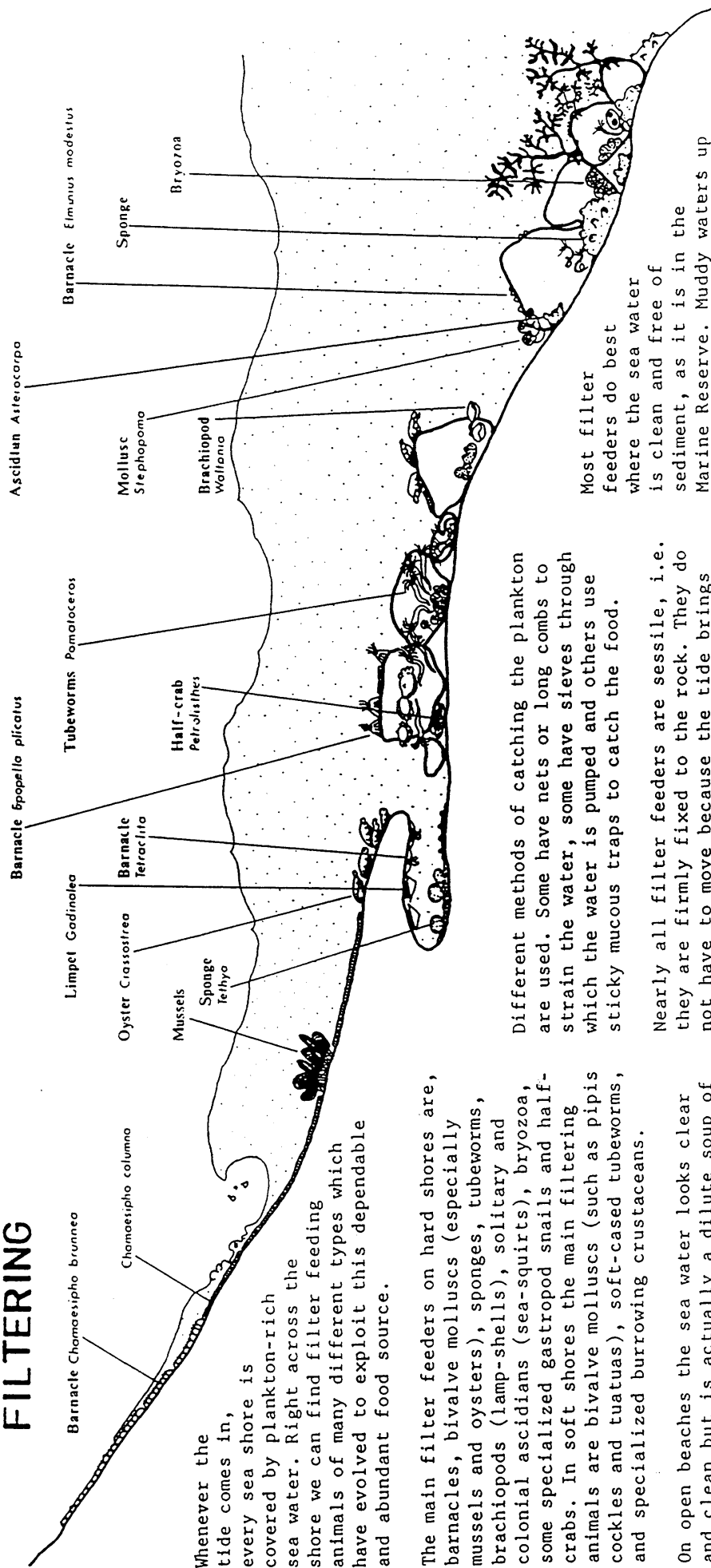


FILTERING



Whenever the tide comes in, every sea shore is covered by plankton-rich sea water. Right across the shore we can find filter feeding animals of many different types which have evolved to exploit this dependable and abundant food source.

