**Emblemariopsis dianae**, a new species of chaenopsid fish from the western Caribbean off Belize (Blennioidei)

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**Abstract**

*Emblemariopsis dianae*, new species, is described based on 35 males. It is easily distinguished from its congeners by the orange flag distally between the first three dorsal fin spines, without a whitish band below the flag, and modally three mandibular sensory pores instead of the four that are typical of most chaenopsids. The new species exhibits significant variation in number of cephalic sensory pores in selected series and in details of the caudal skeleton, including variation in the only known synapomorphy of the genus *Emblemariopsis*, the shape and size of the neural spine of the penultimate vertebra. The new species has been found only in low-energy, mid-shelf, lagoonal waters of the Belize Barrier Reef.

**Zusammenfassung**


**Résumé**

*Emblemariopsis dianae*, nouvelle espèce, est décrit sur base de 35 mâles. Il se distingue aisément de ses congénères par l’étendard orange distal entre les trois premiers rayons durs de la dorsale, sans bande blanchâtre sous l’étendard, et strictement trois pores sensoriels mandibulaires au lieu des quatre typiques pour la plupart des chaenopsidés. La nouvelle espèce montre une différence significative quant au nombre de pores céphaliques en rangées sélectionnées et quant à des détails du squelette caudal, y compris quant à la seule synapomorphie connue dans le genre *Emblemariopsis*, la forme et la taille de l’épine neurale de l’avant-dernière vertèbre. La nouvelle espèce a été trouvée uniquement dans des eaux lagunales calmes et peu profondes de la Barrière de Corail de Belize.

**Introduction**

Of the 11 species of the chaenopsid tube-blenny genus *Emblemariopsis* (*sensu* Hastings, 1997; the species summarized with keys by Williams, 2002), seven are known to occur on the outer barrier reef platform of the Belize Barrier Reef complex. They are most frequently found in high-energy areas along the outer edge of the barrier reef (Smith et al., 2003), such as at...
the Smithsonian Institution’s marine laboratory at Carrie Bow Cay. To these can be added a new species from the lower energy, quieter waters in the lagoonal setting of the mid-shelf cays, including the Rhomboidal Cays, about 20 km south-west of Carrie Bow Cay, and the cays just to the north (Wee Wee) and north-west (Blue Ground Range) of the Rhomboidals.

The Rhomboidal Cays are a group of mangrove islands in a lagoonal mid-shelf region about 10 km west of the outer edge of the barrier reef. They are unusual in that the mangroves are anchored to a live and lush coral reef dominated by Agaricia tenuifolia Dana, 1846 (a thin-leaf lettuce coral), rather than to mud (McIntyre and Rützler, 2000). Included are patch reefs with well-developed mounds of coral heads between and around these mangrove islets (especially on the windward sides). The northern group of cays within the Rhomboidals is referred to as the Pelican Cays, and these structurally defined cays have been the subject of extensive biological and geological study by Smithsonian scientists and their colleagues visiting the Carrie Bow Cay lab. A survey of the Pelican Cays was conducted between 1997 and 2001 to assess this ichthyofauna and to compare it with that of other regions of the Belize Barrier Reef complex (Smith et al., 2003). During this survey, a new species of chaenopsid blenny was found in the patch reefs protecting the mangrove cays, and it is described below.

Males of the new species have a distinctively coloured orangish distal margin or “flag” in the anterior part of the spinous dorsal fin. Unlike some other species of Emblemariopsis, this region of the dorsal fin is not prominently elevated. The new species also is unique in having modally three mandibular sensory pores, whereas most chaenopsids have four. Considerable variation is present in the caudal skeleton, but most individuals have a broad truncate neural spine on the penultimate vertebra, a feature unique among chaenopsids to Emblemariopsis.

Methods
Specimens are deposited at the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM, which includes collections of the former United States National Museum) and the Scripps Institution of Oceanography, La Jolla, California (SIO). All collections were made by scuba diving in relatively shallow water, about 5 m deep or less.

The first two specimens of the new species were collected during the January-February 2001 segment of the Pelican Cays Fish Survey (Smith et al., 2003) at coral heads off North Elbow Cay (northern Rhomboidal Cays) at a small rotenone station (JCT 2001-1) by J.C. Tyler and W. P. Davis. To date, these are the only specimens of the new species that have been collected with rotenone. A few days later, in the central Pelican Cays, the same collectors tried to obtain additional specimens of the new species specifically using quinaldine sulphate (1 gram per 500 ml water), and four individuals (JCT 2001-18) were taken from holes in coral heads. Subsequently, in March-April 2001 and in March 2002, special efforts were made by Diane M. Tyler and J.C. Tyler to collect more specimens from holes in coral heads and to obtain natural history data. Specimens were located by searching for their blackish coloured heads protruding from holes in mounds of massive coral (such as Montastraea, Siderastrea, Diploria). These specimens were trapped in clear plastic tubes placed upright over the opening of the holes immediately after the solution of quinaldine was squirted into the holes, driving out the partially narcotized and disoriented specimens. The great majority of the specimens resulted from the use of quinaldine.

If the coral containing the hole from which the fish specimen was obtained could be broken away with a hammer and chisel, it was often collected to examine it for eggs and to identify the kind of invertebrate that had produced the burrow. However, most burrows were left intact, and some were marked with tape to facilitate subsequent visits and to help in recording occupancy by other blennies after the original inhabitant had been collected.

