

# Box jellyfish diversity in Indian waters with an occurrence report of a deadly species of box jellyfish *Chironex indrasaksajiae*

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Box jellyfish, are among the most toxic invertebrates in the world according to many studies (Barnes 1966; Gershwin *et al.*, 2010). Box jellyfish envenomation is caused by nematocysts, which are produced by specialised cells called nematocytes through a secretory pathway. These little toxin-containing capsules are densely packed in the tentacles and play a crucial role in capturing prey and defending against threats (Hessinger and Lenhoff 1988; Gershwin 2006). With about 50 documented species, the class Cubozoa—also called box jellyfish, because of their cube-shaped bells—is a small group of cnidarians that are well-known to the general public for harbouring some of the world's most dangerous marine organisms (Straehler-Pohl and Jarms, 2022). The Carybdeida and Chirodropida are the two monophyletic orders that make up Cubozoa (Bentlage *et al.* 2010). Chirodropids have numerous tentacles per pedaliu, while Carybdeids have only one and hence it is easy to distinguish between the two groups. About seven species have been so far reported from Indian waters constituting 14% of global box jellyfish diversity. Up to 25 species are thought to be capable of causing Irukandji syndrome. The order Carybdeida contains all of the "box jellyfish" species that cause Irukandji syndrome. These

species are similar to the more well-known species in the genus *Carybdea* and have unforked pedalia with a single tentacle attached to each corner of the bell. The Yirrganydji people, who were the original aboriginal custodians of the areas between Cairns and Port Douglas, are where the word Irukandji originated. This is also the place where the earliest reports of Irukandji syndrome were recorded (Flecker, 1952).

## Materials and methods

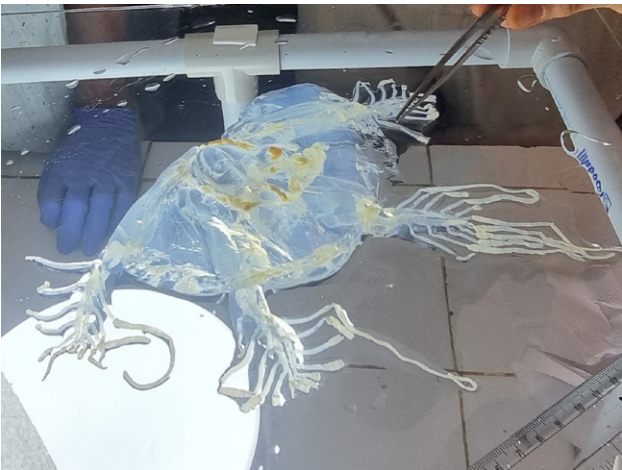
Survey along the Palk Bay coast is conducted during the peak jellyfish bloom season between March to May during 2021. At Dhargavalasai, in a shore seine operation a specimen of box jellyfish was collected and identified following Sucharitakul *et al.* (2017) as *Chironex indrasaksajiae*. There are three species are globally present under the genus *Chironex* viz., *C. fleckeri*, *C. yamaguchii* and *C. indrasaksajiae*. The number of tentacles and the shape of the pedalian canals are the key character to differentiate these three species (Table 1). The present specimen collected had 12 tentacles at each pedalian arm and the shape of the pedalian canal was volcano. These two characters match with the description

Table 1. Key differentiation among the *Chironex* species

	Tentacles	Pedalian canal bend	Geographic location	References
<i>Chironex fleckeri</i>	12–15	Rose thorn-shaped	Australia	Southcott (1956)
<i>Chironex yamaguchii</i>	5–9	Volcano	Japan and the Philippines	Lewis and Bentlage (2009)
<i>Chironex indrasaksajiae</i>	10–12	Bulbous	Thailand	Sucharitakul <i>et al.</i> (2017)
<i>Chironex indrasaksajiae</i>	12	Volcano	Palk Bay	2021 Present study

of this species. This is the first report of the occurrence of this species in Indian waters.

During examination of a jellyfish specimen collected from a shore seine operation at Dhargavalasai coast, Palk Bay as part of a regular survey, it was discovered that this specimen had volcano pedalia canals with 12 tentacles in each pedalia, matching the description of the species *Chironex indrasaksajiae*, which was discovered in the waters of the Gulf of Thailand in 2017. The genus *Chironex* has never been documented before from Indian seas. The discovery of a potentially fatal species of box jellyfish in Palk Bay verifies that it exists, at least along India's east coast. With up to 15 tentacles on each corner of its body and a potential combined tentacle length of over 60 metres, *Chironex fleckeri* is a big jellyfish that can reach a maximum size of 30 cm. Because of its transparent body, it is rarely seen before venoming a victim.