The main filter feeders on hard shores are, barnacles, bivalve molluscs (especially mussels and oysters), sponges, tubeworms, brachiopods (lamp-shells), solitary and colonial ascidians (sea-squirts), bryozoa, some specialized gastropod snails and half-crabs. In soft shores the main filtering animals are bivalve molluscs (such as pipis cockles and tuatuas), soft-cased tubeworms, and specialized burrowing crustaceans.

On open beaches the sea water looks clear and clean but is actually a dilute soup of plankton. Plankton is comprised of all the microscopic plants and animals that either grow in the open sea (pelagic), or on the sea shore surface (benthic). The pelagic plankton stays suspended in the sea water by various methods. Some have small bubbles of air inside, others have oil drops making them lighter than sea water and some of the plankton swim actively to stay near the sea surface and the sunlight.

Across the shore the soup is a mixture of pelagic plankton and the benthic plankton which is washed off the rock by the waves.

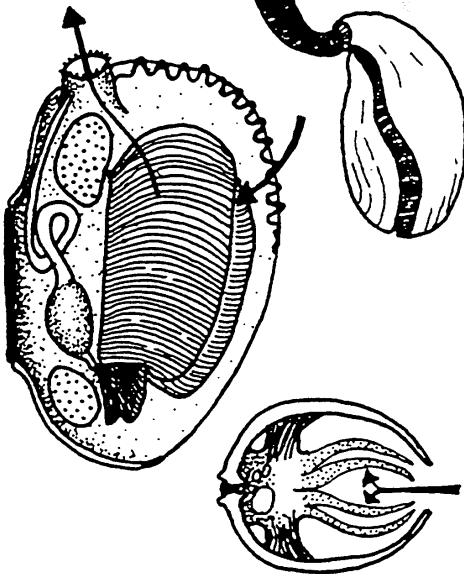
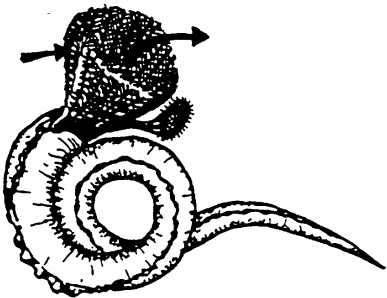
Different methods of catching the plankton are used. Some have nets or long combs to strain the water, some have sieves through which the water is pumped and others use sticky mucous traps to catch the food.

Nearly all filter feeders are sessile, i.e. they are firmly fixed to the rock. They do not have to move because the tide brings their food to them. However, they cannot escape predation or adverse environmental conditions. Most breed rapidly and those on exposed upper surfaces have hard shelly cases to protect them from drying out when the tide is down, and from physical abrasion and predation at other times. Other filter feeders are generally found hiding under boulders and ledges or in crevices away from the sunlight, and inaccessible to predatory snails, urchins and fish. The majority of under-boulder, cave and crevice animals are in fact filter feeders.

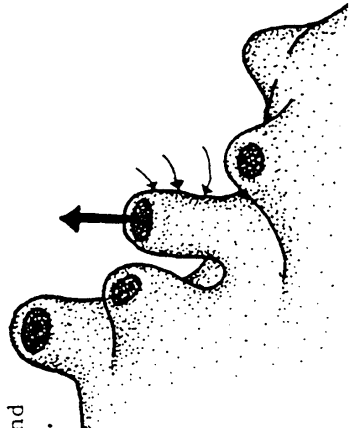
Most filter feeders do best where the sea water is clean and free of sediment, as it is in the Marine Reserve. Muddy waters up estuaries and harbours, cause clogging of the filtering apparatus, and sand scour near open surf beaches damages the animals.