The original two collections by Tyler and Davis bear JCT 2001-__ station numbers; all collections by D.M. Tyler and J.C. Tyler bear JDT 2001-__ or 2002-__ station numbers. The list of specimens is given chronologically and in numerical station order, starting with the JCT stations and proceeding with the JDT stations.

All specimens were radiographed to aid in recording meristic features. We noticed that there was variation in the shape and length of the neural spine of the penultimate vertebra (npu2), but the radiographs were often insufficiently clear to be able to determine the morphology of this neural spine. Therefore, a series of 15 specimens was cleared and counter-stained (Dingerkus and Uhler, 1977) to better understand this variation. Cleared and stained (c&s) individuals are noted as such in the list of specimens.

Cephalic sensory pores of 22 specimens were counted with the aid of a fine jet of compressed air. Counts for bilateral pore series are reported separately for each side. In some specimens, some pores were difficult to discern, accounting for the different sample sizes for some of the pore series. Terminology follows Smith-Vaniz and Palacio (1974), as modified by Hastings (1990).

Specimen lengths are in mm standard length (SL).

Emblemariopsis dianae n. sp.
Orange flag blenny (Figs. 1-3; Tables I, II)

This new species previously had been mentioned in a listing of the fishes of the Pelican Cays (Smith et al., 2003) as Emblemariopsis sp. nov., with a photograph and the common name redflag blenny, but orangeflag blenny is more descriptive of the colour of the distinc-
Fig. 1. *Emblemariopsis dianae*. Specimens (all males and not to scale) photographed freshly preserved in formalin on same day of collection: A, USNM 365355, 16.7 mm (holotype); B, USNM 365355, 17.5 mm; C, USNM 365356, 16.4 mm; D, USNM 365356, 13.6 mm. Photos by Roy E. Clark, Jr.
**Emblemariopsis dianae**, a new species of chaenopsid fish from the western Caribbean off Belize (Blennioidei)

**Fig. 2.** *Emblemariopsis dianae*. Specimens (all males and not to scale) photographed more than one year after preservation: A, USNM 365365, 21.1 mm (largest known specimen); B, USNM 365356, 16.4 mm; C, USNM 367251, 14.4 mm; D, USNM 367250, 12.6 mm. Photos by James F. DiLoreto.

tive flag.

**Type specimens**

A total of 35 male specimens, 12.6-21.1 mm SL (mean 15.0 mm SL).

The two specimens originally collected in a rotenone station and all of the subsequent specimens collected with quinaldine from holes in coral are males. Repeated efforts to find female specimens (by careful observation and finger combing of the algal mat) on the surface of the same coral heads from which males were extracted
Fig. 3. *Emblemariopsis dianae*. Photographs of the posterior region of the vertebral columns of cleared and counter-stained specimens (arrows indicate the distal extent of the neural spine of the penultimate vertebra, npu2). Photos by Philip A. Hastings. A, USNM 365363 with a broad, truncate npu2; B, USNM 367250 with a broad, truncate npu2; C, USNM 367245 with a broad, moderately long npu2; D, SIO 03-56 with a slender, long npu2; E, USNM 365362 with a double npu2 consisting of a slender, long anterior portion and a broad, truncate posterior portion (note also the double haemal spine of the penultimate vertebra and long centrum compared with that of the antepenultimate vertebra); F, USNM 367247 with scoliosis of the posterior vertebral column.
from their holes have been unsuccessful. Surface-dwelling females, however, are equally difficult to find and collect in the related *E. ruetzleri* Tyler and Tyler, 1997, at Carrie Bow Cay, with only two females having been found after similar efforts in previous years (Tyler and Tyler, 1997).

The catalogue number is followed by the number of specimens, size or size range, location, depth, and other collecting data.

**Holotype:** USNM 365355, 16.7 mm, North Elbow Cay (Peripheral Rhomboidal Cays), north-east side of cay, patch reefs on sandy bottom, coral heads from bottom almost to surface, 8 feet depth, field no. JCT 2001-4, J. C. Tyler and W. P. Davis, 28 January 2001, rotenone, 16°42.338'N, 88°10.870'W.

**Paratypes:** USNM 365355, 17.5 mm, same data as holotype; this paratype and the holotype photographed freshly preserved same day of collection (Fig. 1).

USNM 365356, 2, 13.6-16.4 mm, coral ridge on sandy bottom midway between Co-Cat Cay and Little Cat Cay (Pelican Cays), opposite Avicennia Cay, many small and large coral heads (*Montastraea* predominating), 5-10 feet depth, field no. JCT 2001-18, J. C. Tyler and W. P. Davis, 2 February 2001, quinaldine, 16°39.802'N, 88°12.023'W; both specimens photographed freshly preserved on the same day of collection; originally four specimens; two (13.9-14.9 mm) transferred to SIO 03-55.

USNM 365362, 2, 12.9-13.9 mm, both c&s, coral heads on silty sand bottom just south of middle of channel at south end of Wee Wee Cay, just west of (i.e., lagoon side) reef extending south of Wee Wee toward Pelican Cays, 5-10 feet depth, field no. JDT 2001-1, J. C. and D. M. Tyler, 5 April 2001, quinaldine, 16°45.795'N, 88°08.763'W; specimens of *Acanthemblemaria aspera* (Longley, 1927) abundant in holes in dead coral in same habitat.

