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Hydrozoans and their fluorescence patterns in Bocas del Toro, Panama

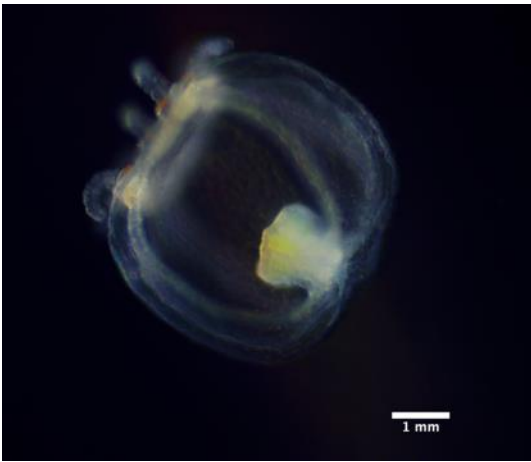
ANTHOATHECATA

Oceaniidae

Turritopsis dohrnii (Weismann, 1883)

Specimen observed: No 1, 23, 37, 39, 40, 56

Medusa obtained from polyp colonies. Immature medusae (24h) with 5-7 tentacles with reddish tentacle bulbs. 4 radial canals. Not fluorescent. Stressed medusa developed into cysts, which didn't show any fluorescence. Polyps showed no fluorescence.



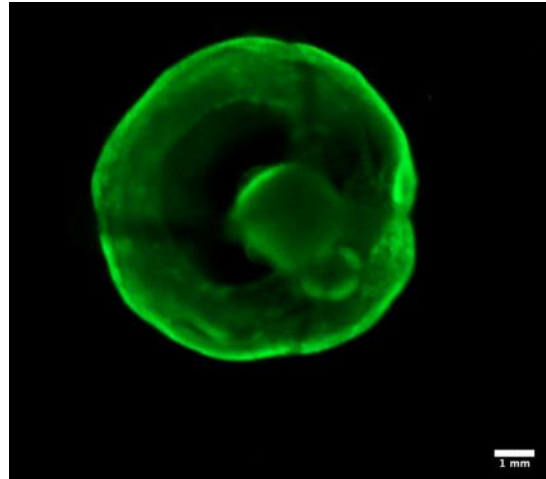
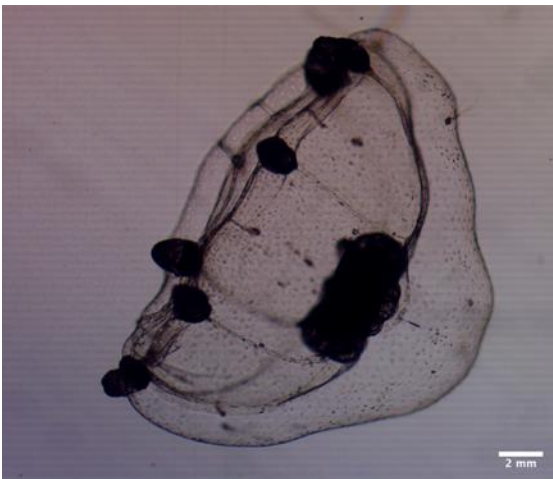
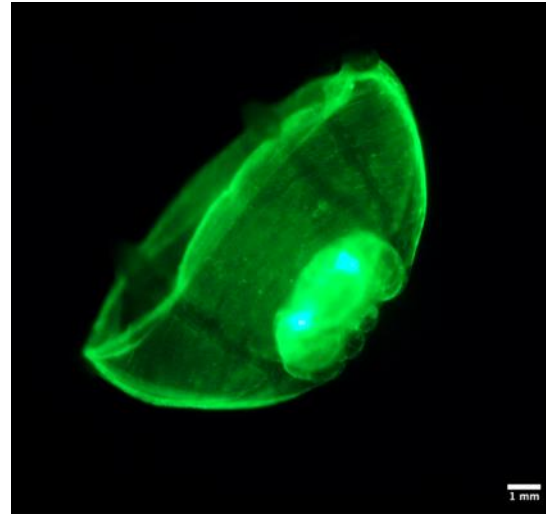
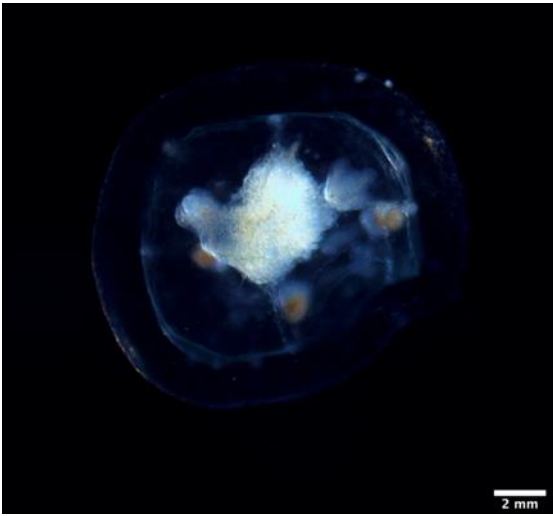
Proboscidactylidae

Proboscidactyla spp. Brandt, 1835

Specimen observed: 2, 84, 85 (Night sampling), 87 (Night sampling)

Medusa. All specimens juveniles. 4-6 tentacles with linear arrays of nematocyst patches of variable length on umbrella, starting from bell margin and alternating with tentacles, reaching mid part of bell. 4-6 radial canals, starting to branch close to the manubrium (in the older specimen). Nematocysts scattered in the

bell. Growing blastostyles (polyp-like structures) attached to radial canals and/or manubrium (but specimen was not fully grown) in 2 of 3 specimens observed. Endogenous fluorescence observed in umbrella, manubrium, circular canal, velum and gonads (blastostyles).

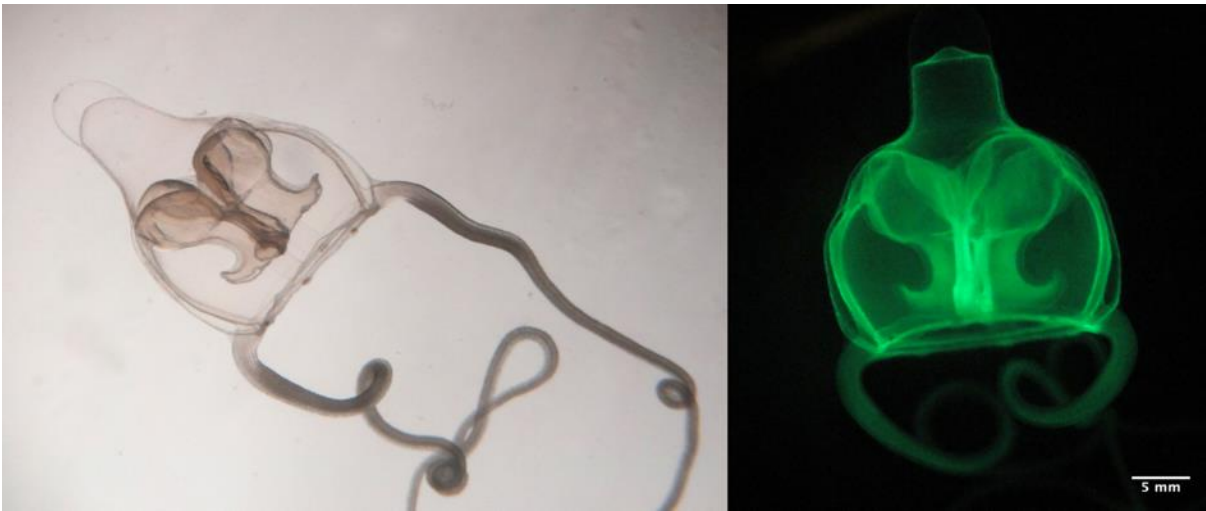


Pandeidae

Amphinema sp. Haeckel, 1879

Specimen observed: 3, 4, 21

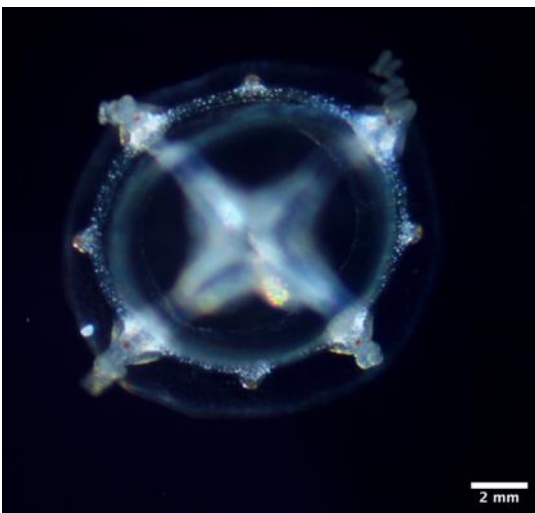
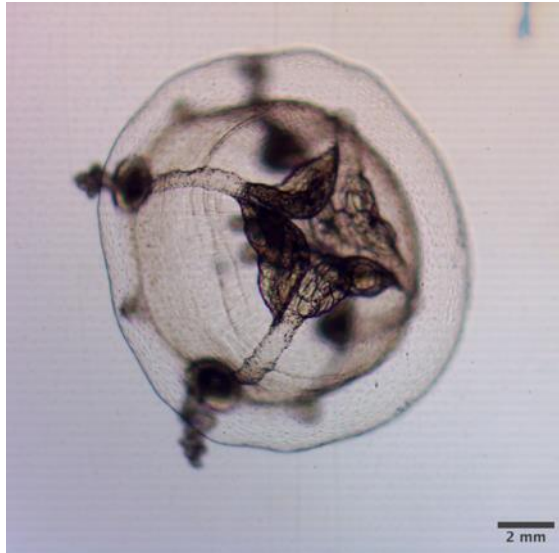
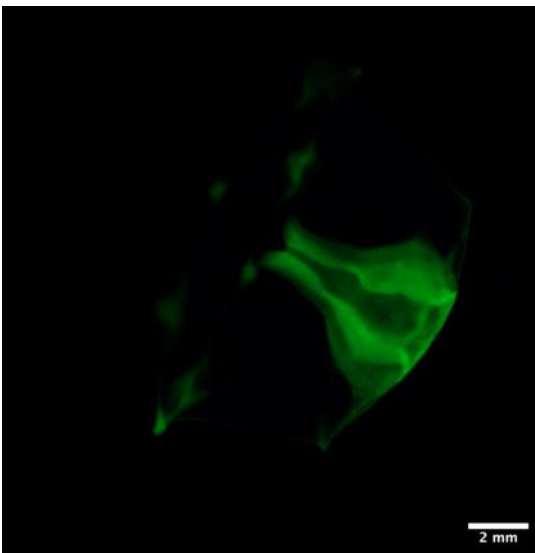
Medusa immature, no gonads developed. Two large tentacles, opposite of each other, without ocelli. 6-7 rudimentary bulbs on bell margin, each with an orange ocelli. Slightly folded manubrium, mouth cross-shaped with 4 lips. 2 radial canals (with mesenteries?). Apical process present. Fluorescence in (sub)umbrella, manubrium, lips, radial and circular canals, tentacles.



