

## = Coconut crab =

The coconut crab, *Birgus latro*, is a species of terrestrial hermit crab, also known as the robber crab or palm thief. It is the largest land @-@ living arthropod in the world, and is probably at the upper size limit for terrestrial animals with exoskeletons in recent times, with a weight of up to 4 @.@ 1 kg ( 9 @.@ 0 lb ). It can grow to up to 1 m ( 3 ft 3 in ) in length from leg to leg. It is found on islands across the Indian Ocean and parts of the Pacific Ocean as far east as the Gambier Islands mirroring the distribution of the coconut palm; it has been extirpated from most areas with a significant human population, including mainland Australia and Madagascar.

The coconut crab is the only species of the genus *Birgus*, and is related to the terrestrial hermit crabs of the genus *Coenobita*. It shows a number of adaptations to life on land. Like hermit crabs, juvenile coconut crabs use empty gastropod shells for protection, but the adults develop a tough exoskeleton on their abdomen and stop carrying a shell. Coconut crabs have organs known as "branchiostegal lungs", which are used instead of the vestigial gills for breathing. They cannot swim, and will drown if immersed in water for long. They have developed an acute sense of smell, which has developed convergently with that of insects, and which they use to find potential food sources. Mating occurs on dry land, but the females migrate to the sea to release their fertilised eggs as they hatch. The larvae are planktonic for 3 ? 4 weeks, before settling to the sea floor and entering a gastropod shell. Sexual maturity is reached after about 5 years, and the total lifespan may be over 60 years.

Adult coconut crabs feed on fruits, nuts, seeds, and the pith of fallen trees, but will eat carrion and other organic matter opportunistically. The species is popularly associated with the coconut, and has been widely reported to climb trees to pick coconuts, which it then opens to eat the insides. While coconut crabs can climb trees, and can eventually open a coconut collectively, coconuts are not a significant part of their diet. Coconut crabs are hunted wherever they come into contact with people and are subject to legal protection in some areas. In the absence of precise information the IUCN lists the species as "data deficient".

## = = Description = =

*Birgus latro* is the largest terrestrial arthropod, and indeed terrestrial invertebrate, in the world; reports about the size of *Birgus latro* vary, but most sources give a body length of up to 40 cm ( 16 in ), a weight of up to 4 @.@ 1 kg ( 9 @.@ 0 lb ), and a leg span of more than 0 @.@ 91 m ( 3 @.@ 0 ft ), with males generally being larger than females. The carapace may reach a length of 78 mm ( 3 @.@ 1 in ), and a width of up to 200 mm ( 7 @.@ 9 in ).

The body of the coconut crab is, like that of all decapods, divided into a front section ( cephalothorax ), which has 10 legs, and an abdomen. The front @-@ most pair of legs has large chelae ( claws ), with the left being larger than the right. The next two pairs, as with other hermit crabs, are large, powerful walking legs with pointed tips, which allow coconut crabs to climb vertical or overhanging surfaces. The fourth pair of legs is smaller with tweezer @-@ like chelae at the end, allowing young coconut crabs to grip the inside of a shell or coconut husk to carry for protection; adults use this pair for walking and climbing. The last pair of legs is very small and is used by females to tend their eggs, and by the males in mating. This last pair of legs is usually held inside the carapace, in the cavity containing the breathing organs. There is some difference in colour between the animals found on different islands, ranging from orange @-@ red to purplish blue; in most regions, blue is the predominant colour, but in some places, including the Seychelles, most individuals are red.

Although *Birgus latro* is a derived type of hermit crab, only the juveniles use salvaged snail shells to protect their soft abdomens, and adolescents sometimes use broken coconut shells to protect their abdomens. Unlike other hermit crabs, the adult coconut crabs do not carry shells but instead harden their abdominal terga by depositing chitin and chalk. Not being constrained by the physical confines of living in a shell allows this species to grow much larger than other hermit crabs in the family Coenobitidae. Like most true crabs, *B. latro* bends its tail underneath its body for protection.