USNM 365363, 4, 13.0-20.8 mm, two of these (13.0 and 19.3 mm) c&s, same region of coral heads just south of Wee Wee Cay as USNM 365362, field no. JDT 2001-2, J. C. and D. M. Tyler, 6 April 2001, quinaldine, 16°45.795'N, 88°08.763'W; fractured burrows of three of the four specimens collected; burrow of one of the two larger specimens (unknown whether 19.3 or 20.8 mm) of unknown worm or mollusc origin (but probably molluscan), a relatively long and straight tube, with 12 mm diameter aperture and 75 mm total length, and with more than 100 eggs of several stages of development; burrows of both smaller specimens (13.0 and 13.2 mm) collected, and both of coiled *Dendropoma* molluscs, with aperture diameters of 3.0 and 3.4 mm, both burrows with eggs but burrows too incomplete for total egg count estimates.

USNM 365364, 2, 15.3-15.8 mm, reef and sand spit west north-west of Wee Wee Cay, coral heads at 4-8 feet depth on gently sloping silty sand bottom leading to a deeper steep slope with much dead coral and silty sediment, field no. JDT 2001-3, J. C. and D. M. Tyler, 6 April 2001, quinaldine, 16°46.467'N, 88°08.652'W; burrows of both specimens collected, and both of coiled *Petalonchus* molluscs; one burrow relatively complete, with 3.6 mm diameter aperture and more than 100 eggs of several stages of development; one burrow fragmentary and only region with 3.9 mm diameter aperture retained.

USNM 365365, 2, 14.6-21.1 mm, extensive coral heads on sandy bottom in clear water on west (lagoon) side of Billy Hawk Cay, just south of south end of Cockney Cay, just south of main cut between cays in southern region of Blue Ground Range, 8–15 feet depth, field no. JDT 2001-4, J. C. and D. M. Tyler, 7 April 2001, quinaldine, 16°47.371'N, 88°09.540'W; smaller specimen from burrow (collected) in dead coral and larger specimen from hole in live coral, with dark head of larger specimen difficult to distinguish from roundish black sponges encrusted on otherwise live parts of coral near to burrow of fish; burrow of smaller specimen of coiled *Dendropoma* mollusc, with aperture diameter of 3.9 mm, eggs of several stages present but burrow too incomplete for total egg count estimate; specimens of *Acanthemblemaria aspera* abundant in holes in dead coral in same habitat.

USNM 365366, 1, 16.2 mm, c&s, coral ridge on sandy bottom midway between Co-Cat Cay and Little Cat Cay (Pelican Cays), opposite Avicennia Cay, many small and large coral heads (*Montastraea* predominating), 5–10 feet depth, field no. JDT 2001-5, J. C. and D. M. Tyler, 10 April 2001, quinaldine, 16°39.802'N, 88°12.023'W; dark head of specimen difficult to distinguish from roundish black sponges encrusted on otherwise live parts of coral near to dead coral surface with burrow of fish.

USNM 367243, 1, 15.5 mm, c&s, coral heads on silty sand bottom just south of middle of channel at south end of Wee Wee Cay, just west of (i.e., lagoon side) of reef extending south of Wee Wee toward Pelican Cays (same region of coral heads as USNM 365365, JCT 2001-18), 5–10 feet depth, field no. JDT 2002-2, J. C. and D. M. Tyler, 8 March 2002, quinaldine, 16°45.795'N, 88°08.763'W; dark head of specimen difficult to distinguish from roundish black sponges in dead coral, and when revisited three days later (11 March) one burrow (original occupant 15.5 mm) empty and one burrow (original occupant 19.0 mm) occupied by 19.0 mm long *Acanthemblemaria aspera*, and when revisited two days later (13 March) one burrow (from the 15.5 mm specimen) occupied by 13.2 mm specimen of *E. dianae*.

USNM 367244, 1, 15.3 mm, c&s, JDT 2002-3, J. C. and D. M. Tyler, 8 March 2002, same region of coral...
heads at Wee Wee Cay as USNM 367362, JDT 2001-1, and USNM 367243, JDT 2002-2; *Emblemariopsis signifera* collected in algal turf of same coral head as burrow in dead coral of *E. dianae*.

USNM 367245, 1, 14.8 mm, c&s, extensive coral heads on sandy bottom in clear water on west (lagoon) side of Billy Hawk Cay, just south of south end of Cockney Cay, just south of main cut between cays in southern region of Blue Ground Range, 8-15 feet depth, field no. JDT 2002-4, J. C. and D. M. Tyler, 11 March 2002, quinaldine, 16°47.371'N, 88°09.540'W (same group of coral heads as USNM 365365, JDT 2001-4); burrow marked with tape and when revisited two days later (13 March) empty; both *Acanthemblemaria aspera* and *A. greenfieldi* Smith-Vaniz and Palacio, 1974, abundant in holes in dead coral in same habitat.

USNM 367246, 1, 14.7 mm, c&s, JDT 2002-5, J. C. and D. M. Tyler, 13 March 2002, same region of coral heads at Wee Wee Cay as USNM 367362, JDT 2001-1, and USNM 367243, JDT 2002-2; specimen from previously unseen hole in dead coral; burrow marked with tape and empty when revisited two days later (15 March).

USNM 367247, 1, 13.2 mm, c&s, JDT 2002-5, J. C. and D. M. Tyler, 13 March 2002, same dive at same locality at Wee Wee Cay as USNM 367246; specimen kept separate because replacement for 15.5 mm specimen, USNM 367243, of *E. dianae* collected five days previously on 8 March (see below, USNM 367252, for second replacement individual from same hole).

