish, the dinoflagellates return to the coral.

Another example of this kind of relationship was between the clown fish and the anemone in which both benefit from the other.

Coral is also crucial in that coral reefs constitute an environment which is very important in the ocean and which will be discussed shortly.

3. Arthropods (joint legged animals). These are animals, which are widely eaten around the world. They include the crustaceans (lobsters, crabs etc.) insects and spiders and the ever-popular horseshoe crab (more closely related to the spiders than to the crabs). The blood of the horseshoe crab is important to pharmaceutical companies for its ability to detect impurities.

4. Mollusks. Another important food group and includes bivalves like clams. Also important are oysters and others which produce pearls as a result of an irritant which has appeared inside the shell (like a grain of sand) and which becomes covered by a secretion which forms the pearl. The deliberate placing of the irritant in the shell produces a pearl known as a "cultured" pearl.

5. Echinoderms or Echinodermata. This is the other radially symmetrical phylum and includes various kinds of starfish, sea cucumbers (Holothuroidea), sea urchins (Echinoidea) echinoids and some others. They are considered closer to the chordate phylum than the others. They also have enormous regenerative powers in which parts of the animal can regenerate the entire animal while an animal having lost an "arm" or something can regenerate that.

6 Chordates: Animals, which at some point in their life cycle have a stiffening rod down there, backs known as a notochord. Within the phylum "chordata" is a subphylum called "vertebrata" or "vertebrates" which developed a backbone. The vertebrates are divided into 5 classes:

Fish

Amphibians

Reptiles

Mammals

Birds

Fish and amphibians are tied to the water. While some fish can live out of the water – sometimes even for a few days) it is their basic environment and a place where they need to spawn and where the young develop. Amphibians are basically oddball fish except in their adult stage they are far more able to remain out of water. A commonly seen amphibian is the frog (the young are tadpoles). Amphibians are notoriously missing from marine animals while fish have been categorized as salt water (biologists say "marine") and fresh water (biologists say "aquatic") forms although this is not a recognized division in terms of taxonomy where the usual distinction is between agnatha (jawless fish) and gnathostomes (jawed fish). The gnathostomes currently greatly outnumber the agnathic fish. The most common distinction made taxonomically is between osteichthys (bony fish) and chondrichthys (cartilaginous fish – sharks and rays and the like). Fish are generally seen as being the dominant animal during the Devonian period.

Reptiles make the major shift in evolution to life on land by developing an egg, which can be laid on the land, and hence no longer need to return to the water. There were a large number of marine reptiles in prehistoric times like the mosasaur, pleisiosaur and others, but they all went extinct at the end of the Cretaceous period along with the dinosaurs and the flying reptiles like the pterodactyl. Of the major reptiles, the crocodile/alligator crew managed to survive the extinction that did in the dinosaurs, but by and large these are not marine animals but usually found in more fresh water environments. Turtles

also survived and the sea turtle is the major reptile found in the oceans although some lizards are involved to a lesser degree with the water.

Mammals have returned to the ocean are in several orders: the cetaceans (whales), sirena (manatees), pinnipeds (seals and sea lions) carnivore (walrus). These are the orders in which there are animals that are basically finned or with flippers that have returned to the sea. Others, like the sea otter and the polar bear, which are also considered marine mammals are far less adapted to ocean living. The seals are heavily adapted to living in the ocean, but can come out on the land and move around with some ease. The whales and manatees do not move between land and ocean.

The cetaceans are divided into two groups (toothed whales (Odontoceti) and baleen whales (Mysticeti). The toothed whales include animals like the killer whale (Orca), the sperm whale (Physeter) and the smaller members of the group – the porpoises and dolphins. The baleen whale includes the huge blue whale, the North Atlantic Right whale (the most endangered of the whales) It gets its name from whalers who claimed it was the “right” whale to take because it slept on the surface and floated when killed. It is still in danger from ships, which tend to collide with the sleeping animal and injure or kill it. Ships in the area where there are right whales have to reduce their speed greatly and keep a watch for the whales The Pacific Gray whale (which once endangered) has made a comeback and is no longer on the endangered species list. Whales have been important largely in the U.S. as animals that were hunted for their whale oil and baleen. Other countries like Iceland and other Scandinavian countries along with Japan have hunted whales for food.

