

## *Cassiopea xamachana* (Upside-down Jellyfish)

Order: Rhizostomeae (Eight-armed Jellyfish)

Class: Scyphozoa (Jellyfish)

Phylum: Cnidaria (Corals, Sea Anemones and Jellyfish)



**Fig. 1.** Upside-down jellyfish, *Cassiopea xamachana*.

[<http://images.fineartamerica.com/images-medium-large/upside-down-jellyfish-cassiopea-sp-pete-oxford.jpg>, downloaded 9 March 2016]

**TRAITS.** *Cassiopea xamachana*, also known as the upside-down jellyfish, is quite large with a dominant medusa (adult jellyfish phase) about 30cm in diameter (Encyclopaedia of Life, 2014), resembling more of a sea anemone than a typical jellyfish. The name is associated with the fact that the umbrella (bell-shaped part) settles on the bottom of the sea floor while its frilly tentacles face upwards (Fig. 1). The saucer-shaped umbrella is relatively flat with a well-defined central depression on the upper surface (exumbrella), the side opposite the tentacles (Berryman, 2016). This depression gives the jellyfish the ability to stick to the bottom of the sea floor while it pulsates gently, via a suction action. There are eight oral arms (tentacles) around the mouth, branched elaborately in four pairs. The most commonly seen colour is a greenish grey-blue, due to the presence of zooxanthellae (algae) embedded in the mesoglea (jelly) of the body, and especially the arms. The mobile medusa stage is dioecious, which means that there are separate males and females, although there are no features which distinguish the sexes. The polyp stage is sessile (fixed to the substrate) and small (Sterrer, 1986).

**DISTRIBUTION.** *Cassiopea xamachana* is fairly widespread, it can be found in Bermuda and ranges throughout the Caribbean Sea, the Gulf of Mexico, and warm waters of the western Atlantic Ocean (Berryman, 2016).

**HABITAT AND ACTIVITY.** *Cassiopea xamachana* favours muddy substrata found in the mangroves for settling. The life cycle consist of the alternation of two stages, the polyp and the medusa, found during summer/early fall and all year round, respectively. The polyp is attached to the substrate and is known as a scyphistoma (Fig. 2). This reproduces asexually by strobilation, budding off sections from the top, each known as an ephyra (newly strobilated medusa), which can be found in abundance during the summer/fall period. The adult medusa is lodged on the sea floor most of its time, with the arms facing upwards. Here it is able to paralyze its unsuspecting prey and consume it. They seldom move up into the water column, only if disturbed will they launch upwards via a pulsating motion. It flops about for a short time before settling once again onto the mud.

**FOOD AND FEEDING.** The zooxanthellae located in the mesoglea of the jellyfish help it acquire most of its energy through a symbiotic (mutually beneficial) relationship. However, sufficient energy isn't provided by the zooxanthellae for its metabolic needs, so the jellyfish must also use predation. The jellyfish can capture its prey through the use of nematocysts contained within their tentacles (Costley and Fitt, 1998). Nematocysts have the ability to sting due to the control of a mechanical and chemical trigger. After injecting a prey with toxins, it is paralyzed and feeding becomes easy for the jellyfish. It proceeds to digest its meal, by the manubrial or oral surface (Fig. 3), reducing it to fragments that can be ingested through the secondary mouths. Most other jellyfish have one mouth at the centre of the oral surface (Berryman, 2016), but in *Cassiopea xamachana* the central mouth is occluded, and secondary mouths at the ends of the manubrial branches are used. The prey are small organisms, including fish eggs and larvae, copepods, planktonic eggs and a variety of small marine invertebrates.

**POPULATION ECOLOGY.** Because of the life cycle, two distinct stages can be found in different areas and at different times of the year. Usually, the jellyfish stay together in a large group, but they do not depend on each other except for reproduction. Since each individual can catch, kill and consume its own prey, the jellyfish in the group are independent of each other.

**REPRODUCTION.** Fertilization occurs because of the fusion of eggs and sperm. The sperms are released from males and fertilize eggs in nearby females. The eggs develop in the female, and planula larvae are eventually released into the water. The planula permanently attaches to surrounding substrate (Fig. 2) based on the presence of a suitable microbial film (Hoffman et al., 1996). After attaching, the planula undergoes metamorphosis into a sessile polyp with tentacles known as a scyphistoma. Asexual reproduction occurs when sufficient food is present, after attaining a certain species of *Symbiodinium* symbiotic alga and an optimum temperature of 20°C or more (Sterrer, 1986). The process is known as monodisc type strobilation, with budding off of a series of disks from the top of the polyp, each forming an ephyra or young medusa. For the life cycle to be completed, the medusa stage of the jellyfish must attain its own food as there is no parental care.

