Exhibit message

Fish use a combination of ram and suction feeding techniques. The lemon shark mostly uses ram feeding, while the sling-jaw wrasse uses ram and suction techniques.

Quick fact

Sharks bite down so forcefully, they often break off their teeth as they feed.

Sharks have rows of reserve teeth in their jaws that emerge to replace broken or missing teeth.

The lemon shark can replace a tooth in about eight days.

Graphic panel text

Lemon shark
(Negaprion brevirostris)

Most fish use ram and suction feeding.

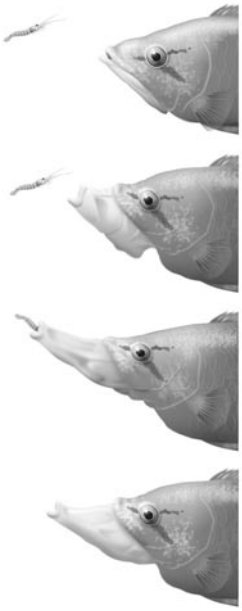
Lemon sharks lunge forward at prey with open, extended jaws. This is called ram feeding.

As the lemon shark prepares to bite, it depresses its lower jaw (mandible), while raising its head.

Its upper jaw and teeth protrude forward as the whole mouth snaps shut. The upper jaw helps to grasp the struggling prey.

After a few bites to break off pieces, the lemon shark uses suction to swallow the food.

Sling-jaw wrasse
(Epibulus insidiator)



Most fish, such as the sling-jaw wrasse, use a combination of ram and suction feeding.

This wrasse has the most extendable jaw of any fish and can thrust its lower jaw forward nearly four centimetres without moving its head. This is the ram stage of feeding for the wrasse.

Once its jaw is extended, its tubular mouth acts like a vacuum cleaner. Water is pulled into its mouth and out through its gills, sucking in prey such as small shrimp. This is the suction stage of the wrasse's feeding.

The whole feeding routine for the wrasse is lightning quick, happening in four hundredths of a second.

Want to know more about how fish feed?

Humans have a relatively simple jaw structure with a lower jaw (mandible) that pivots at the rear. Fish have many jaw-bones, which are cross-connected with various muscles. Fish can drop their lower jaw like we can, but they can also pull out the sides of their mouth (you can see this when a goldfish 'yawns'). This makes their jaws very adaptable for capturing prey.

Very few fish use ram feeding or suction feeding techniques exclusively. Most fish seem to use a combination of the two techniques.

The lemon shark's bite action is fast. Strong bites in lemon sharks have been measured at less than 200 milliseconds (0.200 seconds, or two tenths of a second).

In ram feeding, the predator swims forward with its mouth open to overtake and engulf the prey in the predator's mouth.

If the prey is elusive, the shark will quickly snap their jaws shut to trap the prey. Sharks pursue mobile prey at a high speed and calculate their bite with impeccable timing, because their bite sequence is so fast.

If the prey is not very mobile, the shark swims through the water with their mouth open for minutes at a time. These predators collect prey that is suspended in water such as plankton or tiny crustaceans. These predators are called suspension-feeding ram feeders and they include whale sharks, basking sharks, shad, herring, anchovies, manta ray, paddlefish and the right whale.

Extra for experts

Modern sharks usually have jaws that protrude, maybe so they can capture more food and handle prey better. However, some studies suggest that jaw protrusion in lemon sharks probably decreases the time necessary for the shark to impale prey on the shark's teeth.

An animal's upper jaw is called the maxilla and its lower jaw is called the mandible. Sharks such as the lemon shark have a hinged section on their upper jaw (maxilla) that can swing forwards or protrude.

When the shark prepares to ram feed, it opens its jaws wide so prey is positioned within close range. When its mandible (lower jaw) is extended down as far as possible, its cranium (upper part of its skull) is also raised as high as it can go.

The shark's upper jaw starts to swing forward so it protrudes. The shark's lower jaw starts to move upwards to close the mouth. As the shark snaps its mouth shut, prey often gets impaled on the teeth of its protruding upper jaw.

The lemon shark's upper jaw then is retracted and the prey remains impaled on the shark's teeth. Without the upper jaw protrusion, the shark's mandible would have to be elevated more towards the maxilla to seize the prey between both jaws (i.e., the shark would have to snap its jaws shut even more quickly to trap prey if its upper jaw couldn't protrude).

After a lemon shark has eaten, it starts to expel faeces about 16 to 17 hours after feeding. Its alimentary tract is totally empty within 68 to 82 hours after feeding (if no more food is consumed after the first feed). This is quite a long digestion time, which may contribute to the lemon shark's low consumption of food and slow growth rate.

Fish that use suction feeding tend to have more complex jaw bones and muscles. In suction feeding, the fish expands its buccal (mouth) cavity rapidly, so water sweeps into its mouth and prey nearby is swept into the fish's mouth by suction.

Another series of muscles then rapidly contract the walls of the mouth and raise the floor, literally forcing the food back down the throat of the fish.

Further information

Fish jaw mechanics
http:/www2.biology.ualberta.ca/jackson.hp/IWR/Content/Anatomy/Jaw_Mechanics/index.php

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(high speed footage of lemon shark bite).
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An electromyographic analysis of the biting mechanism of the lemon shark, Negaprion brevirostris. Functional and evolutionary implications. *Journal of Morphology.* P.J. Motta et. al., 1991. Vol 210 (1): 55–70.

Diet feeding habits and estimates of daily ration of young lemon sharks. *Negaprion brevirostris. Copeia.* P.J. Motta et. al., E. Cortes, S. H. Gruber. 1990. (1): 204–218.

X-radiographic observations of food passage through digestive tracts of lemon sharks. *Transactions of the American Fisheries Society.* B. MM Wetherbee, S. H. Gruber, A. L. Ramsey. 1987. Vol 116 (5): 763–767.