USNM 367248, 1, 13.1 mm, c&s (poorly), extensive coral heads on sandy bottom in clear water on west (lagoon) side of Billy Hawk Cay, just south of south end of Cockney Cay, just south of main cut between cays in southern region of Blue Ground Range, 8-15 feet depth, field no. JDT 2002-4, J. C. and D. M. Tyler, 13 March 2002, quinaldine, 16°47.371’N, 88°09.540’W (same group of coral heads as USNM 365356, JDT 2001-1, and USNM 367245, JDT 2002-4). USNM 367249, 1, 13.3 mm, coral ridge on sandy bottom midway between Co-Cat Cay and Little Cat Cay (Pelican Cays), opposite Avicennia Cay, many small and large coral heads (same region of coral heads as USNM 365356, JCT 2001-18, and USNM 365366, JDT 2001-5), 5-10 feet depth, field no. JDT 2002-8, J. C. and D. M. Tyler, 15 March 2002, quinaldine, 16°39.802’N, 88°12.023’W; specimen catalogued separately from three other specimens (USNM 367250, following) from same dive and location because its burrow collected; burrow of coiled *Dendropoma* mollusc, with aperture diameter of 2.8 mm and about 65 eggs at several stages of development.

USNM 367250, 3, 12.6-16.3 mm, two of these (14.3 and 16.3 mm) c&s, JDT 2002-8, same data as USNM 367249, but no burrows collected.

USNM 367251, 6, 13.0-15.8 mm, one of these (15.8 mm) c&s, North Elbow Cay (Peripheral Rhomboidal Cays), north side of cay, patch reefs on sandy bottom, coral heads from bottom almost to surface, 5–10 feet depth, field no. JDT 2002-9, J. C. and D. M. Tyler, 15 March 2002, quinaldine, 16°41.655’N, 88°10.250’W; this is largest collection of individuals of *E. dianae*; this station somewhat further to north end of cay than other collection at North Elbow Cay in which *E. dianae* taken in roteneone collection at north-east side of cay during Pelican Cays Fish Survey, USNM 365355, JCT 2001-4.

USNM 367252, 1, 15.6 mm, JDT 2002-11, J. C. and D. M. Tyler, 17 March 2002, same region of coral heads at Wee Wee Cay as USNM 367362, JDT 2001-1, and USNM 367243, JDT 2002-2, and USNM 367246-367247, JDT 2002-5; this specimen collected from same hole (marked with tape) from which 15.5 mm specimen (USNM 367243) removed on 8 March, and itself replaced by 13.2 mm specimen (USNM 367247) collected on 13 March, with present specimen collected from same hole on 17 March; burrow collected, of coiled *Dendropoma* mollusc, with aperture diameter of 3.5 mm and no eggs present.

**Diagnosis**

Males of *Emblemariopsis dianae* are unique among the species of *Emblemariopsis* in having a bright orange flag on the distal one-third to one-fourth of the anterior region of the spinous dorsal fin. The colour is mostly confined to between the first and third spines (tapering in some larger specimens to end posteriorly between the third and fourth spines, with much less orange color in the tapering region) and without a chalky white band along the ventral margin of the orange flag. *Emblemariopsis dianae* also is unique among the species of *Emblemariopsis* in modally having three mandibular sensory pores.

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**Table I. Meristics of male *Emblemariopsis dianae* (* includes holotype).**

<table>
<thead>
<tr>
<th></th>
<th>Dorsal fin spines</th>
<th>Dorsal fin rays</th>
<th>Anal fin spines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count</td>
<td>XVIII</td>
<td>XIX</td>
<td>XX</td>
</tr>
<tr>
<td>Number of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>specimens</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

|                |                   |                |                |
| Anal fin rays  |                   |                |                |
| Pectoral fin   |                   |                |                |
| rays           |                   |                |                |
| Vertebrae      |                   |                |                |
| Count          |                   |                |                |
| Number of      |                   |                |                |
| specimens     |                   |                |                |

|                | 10                | 11             | 12             |
| Dorsal fin rays|                   |                |                |

| II             |                   | 33*            |
| III            |                   | 1              |

| Anal fin rays  | 19                |
| Pectoral fin   | 4                 |
| rays           | 20                |

| 21             | 29*               |
| 13-13          | 13-14             |
| 30*            | 14-14             |
| 1              | 2                 |

| 11+25=36       | 5                 |
|                | 11+26=37          |

<table>
<thead>
<tr>
<th>XVIII</th>
<th>XIX</th>
<th>XX</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>32*</td>
</tr>
</tbody>
</table>

**Note:** USNM 367243, JDT 2002-2; specimen catalogued separately from three other specimens (USNM 367250, following) from same dive and location because its burrow collected; burrow of coiled *Dendropoma* mollusc, with aperture diameter of 2.8 mm and about 65 eggs at several stages of development.
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**Table II.** Measurements of *Emblemariopsis dianae*, in percent of standard length (SL).  
*H* - holotype, *No* - number of other specimens measured, *X* - mean, *R* - range