The hardened abdomen protects the coconut crab and reduces water loss on land , but has to be moulted periodically . Adults moult annually , and dig a burrow up to 1 m ( 3 ft 3 in ) long in which to hide while vulnerable . It remains in the burrow for 3 to 16 weeks , depending on the size of the animal . After moulting , it takes 1 to 3 weeks for the exoskeleton to harden , depending on the animal 's size , during which time the animal 's body is soft and vulnerable , and it stays hidden for protection .

= = = Respiration = = =

Except as larvae , coconut crabs cannot swim , and they will drown if left in water for more than an hour . They use a special organ called a branchiostegal lung to breathe . This organ can be interpreted as a developmental stage between gills and lungs , and is one of the most significant adaptations of the coconut crab to its habitat . The branchiostegal lung contains a tissue similar to that found in gills , but suited to the absorption of oxygen from air , rather than water . This organ is expanded laterally and is evaginated to increase the surface area ; located in the cephalothorax , it is optimally placed to reduce both the blood / gas diffusion distance and the return distance of oxygenated blood to the pericardium . Coconut crabs use their hindmost , smallest pair of legs to clean these breathing organs and to moisten them with water . The organs require water to properly function , and the coconut crab provides this by stroking its wet legs over the spongy tissues nearby . Coconut crabs may drink water from small puddles by transferring it from their chelipeds to their maxillipeds .

In addition to the branchiostegal lung , the coconut crab has an additional rudimentary set of gills . Although these gills are comparable in number to aquatic species from the families Paguridae and the Diogenidae , they are reduced in size and have comparatively less surface area .

= = = Sense of smell = = =

The coconut crab has a well @-@ developed sense of smell , which it uses to locate its food . The process of smelling works very differently depending on whether the smelled molecules are hydrophilic molecules in water or hydrophobic molecules in air . As most crabs live in the water , they have specialised organs called aesthetascs on their antennae to determine both the concentration and the direction of a smell . However , as coconut crabs live on the land , the aesthetascs on their antennae are shorter and blunter than those of other crabs and look more like those of insects . While insects and the coconut crab originate from different paths , the same need to detect smells in the air led to the development of remarkably similar organs . Coconut crabs flick their antennae as insects do to enhance their reception . They have an excellent sense of smell and can detect interesting odours over large distances . The smells of rotting meat , bananas , and coconuts , all potential food sources , catch their attention especially . Research has shown that the olfactory system in the coconut crab 's brain is well @-@ developed compared to other areas of the brain .

= = = Life cycle = = =

Coconut crabs mate frequently and quickly on dry land in the period from May to September , especially between early June and late August . Male coconut crabs have spermatophores and deposit a mass of spermatophores on the abdomen of the female ; the abdomen opens at the base of the third pereopods , and fertilisation is thought to occur on the external surface of the abdomen as the eggs pass through the spermatophore mass . The extrusion of eggs occurs on land in crevices or burrows near the shore . Shortly thereafter , the female lays her eggs and glues them to the underside of her abdomen , carrying the fertilised eggs underneath her body for a few months . At the time of hatching , the female coconut crab releases the eggs into the ocean . This usually takes place on rocky shores at dusk , especially when this coincides with high tide . The empty egg cases remain on the female 's body after the larvae have been released , and the female eats the

egg cases within a few days . The larvae float in the pelagic zone of the ocean with other plankton for three to four weeks , during which a large number of them are eaten by predators . The larvae pass through three to five zoea stages before moulting into the post @-@ larval glaucothoe stage ; this process takes from 25 to 33 days . Upon reaching the glaucothoe stage of development , they settle to the bottom , find and wear a suitably sized gastropod shell , and migrate to the shoreline with other terrestrial hermit crabs . At that time , they sometimes visit dry land . Afterwards , they leave the ocean permanently and lose the ability to breathe in water . As with all hermit crabs , they change their shells as they grow . Young coconut crabs that cannot find a seashell of the right size often use broken coconut pieces . When they outgrow their shells , they develop a hardened abdomen . The coconut crab reaches sexual maturity around five years after hatching . They reach their maximum size only after 40 to 60 years .