The sirena or manatees live in estuaries and shore environments. They are thought by some to be the stimulus for “mermaids”. They are dwindling in number and are often the victims of boat strikes. Virtually all of them show scars from boat propellers. They also fall victim to certain algal blooms that may, in some instances, be caused by anthropogenic eutrophication. EUTROPHICATION involves an excess of nutrients going into the water. This leads to a rapid growth of large

numbers of algae (known as algal blooms) that are dangerous for several reasons. One is that the algae blankets the water and may cut off sunlight that then destroys the photosynthetic organisms below.

Another problem is the algae have short lives. They die and sink. Bacteria disintegrate the dead algae. This process uses up the oxygen in the water which is needed for the living things in the area.

Some algae contain toxins that are dangerous to other organisms living in the area and the increase in algae may increase the amount of toxins in the water.

Seals, which have been long hunted for their pelts, are no longer hunted and are increasing in number. This had led to some problems in that they eat about 6% of their body weight in fish daily. As their numbers increase, the amount of fish they eat rises. Seals are the favorite food of some of the larger animals like White sharks and Orcas. The block on hunting has caused the number of seals to rise and they have become far more common in places like Cape Cod Bay. White sharks breed off Montauk Point and young sharks are fish eaters. As they approach adolescence, their diet switches to seals which they need to learn to hunt. They have moved up into Cape Cod Bay and the number of shark attacks on people in the Bay has risen. Sharks, learning to find seals, initially seem to mistake people on paddleboard and surfboards for seals and attack them. The growing seal population has caused more seals to be seen in places where they had not been for a long time like New York harbor, which has raised for some the image of potential shark attacks on the Long Island beaches.

Sea Otters, like most animals have their own little niche and they are fond of eating sea urchins, thereby controlling the population of these echinoderms. Sea urchins eat kelp and control that population. Kelp is an important ecological zone and a kind of nursery for many animals. Sea otters figure centrally in several scenarios. Hunters in the 1800 and 1900 hunted them for their wonderful pelts. As a result, their numbers dropped off sharply and they were becoming endangered. Once the hunting was stopped, their numbers grew again. When

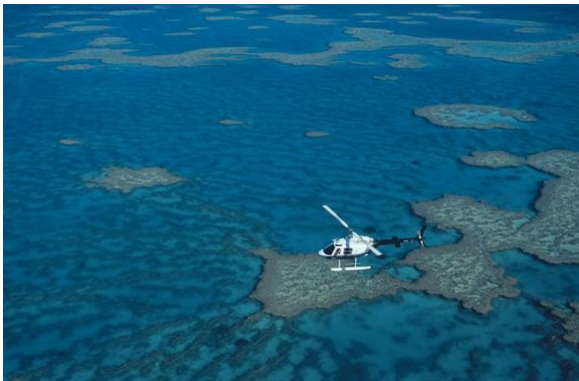
people started taking pollock fish in great numbers, it had an impact on the seal population, which fell off to about $\frac{1}{4}$ of the original number. Seals are the favorite food of Killer Whales (orcas) who were then forced to eat other animals for food. They turned to the already dangerously endangered sea otter. As sea otter numbers plummeted, the sea urchin population rose. (When any trophic level is removed or lessened, the level below tends to increase in number and the one above decrease). Sea urchins then over-ate the kelp and destroyed the kelp forests, thereby destroying the "nurseries" the kelp were serving for many animals.

It is important at all times to keep in mind the idea of "a system" and that doing something in one part of the system will likely cause the system to readjust to the changes – often in ways one does not expect. We have seen this with the anchovies, and seals and fish and now with the fish and the kelp. It is important to remember that analysis of these situations requires a SYSTEMIC approach in which one needs to examine not only the parts, but also how they interact with one another.