<table>
<thead>
<tr>
<th>Character</th>
<th><em>H</em></th>
<th><em>No</em></th>
<th><em>X</em></th>
<th><em>R</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Head length</td>
<td>27.5</td>
<td>35</td>
<td>27.6</td>
<td>23.2-29.5</td>
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<tr>
<td>Head depth</td>
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<td>17.2</td>
<td>15.2-18.6</td>
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<td>Snout length</td>
<td>5.4</td>
<td>31</td>
<td>6.4</td>
<td>5.4- 7.4</td>
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<td>Orbit diameter</td>
<td>7.2</td>
<td>32</td>
<td>8.3</td>
<td>6.2- 9.5</td>
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<tr>
<td>Interorbital width</td>
<td>3.6</td>
<td>27</td>
<td>4.0</td>
<td>3.2- 4.6</td>
</tr>
<tr>
<td>Body depth</td>
<td>17.4</td>
<td>29</td>
<td>15.7</td>
<td>13.9-18.1</td>
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<tr>
<td>First dorsal fin spine length</td>
<td>11.4</td>
<td>33</td>
<td>11.2</td>
<td>8.2-15.5</td>
</tr>
<tr>
<td>Second dorsal fin spine length</td>
<td>9.0</td>
<td>31</td>
<td>9.3</td>
<td>6.6-11.4</td>
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<tr>
<td>Third dorsal fin spine length</td>
<td>10.2</td>
<td>31</td>
<td>10.1</td>
<td>7.3-13.4</td>
</tr>
<tr>
<td>Fourth dorsal fin spine length</td>
<td>–</td>
<td>21</td>
<td>10.7</td>
<td>7.9-14.0</td>
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<td>Middle dorsal fin spines length</td>
<td>13.2</td>
<td>32</td>
<td>12.7</td>
<td>11.0-14.6</td>
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<td>Rear soft dorsal fin rays length</td>
<td>13.2</td>
<td>32</td>
<td>14.0</td>
<td>12.7-16.8</td>
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<tr>
<td>First pelvic fin ray length</td>
<td>–</td>
<td>23</td>
<td>12.3</td>
<td>10.4-14.4</td>
</tr>
<tr>
<td>Second pelvic fin ray length</td>
<td>–</td>
<td>36</td>
<td>15.6</td>
<td>12.9-17.8</td>
</tr>
<tr>
<td>Third pelvic fin ray length</td>
<td>–</td>
<td>20</td>
<td>9.6</td>
<td>7.6-11.7</td>
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<tr>
<td>Pectoral fin length</td>
<td>19.8</td>
<td>26</td>
<td>20.6</td>
<td>15.2-24.0</td>
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<tr>
<td>Caudal fin length</td>
<td>18.6</td>
<td>32</td>
<td>19.7</td>
<td>16.8-22.0</td>
</tr>
</tbody>
</table>

**Description**

See Table I for meristics and Table II for measurements. Length of head about 3.6 times in SL (three largest specimens, 19.3-21.1 mm, tending to have relatively smallest heads, 23.2-25.9% SL). Depth of head about 5.8 times in SL. Snout short, slightly less than diameter of orbit (snout about 1.3 times in orbit). Orbit about 3.3 times in head length (three largest specimens tending to have relatively smallest orbits, 6.2-7.3% SL). Bony interorbital width about 2 times in orbit. Body depth at anal fin origin about 6.4 times in SL. 

Supraorbital cirrus short, simple, speckled with melanophores like head; cirrus usually simply rounded distally, but sometimes (especially in large specimens) with distal edge incised into two or three small lobes, almost trident-like if three lobes; cirrus slender to moderate in width; width 2 to 3 times in cirrus length; cirrus length one-half to two-thirds of pupil diameter.

Anterior nasal opening tubular, with a simple cirrus projecting from rear edge; cirrus of variable length, from about equal to tube length to 3 times tube length.

Teeth on lower (dentary) and upper (premaxillary) jaws similar, each with a row of approximately 20 moderately sized canines, extending from symphysis, across front of jaws, and turning posteriorly along each side of jaws. Teeth in both jaws of moderate size anteriorly, largest in anterior portion of lateral row, and gradually decreasing in size posteriorly. Anteriorly in both jaws a patch of low, pointed teeth, 2 or 3 teeth wide, behind outer row of canines. Anterior margin of vomer with approximately 10 small pointed teeth in crescentic row, with 3 or 4 small teeth behind. Palatine with a single row of 5 small canines.

Number of cephalic sensory pores in each series as follows: nasal = 1 (frequency of count = 44); anterofrontal = 1 (44); commissural = 1 (22); frontal = 0 (39) or 1 (5); supraorbital = 2 (43); posterior infraorbital = 3 (43); anterior infraorbital = 3 (44); median supratemporal = 1 (17), 2 (1), or 3 (2); lateral supratemporal = 2 (25) or 3 (10); posttemporal = 4 (30); preopercular = 4 (40); common = 1 (22); mandibular = 3 (33) or 4 (9).

Anterior end of dorsal fin not prominently elevated; anterior spines not forming upraised lobe, not higher anteriorly than posteriorly. Distal edge of anterior region of dorsal fin with gentle concavity, with membranes between first few spines slightly incised. First dorsal fin spine about 11.2% SL, about same length as fifth spine, with spines gradually increasing in length to middle of series of spines, where length is about 12.7% SL; second spine shortest, about 9.3% SL; third spine about 10.1% SL; fourth spine only slightly shorter than first, 10.7% SL.

Dorsal fin spines somewhat longer in large specimens than in small individuals. Here and for the subsequent measurements, the mean is often followed in parentheses by the range in percent of standard length. First dorsal fin spine 10.7% SL (8.2-13.4%) in 20 small specimens (12.6-14.9 mm, mean 13.6 mm), and 12.1% SL (10.0-15.5%) in 13 large specimens (15.3-21.1 mm, mean 17.0 mm). Second dorsal fin spine 9.0% SL (6.6-10.8%) in 19 small specimens (as above in size and range, here and following), and 9.7% SL (8.5-11.4%) in 12 large specimens. Third dorsal fin spine 9.5% SL (7.3-11.5%) in 19 small specimens, and 11.0% SL (9.2-13.4%) in 12 large specimens. Fourth dorsal fin spine 9.9% SL (7.9-12.3%) in 13 small specimens, and 12.0% SL (10.5-14.0%) in 8 large specimens. Posterior soft dorsal-fin rays about 14.0% SL.