#### = = Distribution = =

Coconut crabs live in the Indian Ocean and the central Pacific Ocean , with a distribution that closely matches that of the coconut palm . The western limit of the range of *B. latro* is Zanzibar , off the coast of Tanzania , while the tropics of Cancer and Capricorn mark the northern and southern limits , respectively , with very few population in the subtropics , such as the Ryukyu Islands . There is evidence that the coconut crab once lived on the mainlands of Australia and Madagascar and on the island of Mauritius , but it no longer occurs in any of these places . As they cannot swim as adults , coconut crabs must have colonised the islands as planktonic larvae .

Christmas Island in the Indian Ocean has the largest and densest population of coconut crabs in the world , although it is outnumbered there by more than 50 times by the Christmas Island red crab , *Gecarcoidea natalis* . Other Indian Ocean populations exist on the Seychelles , including Aldabra and Cosmoledo , but the coconut crab is extinct on the central islands . Coconut crabs occur on several of the Andaman and Nicobar Islands in the Bay of Bengal . They occur on most of the islands , and the northern atolls , of the Chagos Archipelago .

In the Pacific , the coconut crab 's range became known gradually . Charles Darwin believed it was only found on " a single coral island north of the Society group " . The coconut crab is far more widespread , though it is not abundant on every Pacific island it inhabits . Large populations exist on the Cook Islands , especially Pukapuka , Suvarrow , Mangaia , Takutea , Mauke , Atiu , and Palmerston Island . These are close to the eastern limit of its range , as are the Line Islands of Kiribati , where the coconut crab is especially frequent on Teraina ( Washington Island ) , with its abundant coconut palm forest . The Gambier Islands marks the species ' eastern limit .

#### = = Ecology = =

#### = = = Diet = = =

The diet of coconut crabs consists primarily of fleshy fruits ( particularly *Ochrosia ackeringae* , *Arenga listeri* , *Pandanus elatus* , *P. christmatensis* ) , nuts ( coconuts *Cocos nucifera* , *Aleurites moluccanus* ) and seeds ( *Annona reticulata* ) , and the pith of fallen trees . However , as they are omnivores , they will consume other organic materials such as tortoise hatchlings and dead animals . They have been observed to prey upon crabs like *Gecarcoidea natalis* and *Discoplax hirtipes* , as well as scavenge on the carcasses of other coconut crabs . During a tagging experiment , one coconut crab was observed killing and eating a Polynesian Rat ( *Rattus exulans* ) . Coconut crabs may be responsible for the disappearance of Amelia Earhart 's remains , consuming them after her death and hoarding her skeletal remnants in their burrows .

The coconut crab can take a coconut from the ground and cut it to a husk nut , take it with its claw , climb up a tree 10 m ( 33 ft ) high and drop the husk nut , to access the coconut meat inside . They often descend from the trees by falling , and can survive a fall of at least 4 @.@ 5 metres ( 15 ft ) unhurt . Coconut crabs cut holes into coconuts with their strong claws and eat the contents ,

although it can take several days before the coconut is opened .

Thomas Hale Streets discussed the behaviour in 1877 , doubting that the animal would climb trees to get at the nuts . In the 1980s , Holger Rumpff was able to confirm Streets 's report , observing and studying how they open coconuts in the wild . The animal has developed a special technique to do so : if the coconut is still covered with husk , it will use its claws to rip off strips , always starting from the side with the three germination pores , the group of three small circles found on the outside of the coconut . Once the pores are visible , the coconut crab will bang its pincers on one of them until they break . Afterwards , it will turn around and use the smaller pincers on its other legs to pull out the white flesh of the coconut . Using their strong claws , larger individuals can even break the hard coconut into smaller pieces for easier consumption .