Pandeidae sp. Haeckel, 1879

Specimen observed: 83

Medusa with 4 tentacles and 4 rudimentary bulbs with red ocelli. Four radial canals, with mesenteries. Manubrium cross-shaped, flaring. Immature specimen without gonads. Endogenous fluorescence in manubrium and tentacle bulbs.



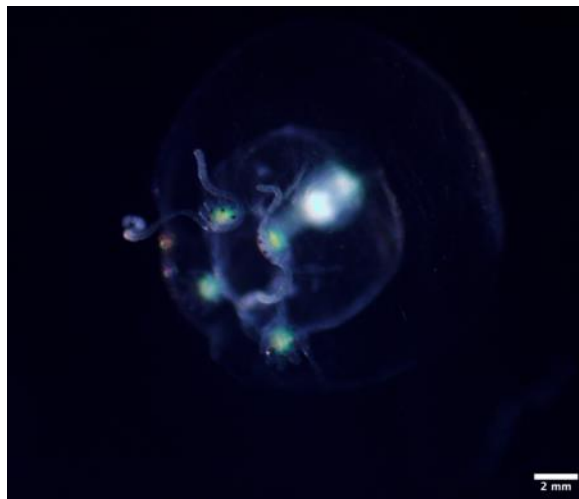
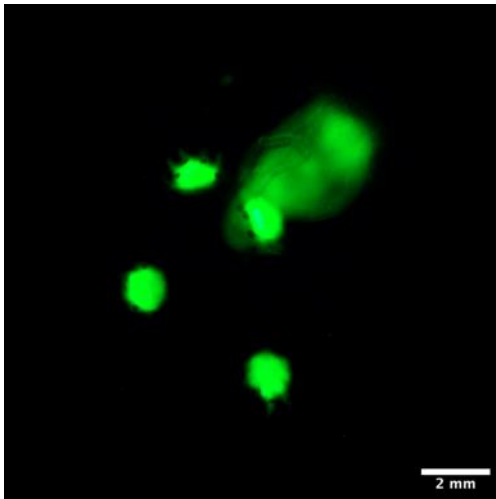
Bougainvillidae

Bougainvillia rugosa Clarke, 1882

Specimen observed: 49

Reported distribution: USA, Florida (Calder, 2019); Brazil (Oliveira et al, 2016); New record for Caribbean Sea, Panama

Medusa with 4 perradial marginal bulbs with two or more long tentacles and 4-6 rudimentary tentacles (but might have been broken during sampling). Each tentacle has one dark red ocellus. Four oral tentacles ending in nematocyst clusters. Thick and round umbrella. Endogenous fluorescence present in marginal bulbs and manubrium.



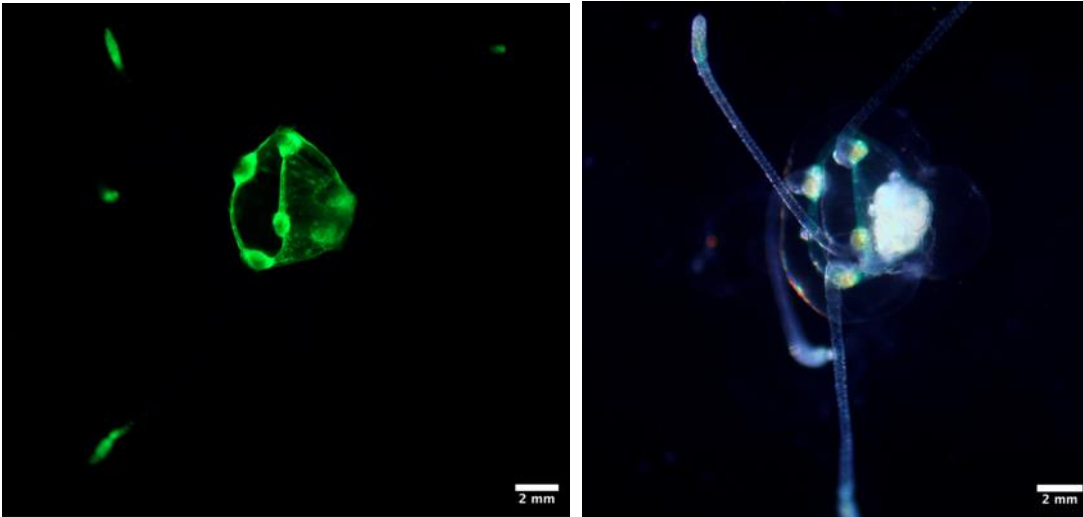
Cytaeididae

Cytaeis tetrastyla Eschscholtz, 1829

Specimen observed: 80

Previous distribution: Pacific Ocean (Oliveira et al, 2016; GBIF), Caribbean Sea (Puerto Rico, Cuba) (GBIF); New record for Caribbean Sea, Panama

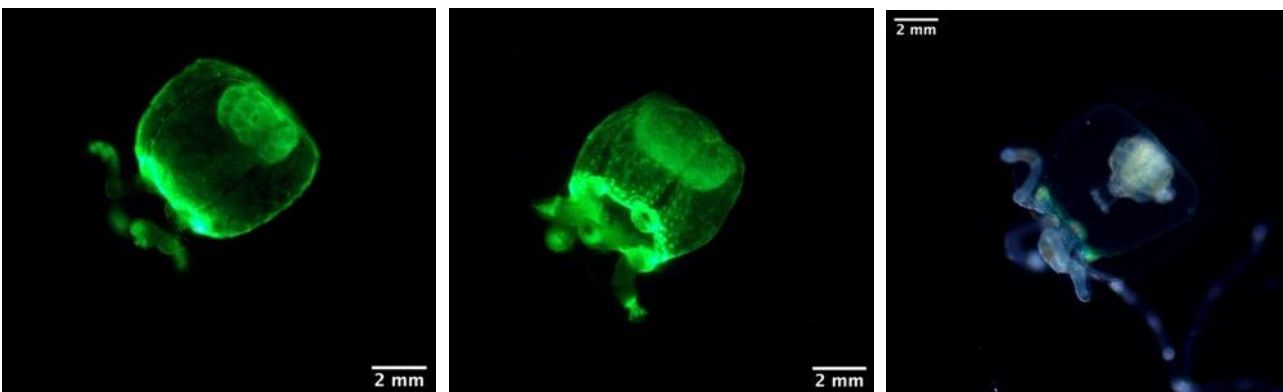
Medusa with 4 strong tentacles with thickening at the tips. Large tentacle bulbs attached to umbrella with an elongated patch. Oral tentacles present. No ocelli. Endogenous fluorescence in (sub)umbrella, tentacle tips, tentacle bulbs, manubrium, circular canal and nematocyst clusters in the umbrella (?).



Cytaeis sp. Eschscholtz, 1829

Specimen observed: 86, 88

Medusa with 4 strong tentacles with thickening at the tips. Green coloration within marginal bulbs and the circular canal and orange coloration on the tentacles and manubrium. Thin radial canals. No ocelli. Manubrium bears many gonads (eggs in our specimen). At least 6 capitate oral tentacles. Small medusa bud on the manubrium. Fluorescence in (sub)umbrella, circular canal, gonads, probably manubrium, tentacle tips and tentacle bulbs.



Eudendriidae

Eudendrium sp. Ehrenberg, 1834

Specimen observed: 62

Polyp with hypostome and long pedicel. Not reproductive. No fluorescence observed.

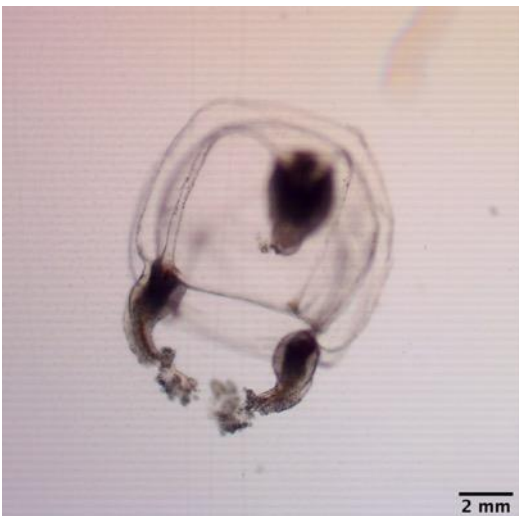


Zancleidae

Zanclea sp. Gegenbaur, 1856

Specimen observed: 77

Medusa with 2 tentacles with tapering ends and nematocyst clusters at the tips. Red coloration in tentacles. Two small bulbs between the two large tentacles might be developing tentacles. Two radial canals. Immature specimen only without gonads. No fluorescence observed.