Pelvic fin much shorter than pectoral fin; 1, 3, each ray
extending beyond incised membrane; second ray longest, third ray shortest; pelvic fin spine a very short splint, only visible in cleared and stained specimens; first pelvic fin ray mean 12.3% SL, second ray mean 15.6% SL, third ray mean 9.6% SL. Pectoral and caudal fins about equal in length, pectoral fin mean 20.6% SL and caudal fin mean 19.7% SL.

Dorsal fin XX, 11 or 12 (34% with 12 rays); a longer space between bases of third and fourth spines than between the others. Anal fin usually II, 20 (one specimen unusual with 3 anal fin spines). Pectoral fin usually with 13 rays on both sides (14% with 13 on one side and 14 on the other, 6% with 14 on both sides). Caudal fin with 13 segmented unbranched principal rays and 2–4, usually 3, procurent rays above and below. Vertebræ: 11 abdominal and usually 26, sometimes 25, caudal; total usually 37, sometimes 36.

Caudal skeleton somewhat variable. All specimens examined with typical chaenopsid features of fused upper and lower hypural plates, a free minimal hypural, and a single epural. Neural spine of penultimate vertebra (npu2) variable in shape and length: in most specimens (10 of 15 c&s) npu2 broad, with its distal margin truncate, ranging from rectilinear to gently rounded, extending much less than half distance from centrum to body outline (Fig. 3A & 3B), similar to that reported for other species of Emblemariopsis; in two specimens (USNM 367244, 367245) npu2 broad but longer, extending a little more than half-way to body outline (Fig. 3C); in two specimens (USNM 367243, SIO 03-56) npu2 slender and similar to more anterior neural spines, extending two-thirds or more to body outline (Fig. 3D); in one specimen (USNM 365362) npu2 divided into a slender, long anterior portion and a broad, truncate posterior portion (Fig. 3E). This variation in shape and size of npu2 not related to body size.

**Colour of males when live:** as seen with only head protruding from hole in coral, uniformly black, the orange flag at front of dorsal fin not visible. Specimens blanch somewhat immediately upon being driven from their burrow with quinaldine, with head becoming less intensely dark, more brownish black, and body becoming lighter coloured posteriorly.

**Colour when freshly preserved:** (Fig. 1) speckled with brownish black melanophores, most dense on head, and becoming progressively less intensely speckled from anteriorly to posteriorly on body; body with tan to yellowish overtones between darker speckling; large specimens usually more darkly pigmented than small specimens. Two to four dark spots on opercular region and on cheek, and often present on base of pectoral fin. Diffuse dark blotch laterally on caudal peduncle. Vertical fins generally dark grey to black, except becoming pale at distal edges. Body along bases of dorsal and anal fins with indistinct pale crescents spaced about every second ray. Abdomen darker than rest of middle of body, with top of abdomen tending to be bordered by indistinct slightly pale band.

Flag at upper front of spinous dorsal fin mostly orange, sometimes slightly orangish red; flag most prominent distally between first three spines, sometimes tapering to termination between third and fourth spines; from fourth spine posteriorly, distal edge of membranes paler than below. Depth of flag usually one-third to one-fourth of first dorsal-fin spine length. No white band below orange flag; membranes of fin below flag same dark grey to black as rest of dorsal fin; depth of flag mean 28% (20–35%) of first dorsal-fin spine length or 3.6 (2.8–5.0) times in first dorsal fin spine length.

Proximal two-thirds of pectoral fin darkly speckled, but less speckled and much paler distally. Pelvic fin with dark interradial membranes, rays pale beyond incised membranes. After long preservation (Fig. 2), orangish flag in dorsal fin becoming whitish, and tan and yellowish overtones on body becoming pale white.

**Etymology**

The species is named in honour of Diane M. Tyler of the Smithsonian Institution Press, in recognition of her studies of the behavioural ecology of chaenopsids at Carrie Bow Cay; she is the co-collector of most of the type specimens of this new species, and her dedicated collecting efforts over the years in and around Carrie Bow Cay have procured many important materials.

**Distribution**

*Emblemariopsis dianae* has been collected in four mid-shelf lagoonal areas to the south and west of the Smithsonian Institution’s marine laboratory at Carrie Bow Cay, Belize. Whereas the marine laboratory is on the outer edge of the Belize Barrier Reef complex, *E. dianae* has been collected only in calmer lagoonal waters. The four areas are the Elbow Cays, about 14 km south-west (bearing 222°) of Carrie Bow in the northern Peripheral Rhomboidal Cays; the central Pelican Cays, about 20 km south-west of Carrie Bow, with the Pelicans being the northern group of cays in the Rhomboidal Cays (the Rhomboidal Cays are comprised of the Peripheral Rhomboids and the Pelicans); Wee Wee Cay, about 7 km south-west of Carrie Bow; and the Blue Ground Range, a series of north to south cays approximately 8 km long, some 8 km west of Carrie Bow. These areas are discussed in Macintyre and Rützler (2000), and their ichthyofauna is detailed in Smith et al. (2003).