= = = Habitat = = =

Coconut Crabs are considered one of the most terrestrial decapods , with most aspects of its life linked to a terrestrial existence ; they will drown in sea water in less than a day . Coconut crabs live alone in underground burrows and rock crevices , depending on the local terrain . They dig their own burrows in sand or loose soil . During the day , the animal stays hidden to reduce water loss from heat . The coconut crabs ' burrows contain very fine yet strong fibres of the coconut husk which the animal uses as bedding . While resting in its burrow , the coconut crab closes the entrances with one of its claws to create the moist microclimate within the burrow necessary for its breathing organs . In areas with a large coconut crab population , some may come out during the day , perhaps to gain an advantage in the search for food . Other times they will emerge if it is moist or raining , since these conditions allow them to breathe more easily . They live almost exclusively on land , returning to the sea only to release their eggs ; on Christmas Island , for instance , *B. latro* is abundant 6 kilometres ( 3 @. @ 7 mi ) from the sea .

= = = Relationship with human beings = = =

Adult coconut crabs have no known predators apart from other coconut crabs and humans . Its large size and the quality of its meat means that the coconut crab is extensively hunted and is very rare on islands with a human population . The coconut crab is eaten by Southeast Asians and Pacific Islanders and is considered a delicacy and an aphrodisiac , and intensive hunting has threatened the species ' survival in some areas . While the coconut crab itself is not innately poisonous , it may become so depending on its diet , and cases of coconut crab poisoning have occurred . For instance , consumption of the sea mango *Cerbera manghas* by the coconut crab may make the coconut crab toxic due to the presence of cardiac cardenolides .

The pincers of the coconut crab are powerful enough to cause noticeable pain to a human ; furthermore , the coconut crab will often keep its hold for extended periods of time . Thomas Hale Streets reports a trick used by Micronesians of the Line Islands to get a coconut crab to loosen its grip : " It may be interesting to know that in such a dilemma a gentle titillation of the under soft parts of the body with any light material will cause the crab to loosen its hold . "

In the Cook Islands , the coconut crab is known as unga or kaveu , and in the Mariana Islands it is called ayuyu , and is sometimes associated with taotaomo 'na because of the traditional belief that ancestral spirits can return in the form of animals such as the coconut crab .

= = Conservation = =

Coconut crab populations in several areas have declined or become locally extinct due to both habitat loss and human predation . In 1981 , it was listed on the IUCN Red List as a vulnerable species , but a lack of biological data caused its assessment to be amended to " data deficient " in 1996 .

Conservation management strategies have been put in place in some regions , such as minimum legal size limit restrictions in Guam and Vanuatu , and a ban on the capture of egg @-@ bearing

females in Guam and the Federated States of Micronesia . In the Northern Mariana Islands , hunting of non @-@ egg @-@ bearing adults above a carapace length of 30 mm ( 1 @.@ 2 in ) may take place in September , October and November , and only under licence . There is a bag limit of 5 coconut crabs on any given day , and 15 across the whole season .

In Tuvalu coconut crabs live on the motu ( islets ) in the Funafuti Conservation Area , a marine conservation area covering 33 square kilometres ( 12 @.@ 74 square miles ) of reef , lagoon and motu on the western side of Funafuti atoll .

= = Names = =

The coconut crab has been known to western scientists since the voyages of Sir Francis Drake around 1580 and William Dampier around 1688 . Based on an account by Georg Eberhard Rumphius ( 1705 ) , who had called the animal " Cancer crumenatus " , Carl Linnaeus ( 1767 ) named the species *Cancer latro* , from the Latin *latro* , meaning " robber " . The genus *Birgus* was erected in 1816 by William Elford Leach , containing only Linnaeus ' *Cancer latro* , which was thus renamed *Birgus latro* . *Birgus* is classified in the family *Coenobitidae* , alongside one other genus , *Coenobita* , which contains the terrestrial hermit crabs .

Common names for the species include coconut crab , robber crab and palm thief , which mirrors the animal 's name in other European languages ( e.g. German : *Palmendieb* ) .