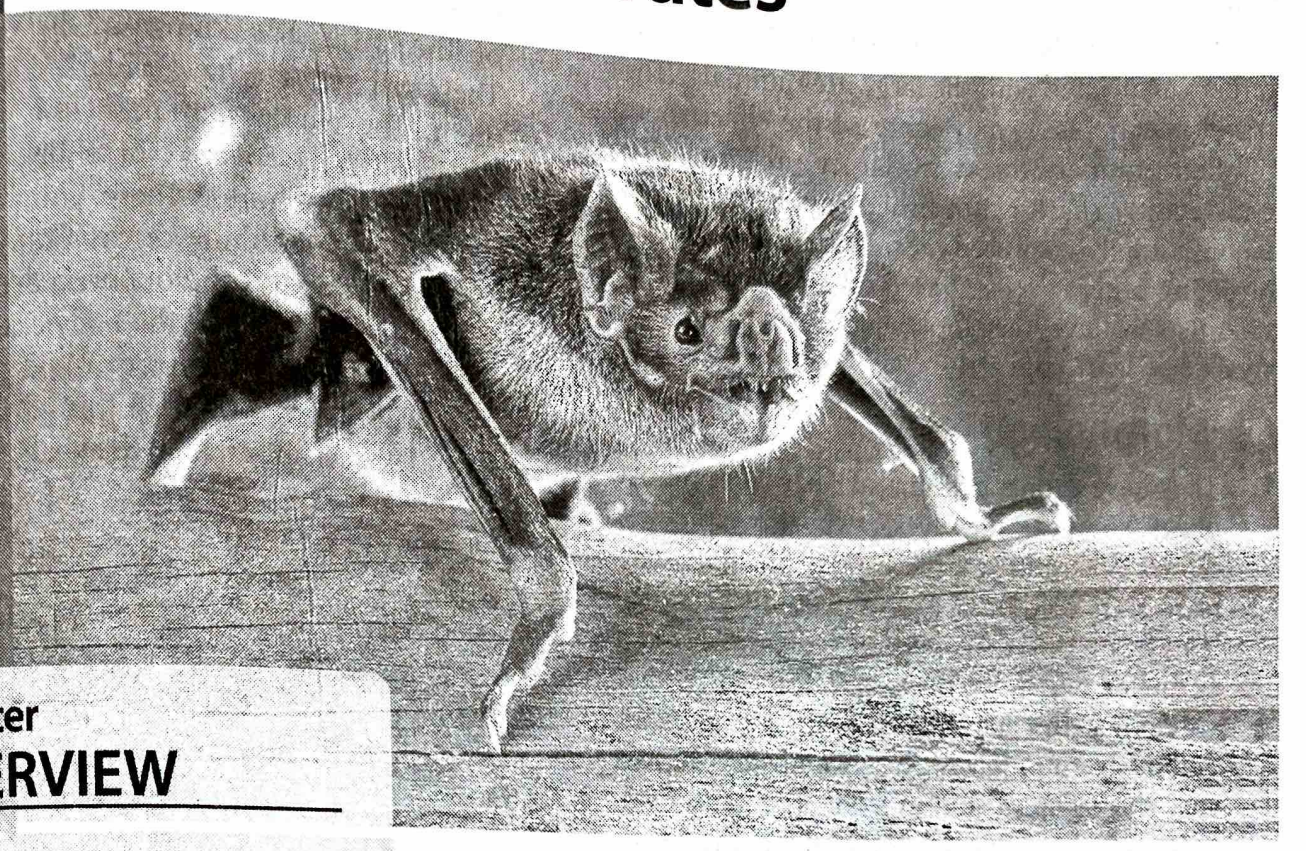
CHAPTER 6

Parasitic Vertebrates



Chapter OVERVIEW

- Cookiecutter shark *(Isistius brasiliensis)*
- Hood Mocking bird
- Vampire bats
- Candiru (the Penis Fish)
- Vampire Ground Finch

Some vertebrates act as parasites. Some of them are aquatic and some are terrestrial. They choose their host and use them as their food source. Majority of them are ectoparasites to their hosts. This chapter deals with parasitic behaviour and effect on host of some well known vertebrate parasites.