All filter feeders except barnacles employ minute fibrils (called cilia) that protrude from surface cells, to filter food. Cilia beat like little whips and work in various ways. They create current so that water passes through the filtration screen, they carry food particles from the filter to the mouth and some stiffer ones serve to form a fine meshwork for filtering small protozoa and diatoms, and bacteria

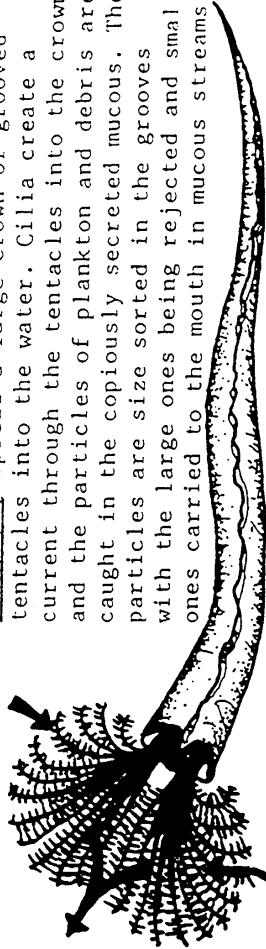
Bivalve molluscs have large paired gills which lie in the mantle cavity. Each gill is an intricate tissue network, with cilia for drawing current, cilia for transport of mucous-trapped food particles and stiff cilia which make a fine filtering meshwork across the gill perforations to strain off fine particles such as bacteria. They occupy many different niches; burried shallow in mud (cockles) or deep in sand (toheroas), held to rocks by byssus threads (mussels), cemented to rocks (oysters) or free living on the sea bottom (scallops).



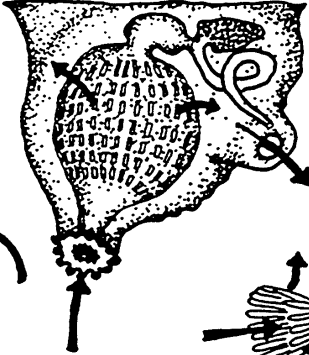
Brachiopods (Lamp-shells). These have two shells, like bivalve molluscs, but they are top and bottom, not two shells laterally opposed. Inside is a heavily ciliated and coiled structure called a lophophore. There are separate cilia for creating a current through the lophophore and for trapping and carrying particles in mucous to the mouth.



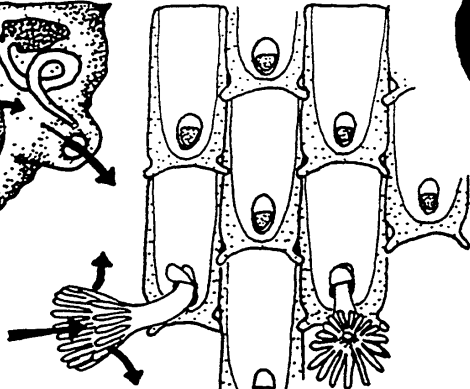
Tubeworms spread a large crown of grooved tentacles into the water. Cilia create a current through the tentacles into the crown and the particles of plankton and debris are caught in the copiously secreted mucous. The particles are size sorted in the grooves with the large ones being rejected and small ones carried to the mouth in mucous streams.



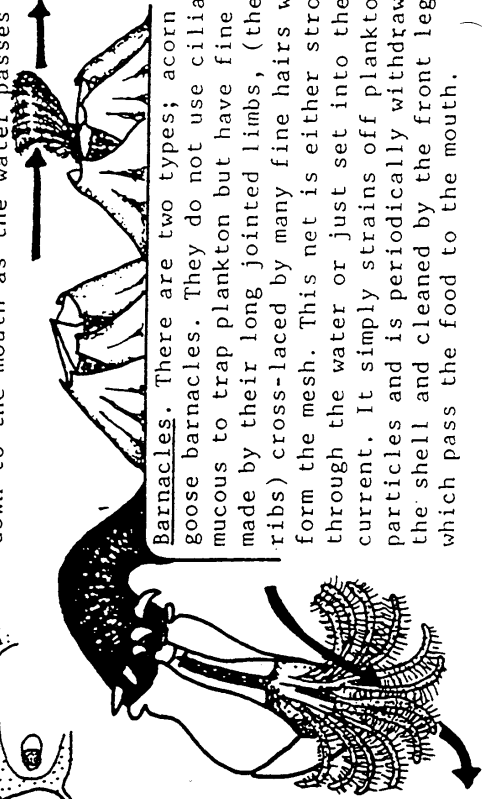
Ascidians. Solitary ascidians are easily recognised. They are the size and shape of small wrinkled plums with two siphons protruding through which jets of water spurt when they are pressed. Normally water flows in through one siphon by ciliated currents, down into and through a large perforated bag, the pharynx. Food particles trapped by mucous and cilia are carried down to the stomach. The cleaned water passes into an atrium and out by the other siphon.