Pennariidae

Pennaria disticha Goldfuss, 1820

Specimen observed: 25

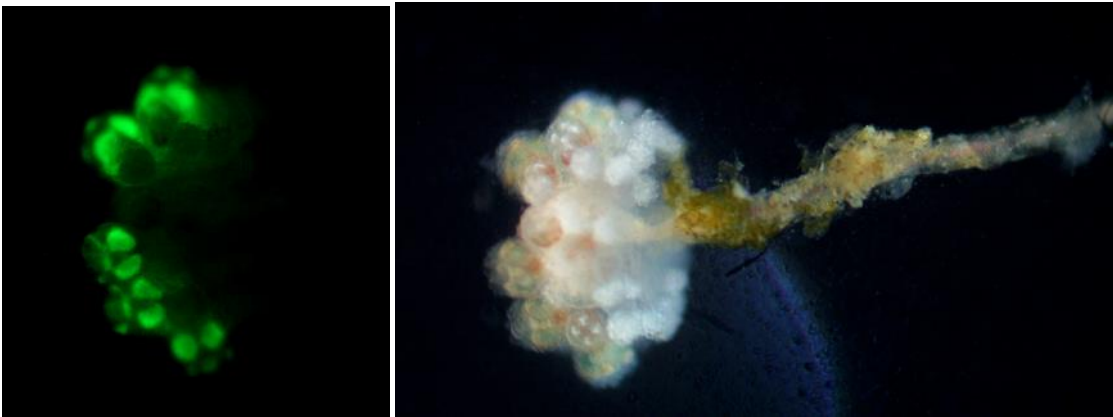
Polyp not fluorescent (no pictures taken)

Sphaerocorynidae

Sphaerocoryne sp. Pictet, 1893

Specimen observed: 33

Polyp stolonial colony of about 1 cm. Capitulate tentacles. Gonophores develop to free medusae and are located at the hypostome of the polyp. Pedicels were embedded in an unidentified, green-colored demosponge. The tentacles, especially the capitulate ends, showed fluorescence.



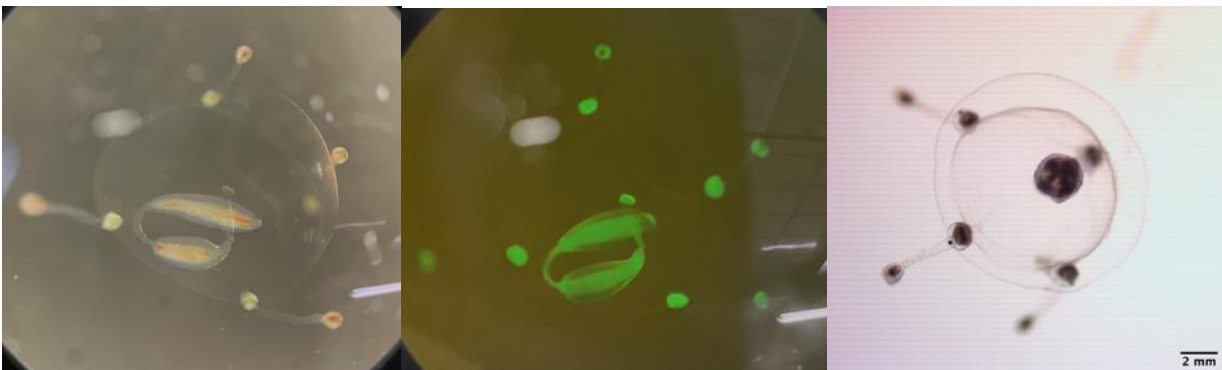
Corynidae

Slabberia strangulata (McCrary, 1859)

Specimen observed: 58, 78

Previous distribution: USA, Gulf of Mexico, and Florida (Schuchert & Collins, 2021 and references within);
New record for Caribbean Sea, Panama

Medusa with 4 capitulate tentacles and black ocelli at tentacle bulbs. The manubrium has two clearly separate gonad patches. Fluorescence observed in tentacle bulbs, nematocyst clusters at the tentacle tips, manubrium and gonads.



Tubulariidae

Zyzyzus warreni Calder, 1988

Specimen observed: 16

Polyp with tubular pedicel up to 1 cm. Sporosacs develop above the tentacle-whorl on the hypostome of the polyp. Polyps were growing on an unidentified demosponge. Slight fluorescence was observed in the complete polyp. Additionally, associated algae growing at the base of the polyps expressed red and orange fluorescence.



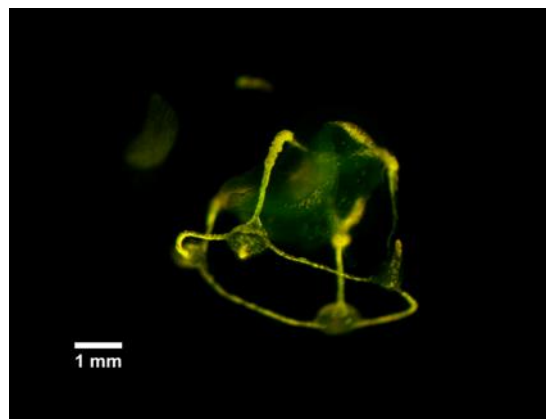
Corymorphidae

Corymorpha gracilis (Brooks, 1883)

Specimen observed: 17, 24

Previous distribution: USA, Gulf of Mexico and Florida (Schuchert & Collins, 2021 and references within);
 New record for Caribbean Sea, Panama. The genus *Corymorpha* has no published records for the Caribbean side of Panama (GBIF).

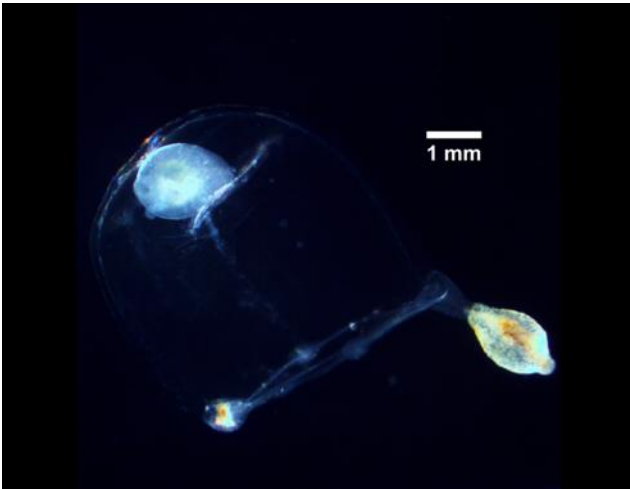
Medusa with four tentacle bulbs and one strong tentacle. The four radial canals and the circular canal are yellowish. Pointed apical process with yellowish apical canal. Our specimens with broad manubria, usually elongated in this species. Yellow extrinsic fluorescence observed in the circular and radial canals, tentacle bulbs and tip, and apical canal. Slight green fluorescence in the manubrium (developing gonads?).



Corymorpha sp.

Specimen observed: 79

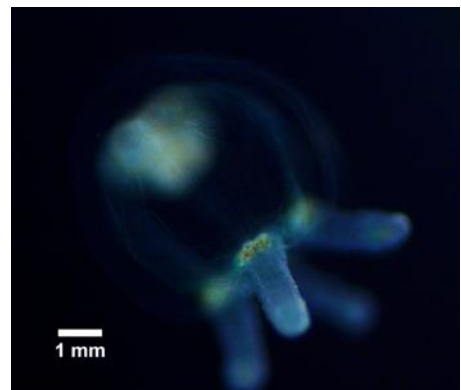
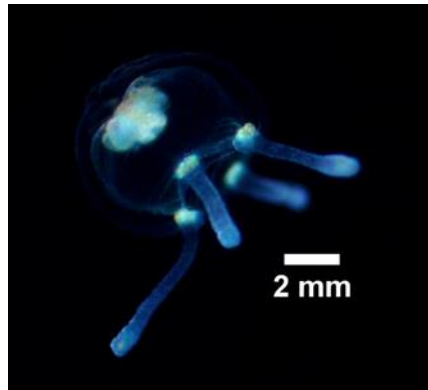
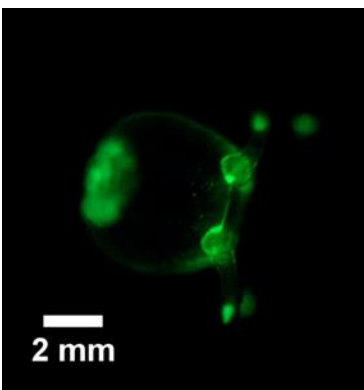
Medusa juvenile with two marginal tentacle bulbs and one enlarged tentacle. Two small developing bulbs visible on the margin. Developing bulbous manubrium. No fluorescence observed.



Filifera sp. 1 (Filifera III or IV)

Specimen observed: 51

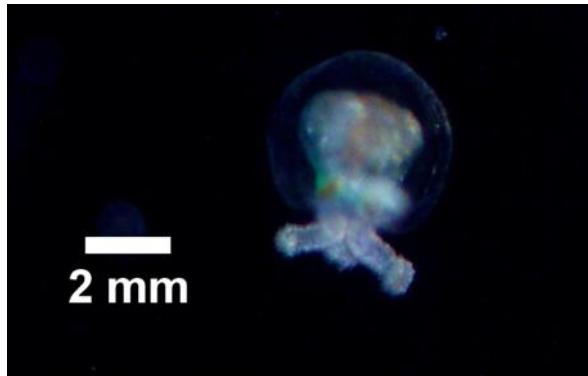
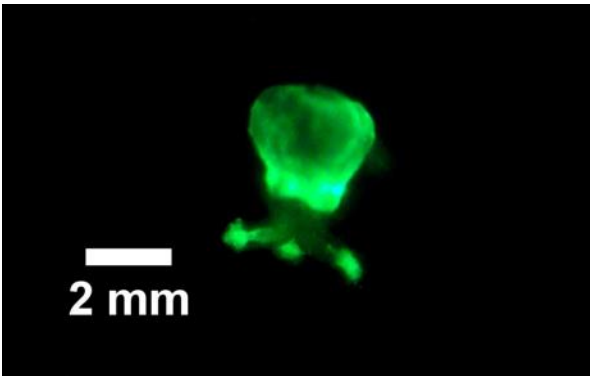
Medusa with 4 strong tentacles ending in a bulbous swelling. Marginal bulbs greenish with dark granules, no ocelli. Mouth with 3 or more small lips. Four radial canals. Description fits well to the family Eucodoniidae, however no unambiguous identification possible due to lack of information for this family and region. Immature specimen (?). Fluorescence pattern fits to Cytaeidae, with endogenous fluorescence in tentacle tips, bulbs, (sub)umbrella, circular canal and manubrium. Maybe also nematocyst clusters on the bell.