6.1 Cookiecutter shark *(Isistius brasiliensis)*

The Cookiecutter shark *(Isistius brasiliensis)* is a species of small dogfish shark. It is also known as cigar shark. They are chocolate brown in color, gradually becomes lighter below. A dark "collar" wraps around the gill region. Round scars from cookiecutter shark bites (Feeding marks) are found on numerous marine mammals and fishes. Its lesion seems as a cut out with a cookie cutter. So, the name is given "cookiecutter shark".

Habitat and Distribution

They occur in warm, oceanic waters, worldwide. They are present in all the major tropical and warm-temperate oceanic basins of the world. The cookiecutter shark shows vertical migration up to 3 km in the ocean water.

They very rarely venture to the surface of the water.

It is frequently found near islands, because they remain associated with the large prey animals. They travel in schools. It may increase the effectiveness of their counter-attacks by larger predators. The cookiecutter shark is not fished commercially, and is only rarely captured accidentally in fisheries targeting other species. Based on a recent analysis, scientists believe the cookiecutter shark to be a species of least concern.

Morphology

1. They have a long, cylindrical body with a short, blunt snout, large eyes, two tiny spineless dorsal fins, and a large caudal fin. It is dark brown in colour. The maximum recorded length for this species is 17 in for males and 22 in for females. The cookiecutter shark has an elongated, cigar-shaped body with a short, bulbously rounded snout. The nostrils have a very short flap of skin in front. The large, oval, green eyes are placed forward on the head. Large spiracles are present behind the eyes. Five pairs of gill slits are present.
2. The mouth is short, surrounded by enlarged, fleshy, suctorial lips. Upper jaw contains about 30–37 rows of teeth and in the lower jaw contains about 25–31 rows of teeth. The upper and lower teeth are extremely different. The upper teeth are small, narrow, and upright. They have smooth-edged cusp. The lower teeth are also smooth-edged, but much larger, broader, and knife-like. They form a single saw-like cutting edge and are small.

ADVANCED STUDIES INFO

Dentition of cookiecutter shark : Unlike other sharks that shed teeth one a time, the cookiecutter shark loses all of their teeth in a single shedding. It even swallows the bottom row, all 25 to 31 of them. It is believed that this is to provide calcium to the body. Cookiecutters also have 30 to 37 smaller upper teeth.

3. The pectoral fins are short and roughly trapezoid in shape. Two spineless dorsal fins are placed far back on the body. The second dorsal fin is slightly larger than the first. The pelvic fins are larger than other fins. The anal fin is absent. The caudal fin is broad.
4. Cookiecutter sharks are dark brown to black on the upper side of their body, which is know as the dorsal side; and a lighter brown on the lower side, known as the ventral side. Their gill regions have a dark collar around them. The whole ventral surface, minus this dark collar, is covered in a dense network of tiny photophores. These emit a greenish glow called bioluminescence. Complex, light-producing organs (photophores) densely cover the entire underside of the body except for the collar region. They produce a vivid green glow. Researchers have observed this glow to last as long as three hours after the shark's death.

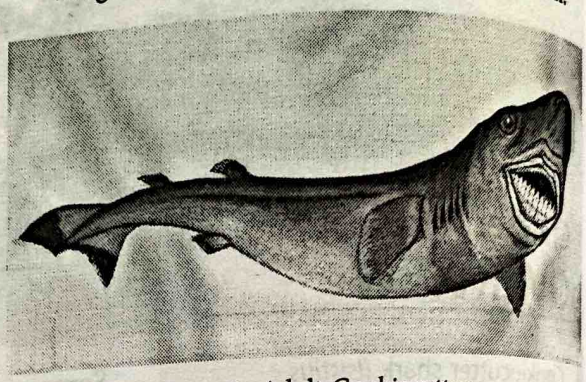


Fig. 6.1 Adult Cookiecutter

Parasitic behaviour

Cookiecutter shark is considered to be a facultative ectoparasite. It also ingests whole smaller sized prey.