Bryozoa are colonies of very small animals each in its own lidded box. These boxes are fused together, commonly forming a miniature bricklike pavement over the rock. Each individual has a simple ring of ciliated tentacles forming a cone around the mouth. Water is drawn down into the tentacle cone and the retained food particles are swept down to the mouth as the water passes by.



Barnacles. There are two types; acorn and goose barnacles. They do not use cilia or mucous to trap plankton but have fine nets made by their long jointed limbs, (the net ribs) cross-laced by many fine hairs which form the mesh. This net is either stroked through the water or just set into the water current. It simply strains off plankton particles and is periodically withdrawn into the shell and cleaned by the front legs which pass the food to the mouth.



PREDATION

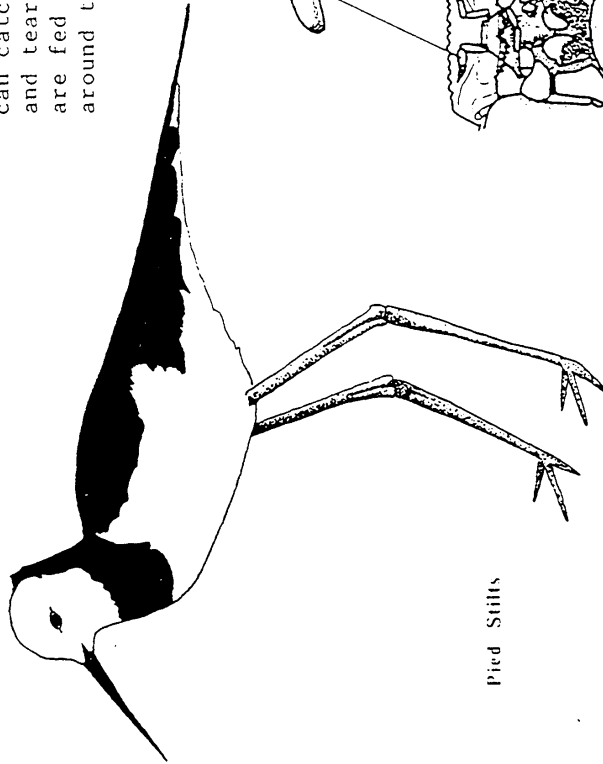
The minute planktonic animals and plants that grow in the sea are eaten by filter feeding animals, while grazers feed on the plants and encrusting animals that grow across the shore. In the next step of the food chain, these grazers and filterers become food for the predators, which only eat other animals.

Predation involves the separate activities of, locating the prey, then catching and immobilizing it, and finally penetrating any protective armour to gain access to the soft body tissues.

Location may either be active or passive. Some predators range across the shore or beneath the waves hunting down their prey, while others wait patiently, sensitive by sight or scent to the approach of some potential victim.

All predators have some particular features especially modified for catching their own preferred prey. They may smother, harpoon, grab, lasso or use sticky secretions or suckers to arrest their prey. Many also use poisons in their saliva or from special skin cells, to paralyse or kill the prey. Their diet is limited by their size and mobility, their particular trapping mechanism and environmental factors which may limit their own distribution.