Dissected *Chironex indrasaksajiae*

Many deaths have been caused by the extremely venomous genus *Chironex* in tropical and subtropical coastal regions across the globe. The most well-known of them, *Chironex fleckeri*, has been linked to fatalities in Australia. There have been fatalities in Japan and most likely the Philippines due to *C. yamaguchii*. Much about the behaviour and ecology of *Chironex*, and cubozoan jellyfish in general, is still unknown despite their widespread recognition.

Severe lower back and abdominal pain, constant nausea and vomiting, cramps and spasms throughout the body, trouble breathing, excessive perspiration, nervousness, twitchy muscles, migraines, and a sense of imminent death are the usual symptoms of Irukandji syndrome (Williamson *et al.*, 1996). In addition, a lot of sufferers' report having a

creepy skin feeling, shivering, chattering teeth, coughing and/or grunting involuntarily, and, in some cases, priapism in men. Sometimes, severe hypertension poses a serious risk to life. The most well-known box jellyfish that are frequently held responsible for fatalities are those belonging to the genus *Chironex* (Thaikruea *et al.*, 2015). Southcott (1956) gave the first description of the genus *Chironex* for a single species, *Chironex fleckeri*, from Australia. Then, 53 years later, Lewis and Bentlage (2009) identified and named *Chironex yamaguchii*, another deadly species of *Chironex* from Japan. The year 2017 saw the description of the third species of *Chironex* (*Chironex indrasaksajiae*) by Sucharitakul *et al.* (2017). This study confirms the expansion of the species distribution from its primary area of description. The continuous surveillance on the jellyfish stings cases recorded about four life threatening cases of box jellyfish envenomation along the Gulf of Mannar and the Palk Bay in the past five years, but many go unnoticed to the scientific community. According to our survey conducted along the coast of the Gulf of Mannar and Palk Bay, fishermen in this area are already dealing with the problem of box jellyfish stings and are receiving treatment at the local hospital. There are two types of sting cases, according to several of the victims we spoke with for our study. While some box jellyfish stings cause excruciating pain that lasts for three to four days, other varieties could be deadly leave behind lasting scars. This study describes the species of *Chironex* that would permanently scar a victim's body. Further molecular work in this line is required to understand how much variation in species occur in Indian waters and to ascertain species through integrative approach.

Table 2. Checklist of the list of Cubozoa species reported globally (Collins and Jarms, 2020; WoRMS, 2024)

<b>Class: Cubozoa</b>	
<b>A. Order: Carybdeida</b>	
<b>I. Family Alatinidae Gershwin, 2005</b>	
<b>1. Genus Alatina Gershwin, 2005</b>	
1. <i>Alatina alata</i> (Reynaud, 1830)	Reported from Indian EEZ
2. <i>Alatina grandis</i> (Agassiz & Mayer, 1902)	
3. <i>Alatina madraspatana</i> (Menon, 1930)	Reported from Indian EEZ
4. <i>Alatina morandinii</i> (Straehler-Pohl & Jarms, 2011)	
5. <i>Alatina pyramis</i> (Haeckel, 1880)	
6. <i>Alatina rainensis</i> Gershwin, 2005	
7. <i>Alatina tetraptera</i> (Haeckel, 1880)	
<b>2. Genus Keesingia Gershwin, 2014</b>	
8. <i>Keesingia gigas</i> Gershwin, 2014	
<b>3. Genus Manokia Southcott, 1967</b>	