1. It has a wide gape and a very strong bite. Because they have heavily calcified cranial and labial cartilages. They can cut round chunks of tissue from marine mammals and large fishes.
2. They spend much of its time hovering in the water column in search of their host. During day time, they usually present at a depth of about 1–3.7 km. At night, it rises to the upper water column.
3. The cookiecutter shark regularly replaces its teeth, but sheds its lower teeth in entire rows.
4. The retina of the cookiecutter shark has ganglion cells concentrated in a concentric area rather than in a horizontal streak across the visual field. This helps to focus on prey in front of the shark.
5. The cookiecutter shark exhibits a number of specializations in its mouth and pharynx for its parasitic lifestyle. The shark first secures itself

to the body surface of its prey by closing its spiracles and retracting its tongue to create pressure. Its suctorial lips ensure a tight seal. It then bites by its narrow upper teeth. Finally, the shark twists and rotates its body to complete a circular cut.

Effect on Host

1. They attack almost every large-sized oceanic animals found in their habitat. Bite scars have been found on porpoises, dolphins, beaked whales, sperm whales and baleen whales, fur seals, elephant seals, dugongs, blue sharks, basking sharks, great white sharks, tiger sharks, deepwater stingrays, pelagic stingrays and several bony fishes.
2. Parasitic attacks by the cookiecutter shark leave a round "crater wound", averaging 5 cm (2.0 in) across and 7 cm (2.8 in) deep.
3. Diseased or weakened animals are more susceptible to their attack. The cookiecutter shark also regularly hunts and eats entire squid. copepods, and other preys.

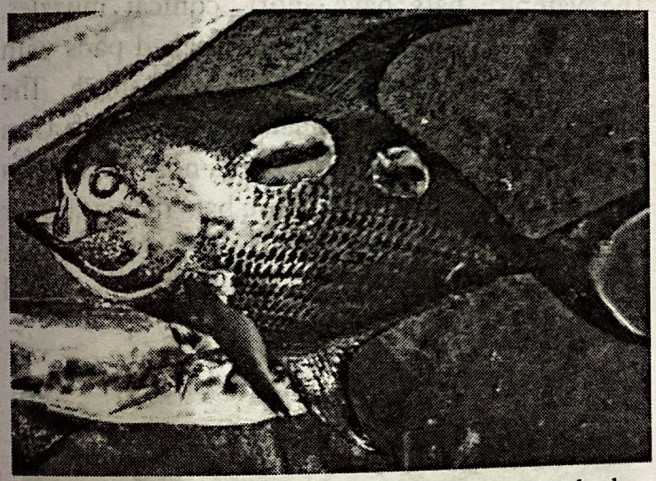


Fig. 6.2 Fish species attacked by Cookiecutter shark

6.2 Hood Mocking bird

The Hood mockingbirds *(Mimus macdonaldi)* are omnivorous or scavenger in habit. They are facultative ectoparasites. The species has a highly territorial social structure and has no fear of humans. The species eats the eggs of seabirds nesting near their habitat. They also eat from dead animals and kills made by other predators. Sometimes, they feed on blood of wounded seabirds.

Habitat and Distribution

The bird is endemic to Galápagos Islands, Ecuador, and surrounding places. It is also found in dry forests. Its natural habitats are subtropical or tropical dry forests and subtropical or tropical dry shrub land.

Morphology

The bird has a mottled gray and brown plumage with a white underbelly. The bird has a long tail and long legs. The species has a long, thin beak, useful for tapping into the eggs of seabirds.