Nearly every major animal group has some representatives that feed by predation and only the most common and frequently found are mentioned here.



Pied Stilts

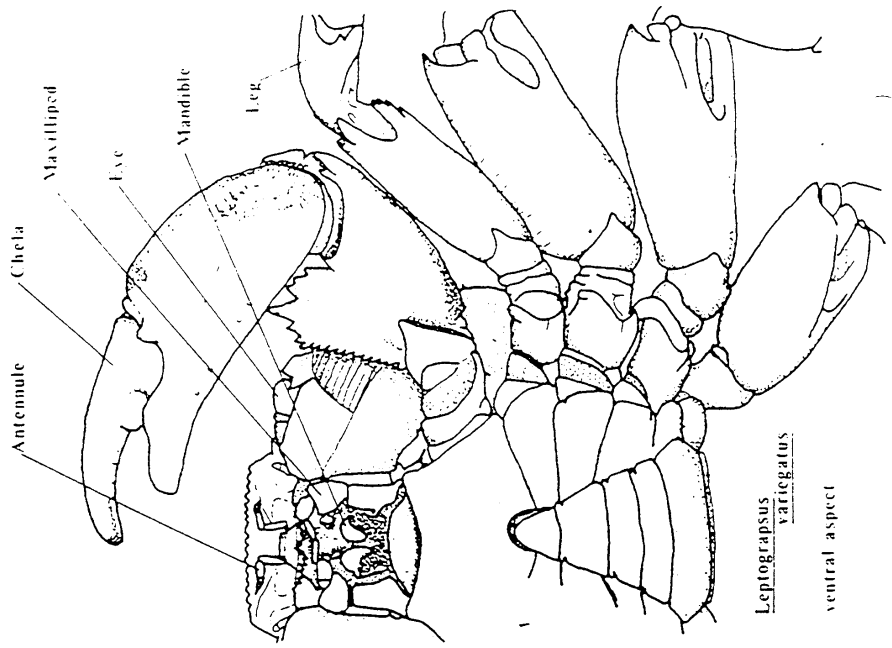
SEA BIRDS AND WADERS

These are expert fishermen of the open sea and great trappers and fossickers amongst the shallows. Terns skip along the waves picking out small fish near the surface. Gannets dive like guided missiles to their submarine targets, and shags and penguins swim skillfully underwater to catch fish. Webbed feet, sharp beaks and keen eyesight are the instruments of their success.

The waders with their long legs and bills, (stilt, oystercatcher, godwit and heron) probe the mud, turn stones or wait motionless for some small beast to move nearby and be snapped up.

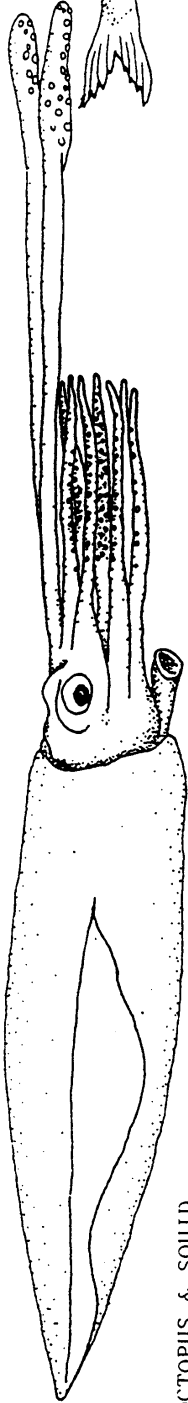
CRABS

These are mostly predators or predacious scavengers. The limbs of the head and thorax are all highly specialized for the chain of jobs from catching to swallowing the food. The large pincers and the sharp clawed walking legs are used to grab and hold the food, which may be any animal it can catch. The maxilliped limbs then cut and tear it into manageable pieces which are fed into the mouth by smaller limbs around the strong chewing jaws.