**Comparisons and Variation**

The morphology of *E. dianae* is consistent with that of other species currently placed in *Emblemariopsis* Longley, including separate nasal bones, a single short supraorbital cirrus (absent in some species of the genus), and, in most specimens, a truncate neural spine on the penultimate vertebra (npu2), the only feature unique to *Emblemariopsis* among chaenopsids (Hastings, 1997). Although most cleared and stained specimens of *E. dianae* have a broad, truncate npu2, two
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have a broad and moderately long (half-way out to body outline) npu2, two have a slender and long npu2, and one has a divided npu2, with the anterior part slender and long and the posterior part broad and truncate. In the latter specimen (USNM 365362; Fig. 3E), the length of the centrum of the penultimate vertebra is slightly greater than that of more anterior vertebrae and the haemal spine is divided, much as is the neural spine, which we interpret as indicative of incomplete fusion of two posterior vertebrae. The cause of the variation in these features is unknown, but the presence in one specimen (USNM 367247; Fig. 3F) of severe scoliosis and in another (USNM 367251, 13.4 mm SL) of three anal fin spines may indicate disruption or instability in the developmental program of some individuals.

Emblemariopsis dianae is unique within Emblemariosis in modally having three mandibular sensory pores, although some variation exists. Seventeen of 22 specimens carefully examined for the cephalic pore system have three mandibular pores on both jaws; three specimens have four mandibular pores on both jaws, and three specimens are asymmetric, with three pores on one side and four on the other. Counts made prior to clearing and staining were generally confirmed for 12 specimens. Those specimens with four external mandibular pores have four evident pores internally: pores 1-3 pass through the dentary and pore 4 is in the space between the dentary and the anguloarticular. Specimens with three external pores most often have pores 1, 2 and 4 present, and pore 3 absent, but occasionally (n = 5 rami in 3 specimens) pore 3 is present as a tiny perforation, less than one-half the diameter of the other mandibular pores. In these later cases, this pore is either not open through the skin or can be overlooked due to its small size.

The numbers of cephalic sensory pores in most other series are invariant in E. dianae except for those along the posterior dorsal surface of the head (frontal, median, and lateral supratemporal series), a feature common among chaenopsids. However, unlike E. dianae, the number of mandibular pores is usually constant in species of chaenopsids (e.g., the genus Acanthemblemaria, see Smith-Vaniz and Palacio, 1974), with only occasional variants reported in, for example, Stathmonotus and Ekamplemaria (Hastings, 1992; Hastings and Springer, 1994). Other than four of the species of Stathmonotus (Hastings and Springer, 1994), E. dianae is the only chaenopsid with predominantly three rather than four mandibular pores. Stephens’ (1970, Table I) report of five mandibular pores in all genera of chaenopsids includes the “common pore,” located between the jaw articulation and preopercular series (see Smith-Vaniz and Palacio, 1974), in the mandibular pore count and does not include data for Stathmonotus.

An orangish red distal flag similar to that of E. dianae occurs in E. tayrona (Acero, 1987), E. ramirez (Cervigon, 1999) and E. occidentalis Stephens, 1970, but the flag in these three species extends posteriorly beyond the fourth dorsal fin spine to at least the fifth or sixth spine (versus to between only the third and fourth spines in E. dianae) and the ventral margin of the flag is bordered by a chalky white band (versus no such white band in E. dianae).

Emblemariopsis dianae is similar to E. tayrona, E. ramirez, E. occidentalis, E. leptocirrus Stephens, 1970, and E. signifera (Ginsburg, 1942) in having modally 13 pectoral fin rays and a supraoccipital cirrus. Among these, Emblemariopsis dianae is most similar to E. leptocirrus in having a relatively low anterior region of the spinous dorsal fin, with the first dorsal fin spine only slightly elongate relative to more posterior dorsal fin spines; thus, the characters of E. dianae would approximate those of E. leptocirrus in the key to the species of Emblemariopsis by Williams (2002). Emblemariopsis leptocirrus differs from E. dianae, however, in having a relatively uniformly pigmented anterior dorsal fin, without a prominent flag distally between the more anterior spines; in having the first few dorsal spines of about the same length; and in having the interradial membranes of the dorsal fin spines not prominently incised (versus E. dianae having a prominent flag, the second spine distinctly shorter than the first spine, and the membranes clearly incised between the first three spines in a concave distal edge of the fin).

Natural History

Emblemariopsis dianae males have been found only in the relatively quiet, low-energy, mid-shelf, lagoonal waters many kilometers inside (westward of) the outer edge of the Belize Barrier Reef. This protected habitat is in marked contrast to the high-energy waters at the outer edge of the barrier reef at Carrie Bow Cay where two other species of Emblemariosis, E. ruetzleri Tyler and Tyler, 1997, and E. pricei Greenfield, 1975, are common. Both E. ruetzleri and E. pricei utilize similar habitats around the reef crest, on patch reefs just inside the lagoon, and in the spur and groove zone in front of the reef crest (Tyler and Tyler, 1997, 1999). This differential distribution of E. dianae relative to E. pricei and E. ruetzleri is documented by more than 100 quinaldine collections (deposited at the Smithsonian’s National Museum of Natural History) of these taxa of tube dwelling chaenopsids across the outer barrier reef platform from the reef crest westward far into the lagoon between Carrie Bow Cay and the Rhombooidal Cays. In all three of these species, mature males are confined to holes in coral, and females (not known for E. dianae) and immature individuals are surface dwellers. Whereas E. pricei and E. ruetzleri are similar in being found only in high-energy habitats, versus only in low-energy habitats for E. dianae, the males of E. ruetzleri and E. dianae are similar in being found mostly in holes in dead coral, versus in holes in live coral for E. pricei.