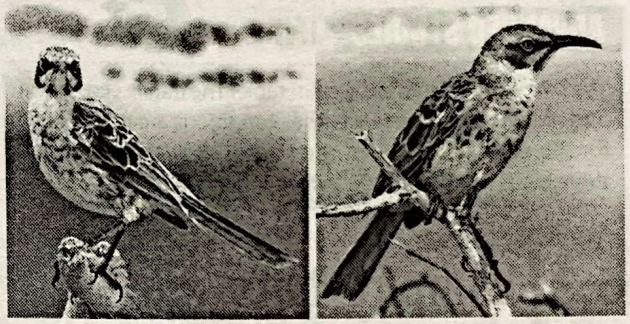


Fig. 6.3 Showing Hood mocking bird

Parasitic behaviour and effect on host

1. They scavenge food and water from human camps, often right in front of the humans. If a human gets annoyed by this, and chases after the bird, it happens to fall down and get a scratch. The bird returns to drink the human's blood.
2. Hood mocking birds are opportunistic vampires. They are known to drink the blood of wounded sea birds, injured sea lions, sea lion placenta, etc.

▶ Remark

They has also been noted to drink blood from wounds on the legs of humans. This characteristic is unique to this group of mocking birds and could be a result of hawk predation.

3. When they could not get any blood, the bird often land on an animal's back and pluck off ticks and other ectoparasites. They can collect blood from these blood-filled insects, and the wounds caused by the attack of ticks.

4. The bird is extremely aggressive and curious, and has no fear of humans. The bird chases after tourists in search of food, drink, or any other objects. In some cases, the species will attempt to obtain water from tourists by pecking at their water bottles.
5. The birds have a strong social structure organized into family groups. Highly territorial, these groups cooperatively hunt within their area as well as defend it against other groups. Lower-ranking members of the group will assist in caring for the young.

ADVANCED STUDIES INFO

The bird is considered to be vulnerable. The fragile ecosystem and high risk of adverse weather conditions are responsible for the population loss of the species. It is estimated that there are fewer than 2,500 individuals left in the wild.

6.3 Vampire bats

The food source of vampire bat is blood. They show hematophagy. Vampire bats can walk, jump, and even run. The wings are much more powerful than the legs. They tend live in the colonies in almost completely dark places.

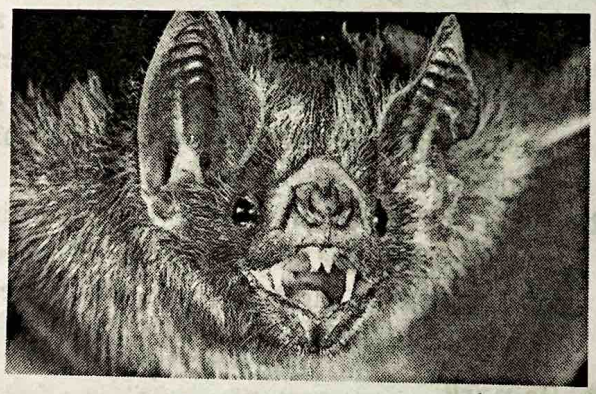


Fig. 6.4 Vampire bat

Three bat species feed on blood. They are :

1. **The common vampire bat *(Desmodus rotundus)* :** They feed on the blood of mammals, including humans.
2. **The hairy-legged vampire bat *(Diphylla ecaudata)* :** They feed on the blood of birds.
3. **The white-winged vampire bat *(Diaemus youngi)* :** They feed on the blood of birds.

All three species are native to the Americas. Vampire bats hunt in fully dark night. Like fruit-eating bats, they emit only low-energy sound pulses.

ADVANCED STUDIES INFO

Hematophagy : The practice of consuming blood as a source of food is called hematophagy. It is observed in insect (mosquitoes) vampire bats etc. Hematophagms animals have evolved chemical solution in their saliva which help in capillany dilation in some cases.

Habitat and Distribution

Vampire bats are leaf-nosed bats found in Central and South America. All three species are native to the Americas, ranging from Mexico to Brazil, Chile, Uruguay, Argentina. They range in Central to South America. They live in arid to humid, tropical and subtropical areas. In India, some vampire bats are found in Odisha.