Filifera sp. 2 (Filifera III or IV)

Specimen observed: 55

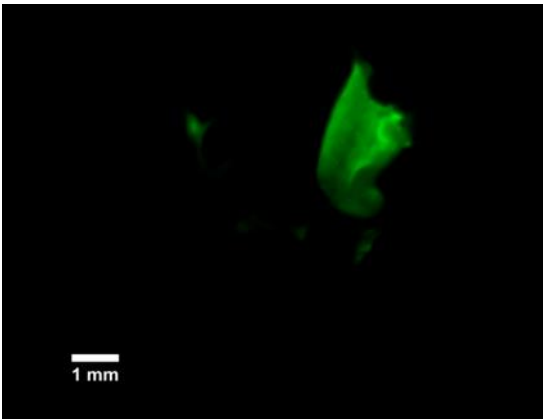
Medusa with three (capitate?) tentacles (probably still developing). Fluorescence observed in the tentacles, tentacle tips and the manubrium.



Anthoathecata sp. 1

Specimen observed: 5

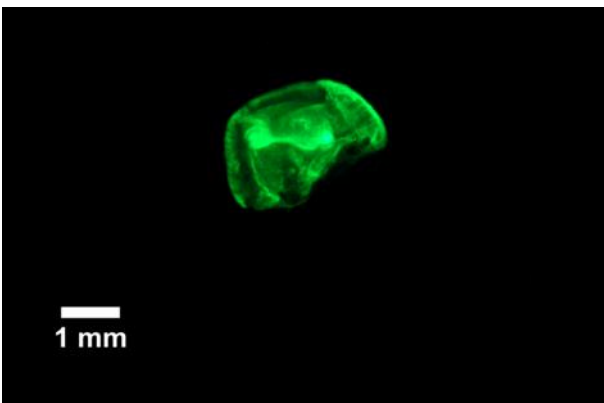
Medusa with 2 thick tentacles with strong red coloration. Four radial canals, maybe more developing. Small bulbs and developing buds (?) on the circular canals. Manubrium 2/3 of subumbrella length. No ocelli observed. Specimen was immature, not further identified. Possible candidates are Pandeidae (fits to the observed fluorescence pattern) or Zancleidae. Fluorescent in Manubrium and tentacle bulbs.



Anthoathecata sp. 2

Specimen observed: 67

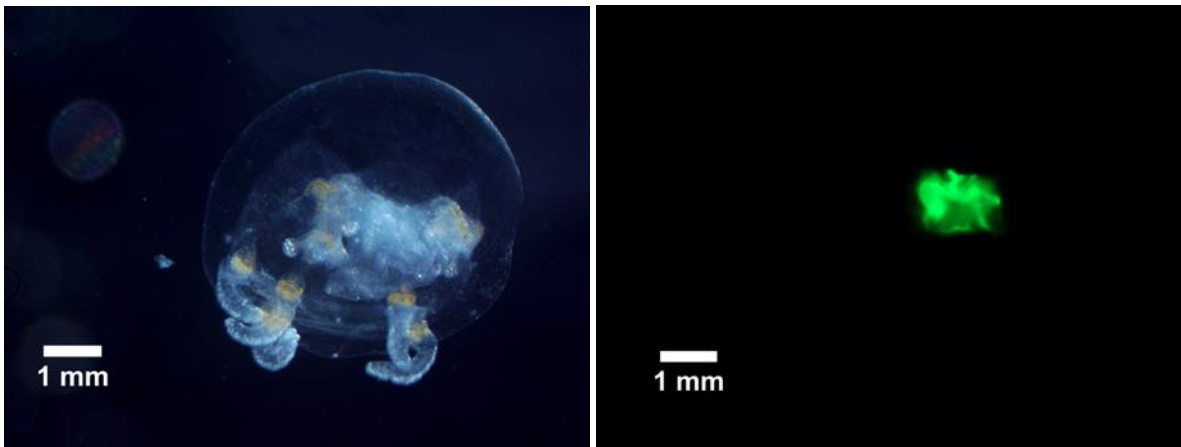
Medusa with four tentacles broadened at the tips. Has black pigments in the tentacle bulbs. Probably a juvenile *Anthoathecata*. Fluorescence observed in the complete (sub)umbrella and manubrium.



Anthoathecata sp. 3

Specimen observed: 82

Medusa with 5 tentacles and orange tentacle bulbs. Oral tentacles present. Manubrium broadened and with intense green fluorescence.



LEPTOTHECATA

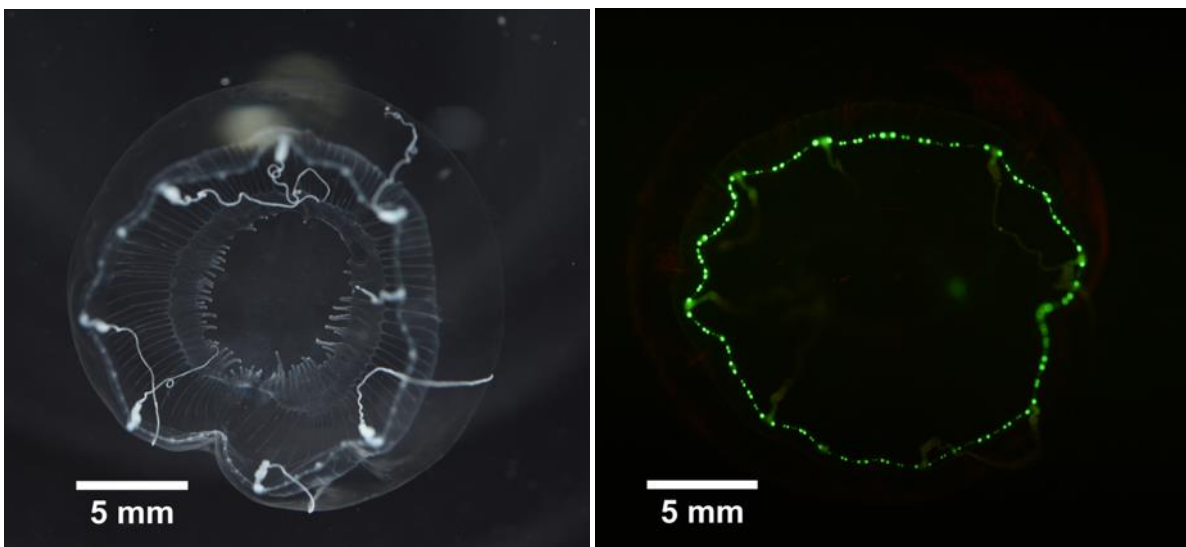
Aequoreidae

Aequorea sp. Péron & Lesueur, 1810

Specimen observed: 59, 60, 65

Previous distribution for genus: Gulf of Mexico, Florida, Bahamas (Schuchert & Collins, 2021 and references within); New record for Caribbean Sea, Panama? The genus *Aequorea* has no published records for the Caribbean side of Panama (GBIF).

Medusa large up to 10 cm. Very transparent with thick mesoglea. Tentacles are numerous. Fluorescent in the tentacle bulbs and beginning of tentacles.

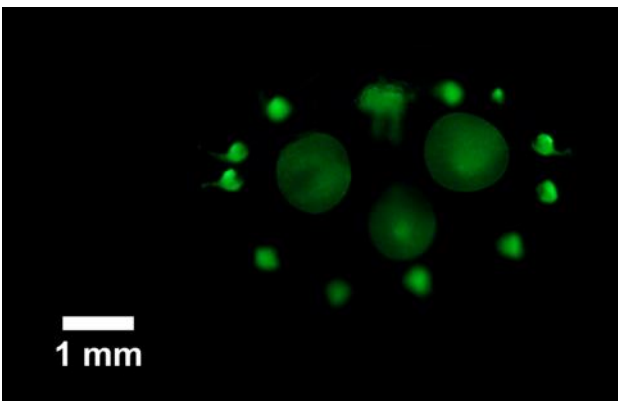
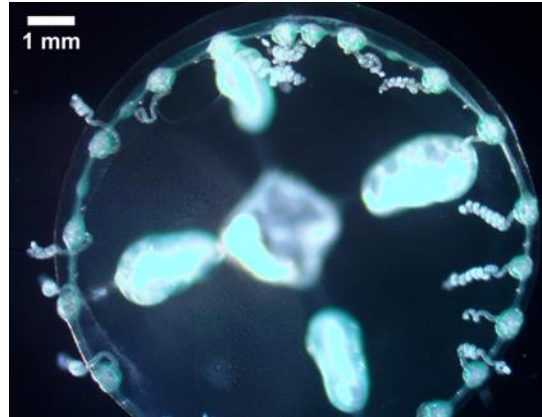
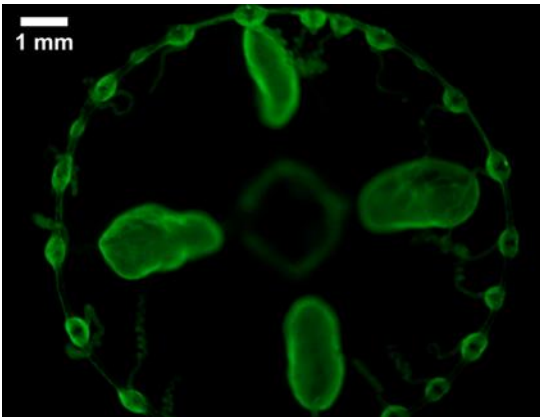