9. <i>Manokia stiasnyi</i> (Bigelow, 1938)
<b>II. Family Carukiidae Bentlage, Cartwright, Yanagihara, Lewis, Richards &amp; Collins, 2010</b>
<b>4. Genus <i>Carukia</i> Southcott, 1967</b>
10. <i>Carukia barnesi</i> Southcott, 1967
11. <i>Carukia shinju</i> Gershwin, 2005
<b>5. Genus <i>Gershwinia</i> Wutthituntisil, Xiao &amp; Aungtonya, 2023</b>
12. <i>Gershwinia thailandensis</i> Wutthituntisil, Xiao & Aungtonya, 2023
<b>6. Genus <i>Gerongia</i> Gershwin &amp; Alderslade, 2005</b>
13. <i>Gerongia rifkinae</i> Gershwin & Alderslade, 2005
<b>7. Genus <i>Malo</i> Gershwin, 2005</b>
14. <i>Malo bella</i> Gershwin, 2014
15. <i>Malo filipina</i> Bentlage & Lewis, 2012
16. <i>Malo kingi</i> Gershwin, 2007
17. <i>Malo maxima</i> Gershwin, 2005
<b>8. Genus <i>Morbakka</i> Gershwin, 2008</b>
18. <i>Morbakka fenneri</i> Gershwin, 2008
19. <i>Morbakka virulenta</i> (Kishinouye, 1910)
<b>III. Family Carybdeidae Gegenbaur, 1857</b>
<b>9. Genus <i>Carybdea</i> Péron &amp; Lesueur, 1810</b>
20. <i>Carybdea arborifera</i> Maas, 1897
21. <i>Carybdea brevipedalia</i> Kishinouye, 1891
22. <i>Carybdea confusa</i> Straehler-Pohl, Matsumoto & Acevedo, 2017
23. <i>Carybdea irregularis</i> Straehler-Pohl, 2019
24. <i>Carybdea marsupialis</i> (Linnaeus, 1758)
25. <i>Carybdea murrayana</i> Haeckel, 1880
26. <i>Carybdea rastonii</i> Haacke, 1886
27. <i>Carybdea xaymacana</i> Conant, 1897
28. <i>Carybdea wayamba</i> Karunarathne & de Croos, 2020
<b>IV. Family Tamoyidae Haeckel, 1880</b>
<b>10. Genus <i>Tamoya</i> Mueller, 1859</b>
29. <i>Tamoya ancarnoti</i> Straehler-Pohl, 2020
30. <i>Tamoya gargantua</i> Haeckel, 1880
31. <i>Tamoya haplonema</i> F. Müller, 1859
32. <i>Tamoya ohboya</i> Collins, Bentlage, Gillan, Lynn, Morandini & Marques, 2011
<b>V. Family Tripedaliidae Conant, 1897</b>
<b>11. Genus <i>Copula</i> Bentlage, Cartwright, Yanagihara,</b>
Lewis, Richards & Collins, 2010
33. <i>Copula sivickisi</i> (Stiasny, 1926)

<b>12. Genus <i>Tripedalia</i> Conant, 1897</b>
34. <i>Tripedalia binata</i> Moore, 1988
35. <i>Tripedalia cystophora</i> Conant, 1897
Reported from Indian EEZ
36. <i>Tripedalia maipoensis</i> Sun, Tsui, Wong, Cheung, Ng, Or & Qiu, 2023
<b>B. Order Chirodropida</b>
<b>I. Family Chiropsellidae Toshino, Miyake &amp; Shibata, 2015</b>
<b>1. Genus <i>Meteorona</i> Toshino, Miyake &amp; Shibata, 2015</b>
37. <i>Meteorona kishinouyei</i> Toshino, Miyake & Shibata, 2015
<b>2. Genus <i>Chiropsella</i> Gershwin, 2006</b>
38. <i>Chiropsella bart</i> Gershwin & Alderslade, 2007
39. <i>Chiropsella bronzie</i> Gershwin, 2006
40. <i>Chiropsella rudloei</i> Bentlage, 2013
41. <i>Chiropsella saxoni</i> Gershwin & Ekins, 2015
<b>II. Family Chirodropidae Haeckel, 1880</b>
<b>3. Genus <i>Chironex</i> Southcott, 1956</b>
42. <i>Chironex fleckeri</i> Southcott, 1956
43. <i>Chironex indrasaksajae</i> Sucharitakul, 2017
Reported from Indian EEZ
44. <i>Chironex yamaguchii</i> Lewis & Bentlage, 2009
<b>4. Genus <i>Chirodropus</i> Haeckel, 1880</b>
45. <i>Chirodropus gorilla</i> Haeckel, 1880
46. <i>Chirodropus palmatus</i> Haeckel, 1880
<b>5. Genus <i>Chirodectes</i> Gershwin, 2006</b>
47. <i>Chirodectes maculatus</i> (Cornelius, Fenner & Hore, 2005)
<b>III. Family Chiropsalmidae Thiel, 1936</b>
<b>6. Genus <i>Chiropsalmus</i> Agassiz, 1862</b>
48. <i>Chiropsalmus alipes</i> Gershwin, 2006
49. <i>Chiropsalmus quadrumanus</i> (F. Muller, 1859)
Reported from Indian EEZ
<b>7. Genus <i>Chiropsoides</i> Southcott, 1956</b>
50. <i>Chiropsoides buitendijki</i> (van der Horst, 1907)
Reported from Indian EEZ

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