Morphology

The vampire bats have short, conical muzzles. They lack a nose leaf. They have naked pads with U-shaped grooves at the tip of the nose. The common vampire bat, *Desmodus rotundus,* also has specialized thermoreceptors on its nose. A nucleus is found in the brain of vampire bats that is similar to the infrared receptor of infrared-sensing snakes. Vampire bats use infrared radiation to locate blood hotspots on their prey.

Fig. 6.5 Vampire bats leaking blood from the foot of cattle

A vampire bat has front teeth, specialized for cutting. The back teeth are much smaller than in other bats. The inferior colliculus (the part of the brain that processes sound) is well adapted

to detect the breathing sounds of sleeping host animals.

A typical female vampire can consume over 20g of blood. This feeding behavior is facilitated by its anatomy and physiology for rapid processing and digestion of the blood. The stomach and intestine rapidly absorb the water in the blood meal.

Parasitic behaviour and effect on host

1. Once the vampire bat locates a host, it lands and approaches it on the ground. They use thermoception to identify a warm spot on the skin to bite. They create a small incision with their teeth and lap up blood from the wound. Vampire bats have developed highly sensitive thermosensation, with specialized systems for detecting infrared radiation.
2. If there is fur on the skin of the host, the common vampire bat uses its canine and cheek teeth (like a barber's blades) to shave away the hairs. The bat's razor-sharp upper incisor teeth then make a deep cut. Their teeth are very sharp.
3. The specialized tongue of *Desmodus* has two lateral grooves on the underside that expand and contract to help draw blood into the mouth as the bat licks the site.
4. Saliva of the bat contains several compounds (anticoagulants-Desmoteplase) that inhibit blood clotting and compounds that prevent the constriction of blood vessels near the wound.
5. Vampire bat bite can cause rabies in the host, including humans. The highest occurrence of rabies due to bites of vampire bat occurs in the populations in South America.
6. Vampire bats form strong bonds with other members of the colony. They share their food with the members of their colony. A vampire bat can only survive about two days without feeding. Therefore, when a bat fails to find food, it will often "beg" another bat for food. A "donor" bat regurgitates a small amount of blood to sustain the other member of the colony. This phenomenon is known as reciprocal altruism.

Remark

■ ***Evolutionary significance :*** Vampire bats are members of a large and diverse mammalian Family known as Phyllostomidae (New World Leaf-nosed Bats). At least 160 known species of bats are in the phyllostomid family. Most of the phyllostomid species feed primarily on fruit and other plant material, whileothers feed on insects, nectar, frogs, or are omnivores. Only the three vampire species feed on blood. Recent genetic studies have determined that the vampires diverged from the remainder of the Phyllostomid family about 26 million years ago. Blood-feeding is thought to have evolved only once, in a common ancestor that is shared by the three vampire bat species of today. Some researchers suspect that the first vampire bats may have evolved from insect-eating bats that were feeding on the parasites of birds and mammals. Thus, the bats were consuming a partial diet of blood (the blood that the parasites had eaten), and when they pulled the parasites off the bird or mammal, they were further exposed to blood at the attachment site. Behaviorally, it would not be a large leap for the bats to begin feeding directly on blood. This view is supported by observing other animals that feed in a similar manner. For example, although obligate (meaning compelled or constrained, required to survive) blood-feeding has evolved only once among vertebrates (vampire bats), some species of bird, such as the vampire finch, also feed on the ectoparasites of other birds and occasionally consumes some blood at the site where the ectoparasites were attached.

ADVANCED STUDIES INFO

Vampire bats' saliva can be used in medicine. Scientists have isolated an anticoagulant called 'Desmoteplase' from the saliva of *Desmodus rotundus*. It is used for the treatment of stroke patients.

Vampire bats being a social animal display reciprocal altruism. The bats feed each other by regurgitating blood. Since bats only feed on blood and will die after just 70 hours of not eating, this food sharing is a great benefit to the receiver and a great cost to the giver. However, vampire bats do so in reciprocation with the fact that, in starvation period the same thing will be done by other organism of the same group.