Leptograpsus variegatus

ventral aspect



OCTOPUS & SQUID

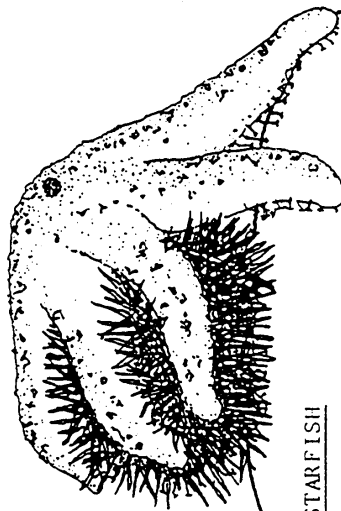
Both of these cephalopod molluscs use long tentacles to secure their prey and a sharp beak to bite and kill it. Squid can swim very fast and take crustaceans and small fish, severing the nerve cord with a single bite. Octopus are more sedentary and drag passing snails, crabs and fish into their hole to kill and eat them. The food is cut up by the beak into small pieces and drawn into the mouth by the tongue-like radula.

WHELKS

These carnivorous snails have the front of the shell elongated to accommodate a siphon. This helps them locate their prey by its scent. Some prey on barnacles, bivalves and tubeworms, and some on the slow moving sea eggs and grazing snails. They use the foot and shell to trap, secure and dislodge the prey. The long proboscis with its drilling radula is used to probe a way into or bore through the shell, wherein the soft tissues are macerated and part digested into an easily ingested pulp.

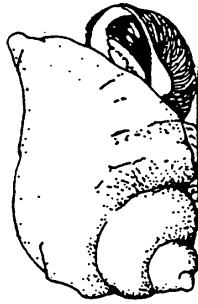
FISH

From large to very small, ocean living and fast swimming or almost sedentary around reefs, brightly coloured or camouflaged cunningly: these predators employ as much variety in their capturing methods as they show in their variations in form. Bottom living fish disturb the mud, pecking up the worms and crustacea that they release. Small fast swimming pelagic fish chase the large zooplankton and in turn are eaten by larger pelagic fish, such as kingfish.



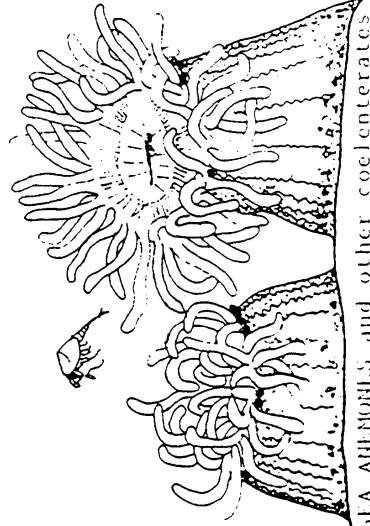
STARFISH

Starfish eat worms, crabs, bivalves and snails. The local blue and orange Coscinasterias often eats sea eggs. The arms of most starfish are flexible and muscular and equipped underneath with rows of tube feet (flexible suckers). Together they enable it to exert great pressures to pull snails off the rock, tear open bivalve shells, and secure and immobilize struggling crustaceans. Some starfish swallow small prey whole but most evert the stomach through the mouth to unwrap and partly digest the food into an easily swallowed soup.



Errant Polychaete WORMS, Ragworms

These mobile worms generally burrow in mud or under boulders, and trap small animals that come near to the burrow mouth. Their highly eversible proboscis bears a pair of long pincer-like teeth that bite into and hang on to the prey. The victim is usually dragged back into the mouth of the burrow where rows of shorter teeth on the proboscis then rasp away the soft tissues and convey them into the mouth.



SEA ANEMONES and other coelenterates

These feed on any small animal that passes within range of the crown of long tentacles around the mouth. The tentacles have special surface cells that discharge poisonous barbed whips to anaesthetize and lasso the prey. The tentacles then quickly entwine around the animal, gather it in and stuff it through the mouth into the simple gut chamber..