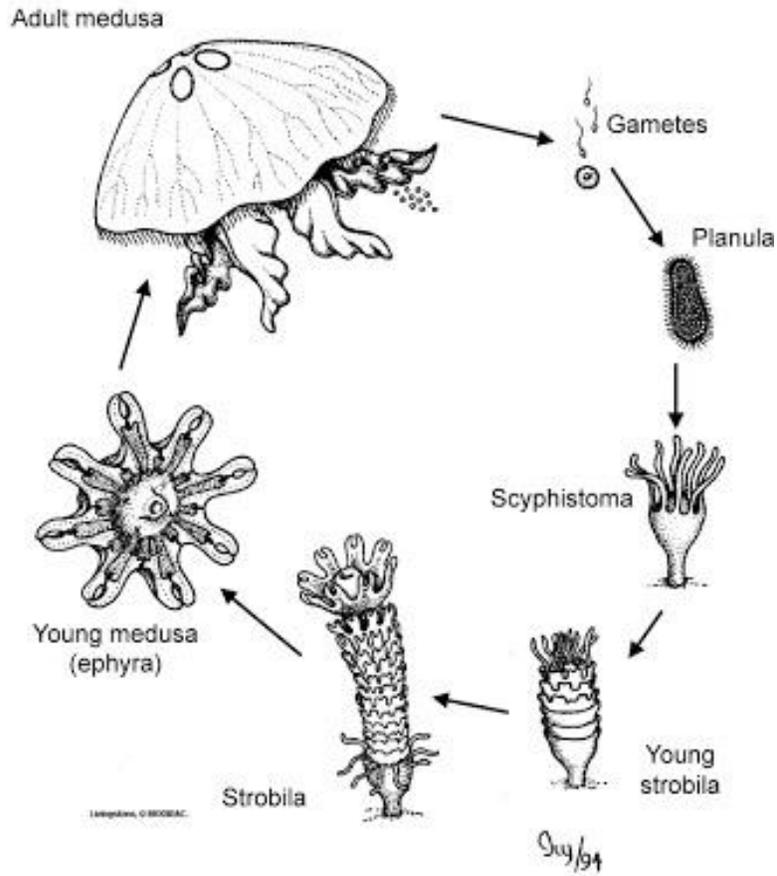
**BEHAVIOUR.** A symbiotic relationship exists between *Symbiodinium microdraiticum* and *Cassiopea xamachana*, which determines a lot about its behaviour and habitat. This dinoflagellate requires sunlight to be able to photosynthesize hence the jellyfish inhabits shallow waters so that access to sunlight is provided. The zooxanthellae reside on the underside of the bell, on the tentacles, so *Cassiopea xamachana* positions itself upside-down.

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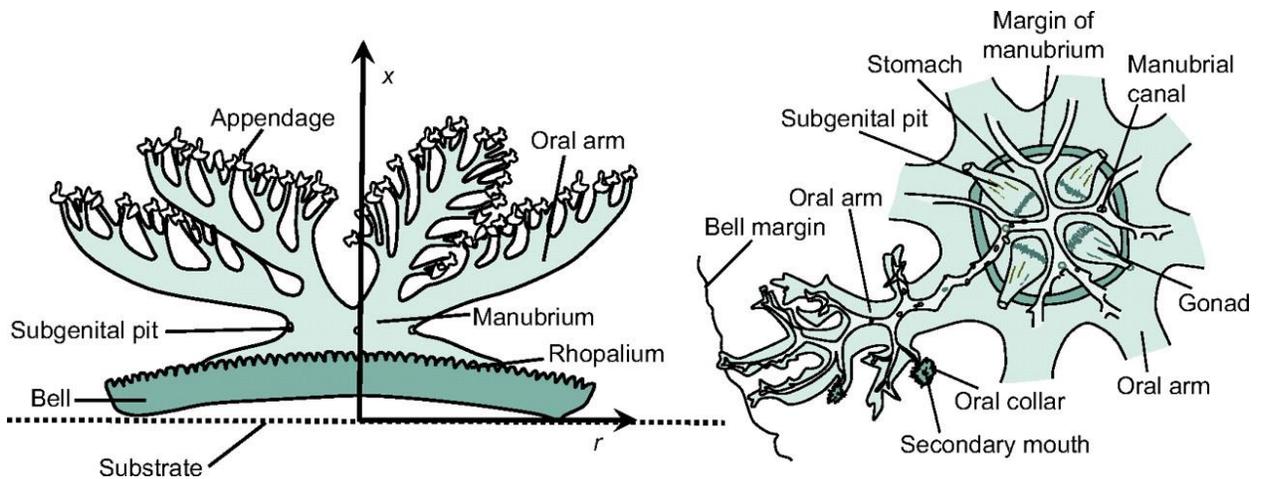
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**Fig. 2.** Life cycle of *Cassiopea xamachana*.

[<http://livelikedirt.blogspot.com/2009/10/sunday-inverts-scyphozoa.html>, download 9 March 2016]



**Fig. 3.** *Cassiopea xamachana* structure.

[<http://upsidedownjellyfishresource.weebly.com/physiology.html>, downloaded 9 March 2016]

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