Campanulariidae

Clytia linearis (Thorneley, 1900)

Specimen observed: 19, 90

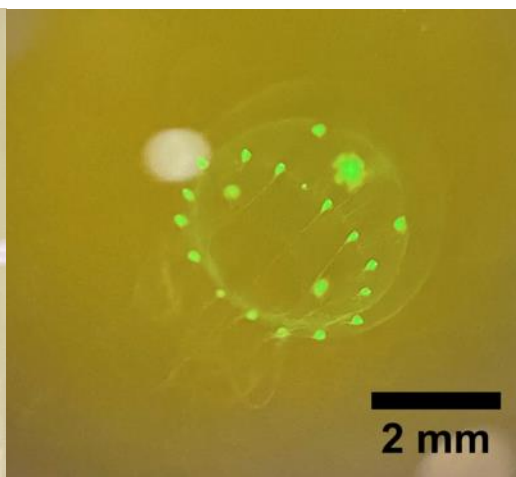
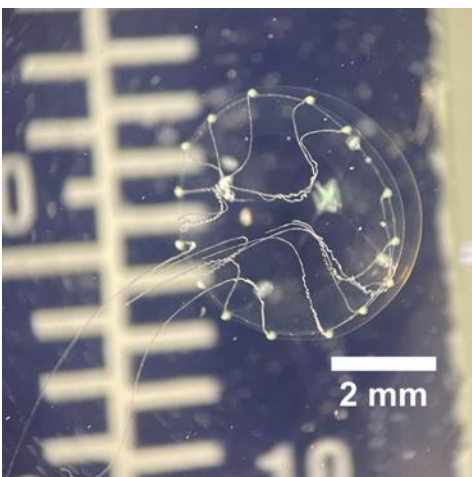
Medusa with elongated and/or bulbous gonads extending almost complete radial canals. Four radial canals. Up to 25 tentacles and >25 statocysts in irregular position. Mouth broad. Fluorescence observed in the gonads, tentacle bulbs and slightly in the manubrium.



Clytia sp. 1

Specimen observed: 27, 30

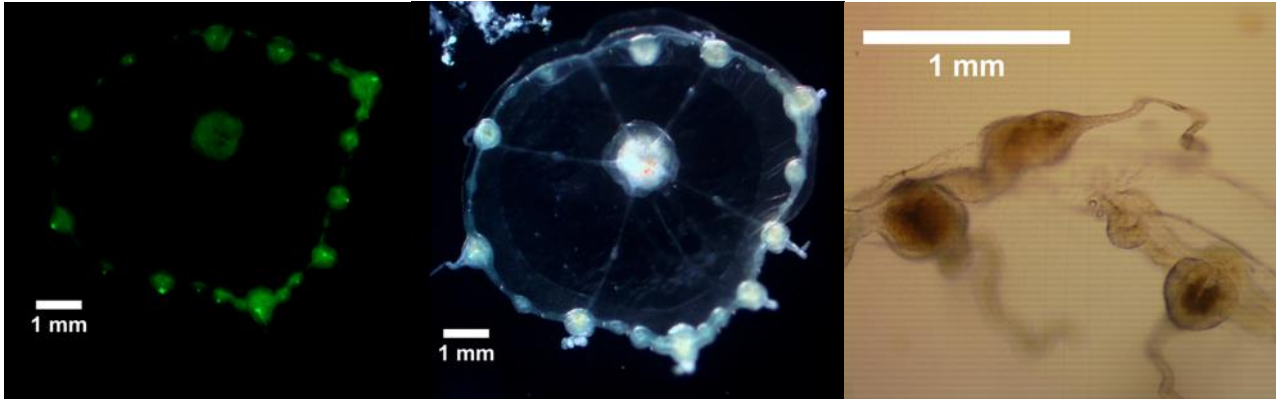
Medusa with four small, circular gonads along the radial canals, approximately half-way between manubrium and margin. Typical *Clytia* medusa, thus not further identified to species. Fluorescence observed in gonads, manubrium and tentacle bulbs.



? *Clytia* sp.2

Specimen observed: 9, 20, 32

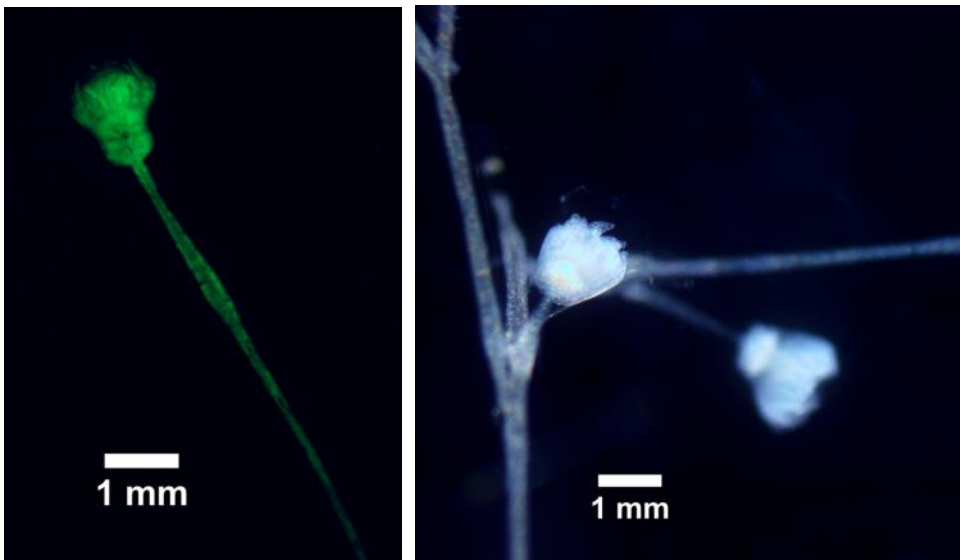
Medusa with 5 radial canals and small, circular gonads developing at the center of the canals. Similar to the species described as *Clytia* spec. 2 in Schuchert & Collins 2021. In our specimen 15-20 tentacles (some developing), with more statocysts than tentacles between the marginal bulbs and sometimes grouped. Fluorescence observed in tentacle bulbs, manubrium and gonads (slightly).

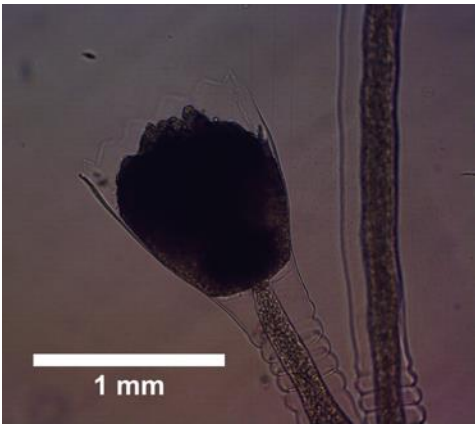


Clytia sp. 3

Specimen observed: 44

Polyp colonies typical for the family, erect and monosiphonic. Hydrotheca with indented rim (teeth), quite broad and short. Colony observed was not reproductive and no further identification was possible based on the material. Long internodes between the hydrotheca. Fluorescent in the entire polyp and tissue within the pedicel.

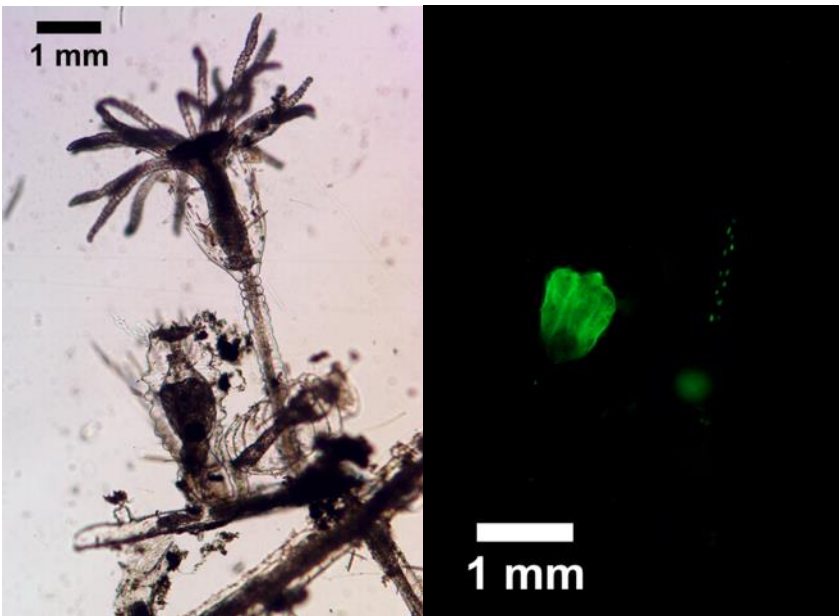




Clytia cf. hemispherica (Linnaeus, 1767)

Specimen observed: 75

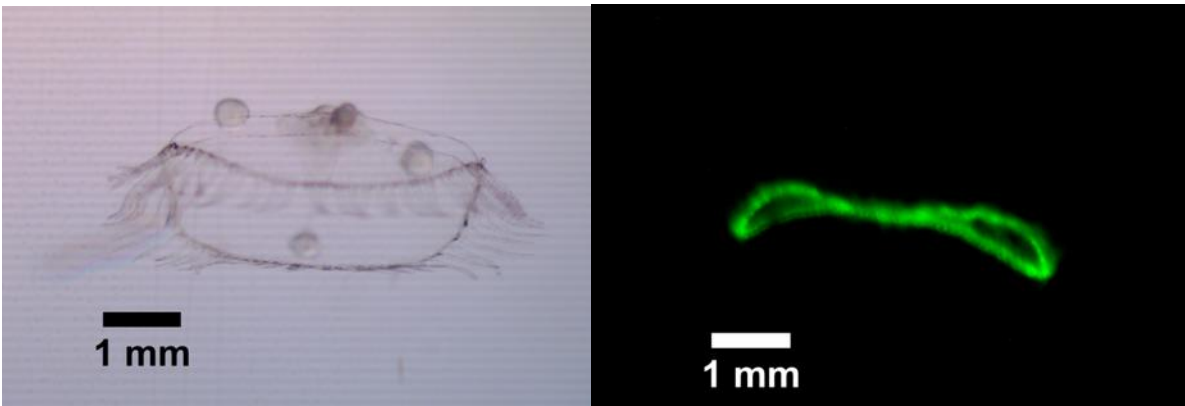
Polyp (identified as in Miglietta et al. 2018). Fluorescent in the medusa bud and single dots within the tissue of the pedicel.