Birds: These are, like the mammals descended from reptiles but the affinities are much closer. Thought by many to evolve from "saurischian dinosaurs" none of the birds actually has returned to the ocean as a permanent habitat. Penguins are perhaps the most involved. They no longer fly (like the ostrich and emu) but unlike the ostrich and emu are remarkably at home in the water and can swim with great speed, efficiency, and grace. On land, they look peculiarly clumsy and waddle around.

Other birds, while spending less time actually in the water get much of their food from the ocean by diving onto and into it to take fish – often when a school of fish is being attacked from below by other predators. Many of the adaptations in the birds has to do with the way they take the food from the water – diving, plunging etc.

CORAL REEFS



We have looked at the development of coral reefs starting with a volcanic island on which coral starts to appear. Coral is a kind of animal that needs to be in water. Being an animal, it also needs food. It has developed a relationship with a zooxanthella (,zōəzan'THelə)- a unicellular dinoflagellate that can photosynthesize.

These are frequently found in the deep ocean since the shore they are involved with is the one that was a volcanic island now submerged. The coral can grow where there is enough sunlight for the zooxanthella to photosynthesize so as the island "sinks", the coral is simply building on the coral that was laid down earlier.

Coral reefs are home to many organisms – Provide habitat and shelter for 25 percent of all fish species in the deeper parts of the ocean. Many of the shore line environments are also home to many organisms

and act as nurseries affording protection to the small baby organisms which are living somewhat protected there

Coral Reefs are:

1. About as diverse as rain forest in animals.
2. Great Barrier Reef is more than 1,400 miles long
 - a. Started 20,000 years ago Largest structure in the world made by non-human animals
 - b. Now world heritage site.
3. Caribbean reefs
 - a. many dead
 - b. 9% of the world's coral reefs here.
 - c. About 1/6 remain. Much of the problem is caused by algae and sponges.
 - d. Attempts to restore (tires – disaster)

Kane'ohē Bay Hawai'i.

Eutrophication of bay from sewerage acting as fertilizer caused certain seaweeds and green "bubble" alga to grow extremely rapidly, covering much of the bottom of the bay. The alga began to overgrow the coral and smother it. Phytoplankton increased as the result of the nutrients and clouded the water blocking light.

Some public outcry reduced the amount of pollution and the green alga started to disappear and the coral began to recover – more rapidly than expected.

During the time of the pollution, the coral skeleton had weakened and become fragile and crumbly. When a hurricane hit the island, in 1982, the weak layer collapsed. However, recovery continued because the coral had already started to rebound.

By 1990, the recovery seemed to have leveled off, but some areas started to decline and the green "bubble" algae starting to increase again. It is not clear why. The sewerage is no longer released in the bay.

Possible explanations.

1. Some sewerage remained in the sediment and is still being released (but that has been happening since the recovery started)
2. Some of the sewerage now released elsewhere has begun to flow into the bay
3. There is sewerage from boats, septic tanks and cesspools of private homes and other sources. The population is increasing so there is a change here. It seems unlikely though that the sewerage has increased as much as a result of population increase as had been there before.
4. Increased fishing may have reduced the number of fish that graze on the bubble algae.
5. Another seaweed has been introduced into the area, which the fish prefer and so they have stopped eating the bubble algae allowing it to increase again
6. Another algae has been introduced which is not a preferred food and so has started to proliferate and is beginning to suffocate the corals.

Eutrophication is not necessarily bad. In some cases it may be good for the zooxanthella and help the coral grow faster. However when the algal grazers are reduced then the eutrophication seems especially damaging.

THE COASTAL AREAS OF THE CONTINENTS ARE CRUCIAL TO MARINE LIFE.
WHILE THERE ARE MANY DIFFERENT NICHES ALONG THE SHORE LINE
SOME OF THE MOST CRUCIAL AND ENDANGERED ARE VARIOUS WETLANDS