Whereas different energy levels characterize the restricted habitats of E. dianae versus E. ruetzleri and E. pricei, at least two other species of Emblemariosis
in this region are found in a wide variety of water conditions: *E. leptocirrus* is found both in the high-energy waters of offshore banks such as Gloves Reef and of the barrier reef such as Carrie Bow Cay and English Cay, and in the low-energy waters of Cat Cay in the Pelican Cays (Smith et al., 2003); *E. signifera* is common in the cays of the offshore banks and the barrier reef (many records in Greenfield and Johnson, 1981, and in Smith et al., 2003), but it has also been collected along with *E. dianae* in the quiet waters of the mid-shelf cays at Wee Wee Cay (see annotations in list of type specimens). We note that both mature males and females of the ubiquitous *E. signifera* are mostly out on the surface of corals and associated algal mats during daylight (also see long-term observations of this species in Smith and Tyler, 1972), rather than with at least adult males being mostly confined to holes in corals as in many other species of *Emblemariopsis*.

Previous studies at Carrie Bow Cay of *E. pricei* and *E. ruetzleri* have demonstrated a difference between the two species in how rapidly immature males occupy vacant shelter sites. In the case of *E. pricei*, the numerous serpulid (*Spirobranchus*) worm tubes from which a mature male had been extracted were usually immediately occupied by an immature male lurking on the nearby surface (Tyler and Tyler, 1999). In the case of *E. ruetzleri*, the burrows in coiled vermetid (*Dendropoma*) gastropods from which the fish had been extracted were not so frequently or rapidly occupied, and suitable holes in coral are apparently not in short supply for *E. ruetzleri*.

An effort in 2002 to obtain similar data for *Emblemariopsis dianae* was minimally successful, with only four burrows tagged and subsequently revisited. One of these burrows, from which a 14.8 mm original occupant was extracted (USNM 367245) on 11 March, was empty when revisited on 13 March and was not examined again. Another burrow, from which a 14.7 mm original occupant was extracted (USNM 367246) on 13 March, was empty when revisited on 15 March and was not examined again. On 8 March at Wee Wee Cay, two burrows were marked from which specimens of 13.3 mm (SIO 03-56) and 15.5 mm (USNM 367243) were extracted. When revisited on 11 March, the burrow from which the 13.3 mm specimen had been extracted was empty and was also empty subsequently when revisited on 13 and 17 March. The burrow from which the 15.5 mm specimen had been extracted on 8 March had a 19 mm specimen of *Acanthemblemaria aspera* (specimen collected, not retained) when revisited on 11 March, and when this burrow was revisited on 13 March it had a 13.2 mm specimen of *Emblemariopsis dianae* (USNM 367247); when this same burrow was revisited for the last time on 17 March, it had a 15.6 mm specimen of *E. dianae* (USNM 367252). Thus, three of the four burrows that were revisited were not reoccupied, but one of them was, by a combination during a nine-day period of two individuals of *E. dianae* and one of *A. aspera*. The rapidity of reoccupation of suitable shelter sites for *E. dianae* seems to be at about the same low level as for *E. ruetzleri*, and it surely is not like the rapid reoccupancy of burrows typical of *E. pricei*.

The holes from which specimens of *E. dianae* were extracted were in dead parts of the coral heads, with the single exception of one of the two specimens in USNM 365365 (see list of type specimens), whose hole was in a live part of the head.

Of the eight burrows that were collected of *E. dianae*, seven were the coiled shells of “worm-shell” gastropod molluscs, family Vermetidae. Of these vermetids, five were of species of *Dendropoma* and two were of species of *Petaloconchus* (without determination to the species level). The diameters of the apertures of these vermetid shells ranged from 2.8 to 3.9 mm, with total coiled lengths estimated at about 25 to 60 mm; the size of the specimens of *E. dianae* occupying these burrows ranged from 13.0 to 15.8 mm. Five of the vermetid burrows had fish eggs from different depositions; three of these burrows were too incomplete for estimates to be made of the total number of eggs, but one had 65 eggs and the other more than 100 eggs. One vermetid burrow had only the region of the aperture collected, and it is unknown whether eggs were present. One of the seven vermetid burrows, whose entire length could be examined after being broken open, had no eggs. In addition to these seven coiled vermetid shells, one of the collected burrows was of much larger size and relatively straight, with an aperture diameter of 12 mm and a total length of about 75 mm; more than 100 eggs were present, in several stages of development. The size of the specimen of *E. dianae* occupying this large burrow was either 19.3 or 20.8 mm (USNM 365363), these two specimens being among the three largest specimens collected. It could not be determined whether this large burrow belonged to a mollusc or a worm, but it most probably belonged to a non-vermetid mollusc. Thus, at present, we can only state that *E. dianae* usually utilizes the tubes formed by at least two different vermetid molluscs but is sometimes found in tubes of a presently unknown larger invertebrate. Many of the burrows of *E. dianae* that were not collected seemed frequently to be those of coiled vermetid gastropods. At Carrie Bow Cay, *E. pricei* is mostly found in serpulid (*Spirobranchus*) worm tubes, whereas *E. ruetzleri* is mostly found in vermetid (*Dendropoma*) shells, so *E. dianae* and *E. ruetzleri* are similar in this respect.

The black head of *E. dianae* protruding from its burrow is especially easy to overlook when the burrow is near patches of the encrusting black sponge *Cliona caribbaea* Carter, 1882, that is often present on coral heads in this region (see Rützler, 2002).

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