Obelia sp. Péron & Lesueur, 1810

Specimen observed: 11 (and more not recorded with picture)

Medusa typical for the genus with flattened umbrella, numerous marginal tentacles and 4 gonads central of the 4 radial canals. Tentacle bulbs and/or circular canal fluorescent.

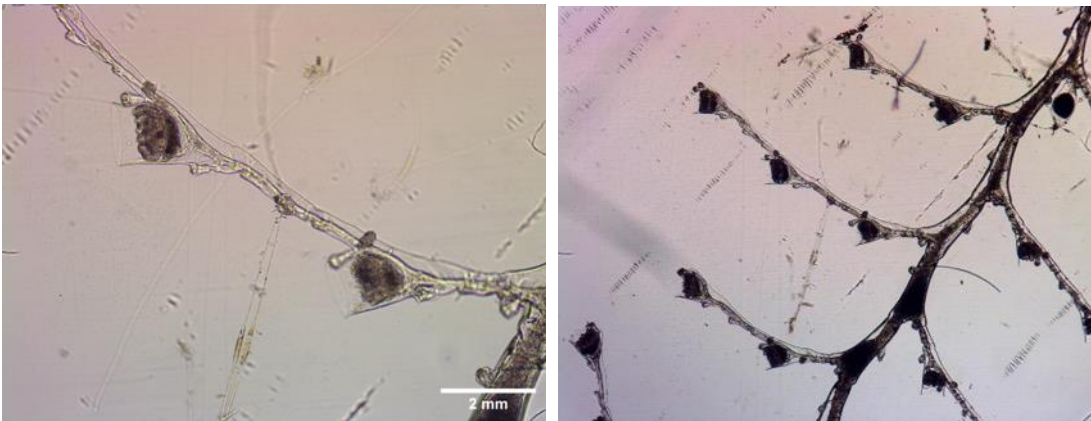


Halopteriidae

Halopteris sp. Allman, 1877

Specimen observed: 76

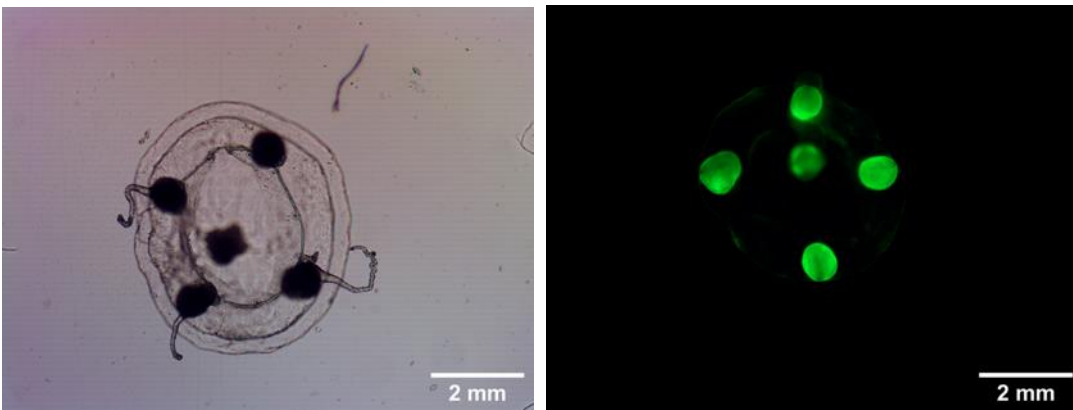
No fluorescence observed.

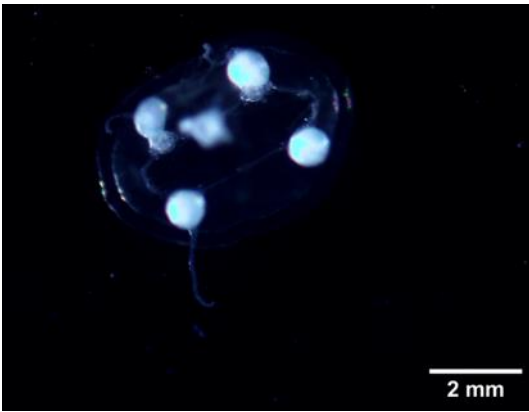


Leptothecata sp. 1

Specimen observed: 61

Medusa unidentified with 4 thick tentacle bulbs (fused with gonads?), 4 radial canals and small manubrium. 10 open statocysts. Fluorescence in manubrium, gonads, maybe tentacle bulbs (?).

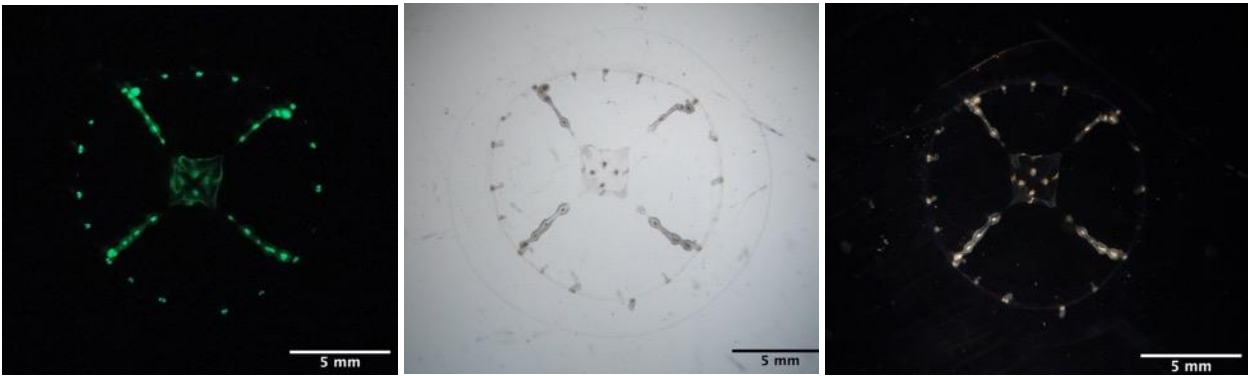




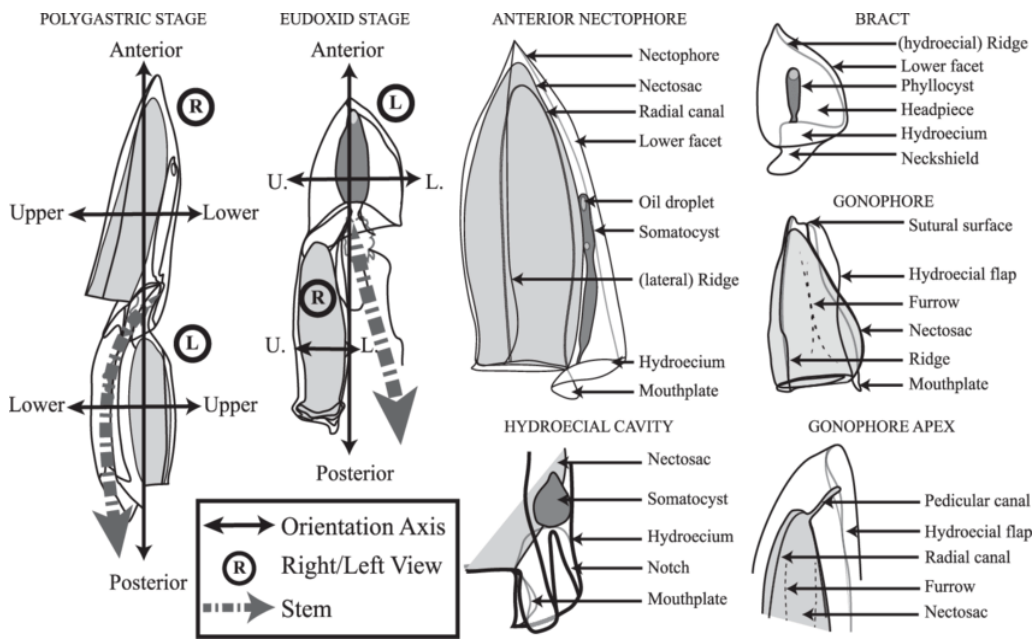
Leptothecata sp. 2

Specimen observed: 28, 29, 72

Medusa unidentified but found abundant in the collected samples. Thick mesoglea, with 4 radial canals and pearl-like arrange gonads along the canals. With statocysts. 18-22 tentacle bulbs with short tentacles. Manubrium short and flaring. Fluorescent in tentacle bulbs, gonads, parts of the manubrium.



SIPHONOPHORAE



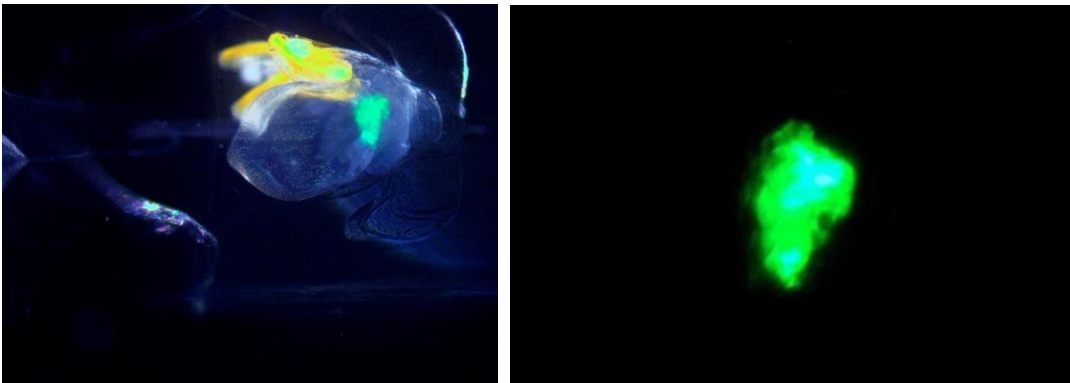
Anatomy overview and terminology. Image taken from Grossmann et al., 2014

Abylidae

Enneagonum hyalinum Quoy & Gaimard, 1827

Specimen observed: 6 (Eudoxid)

Fluorescence observed in somatocyst and/or phyllocyst.



Ceratocymba dentata (Bigelow, 1918)

Specimen observed: 69 (Anterior nectophore)

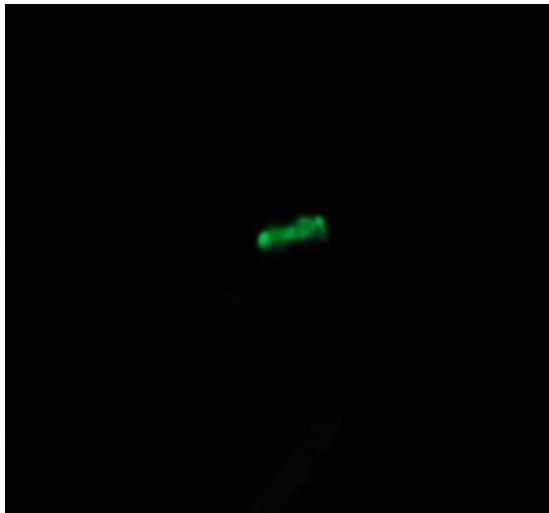
No fluorescence observed.



Abylopsis tetragona (Otto, 1823)

Specimen observed: 70 (Eudoxid)

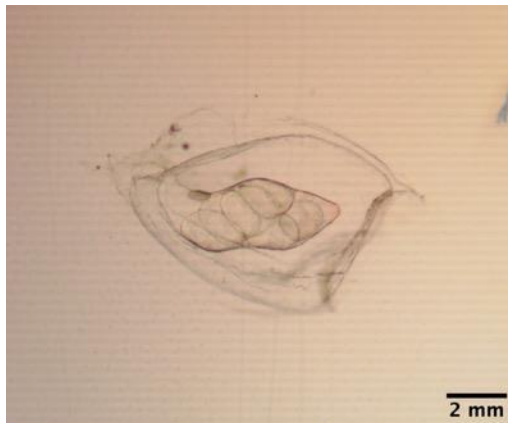
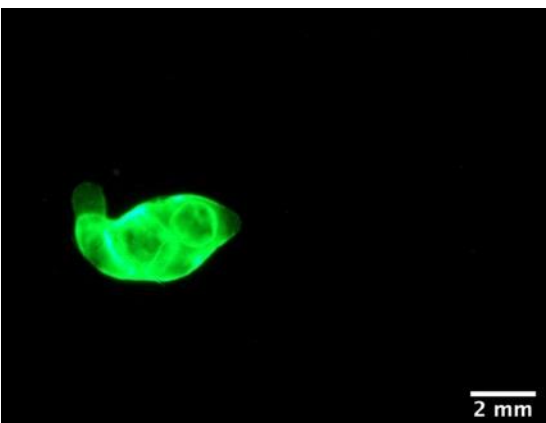
Fluorescence observed in the yellow-colored patch of the gastrozoid.

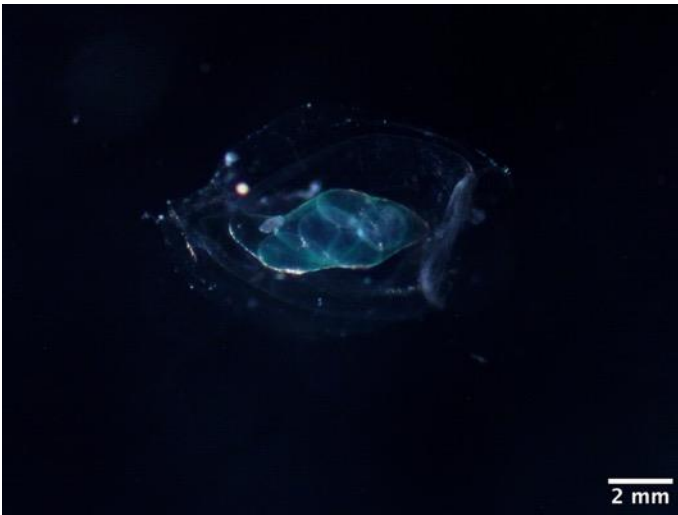


Abylidae sp. L. Agassiz, 1862

Specimen observed: 36 (Eudoxid)

Fluorescence of gonads (eggs) and surrounding tissue.





Diphyidae

Diphyes bojani (Eschscholtz, 1825)

Specimen observed: 7 (anterior nectophore)

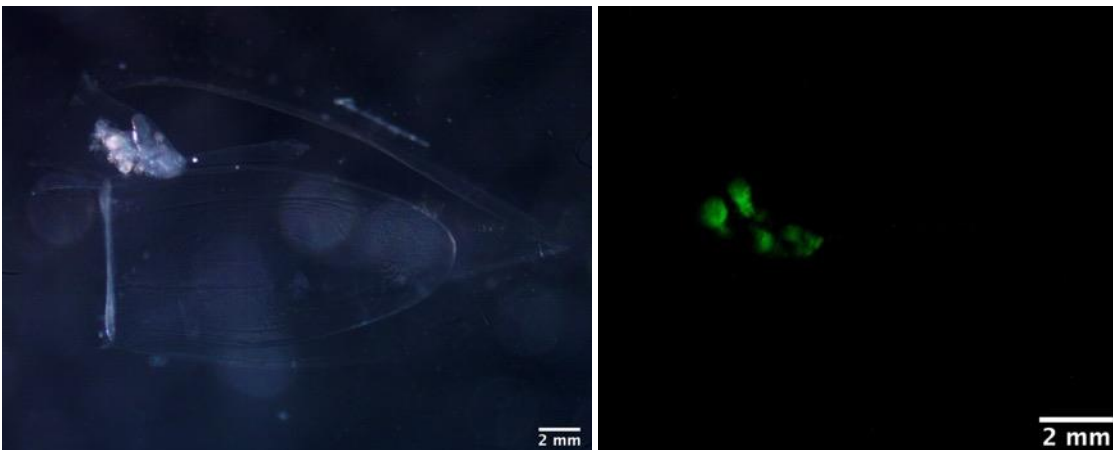
No fluorescence observed.



Muggiaea kochii (Will, 1844)

Specimen observed: 22 (anterior nectophore)

Fluorescence on gastrozoid



Muggiaea cf. atlantica Cunningham, 1892

Specimen observed: 48 (anterior nectophore)

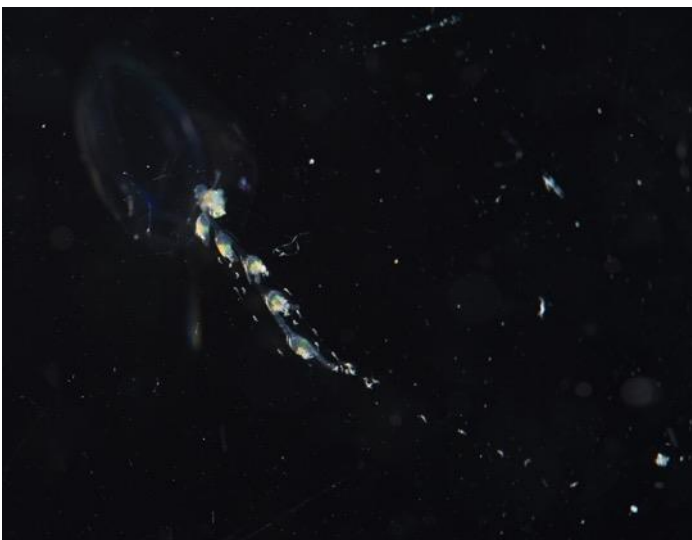
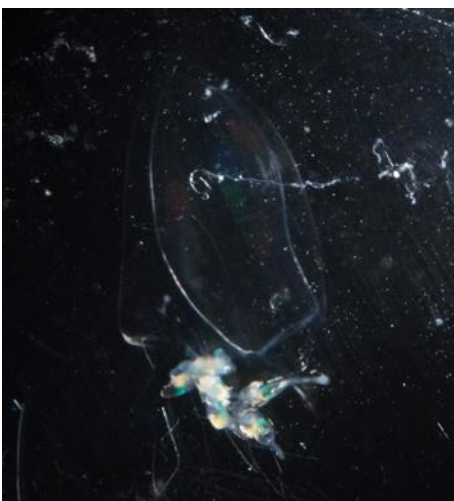
Fluorescence in part of gastrozoid.



Calycophora sp. 1

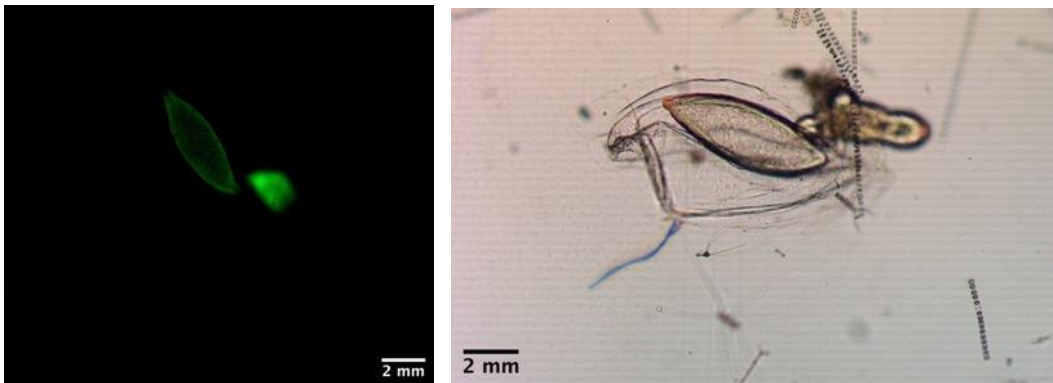
Specimen observed: 71 (anterior nectophore)

Fluorescence observed in parts of gastrozoids (mouth?)

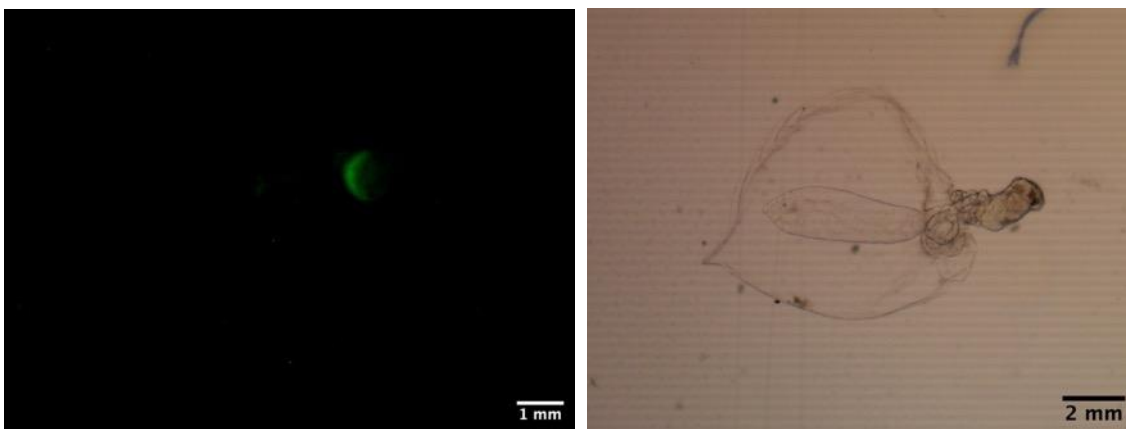


Various calyphoran eudoxids:

Specimen 8: Fluorescence in unidentified part and gonads (developing)



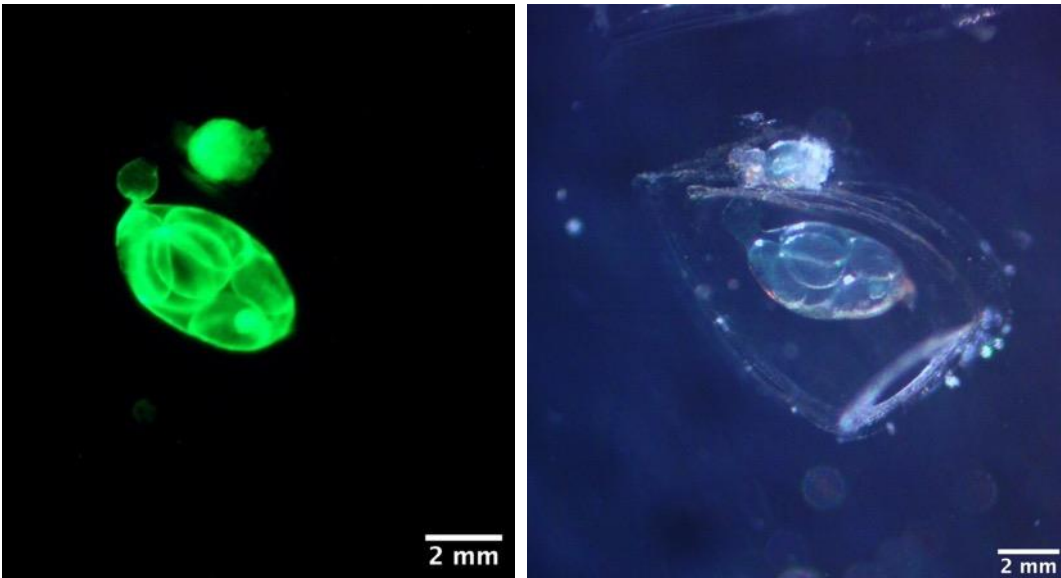
Specimen 35: Fluorescence in unidentified part



Specimen 43: Fluorescence in unidentified structure



Specimen 47: Fluorescence in gonads (eggs) and surrounding tissue, as well as unidentified part.



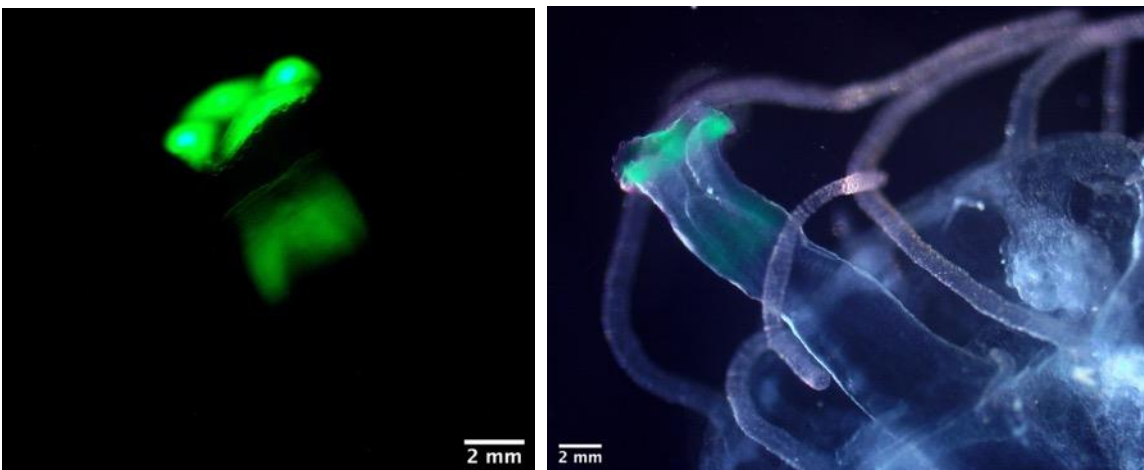
LIMNOMEDUSA

Gerioniidae

Liriopse tetraphylla (Chamisso & Eysenhardt, 1821)

Specimen observed: 34, 45, 46, 50, 63

Medusa with four long tentacles and four short interradial tentacles. Gonads as wide and heart-shaped patches. Stomach on long gastric peduncle with four lips. Different stages were observed, and juveniles did not fluoresce (no manubrium developed yet). In adults fluorescence is observed at the four oral lips or lobes with an additional second band of fluorescence at the end of the gastric peduncle. Green coloration on the mouth and manubrium is already visible under normal light conditions, very strong fluorescence.



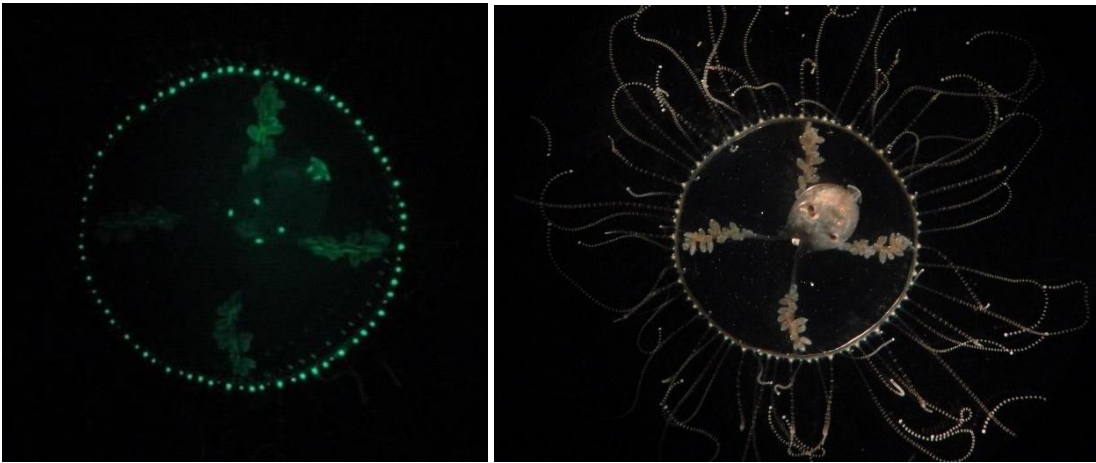
Olindiidae

Gonionemus vertens A. Agassiz, 1862

Specimen observed: 52, 53, 54

Previous distribution: Argentina (Rodriguez et al, 2014); USA (GBIF); New record for Caribbean Sea, Panama

Medusa with 4 radial canals and numerous marginal tentacles with adhesive pad at ends of each tentacle. Gonads along the radial canals, folded and forming elongated 'leaves'. Gastric peduncle and manubrium extended in two individuals (see pictures). Fluorescence is observed in tentacle bulbs, oral lobes or lips, gonads and the crossing between radial canals and manubrium. Collected from under docks during the night using a flashlight.



NARCOMEDUSA

Cuninidae

Cunina octonaria McCrady, 1859

Specimen observed: 18, 26, 38

Previous distribution: USA, Gulf of Mexico, and Florida (Schuchert & Collins, 2021 and references within); Columbia to Argentina (Oliveira et al, 2016 and references within). New record for Caribbean Sea, Panama

Medusa with eight tentacles originating in middle of pocket base with a short, conical root; tentacles projecting from exumbrella at about $\frac{1}{4}$ between margin and apex of bell. Bell margin between pairs of tentacles lobed, with 4-5 otoporphae and statocysts. Circular stomach, about half the diameter of bell, without mesoglea cone, with eight broad, manubrial pockets shaped like an isosceles trapezium.

